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

Publication Date: June 2016

NVZ Name: Bar Mere
NVZ ID: EL140
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. 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).
# Section 1. Lake and catchment characteristics

**WB ID:** 34328  
**2013 NVZ status:** Not Designated

## Lake attributes

<table>
<thead>
<tr>
<th>EA Area</th>
<th>Greater Manchester Merseyside and Cheshire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake grid co-ordinates (Easting/Northing)</td>
<td>353662 / 347885</td>
</tr>
<tr>
<td>Lake waterbody area (ha)</td>
<td>10.3</td>
</tr>
<tr>
<td>WFD Lake Typology</td>
<td>Organic, very shallow, small, lowland</td>
</tr>
<tr>
<td>Lake Alkalinity (ueq/L)</td>
<td>4655</td>
</tr>
<tr>
<td>Mean lake depth (m)</td>
<td>2.5</td>
</tr>
<tr>
<td>Is the lake heavily modified according to WFD?</td>
<td>Yes</td>
</tr>
<tr>
<td>Does stratification occur?</td>
<td>Well mixed</td>
</tr>
<tr>
<td>Is this waterbody a reservoir?</td>
<td>No</td>
</tr>
</tbody>
</table>

**Natural or artificial lake:** Natural  
**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):**

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**NVZ Name:** Bar Mere  
**NVZ ID:** EL140
Hydrological character

Primarily surface water --- Hydrology sections of the Bar Mere Diffuse Water Pollution Plans 2015

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?

No --- Catchment area confirmed from walk over survey has got an area of 1932 ha (Reference: Bar Mere SSSI – Catchment Walkover Survey, April 2015). 04/01/2016: The catchment map above has been updated using a shapefile supplied by EA area staff.

Is the map representative of the artificial catchment?

n/a
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:
Accessiblity to public:
Not easily accessible, few visits
Recreational fishing:
Little activity
Contact watersports
No activity
Nature of watersports (if applicable):
n/k ---
Other public benefit visits:
No activity

Conservation status:
Conservation value of lake:
National
Habitats Directive site:
Not SPA or SAC --- SSSI
SPA or SAC for aquatic interest features
---
SSSI or local conservation designation:
SSSI
Description of Aquatic interest features:
--- The submerged aquatic vegetation is sparse, consisting mainly of horned pond-weed Zannichellia palustris and various-leaved water-starwort Callitriche platycarpa. A large stand of yellow water-lily Nuphar lutea is present at the southern end of the mere. Common reed Phragmites australis is dominant around the mere with areas of lesser reedmace Typha angustifolia, branched bur-reed Sparganium erectum, lesser pond-sedge and greater pond-sedge Carex cutiformis and C. riparia. The comparatively uncommon glaucous bulrush Schoenoplectus tabernaemontani and purple small-reed Calamagrostis canescens are also present. The aquatic invertebrate fauna is characteristic of a mere of this type but particularly good for molluscs. (SSSI citation for Bar Mere)
### Total oxidised nitrogen (TON) data

<table>
<thead>
<tr>
<th>Mean summer TON (mg/l)</th>
<th>2.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of summer TON samples</td>
<td>9</td>
</tr>
<tr>
<td>75th percentile annual TON (mg/l)</td>
<td>5.1</td>
</tr>
<tr>
<td>Total number of TON samples</td>
<td>18</td>
</tr>
<tr>
<td>Confidence of annual 75th %-ile TON exceeding 1 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Confidence of annual 75th %-ile TON exceeding 2 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Date range of TON samples</td>
<td>2010 - 2014</td>
</tr>
</tbody>
</table>

### TON monitoring data

![TON monitoring data graph](image_url)
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>4.8</td>
</tr>
<tr>
<td>Total number of TN samples</td>
<td>18</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>High</td>
</tr>
<tr>
<td>Date range of TN samples</td>
<td>2010 - 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 --- Only routine WFD monitoring undertaken at Bar Mere by the EA. DWPP has identified gaps in our understanding of this WB but no additional monitoring has been initiated. Third party (limited spot sample) data available for Bickley Brook and it's tributaries (Bar Mere catchment walkover report.) 5 sites sampled in Feb 15 for the catchment walkover conducted by AECOM for the Meres and Mosses Partnership. DO very low at 2 sites (below 3mg/l). Total N above 2mg/l at 4 out of 5 sites (max 6.3 mg/l) lowest reading below LoD in upper Bickley Brook. Ortho P above 0.12 mg/l at 4 of the 5 sites (max 10.23 mg/l in Trib of Bickley Brook). Ref : Bar Mere SSSI – Catchment Walkover Survey AECOM Report for: The Meres and Mosses Partnership (April 2015). link N:\Water\GMMC WFD\Weaver Gowy\3rd party data
Total phosphorus (TP) data

<table>
<thead>
<tr>
<th>Annual geometric mean TP (ug/l)</th>
<th>167</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFD face value TP class</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence of moderate or worse TP status</td>
<td>100%</td>
</tr>
<tr>
<td>Date range of TP samples</td>
<td>2010 - 2014</td>
</tr>
</tbody>
</table>

TP monitoring data

[Graph showing TP ug/l over time]

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

No change --- Only routine WFD monitoring undertaken at Bar Mere by the EA. DWPP has identified gaps in our understanding of this WB but no additional monitoring has been initiated. No field readings (DO or pH) have been taken therefore no assessment of any eutrophic effect can be made on these parameters. Third party (limited spot sample) data available for Bickley Brook and its tributaries (Bar Mere catchment walkover report.) See 6 notes.
Nutrient sources

Nitrogen loading estimates based on catchment map area

<table>
<thead>
<tr>
<th>Source</th>
<th>Leached N (kgN/yr)</th>
<th>Conc. (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From all agricultural sources</td>
<td>43413</td>
<td>12.8</td>
</tr>
<tr>
<td>From agricultural sources minus atmospheric deposition</td>
<td>42183</td>
<td>11</td>
</tr>
<tr>
<td>From urban sources</td>
<td>130</td>
<td>0</td>
</tr>
<tr>
<td>From all sources</td>
<td>43542</td>
<td>12.9</td>
</tr>
<tr>
<td>From all sources (minus atmospheric deposition)</td>
<td>42312</td>
<td>12.5</td>
</tr>
<tr>
<td>Ranking based on nitrogen loading from agricultural sources</td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

Local assessment 2015

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

n/k --- The Bar Mere Diffuse Water Pollution Plan 2015 identified a need to confirm the precise sources of nutrients into the lake, however agricultural waste and run off was listed as a potential pollutant. No assessment available for apportionment

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

n/k --- The Bar Mere Diffuse Water Pollution Plan 2015 identified a need to confirm the precise sources of nutrients into the lake, however domestic waste was listed as a potential pollutant. No assessment available for apportionment

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

NVZ Name: Bar Mere
NVZ ID: EL140
Section IV - Response - Plants/Algae

Chlorophyll data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mean Chlorophyll (ug/l)</td>
<td>9</td>
</tr>
<tr>
<td>total number of Chlorophyll samples</td>
<td>18</td>
</tr>
<tr>
<td>WFD face value Chlorophyll class</td>
<td>Good</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>18%</td>
</tr>
<tr>
<td>Chlorophyll Good/Moderate boundary value</td>
<td>20</td>
</tr>
<tr>
<td>Date range of Chlorophyll samples</td>
<td>2010-2014</td>
</tr>
</tbody>
</table>

Chlorophyll monitoring data

NVZ Name: Bar Mere
NVZ ID: EL140
### 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>EQR</td>
<td>0.49</td>
<td>0.4</td>
<td>No data</td>
</tr>
<tr>
<td>Total number of samples/surveys</td>
<td>12</td>
<td>1</td>
<td>No data</td>
</tr>
<tr>
<td>WFD face value class</td>
<td>Good</td>
<td>Poor</td>
<td>No data</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>44%</td>
<td>99%</td>
<td>No data</td>
</tr>
<tr>
<td>Date range of samples</td>
<td>2011 - 2013</td>
<td>2008 - 2008</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)**

No change --- No supporting data (i.e. pH or DO) available for Bar Mere. Limited third party data (spot samples) available for Bickley Brook and its tributaries. 5 sites sampled in Feb 15 for the catchment walkover conducted by AECOM for the Meres and Mosses Partnership. DO very low at 2 sites (below 3mg/l). Total N above 2mg/l at 4 out of 5 sites (max 6.3 mg/l) lowest reading below LoD in upper Bickley Brook. Ortho P above 0.12 mg/l at 4 of the 5 sites (max 10.23 mg/l in Trib of Bickley Brook). Ref: Bar Mere SSSI – Catchment Walkover Survey AECOM Report for: The Meres and Mosses Partnership (April 2015). link N:\Water\GMMC WFD\Weaver Gowy\3rd party data. No recorded observations of algae or colour.

**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>Change as Square Chord Distance</td>
<td>No data</td>
</tr>
<tr>
<td>Change in Diatom community</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)**

Affected- It has species poor aquatic flora and fails to meet species targets in conjunction with the presence of excessive growth of filamentous algae and the non native species Elodea canadensis. The mere also fails it water quality targets with the mere being excessively enriched and turbid. Total phosphorous exceeds the 35 ug/l upper limit, with the average for Bar Mere being TP 140 ug/l. Source Natural England

**Strength of evidence (local judgement)**

Strong evidence ---

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

Y, definitely
### Comments and decisions

**WFD Weight of evidence for eutrophication:**

<table>
<thead>
<tr>
<th>Certainty of eutrophication problem based on core WFD tools:</th>
<th>Very certain eutrophication problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of eutrophication problem based on overall weight of evidence:</td>
<td>Very certain eutrophication problem</td>
</tr>
<tr>
<td>WFD overall ecological status:</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence in WFD status:</td>
<td>Very Certain</td>
</tr>
</tbody>
</table>

#### Current assessment of weight of evidence supporting designation in 2017

**First national panel**

**Recommended action:**

Needs further investigation

**Comments from first panel:**

Evidence is strong - N is significantly elevated (>2mg/l) and supporting ecological evidence demonstrates eutrophic impact.

**Second national panel**

**Comments from second national panel:**

Filamentous algae may account for lower chlorophyll production than would be expected from the nutrient levels. Agreed sufficient evidence to warrant designation, given significant exceedance of the N threshold values.

**Recommendation:** Designate

**Local summary and recommendation:**

There is good evidence for eutrophication from the unfavourable condition of the SSSI. There is high confidence of elevated nutrient levels supporting this, both phosphorous and nitrogen. Whilst the catchment is mainly agricultural land use we have no additional evidence to quantify the contribution of agricultural run off.

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**NVZ Name:** Bar Mere  
**NVZ ID:** EL140
Lake Description:
Bar Mere like other meres is thought to have developed from a natural depression in the glacial drift left by the ice sheets in the last ice age. Bar mere is a nutrient rich mere with a fringe of emergent vegetation. The Blickley brook flows into it and its catchment follows that of the brook to a great extent. Bar Mere is very shallow and has a mean depth of around 2.5m. It is in a SSSI and the SSSI citation notes that it is particularly good for aquatic molluscs, has sparse aquatic vegetation and names a number of emergent plant species. However the SSSI is currently in unfavourable condition.

Why the lake should be designated as a Polluted Water (eutrophic):
Bar Mere lies within existing surface water and groundwater NVZs. Nitrogen concentrations significantly exceed the 1-2 mg/l threshold. Agriculture contributes significantly to the nitrogen load.

Nitrogen:
The TON and TN concentrations are more than double the 2mg/l threshold, with 75th percentile TON at 5.1 mg/l and mean annual TN at 4.8 mg/l.

Phosphorus:
The WFD total phosphorus classification is Poor status.

Ecological response:
Phytoplankton is at Good status but Macrophytes are Poor. The types of submerged plant found in Bar Mere are typical of eutrophic conditions.

Supplementary evidence:
The Bar Mere SSSI catchment walkover survey report for the Meres and Mosses Partnership found total N above 2mg/l at 4 out of 5 sites in the catchment, and a maximum of 6.3mg/l.
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