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

Publication Date: June 2016

NVZ Name: Hornsea Mere
NVZ ID: EL113
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).

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NVZ Name: Hornsea Mere
NVZ ID: EL113
Section 1. Lake and catchment characteristics

WB ID: 30244  2013 NVZ status: Designate (Precautionary)

Lake attributes

<table>
<thead>
<tr>
<th>EA Area</th>
<th>Yorkshire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake grid co-ordinates (Easting/Northing)</td>
<td>519041 / 446979</td>
</tr>
<tr>
<td>Lake waterbody area (ha)</td>
<td>133.3</td>
</tr>
<tr>
<td>WFD Lake Typology</td>
<td>High alkalinity, very shallow, large, lowland</td>
</tr>
<tr>
<td>Lake Alkalinity (ueq/L)</td>
<td>3083</td>
</tr>
<tr>
<td>Mean lake depth (m)</td>
<td>1.5</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:

Type of artificial lake:

Lake perimeter (% artificial)

Significant changes in lake level due to seasonal drawdown:

--- Lake level controlled by a sluice at the outlet to the Mere. This maintains a level higher than would occur naturally.

Pumped storage or other reservoir:

0

Information on abstraction (if available)
<table>
<thead>
<tr>
<th>Lake catchment area (ha)</th>
<th>1885</th>
</tr>
</thead>
<tbody>
<tr>
<td>If pumped, pumped catchment area (ha)</td>
<td></td>
</tr>
</tbody>
</table>

**Hydrological character**

--- Sand and gravel lenses conduct groundwater from land to the east of the mere, extending some distance inland.

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?

Is the map representative of the artificial catchment?
Section II - Waterbody uses

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

Public Water Supply:
Drinking Water Protected Area:
UWWTD designation
Used for hydropower or flow regulation:

Recreational use:
Accessibility to public:
Recreational fishing:
Contact watersports
--- Supports a boating/sailing club.
Nature of watersports (if applicable):
---

Other public benefit visits:
- Very popular local amenity in terms of bird watching, walking, etc.

Conservation status:
Conservation value of lake:
Habitats Directive site:
--- SPA, SSSI
SPA or SAC for aquatic interest features
--- The reedbeds support a diverse insect fauna with several local fenland species; the mayfly Caenis horaria has been recorded. The mere is however principally valued for its importance as a refuge and feeding area for duck.

SSSI or local conservation designation:

Description of Aquatic interest features:
--- International Importance for a migratory population of Gadwall. Designated habitat - broadleaved mixed and yew woodland/lowland. Fen, marsh and swamp lowland. 2015 Comment: 0

NVZ Name: Hornsea Mere
NVZ ID: EL113
Total oxidised nitrogen (TON) data

<table>
<thead>
<tr>
<th>Mean summer TON (mg/l)</th>
<th>0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of summer TON samples</td>
<td>15</td>
</tr>
<tr>
<td>75th percentile annual TON (mg/l)</td>
<td>2</td>
</tr>
<tr>
<td>Total number of TON samples</td>
<td>31</td>
</tr>
<tr>
<td>Confidence of annual 75th %ile TON exceeding 1 mg/l</td>
<td>Low</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>2010 - 2014</td>
</tr>
</tbody>
</table>

TON monitoring data

NVZ Name: Hornsea Mere
NVZ ID: EL113
Mean annual TN (mg/l) | 2
Total number of TN samples | 31
Confidence of annual mean TN exceeding 1 mg/l | High
Confidence of annual mean TN exceeding 2 mg/l | Not confident
Date range of TN samples | 2010 - 2014

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

<table>
<thead>
<tr>
<th>Annual geometric mean TP (ug/l)</th>
<th>172</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

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
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>57769</td>
<td>18</td>
</tr>
<tr>
<td>From agricultural sources minus atmospheric deposition</td>
<td>53392</td>
<td>16.8</td>
</tr>
<tr>
<td>From urban sources</td>
<td>2459</td>
<td>0.8</td>
</tr>
<tr>
<td>From all sources</td>
<td>60228</td>
<td>18.8</td>
</tr>
<tr>
<td>From all sources (minus atmospheric deposition)</td>
<td>55851</td>
<td>17.4</td>
</tr>
<tr>
<td>Ranking based on nitrogen loading from agricultural sources</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Local assessment 2015

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

Minor source --- Area surrounding the feeder streams upstream of the Mere is largely agricultural with a number of small outlying settlements and isolated dwellings. 2015 Comment: Our WFD investigations suggest Agriculture currently has a minimal impact on Hornsea mere, certainly when comparing it to the issues we have with septic tanks etc. Having said that, removing the NVZ could only put pressure on the lake which is already has a Poor status under WFD, and therefore retaining the NVZ is the correct one.

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

Principal source --- Outlying areas not on mains drainage and have private drainage systems, which are mainly thought to be septic tanks, although there are also a number of consented private sewage treatment plants.

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

--- Surface water inputs from urban areas in the town of Hornsea immediately adjacent to the Mere - and likely to be a source of inputs from, e.g. cross connection / car washing activities.
Chlorophyll data

<table>
<thead>
<tr>
<th>Annual mean Chlorophyll (ug/l)</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>total number of Chlorophyll samples</td>
<td>29</td>
</tr>
<tr>
<td>WFD face value Chlorophyll class</td>
<td>High</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>2%</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
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>1.52</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Total number of samples/surveys</td>
<td>14</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>WFD face value class</td>
<td>Good</td>
<td>Moderate</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>3%</td>
<td>84%</td>
<td>100%</td>
</tr>
<tr>
<td>Date range of samples</td>
<td>2013 - 2013</td>
<td>2009 - 2011</td>
<td>2011 - 2013</td>
</tr>
<tr>
<td>Number of years when algal blooms were observed based on reactive monitoring 2010-2015:</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

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

To which biological element(s) does it relate?

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**Palaeolimnology**

| Change as Square Chord Distance | 0.89          |
| Change in Diatom community     | Significant Change |

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
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:

WFD overall ecological status :  Poor

Certainty of eutrophication problem based on overall weight of evidence:  Very certain eutrophication problem

Confidence in WFD status :  Very Certain

Current assessment of weight of evidence supporting designation in 2017

First national panel

Recommended action :  Existing designation - check needed

Comments from first panel:

Existing designation - N remains >1 mg/l and there is evidence of ecological impact for eutrophication. Recommend continued designation.

Second national panel

Comments from second national panel :

Recommend check sampling site location, panel member thought possibly influenced by discharge [subsequently checked, influence considered unlikely]. Natural England report received after initial assessment suggests there are still significant catchment sources of N, adding to the evidence base (APEM (2015) Hornsea Mere catchment water quality report and nutrient source apportionment. Report to Natural England). Panel support continued designation.

Recommendation:  Continued designation

Local summary and recommendation:

Our WFD investigations suggest Agriculture currently has a minimal impact on Hornsea mere, certainly when comparing it to the issues we have with septic tanks etc. But removing the NVZ could only put pressure on the lake which is already has a Poor status under WFD, and therefore the conclusion that we retain the NVZ is the correct one.

NVZ Name:  Hornsea Mere
NVZ ID:  EL113
Lake Description:
Hornsea is the largest natural fresh water lake in Yorkshire and a sluice at the outlet to the Mere controls its level. It is high alkalinity, very shallow and well mixed. It is an SSSI designated habitat - broadleaved mixed and yew woodland / lowland, Fen, marsh and lowland swamp. It is an internationally important site (SPA) for a migratory population of Gadwall.

Why the lake should be designated as a Polluted Water (eutrophic):
Hornsea Mere is an existing eutrophic waters NVZ designation, nitrogen concentrations are at the upper end of the 1-2 mg/l threshold range high and biological elements are impacted by eutrophication. Although agriculture may not be the principal source of nitrogen but it is still significant and continued designation is proposed.

Nitrogen:
75th percentile TON and mean annual TN both have concentrations of 2mg/l. This represents a slight increase over the concentrations at the last review. TON concentration declines to close to zero in most summers, indicating that nitrogen limitation of phytoplankton growth may occur.

Phosphorus:
The WFD classification for total phosphorus is Poor status.

Ecological response:
Both chlorophyll and phytoplankton are at Good or better status for WFD but plants are at Moderate status and diatoms are at Poor status. Thus there is evidence for eutrophic impact on some of the biological elements.

Supplementary evidence:

NVZ Name: Hornsea Mere
NVZ ID: EL113
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Then call us on
03708 506 506 (Monday to Friday, 8am to 6pm)

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enquiries@environment-agency.gov.uk

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