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

Publication Date: June 2016

NVZ Name: Blagdon Lake
NVZ ID: EL112
Evidence of eutrophication 2017

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).

NVZ Name: Blagdon Lake
NVZ ID: EL112
Section 1. Lake and catchment characteristics

WB ID: 43135  2013 NVZ status: Designate

Lake attributes

<table>
<thead>
<tr>
<th>EA Area</th>
<th>Wessex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake grid co-ordinates (Easting/Northing)</td>
<td>351550 / 159651</td>
</tr>
<tr>
<td>Lake waterbody area (ha)</td>
<td>164.6</td>
</tr>
<tr>
<td>WFD Lake Typology</td>
<td>High alkalinity, shallow, large, lowland</td>
</tr>
<tr>
<td>Lake Alkalinity (ueq/L)</td>
<td>3575</td>
</tr>
<tr>
<td>Mean lake depth (m)</td>
<td>4.8</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>Yes</td>
</tr>
</tbody>
</table>

Natural or artificial lake:
Natural --- Blagdon Lake was formed as a result of impounding the Congresbury Yeo. It is fed by the River Yeo, Rickford and Langford Springs and other small streams (in particular Butcombe Stream) and springs within the topographical catchment. Blagdon Lake does not receive water pumped from elsewhere (except in the most unusual of circumstances in response to an emergency condition). Licence No 16/52/014/S/01 3 Sources of Supply and points of abstraction - River (Congresbury) Yeo at Blagdon Impounding Reservoir - ST 504 600 - Upper Langford Stream - ST 466 593 - Rickford Stream - ST 486 593

Type of artificial lake:

n/a

Lake perimeter (% artificial)

<20% (some of the bank adjacent to the dam has stone revetment around the top water mark but this does not extend very far down – very small 5 of bank length (<2% is a guess). Dam at both reservoirs is stone clad. Blagdon dam was built of puddled clay with a central concrete core and faced with granite on the lake side. At Chew the main dam was initially stabilised by injecting concrete into the cracks in the bedrock. The core of the dam was made of puddled clay mixed with sand.)

Significant changes in lake level due to seasonal drawdown:

n/k --- Although this is a natural lake, there is drawdown on this lake that we feel could impact the macrophyte community/classification.

Pumped storage or other reservoir:

n/a --- Pumping does occur but only in rare emergencies.

Information on abstraction (if available)

Sources of Supply and points of abstraction - River (Congresbury) Yeo at Blagdon Impounding Reservoir - ST 504 600- Upper Langford Stream - ST 466 593- Rickford Stream - ST 486 593.

NVZ Name: Blagdon Lake
NVZ ID: EL112
Lake catchment attributes

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake catchment area (ha)</td>
<td>3060</td>
</tr>
<tr>
<td>If pumped, pumped catchment area (ha)</td>
<td>3060</td>
</tr>
</tbody>
</table>

Hydrological character
Primarily surface water --- some spring fed

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?
--- The catchment now reflects the DrWPA SGZ map boundary

Is the map representative of the artificial catchment?

n/a
Water Supply:
Controlled water (Section 104 of Water Resources Act):
Yes

Public Water Supply:
Yes

Drinking Water Protected Area:
Yes

UWWTD designation
No

Used for hydropower or flow regulation:
n/a

Recreational use:
Accessiblity to public:
Easily accessible, many visits --- There is a footpath around approx half of the lake. Bath, Bristol and Weston Supermare are in the local area. Open days Sundays only April - August for visitors walking trials, exhibitions etc Permit holders at other times in the summer

Recreational fishing:
Significant benefit --- The lake is well known for trout fishing from its banks and the fleet of 18 rowing boats for hire and fishing lodge. The suction tanks which originally supplied water to the steam boilers are now used as rearing pools for the fish before they are transferred into the lake. On average 50,000 trout are reared at Blagdon each year by Bristol Water to stock this and surrounding lakes such as Chew Valley Lake and the Barrow Tanks. Permit holders only

Contact watersports
Little activity --- 18 rowing boats for hire for angling.

Nature of watersports (if applicable):
---

Other public benefit visits:
Moderate benefit- Blagdon pumping station and visitor centre includes science and environment exhibits and hands-on displays. World famous trout fishing and bird hides available. The trail is only accessible on open days or for tours or short visits.

Conservation status:

Conservation value of lake:
National

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

SPA or SAC for aquatic interest features
---

SSSI or local conservation designation:
SSSI --- Blagdon Lake is designated a Site of Special Scientific Interest (SSSI) of 212.7 hectares, notified in 1971.[4] largely because of the variety of species and habitats. NE report the SSSI is in Favourable condition (2011)
Description of Aquatic interest features:

--- This site consists of a large freshwater reservoir with peripheral areas of reedbed, carr, woodland and natural grassland. Blagdon Lake has an average depth of only 5m, reaching 13m at its deepest point. The moderately nutrient-rich and alkaline waters stratify during the summer, but have not been known to develop dense algal blooms. The Lake floor has a diverse invertebrate fauna characteristic of well oxygenated conditions, with snails and water beetles particularly well represented. Of special interest is the local dragonfly, the Ruddy Darter Sympetrum sanguineum. Blagdon Lake supports large numbers of wintering waterfowl. There are nationally important populations of Teal Anas crecca (up to 2,000). Aquatic plants of particular interest include Flowering rush Butomus umbellatus, and Shoreweed Littorella uniflora.

NVZ Name: Blagdon Lake
NVZ ID: EL112
Section III - Causes - Nutrients

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>0.3</td>
</tr>
<tr>
<td>Total number of summer TON samples</td>
<td>20</td>
</tr>
<tr>
<td>75th percentile annual TON (mg/l)</td>
<td>1.3</td>
</tr>
<tr>
<td>Total number of TON samples</td>
<td>40</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>2011 - 2014</td>
</tr>
</tbody>
</table>

**TON monitoring data**

NVZ Name: Blagdon Lake
NVZ ID: EL112
Total nitrogen (TN) data

<table>
<thead>
<tr>
<th>Mean annual TN (mg/l)</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of TN samples</td>
<td>40</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>2011 - 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?

Strengthens --- SGZ action plan dated Oct 2013, TON concentrations (Bristol Water's data) follow a seasonal pattern with increased levels from autumn through to spring.
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 --- 2011 Comment: EA-32 samples for phosphorus since 2009, Mean value from 2009 onwards is 0.12 mg/l. Bristol Water has been monitoring nutrient TP routinely since 2000. 2015 Comment: SGZ action plan dated Oct 2013, Bristol Water's monitoring data for orthophosphate and total phosphorus show a seasonal pattern, generally peaking in summer. Bristol Water started monitoring for TP in 2013. This data shows very high levels of phosphate. The most up to date information from Bristol water shows that the two holt streams are above double the boundary. The 2009-2011 data shows that historically the river Yeo was also more than double the G/M hence a yes to high inflow P. Historic reports suggests that there may be concentrations of <4 mg/l in the bottom layer.
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>58313</td>
<td>4.5</td>
</tr>
<tr>
<td>From agricultural sources minus atmospheric deposition</td>
<td>50480</td>
<td>5</td>
</tr>
<tr>
<td>From urban sources</td>
<td>759</td>
<td>0.1</td>
</tr>
<tr>
<td>From all sources</td>
<td>66905</td>
<td>6.6</td>
</tr>
<tr>
<td>From all sources (minus atmospheric deposition)</td>
<td>59072</td>
<td>5.8</td>
</tr>
<tr>
<td>Ranking based on nitrogen loading from agricultural sources</td>
<td></td>
<td>66</td>
</tr>
</tbody>
</table>

Local assessment 2015

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

Principal source --- Upstream land is mostly agricultural, Butcome stw emits 30m3/d into lake so it's influence is relatively small.

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

Minor source --- Ubley sewage works is located next to the lake, but the treated effluent discharge enters the River Yeo downstream of the lake and only discharges into the lake during high flows. There is a AMP investigation to assess the impact of Ubley STW which may be discharging to the lake frequently rather than just during highflows (see AMP scope for more information). There is, however a storm discharge into the lake. Butcombe and Blagdon STW in the vicinity of the lake.

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

--- Bristol Water Trout hatchery at Ubley
Chlorophyll data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mean Chlorophyll (ug/l)</td>
<td>12</td>
</tr>
<tr>
<td>total number of Chlorophyll samples</td>
<td>40</td>
</tr>
<tr>
<td>WFD face value Chlorophyll class</td>
<td>Moderate</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>82%</td>
</tr>
<tr>
<td>Chlorophyll Good/Moderate boundary value</td>
<td>10</td>
</tr>
<tr>
<td>Date range of Chlorophyll samples</td>
<td>2011-2014</td>
</tr>
</tbody>
</table>

Chlorophyll monitoring data

NVZ Name: Blagdon Lake
NVZ ID: EL112
Other responses

<table>
<thead>
<tr>
<th>EQR</th>
<th>Phytoplankton (Pluto EQR)</th>
<th>Macrophytes (EQR)</th>
<th>Diatoms (EQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.28</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Total number of samples/surveys</td>
<td>31</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>WFD face value class</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>100%</td>
<td>64%</td>
<td>100%</td>
</tr>
<tr>
<td>Date range of samples</td>
<td>2011 - 2013</td>
<td>2010 - 2013</td>
<td>2013 - 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)

Strengthens evidence --- Bristol Water’s raw water monitoring data for Blagdon Lake show that algal blooms are putting Blagdon Lake at risk of failing the objective of Article 7.3 of the Water Framework Directive. The frequency and scale of blue-green algal blooms have increased since 2006. Large blue-green algal blooms, >20,000 cells/ml, occurred in every year from 2006 to 2014. There were no large blue-green algal blooms for the period 2000-2005. Large blooms occurred in all years from 2006 to 2014, with 11 incidences of blooms >20,000 cells/ml in 2014. When this happened Bristol Water had to post warning signs at the Lake and inform the relevant authorities. Bristol Water’s monitoring data also indicate that Total algal cell counts have increased since 2006. 2015 WFD classification data shows macrophytes/phytobenthos combined is at poor status (very certain), phytoplankton blooms are at moderate status (very certain) and total phosphorous is at poor (very certain). 2014 weight of evidence data shows Blagdon lake as very certain eutrophic - Bristol Water evidence for DrWPA also supports very certain eutrophic.

To which biological element(s) does it relate?

More than one (describe) ---

**Palaeolimnology**

| Change as Square Chord Distance | No data |
| Change in Diatom community | No data |

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

Not affected or likely to be

**Strength of evidence (local judgement)**

---

Local judgement on the evidence of eutrophic disturbance

Y, definitely --- Bristol Water monitoring as outlined above. During recent years, eutrophication and stratification of the Company's impounding reservoirs has increased and counter measures have been taken to combat the problem. BW issues Blue green reports on its web site http://www.bristolwater.co.uk/news/mainNews.asp?newsID=854 http://www.bristolwater.co.uk/news/mainNews.asp?newsID=889  Bristol Water installed a syphon draw-off arrangement 1973 to enable better quality water to be drawn off from a total of five inlets, which enabled a choice to be made to give access to the best quality water. In addition, to combat stratification, a single Helixor unit has been installed which enables compressed air to be released through a perforated pipe laid in the deep water in front of the dam.
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

Certainty 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:
Agreed with provisional decision to continue designation

Recommendation: Continued designation

Local summary and recommendation:
The evidence base is strong for designation of Blagdon Lake with considerable evidence of eutrophic disturbance and recent Bristol Water data continues to support this view.
**Final summary (2017)**

**2017 Recommendation:** Continued designation

**2013 Decision:** Designate

**2008 Decision:** Precautionary designation

**Lake Description:**
This site consists of a large freshwater, managed reservoir that also functions as a natural lake. It is high alkalinity, shallow and is likely to experience summer stratification. The reservoir has peripheral areas of reed bed, carr, woodland and natural grassland. The moderately nutrient-rich and alkaline waters stratify during the summer. It is an SSSI. Natural England report the SSSI as in favourable condition.

**Why the lake should be designated as a Polluted Water (eutrophic):**
Much of the catchment is within an existing eutrophic NVZ but for this review EA local experts recommended that the NVZ area should include water draining from the west, consequently the proposed NVZ area has been extended to match the drinking water Safeguard Zone. While there has been a reduction in nitrogen concentrations in this lake since the previous review, it is not yet improved enough to consider removing the designation, continued designation is therefore proposed.

**Nitrogen:**
TN and TON concentrations are between 1 and 2 mg/l. 75th percentile TON has fallen from 2mg/l at the last review to 1.3 mg/l, and annual mean TN concentration is 1.2 mg/l, down from 1.8 mg/l previously.

**Phosphorus:**
The WFD total phosphorus classification is Moderate status.

**Ecological response:**
WFD class for chlorophyll is Moderate (compared to Poor status at the last review). Diatoms are unchanged at Poor status and the macrophyte class is Moderate. There is therefore continued evidence of eutrophic impact on the ecology.

**Supplementary evidence:**
Bristol Water recorded algal blooms in every year between 2006 and 2014.

---

**NVZ Name:** Blagdon Lake

**NVZ ID:** EL112
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