



Llyn Bran Water Framework Directive (WFD) Assessment

Report for Dwr Cymru Welsh Water

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Cover photo:

Watercourse flowing from Llyn Bran Reservoir, 4 February 2021.

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Contents

1	Introduction.....	1
1.1	Background information.....	1
1.2	WFD assessment objectives	1
2	WFD assessment.....	3
2.1	Scheme description	3
2.2	Watercourse baseline description	5
2.2.1	Physical Environment.....	5
2.2.2	Aquatic Ecology.....	5
2.3	WFD waterbodies and RBMP2 status	5
2.4	Screening of activities.....	6
2.5	Scoping level assessment	7
2.6	WFD Regulations compliance summary	10
2.7	Recommendations.....	10

1 Introduction

1.1 Background information

This work forms part of the ongoing project to decommission Llyn Bran Reservoir. Section 4 of The Water Resources (Abstraction and Impounding) Regulations (amended) 2008 requires that an application for an abstraction licence or an impounding licence must include such information, including maps, and must be accompanied by such reports, as the relevant agency reasonably requires in order to determine it. This includes a Water Framework Directive (WFD) assessment to support the application.

Previously, a WFD assessment has been undertaken to determine the impact of the decommissioning of Llyn Bran Reservoir on the downstream watercourses. An impact assessment was conducted on WFD water body between the spillway of Llyn Bran Reservoir, along the Afon Bran and Afon Brenig, to the point the Afon Brenig enters Llyn Brenig (GB111067051780). The scoping assessment deemed that the changes in outflow could lead to beneficial to minor impacts on the elements screened into the assessment for this WFD water body. The impacts on the downstream lake water body, Llyn Brenig (GB31133923), were considered; however, this water body was screened out of the scoping assessment based on the impact of the decommissioning of Llyn Bran Reservoir on the identified receptors in this water body being negligible.

The objective of this assessment is to identify if the decommissioning of the Llyn Bran Reservoir, and any activities associated with it, will impact on any of the WFD receptors and lead to deterioration of WFD status of the Llyn Bran Reservoir waterbody (GB31133854).

Within this assessment, the following key tasks have been identified:

- Utilise existing assessments conducted on Llyn Bran Reservoir and open source data to establish the baseline conditions at Llyn Bran Reservoir.
- Risk assessment screening against WFD objectives using the data collected and expert judgement.

This report details sets out the baseline conditions of the watercourse and current WFD status, followed by a Source-Receptor-Pathway screening exercise and a WFD assessment of the screened in receptors.

1.2 WFD assessment objectives

A WFD scoping level assessment was undertaken for the decommissioning of Llyn Bran Reservoir. The 'UKWIR Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans'¹ guidance has been followed. The Guidance sets out the context of a WFD assessment and background to WFD ecological status.

Section 1.2 of the Guidance sets out three objectives to test for a WFD assessment:

- **Objective 1** - To prevent deterioration of any WFD element of any water body.
- **Objective 2** - To prevent the introduction of impediments to the attainment of 'Good' WFD status or potential for any water body. It is accepted that for some water bodies achievement of Good status or potential is currently technically infeasible or disproportionately costly. Where this is the case, the test is applied to the currently agreed objectives for that water body rather than against Good status/potential.

¹ Andrews, R., Ashmole, R., Fredenham, E., Mant, J.M., Pitcher, C., Sanders, J., Twigg, W., Wade, T.I. and Westbrook, M. (2021) Environmental Assessments for Water Resources Planning. UK Water Industry Research Ltd Report 21/WR/02/15.

- **Objective 3** - To ensure that the legally binding planned programme of measures in the [current] cycle of RBMPs to protect and enhance the status of water bodies are not compromised.

The WFD assessment for this scheme has been set out against these three objectives.

Confidence in the assessment has been assigned for impacts on biology. Consistent with other reported WFD approaches, a three-point confidence index has been used: very certain, quite certain and uncertain. Very certain reflects where a confirmed or probable biological change (or no change) would be affected by the scheme, supported by measured evidence or expert judgement of a strong cause-effect relationship. Quite certain reflects where a probable or suspected biological change (or no change) would be affected by the scheme, supported by limited measured evidence or expert judgement of a moderate cause-effect relationship. Uncertain reflects where a suspected biological change (or no change) would be affected by the scheme, supported by expert judgement of a weak or unknown cause-effect relationship.

2 WFD assessment

This section provides an overview of the current baseline conditions within Llyn Bran Reservoir, an understanding of the current WFD status of this water body followed by a screening and scoping level assessment for identifying potential WFD impacts due to the decommissioning of Llyn Bran reservoir.

2.1 Scheme description

Llyn Bran is an impoundment reservoir operated by DCWW and is located in Denbighshire, Wales, 11.2 km Southwest of the town of Denbigh. The current capacity of the reservoir is 257,000 m³ when full. The reservoir outflow is controlled by a large masonry weir, located on the dam face on the south side of the reservoir (see image on front cover), which provides flow to the Afon Bran, a tributary to the Afon Brenig.

Since Llyn Bran is no longer required to support DCWW's water supply and will require significant funding to meet UK dam safety and good practice standards in the near future², DCWW have begun commissioning work to investigate the decommissioning of Llyn Bran Reservoir with the projection to commence drawdown and discontinuance of Llyn Bran in early April 2022. The decommissioning of the reservoir would see the dam completely removed allowing Llyn Bran to be restored to its natural size, which is significantly smaller than its current extent, with an estimated top water surface area reduction of around 50%³. As a result of this, it is expected that much of the marginal habitat of Llyn Bran will be lost as the reservoir returns to its natural lake extent. The outflow from Llyn Bran (which constitutes the flow in the Afon Bran) will behave more naturally, responding to meteorological events affecting the upstream catchment (particularly in dry periods where the reservoir is usually drawn down below the crest of the weir).

A series of mitigation measures have been set out for the decommissioning of Llyn Bran Reservoir in an Environmental Report⁴. These mitigation measures include water quality and sedimentation mitigation along with the restoration of marginal and terrestrial habitat following the completion of the work. A first draft of the Environmental Report was submitted to NRW for review. The updated report will be submitted as part of the impoundment license application and the mitigation measures will become part of the license conditions.

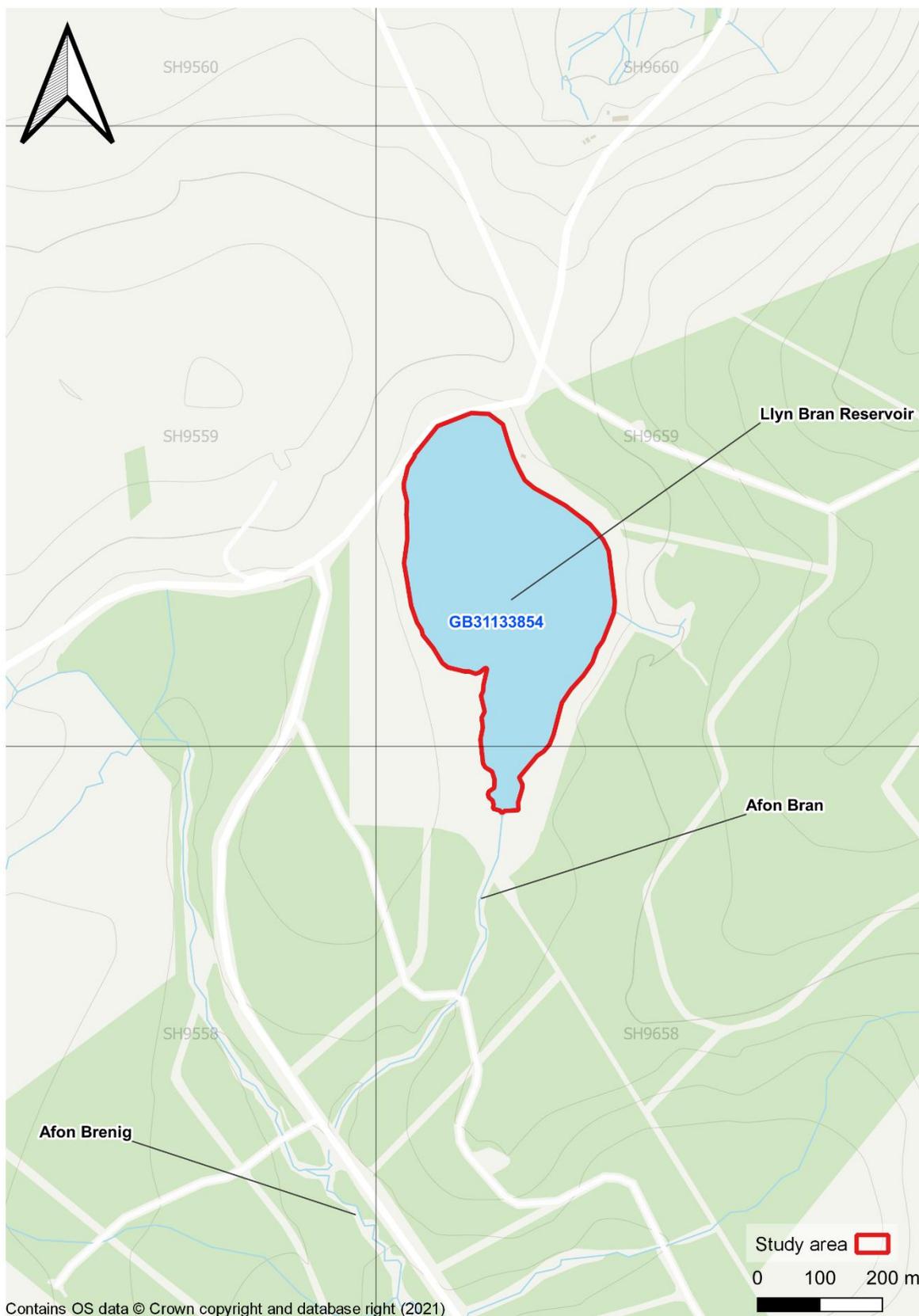
As mentioned previously, a WFD assessment has previously been undertaken for the watercourse between Llyn Bran Reservoir and Llyn Brenig Reservoir; therefore, the study area for this report is the Llyn Bran Reservoir alone. The study area is detailed on Figure 2-1.

² Stillwater Associates, (2020). Llyn Bran Reservoir: Assessment of Post-discontinuance Downstream Flood Risk to B4501 Road.

³ *ibid*

⁴ Ricardo, (2021). Llyn Bran Environmental Report Assessment of Potential Impacts and Proposed Mitigation Measures Associated with Single Drawdown Event. April 2021.

Figure 2-1 Llyn Bran Reservoir study area



2.2 Watercourse baseline description

This section provides a brief overview of the physical environment features and aquatic ecology of Llyn Bran Reservoir. This will describe the baseline conditions which the WFD assessment has been conducted against.

2.2.1 Physical Environment

Llyn Bran Reservoir is located in an upland moorland setting and drains a catchment area of 0.69 km². The bedrock geology beneath the reservoir is comprised of the Nantglyn Flags Formation (mudstone and siltstone) and the Upper Mottled Mudstone Member (mudstone). Surrounding the reservoir are superficial deposits of Devensian tills and peat to the west. There are no superficial deposits to the East. The soft bed sediment of the reservoir is dominantly comprised of sand and silt with the hard bed being comprised of predominantly peat in the southern area of the reservoir and clay or silt in the northern area of the reservoir. The reservoir margins are dominated by coarse pebbles⁵. The reservoir has a top water level of 434.43 m AOD and reaches depths of up to 11.2 m⁶ towards its centre.

The water body is classed as a shallow, low alkalinity lake with no risk of eutrophication⁷. In 2019, water quality CSMG water quality targets were met for dissolved oxygen, pH, nitrogen and total phosphorus despite not meeting the target for total phosphorus in 2018⁸.

2.2.2 Aquatic Ecology

During the completion of the Llyn Bran Environmental and Ecology Baseline Report⁹ eDNA samples were collected from Llyn Bran in order to characterise the fish community of the reservoir. The results showed the presence of two fish species namely perch (*Perca fluviatilis*) and pike (*Esox lucius*), with perch making up 95.33% of the DNA sequence output and pike made up the remaining 4.67%. No protected or notable fish species were identified in the reservoir.

2.3 WFD waterbodies and RBMP2 status

This assessment focusses on the Llyn Bran lake waterbody (*GB31133854*) alone. Table 2-1 identifies specific details about this water body and lists the current status based on the Natural Resources Wales WFD RBMP2 2015 classification. Criteria are colour coded based on their potential impacts on agreed measures and objectives which are undertaken later in the report. The key for this colour coding is provided below the table.

Table 2-1 WFD RBMP2 waterbodies within the study area

WFD waterbody name		Llyn Bran
WFD waterbody type		Lake
WFD waterbody ID		GB31133854
RBMP2 Overall Status		Moderate
Hydromorphological designation		Heavily Modified Waterbody
Mitigation Measures Assessment		Moderate
RBMP2 mitigation measures		None
WFD Protected Areas		Drinking water protected area
Biological status elements	Benthic macroinvertebrates	Not assessed
	Macrophytes	Not assessed
	Phytobenthos	Not assessed
	Phytoplankton	Good
	Littoral macroinvertebrates	Not assessed

⁵ Ricardo, 2020. Llyn Bran Environmental and Ecology Baseline Report. Report for Dŵr Cymru Welsh Water. ED12621100-Issue Number 1

⁶ Stillwater associates limited, 2018. Llyn Gelli Gain & Llyn Bran Reservoirs Discontinuance Feasibility Assessment Report

⁷ NRW, 2016. Evidence Review of Lake Eutrophication in Wales, NRW Evidence Reports, January 2016

⁸ Ricardo, 2020. Llyn Bran Environmental and Ecology Baseline Report. Report for Dŵr Cymru Welsh Water. ED12621100-Issue Number 1

⁹ *ibid*

WFD waterbody name		Llyn Bran
Physico-chemical water quality status elements	Acid Neutralising Capacity	Not assessed
	Ammonia (Phys-Chem)	Not assessed
	Dissolved oxygen	Not assessed
	Total phosphorus	Good
	Salinity	Not assessed
	Specific pollutants	n/a
	Chemical (Overall)	Good

Key to Table 2-1:

Review for risk of status deterioration only (Objective 1)
Review for risk of in class deterioration only (Objective 1)
Review for risk of status deterioration (Objective 1) and for risk of impediment to improvement in status to target (Objective 2)
Review for risk of in class deterioration (Objective 1) and for risk of impediment to improvement in status to target (Objective 2)
Review for risk of compromising RBMP2 agreed measures (Objective 3)

2.4 Screening of activities

Table 2-2 presents a Source-Pathway-Receptor approach to screening the potential impacts on the WFD water body with respect to the Llyn Bran decommissioning. Those receptors screened in will be passed forward onto the scoping level assessment stage.

Table 2-2 Source-Pathway-Receptor approach to screening elements for WFD compliance assessment of the Llyn Bran decommissioning on the downstream watercourse

WFD water body	Llyn Brenig
Source	<ul style="list-style-type: none"> Complete removal of Llyn Bran Reservoir dam wall.
Pathways	<ul style="list-style-type: none"> Reduction in water volume within Llyn Bran. Steeper lake margins will lead to a greater variability in depth and a lower variability in marginal habitat. Loss of marginal habitat. Reduction in buffering capacity of the lake against any water quality pressures.
Receptors screened in	<ul style="list-style-type: none"> Benthic macroinvertebrates Macrophytes Phytobenthos Phytoplankton. Littoral macroinvertebrates. Acid Neutralising Capacity. Ammonia (Phys-Chem). Dissolved oxygen. Total phosphorus. Salinity. Chemical status elements. Drinking water protected area.
Receptors screened out	<ul style="list-style-type: none"> None

The complete removal of the dam at Llyn Bran Reservoir is expected to lead to significant changes to the Llyn Bran WFD water body. It is expected that much of the shallow areas around the periphery of the water body would become exposed and uninhabitable for the current aquatic ecology. There is not expected to be a change in the inflow and outflow regime of Llyn Bran since the current regime is controlled by the inflow to the lake (with no compensation flow and no abstraction from the lake) which will remain the same post decommissioning. Despite this, it is expected that the new lake will have steeper margins than the current lake; therefore, there will be a greater variability in changes in water depth and a lower variability in area of marginal habitat exposure. Further, a reduction in the lake volume has the potential to reduce the buffering capacity of the lake against any water quality pressures.

As a result of the significant changes resulting from the decommissioning of the reservoir and the complete removal of the dam, all of the receptors for this water body have been screened into a scoping level assessment.

2.5 Scoping level assessment

An assessment of the impact of the receptors screened in for the *Llyn Bran* waterbody is provided in **Table 2-3**.

Table 2-3 Presentation of impacts of the Llyn Bran decommissioning on WFD lake water body GB31133854 (Llyn Bran). A confidence rating is assigned to each impact for each biological element.

Scheme Component	Potential impact on			WFD objective compliance		
	Biology	Water quality	Hydro-morphology	1	2	3
Complete removal of Llyn Bran Reservoir dam wall	<ul style="list-style-type: none"> Benthic macroinvertebrates- potential for minor impacts on the benthic macroinvertebrate community with the reduction in habitat area. There are not expected to be major changes to the benthic habitat; therefore, this impact is only expected to be minor and short term – Quite Certain Macrophytes- Major, immediate, short term, reversible, adverse impacts on the marginal macrophyte community due to the current marginal habitat becoming dry. There is some uncertainty over the resilience of the existing macrophyte community to changes in marginal habitat. With the mitigation measures proposed in the Environmental Report¹⁰, it is expected that the macrophyte community would become re-established after a number of seasons; therefore, deterioration in macrophyte status is not expected to occur over a RBMP period.- Quite Certain Phytobenthos- There are expected to be negligible/minor changes to the phytobenthos community in Llyn Bran. There is not expected to be a change in nutrients within Llyn Bran as a result of the removal of the dam. Littoral macroinvertebrates – Major, immediate, short term, reversible, adverse impacts on the littoral macroinvertebrate community with the current marginal habitat becoming dry. With the drawdown expected to occur in the spiring it is likely that the majority of the littoral macroinvertebrate larvae will not be able to migrate away from the marginal areas that will become dry, leading to a major impact on the community. There is some uncertainty over the resilience of the existing littoral macroinvertebrate community to changes in the marginal habitat. With the mitigation measures proposed in the Environmental Report¹¹, it is expected that the littoral macroinvertebrate community would become re-established after a number of seasons; therefore, deterioration in littoral 	<ul style="list-style-type: none"> Chemical status elements – This scheme will not result in any additional water quality pressures which would affect chemical status. There may be some limited potential for minor impacts to water quality due to a change in buffering capacity of the lake. There is the potential for impacts to the physicochemical supporting element status in Llyn Bran with a reduction in buffering capacity. This is particularly concerning for total phosphorus as this as listed as a concern in the RNAG assessment (even though total phosphorus is already prescribed as good status). There is uncertainty over the source of this pressure. Drinking Water Protected Areas – The removal of the Llyn Bran Reservoir dam will not lead to any discharges into the water environment. There is not expected to be any construction associated with this scheme so there is no risk of pollution to the water environment through sources such as concrete. As a result, this scheme is expected to have a negligible impact on the Drinking Water Protected Area as it will not led to greater water treatment requirements. 	<ul style="list-style-type: none"> Significant reduction in lake volume with much of the areas that are currently shallow marginal areas becoming dry. Change in bathymetry of the lake with margins likely to become steeper. This will lead to greater variability of the level within Llyn Bran and will reduce the spatial variability in marginal lake habitat. 	Y	Y	N/A

¹⁰ Ricardo, (2021). Llyn Bran Environmental Report Assessment of Potential Impacts and Proposed Mitigation Measures Associated with Single Drawdown Event. April 2021.

¹¹ *ibid*

Scheme Component	Potential impact on			WFD objective compliance		
	Biology	Water quality	Hydro-morphology	1	2	3
	<p>macroinvertebrate status is not expected to occur over a RBMP period.- Quite certain</p> <ul style="list-style-type: none"> • Potential minor impacts on the littoral macroinvertebrate community due to the reduction in marginal habitat area of the lake. This is likely to lead to a reduction in population of invertebrates, not necessarily a change in invertebrate diversity. • Potential minor impacts to the littoral macroinvertebrates caused by changes to physicochemical water quality elements and chemical water quality elements due to changes to the buffering capacity of Llyn Bran. Uncertain • Phytoplankton – This scheme is likely to lead to negligible impacts on the phytoplankton community. Impacts of the total phosphorus pressure are unlikely to lead to deterioration in this element as Llyn Bran is listed as a lake considered to be at no risk of eutrophication¹² and is classed as a shallow, low alkalinity lake. Certain 					

¹² NRW, 2016. Evidence Review of Lake Eutrophication in Wales, NRW Evidence Reports, January 2016

2.6 WFD Regulations compliance summary

Through the screening of activities (**Section 2.4**) and scoping level assessment (**Section 2.5**) the compliance of the discontinuance of Llyn Bran as a storage reservoir and the removal of the dam has been assessed against the three WFD objectives set out in **Section 1.2**. This assessment has focussed exclusively on the impacts on the Llyn Bran WFD water body (GB31133854).

A source-pathway-receptor approach identified that all of the receptors in this water body required a scoping level assessment. The scoping level assessment then identified that there would be immediate, short term, reversible, adverse impacts on the littoral macroinvertebrate community and macrophyte community as a result of the loss of marginal lake habitat associated with the removal of the Llyn Bran Reservoir dam. A confidence rating of *quite certain* has been assigned to this impact with the only uncertainty being a lack of evidence around the resilience of the communities to changes in marginal habitat. The mitigation measures set out in the Environmental Report¹³ are expected to be sufficient to allow the littoral macroinvertebrate and macrophyte communities to become re-established in Llyn Bran; therefore, any deterioration or impediments to good status would only be short term, reversible and not span across an RBMP cycle during this recolonisation phase. As a result, it is likely that this scheme would be compliant with the WFD objectives.

2.7 Recommendations

This section sets out a number of recommendations to DCWW in relation to the decommissioning of Llyn Bran Reservoir and the WFD:

- DCWW may consider having Llyn Bran delisted as a WFD water body. For a lake to be obligatory required to be listed as a WFD water body it must have a top water surface area of greater than 50ha¹⁴, much greater than the current top water surface area of Llyn Bran (12.35ha). Once fully decommissioned the top water surface area is expected to be reduced to roughly 6.15ha. The classification for Llyn Bran as a WFD water body is driven by the requirements of the Drinking Water Protected Area which will likely no longer be a significant driver with Llyn Bran not being used for supply and Llyn Brenig being a regulation reservoir (rather than a direct supply reservoir). As a result, with agreement from NRW, it is possible for Llyn Bran to be delisted as a WFD water body.

¹³ Ricardo, (2021). Llyn Bran Environmental Report Assessment of Potential Impacts and Proposed Mitigation Measures Associated with Single Drawdown Event. April 2021.

¹⁴ UKTAG, (2003) UK TAG Work Programme Task 3a (02) Identification of small surface water bodies. July, 2003.