

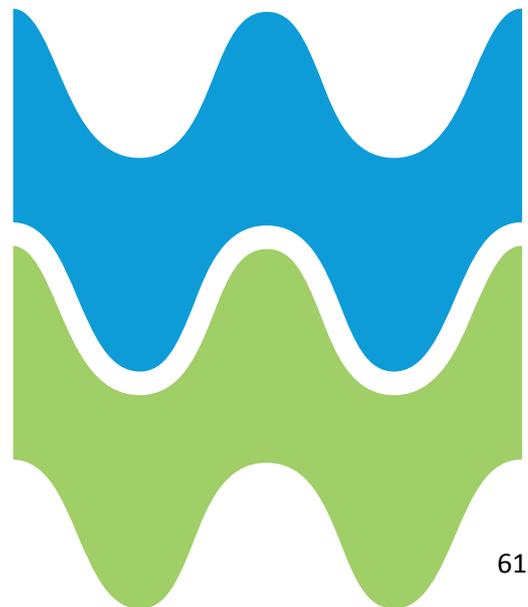
Draft

Drought Plan 2020:

Annex 1g – Barmouth

WRZ

March 2019



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# 1. Barmouth – WRZ Reference no. 8033

## 1.1. Barmouth Water Resources Overview

The Barmouth Water Resource Zone covers the coastal region from Harlech to Barmouth (see Figure 1).



Figure 1 - Map of the Barmouth WRZ

The water resources within the zone consist of one impounding reservoir, Llyn Bodlyn (see Table 1).

Site Name	Licence No.	Source Type	Status
Bodlyn	23/64/15/0009	Impounding Reservoir	Operational

Table 1 - Licensed sources in the Barmouth WRZ

Water from Llyn Bodlyn is treated at Eithinfynydd water treatment works (WTW). Peak demands (caused primarily by tourism) can approach the maximum amount we are able to treat at Eithinfynydd. When this happens we can transfer treated water southwards from the Cilfor and/or Rhiw Goch works, in the Llyn Harlech zone, to help meet the demand or to preserve stocks in Bodlyn. Water can also be transferred north from Barmouth to Llyn Harlech to allow Rhiwgoch works to be mothballed during the winter which reduces our operating costs.

## 1.2.Drought Triggers

The drought status of the zone is assessed by the reservoir storage position at any time in relation to the Drought Action Zones (DAZs), defined for Llyn Bodlyn, as shown in Figure 2. The use of the DAZs are described in more detail in Chapter 2 of the main report.

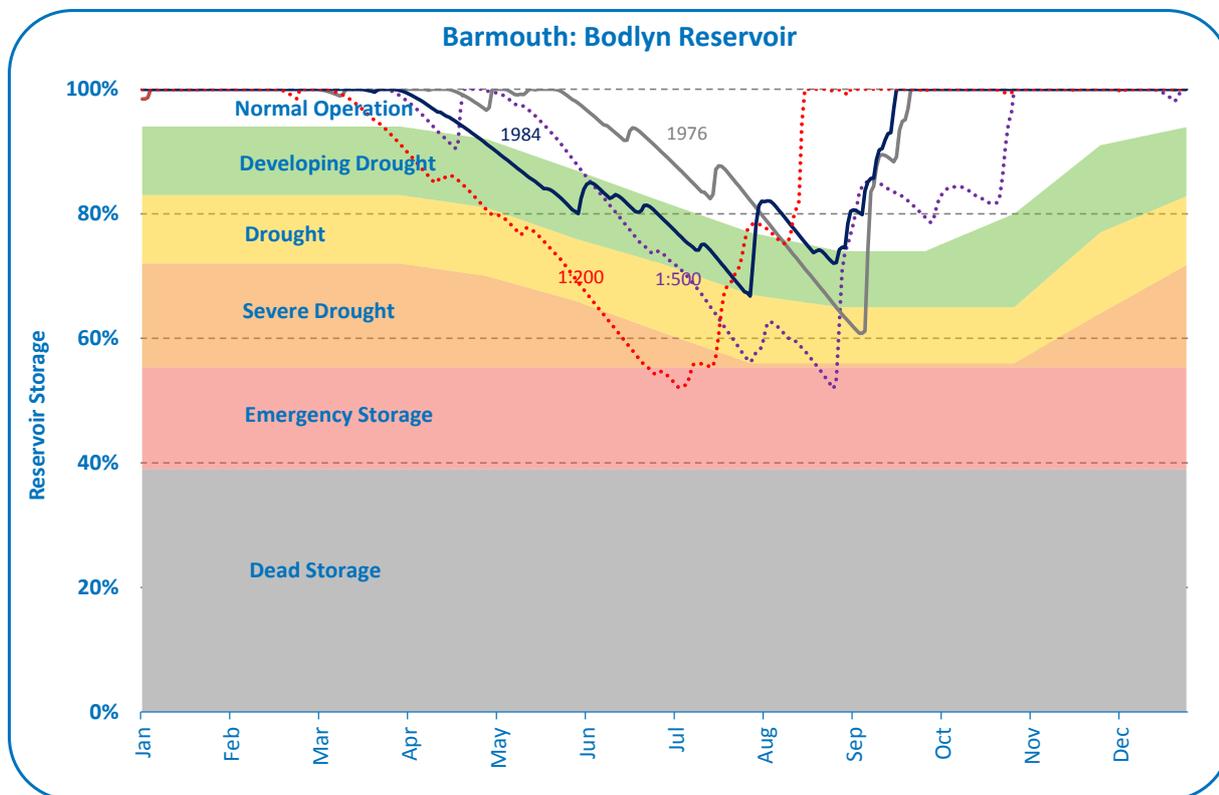


Figure 2 - Llyn Bodlyn Reservoir Drought Action Zones showing the results of scenario testing, without the link to the Lleyl Harlech zone

## 1.3.Assessment of Drought Risk

Using a stochastically generated time series, we've looked at the performance of Llyn Bodlyn against more severe drought events than we've seen in our historic record. Figure 2 shows a sample of results from the drought library scenario testing together with output from our baseline scenario testing. Prior to the 2018 drought although the infrastructure was in place to transfer water between the Eithinfynydd and Rhiw Goch zones it had only ever been tested and used to allow Rhiw Goch WTW to be mothballed during the winter (i.e. moving the water northwards). We had never used it to move water to the south and support the Barmouth zone. The dry weather from mid-May through to mid-July 2018 caused storage in Llyn Bodlyn to cross into the developing drought action zone, with a forecast to fall much lower if the dry weather continued. To prevent any risks to customer supplies, water was transferred from Rhiw Goch into the Barmouth zone and a temporary connection was installed that allowed water to be brought down from the Cilfor water treatment works in the Lleyl Harlech zone.

Figure 2 shows that without these connections in place, there was a risk in the zone of needing to implement extreme supply side measures such as widespread pressure management and local water

rationing during a drought event less severe than a 1:200. This is lower than our target level and so in AMP 7 we will make these connections permanent and available for use every year to ensure a high level of drought resilience for our customers.

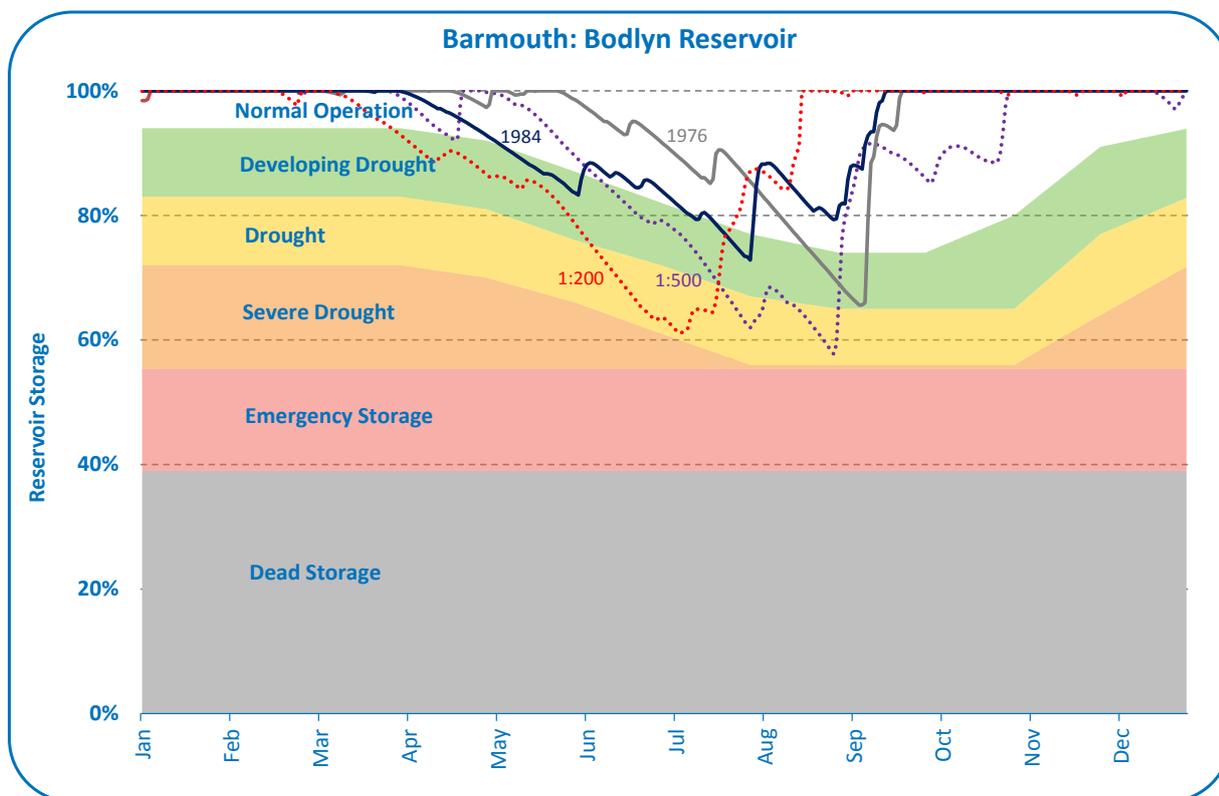


Figure 3 - Llyn Bodlyn Reservoir Drought Action Zones showing the results of scenario testing with the link to the Llyn Harlech zone

Figure 3 shows that with the support in place from the Llyn Harlech zone, the zone is resilient to historic events such as 1976 and 1984, and we’re unlikely to need a hosepipe ban to preserve resource. The testing also shows that at Llyn Bodlyn, even under more extreme events such as a 1:500 year return period drought (i.e. a drought that has a 0.2% chance of occurring in any year), it is unlikely that we will need to impose wide spread pressure management and local water rationing on our customers.

Overall, our scenario testing tells us that with permanent installation of the linkages to the Llyn Harlech zone, the risk of needing to implement extreme supply side measures is negligible but that during these more severe drought events, we need to ensure careful management of our water resources as reservoir storage will fall to levels we have not experienced before. Based on this information we have therefore chosen to retain one drought order option to provide additional support, should it ever be required. Section 1.5 provides details of this.

#### 1.4. Drought Management of the WRZ

As the identified drought risk in the zone is low then our water resource management philosophy is to ensure we operate our water resources in line with our control curves and take all necessary actions in good time, in order to maintain this high level of drought resilience.

The following sections describe the operation of the zone as we move into a drought period and the actions that we will take to ensure we minimise the impact on customers.

#### 1.4.1. Normal Action Zone

During normal weather conditions we abstract from Llyn Bodlyn and treat the water at our Eithinfynydd water treatment works to supply the Barmouth area. If we are concerned about meeting peak demands in the Barmouth zone we can transfer treated water from the Rhiw Goch WTW in Lleyr Harlech to help support the demands being placed on Eithinfynydd WW.

#### 1.4.2. Developing Drought Action Zone

As reservoir storages move into the developing drought action zone, we are more likely to have to carry out operations which are not usually undertaken and as a result increase the risk of impacting our customers. To authorise these activities, the 'Gold' command centre may convene.

If the Rhiw Goch transfer is not already in place we will bring this on line to protect stocks in Llyn Bodlyn. We have undertaken this action on a number of occasions and so with careful management we are confident that the changes being made to our networks will not impact upon customer water quality.

If the dry weather continues we have a second option available to us which is to bring additional water in to the zone from Cilfor water treatment works, which is also in the Lleyr Harlech zone. This is a less frequently taken action and so we would need to exercise more caution as we are making the required changes to our supply networks.

To supplement these changes we will increase our leakage efforts to minimise losses in the network.

#### 1.4.3. Drought Action Zone

Once all changes to our water supply systems have been made, the operation of the zone will be fully optimised with all actions taken that utilise our existing resources. Following the conclusion of NRW's Habitats Directive Review of Consents process, we have had to modify our abstraction licence at Llyn Eiddew Mawr (which feeds the Rhiw Goch WTW in the Lleyr Harlech zone) to restrict the extent and frequency of drawdowns. As storage in Llyn Eiddew Mawr reduces then we may need to reduce, or stop altogether, this transfer thus reducing the support available for Llyn Bodlyn. As reservoir storage enters the Drought Action Zone we will consider implementing temporary use bans (hosepipe bans) and start preparations to request our drought order. To support this request, we will commence environmental monitoring in line with our Environmental Assessment Report (Appendix 14) and submit our application for the option identified in Section 1.5.

#### 1.4.4. Severe Drought Action Zone

As reservoir storage enters the Severe Drought Action zone, subject to receiving the necessary permissions from NRW and Welsh Government, we will look to implement non-essential use bans and our Drought order scheme. As set out in Section 1.5, the option available to us is reducing the compensation flows at Bodlyn reservoir. This option will have the effect of preserving storage in our reservoir which will enable us to maintain customer supplies for longer.

## 1.5. Supply-side drought management action

Table 2 below provides the information required by Appendix G of NRW's Water Company Drought Plan Technical Guideline (Dec 2017). The table summarises the key information from within the associated Environmental Assessment Report (EAR) including any potential environmental impacts, risks to the scheme implementation and any necessary mitigation that may be required.

<b>Action Implementation Assessment</b>	<b>Name :</b>	<b>Reduce Bodlyn compensation flow by 50%</b>
	<b>Trigger(s)</b>	Storage in Bodlyn reservoir crosses into Severe Drought Action zone.
	<b>Deployable Output or yield of the action</b>	1 Ml/d
	<b>Location</b>	Whole WRZ
	<b>Implementation timetable</b>	<p><b>Preparation time:</b> We assume a decision from NRW within 14 days of submitting the Drought Order application. The practical implementation of the option could be effected immediately.</p> <p><b>Time of year effective:</b> The option is most likely to be implemented during late summer/early autumn.</p> <p><b>Duration:</b> Drought Order are valid for up to six months, but is most likely to be three months.</p>
	<b>Risks associated with action</b>	The application, as applied for, is not approved. Reduction in compensation releases have potential environmental impacts. These will be assessed through the EAR submitted with the application.
<b>Environmental Assessment: alone &amp; in-combination</b>	<b>Other considerations</b>	N/A
	<b>Risk to the Environment</b>	Reduced flow on the Afon Ysgethin
	<b>Summary of likely environmental impacts</b>	<p>The hydrological assessment has concluded that there are major-moderate impacts on river flows as a result of implementing the drought order. There are minor impacts on the physical environment of the river, including minor impacts for water quality.</p> <p>The environmental assessment has concluded that there are major to minor impacts on aquatic ecology specifically: major impacts on fish; moderate impacts on macroinvertebrates and macrophytes; and minor impacts on phytobenthos.</p>
	<b>Baseline information used</b>	<p>Continuous monitoring is undertaken by Welsh Water to monitor its operations at Llyn Bodlyn Reservoir, including:</p> <ul style="list-style-type: none"> <li>• Weekly Llyn Bodlyn water level data: 1982 to present (daily from 2001)</li> <li>• Daily Llyn Bodlyn compensation flow data: 1995 to present</li> <li>• Daily Llyn Bodlyn abstraction flows: 2005 to present.</li> </ul> <p>There is no continuous measurement of the Afon Ysgethin stream flow downstream of the Llyn Bodlyn Reservoir, and reservoir overflows, which occur when reservoir storage is at top water level, are not measured.</p>
	<b>Summary of additional monitoring requirements</b>	<ul style="list-style-type: none"> <li>• Spot flow gaugings</li> <li>• Biochemical water sampling</li> <li>• Fish surveys (including salmon, brown trout, lamprey, eel)</li> </ul>
	<b>Mitigation &amp; Compensation measures</b>	<p>The mitigation measures that could be considered at the on-set of drought, during implementation of the drought order and post-drought order implementation include:</p> <ul style="list-style-type: none"> <li>• Temporary reduction or cessation of the terms of the Drought Order</li> <li>• Fish distress monitoring with triggers and response plan</li> <li>• Protection of 'spate flows'</li> <li>• Reduction of fish predation</li> <li>• Physical in-river works</li> <li>• Provision of alternative compensation flows</li> <li>• Provision of alternative water supplies if other water users are at risk of derogation.</li> </ul>

		Potential mitigation measures have also been proposed and further discussion with NRW is required in order to develop suitable mitigation measures.
	<b>Impact on other activities</b>	A reduction in flows on the Afon Ysgethin has potential temporary and uncertain impact to visual amenity and recreation. Because flows would be naturally low at the time of the drought order, it is uncertain how significant further reduction in flows would be on the visual appeal of the rivers, local archaeological sites, and recreational activities in the area include angling, riding, cycling, walking and canoeing.
	<b>Any permissions or approvals required and constraints that apply</b>	N/A

*Table 2 - Option 8033-2 Reduce Bodlyn compensation flow*