



Boora Priority Area for Action

AFA0025

Deskstudy Report

14th December 2020

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2. Non-Technical Summary

The Boora Priority Area for Action (PAA) is located near Boora village Co. Offaly and consists of two waterbodies, the Boora_010 and the Pollagh Stream_010. Boora_020 is proposed to be included in the 3rd cycle of the RBMP and so is included within the report for completeness. The PAA was selected as it is important for tourism and from a research aspect as most of the PAA is on cutaway bog. Peat was harvested for fuel between the 1950s and 1970s from this area, the land is now being reclaimed for agricultural and eco-tourism use. The PAA contains the Lough Boora Parklands, which is used for eco-tourism (2000 hectares and has a network of off-road walking and cycle routes within a perimeter of approximately 20 kilometres, art exhibitions, and bird watching). There was a lake called Lough Boora (*Loch na Buaraí*), which was drained by Bord na Móna, but was not used for peat production: this area is now maintained as a nature reserve by the Irish Wildlife Trust. There are also a number of artificial angling lakes in the PAA. Boora is the Irish stronghold of the grey partridge. A conservation project funded by the National Parks and Wildlife Service has turned the fortunes of the species around from a critically low 22 to 932 birds. Other species seen regularly include hen harrier, common buzzard, cuckoo, merlin, green sandpiper and ruff. The water quality in these waterbodies are assessed, based on different factors such as ecology, chemistry and physiochemical sampling, a water quality status is applied. This is known as an ecological status. There are five water quality bands, High, Good, Moderate, Poor and Bad status. The aim under the Water Framework Directive is to get all waterbodies up to Good/ High status. The Boora_010 was assigned Moderate Ecological Status (2015-2018). The Boora_020 and Pollagh Stream_010 are at Good Ecological Status. The Pollagh Stream_010 improved from Moderate to Good status between 2015-2018. The WFD allows us to see what actions are needed to achieve 'good' status or to protect 'good' status where it already exists. We can restore rivers to 'good' status by using targeted actions and measures to reduce the impact of human activities.

The waterbodies overlay locally and regionally important aquifers, all limestones and the soils are predominantly peat, with small pockets of poorly draining soils. There are well draining soils present to the south of the PAA. The Boora_010 and Pollagh Stream_010 rise in poorly draining and peaty soils, just downstream from the well-draining area. Nitrate may leach from the well-draining land into the groundwater and discharge into the surface waters, while the main pathways for phosphorus, sediment and pesticides are overland flow, and along drains and ditches, where poorly draining soils exist.

Chemistry data is available for Boora_010 and the Pollagh Stream_010. The 2010-2019 data was reviewed and identified ammonia and BOD issues in both waterbodies. In 2019, the annual averages were below the mean EQS at the EPA monitoring point along the Pollagh Stream_010, however, these parameters remain an issue on the Boora_010. No chemistry data is available for the Boora_020.

The significant pressures in the Boora_010 were identified (from the WFD App) as extractive Industries, forestry and hydromorphology. The pressures within the Pollagh Stream_010 are extractive industries and forestry, however, they are not deemed significant by the EPA as the waterbody is now achieving Good status. No significant pressures were assigned to Boora_020 as this waterbody has been at Good status over the last number of sampling years.

Water quality will be assessed from the bridges firstly using Small Stream Impact Score (SSIS) and chemistry, this is to assist in narrowing down the areas requiring further assessment. SSIS is a biological assessment tool which assists in determining water quality based on the presence/absence of macroinvertebrates (aquatic insects). Where SSIS is not suitable and further information is necessary, chemical analysis will be undertaken. As the Pollagh Stream_010 and Boora_020 have good

water quality a full assessment may not need to be carried out, however, there will be spot sampling to ensure the water quality is maintained in these waterbodies.

Depending on the pressure identified, specific actions will be required to be implemented in order to improve the water quality. Hydromorphology was deemed a significant issue in the Boora_010, the historic and current maps were reviewed, waterbody straightening, drainage and the removal of a small lake were identified. These alterations to the natural river course may be damaging to the habitat and flow of the river. This will be verified during field assessment and the potential impact will be determined. Forestry was reviewed during the desk study and is deemed an unlikely pressure to date, clear felling may occur in the coming years and mitigations measures will need to be implemented to ensure the protection of water quality. Peat harvesting was the 3rd pressure along the Boora_010. Peat harvesting ceased on this section of bog in the 1990's and therefore is not deemed to be having a current impact, however historical changes to the waterbody from these activities may still be impacting water quality.

3. Background

3.1.PAA background information

The Boora Priority Area for Action consists of two waterbodies, Boora_010 and Pollagh Stream_010. Boora_020 is proposed to be included in the 3rd cycle of the RBMP and so is included here for completeness. These waterbodies, along with the Brosna_110 combine to form catchment 25A Lower Shannon and subcatchment 25A_2 BROSNA_SC_050. The subcatchment is 77.57km² in area and consists of 4 rivers. The Brosna_110 is proposed to be included in a new PAA in the 3rd Cycle – Brosna Lower.

The Midlands and Eastern catchment assessment workshops for the 2nd Cycle of the RBMP were held in Ballycoolin, Dublin from the 9th to 12th of May 2017. They were attended by representatives of local authority staff (operational staff on all days and both operational and senior staff on the final day of the workshop), Local Authority Waters and Communities Office (LAWCO) (now part of the Local Authority Waters Programme LAWPRO), Irish Water, Inland Fisheries Ireland, Forest Service, Coillte, National Parks and Wildlife Service, Teagasc, Department of Housing Planning and Local Government, Geological Survey Ireland, National Federation of Group Water Schemes, Department of Agriculture, Food and the Marine, Bord na Mona, Waterways Ireland and the Environmental Protection Agency. The workshop was facilitated jointly by LAWCO and the EPA. The Boora PAA was selected as a priority area for action in the 2nd cycle. The EPA report includes the following reasons:

- Bog project to examine potential for improvement by rewetting, in collaboration with Bord na Móna.
- Long term challenge.
- Area important for tourism.

As part of this characterisation process the Boora_010 and Pollagh Stream_010 have been assigned investigative actions (IAs) to assist in meeting the overall WFD objective of good status. These actions have been assigned accordingly based upon the action required. Within this PAA actions have been assigned to LAWPRO and the EPA, and therefore must be completed as part of the local catchment assessment process. The following IA's apply to this PAA:

Waterbody	Investigative Assessment No.	Assigned Organisation	Description of IA
Boora_010	IA1	EPA	Peat harvesting impacting the water body. This is an issue across a number of water bodies in Ireland - a Review is to be carried out to determine how to resolve these issues at a national level
Pollagh Stream_010	IA1	EPA	Peat harvesting impacting the water body. This is an issue across a number of water bodies in Ireland - a Review is to be carried out to determine how to resolve these issues at a national level
	IA5	LAWPRO	IA 5 (catchment walk over approx. a 1km distance) to be undertaken by LA in the

			vicinity of forestry activity, to rule in or out of issues with siltation and nutrients
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TABLE 1: INVESTIGATIVE ASSESSMENT ACTIONS REQUIRED WITHIN EACH WATERBODY

3.2. Description of catchment

Sections of the Boora PAA run within Lough Boora parklands, this is a BnM cutaway bog which has undergone rehabilitation works. A section of the bog was rewetted and is now used as a recreational area. Boora_010 rises North of Kilcormac, Co. Offaly. The Boora_010 has two branches, which join together before entering Boora_020. The Boora_010 flows through peat lands previously used for peat extraction. Boora_010 flows into the Boora_020 which is outside the current PAA boundary but is proposed for the 3rd cycle. The Boora_020 then flows North and enters the Brosna_110 south east of Fербane, Co. Offaly.

The catchment area is relatively flat, there is a minimal topographic fall from the river source (Boora_010) at 58m OD to 46m OD where Boora_020 enters the Brosna_110. There are no Natura protected sites listed within the Boora PAA. There are also no drinking water protection areas identified on the WFD app.

The source of the Pollagh Stream_010 is branched with tributaries rising at Coolanarey, Garbally and Killooly. The tributaries are all relatively straight and may reflect drainage systems from peat production and/or forestry. The river rises at approximately 66m OD. The waterbody flows downstream towards Derrymore at 61m OD, before several branches join the main channel at Oughter. Four further tributaries converged with the main channel just upstream of Pollagh village. The Pollagh Stream_010 joins the Brosna_110 at 45m OD.

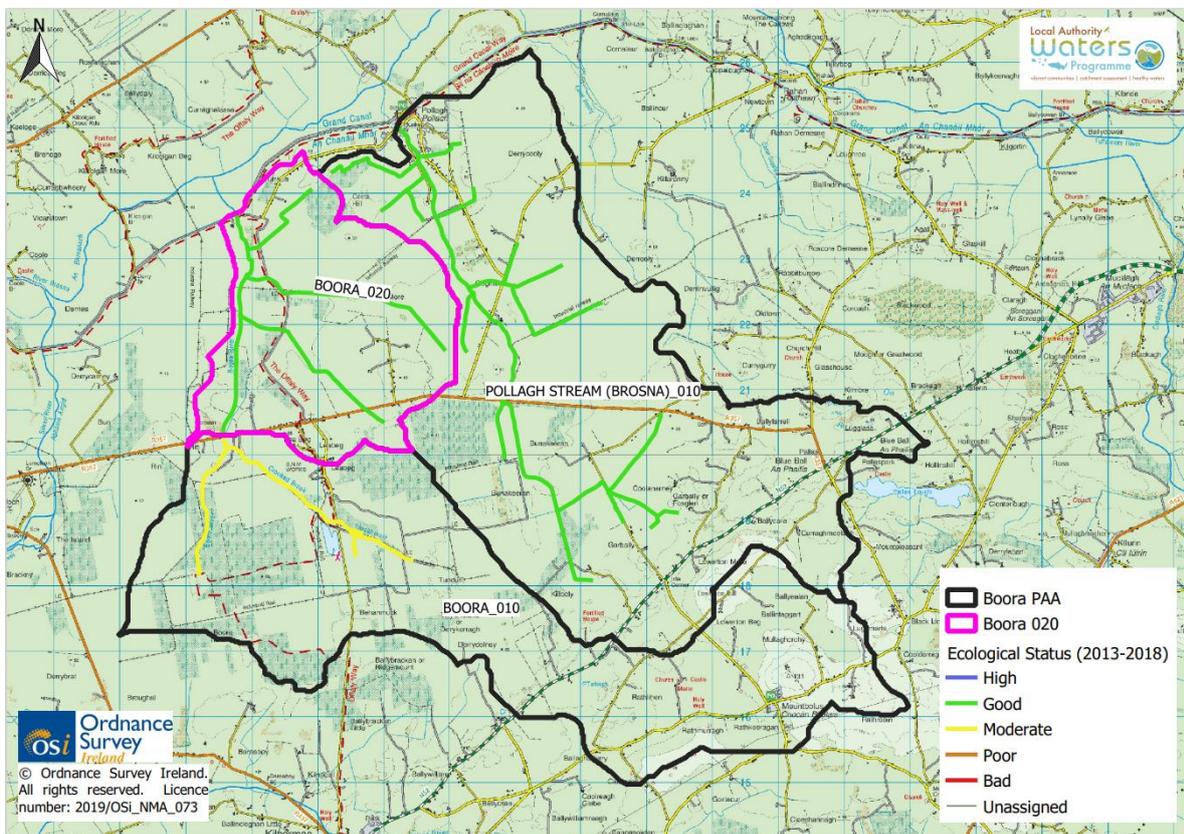


FIGURE 1: BOORA PAA (INC. BOORA_020)

3.3. Information Sources Consulted

Several information sources were consulted during the preparation of the desk study for the Boora PAA including:

- WFD web application – EPA characterisation data
- Data from Offaly County Council
- Data from the Office of Public Works
- GEOHIVE OSi
- Bord na Móna
- Forestry Service
- MQI – EPA

3.4. PAA Summary Information

A summary of risk, ecological status, known pressures and associated significance for the Boora PAA are presented in Table 2 below. Two of the waterbodies within the PAA were characterised as *At Risk*. The ecological status (2015-2018) of Boora_010 is Moderate. In Boora_010 the ecological status has had no changes in the last three ecological assessment iterations (Table 2). The Moderate ecological classifications are based primarily upon Invertebrate Status or Potential. Boora_020 is at Good status and is classified not at Risk. Boora_020 has been at Good status for the last three ecological status assessments. The Pollagh Stream_010 is now at Good ecological status. The ecological status in Pollagh Stream_010 improved from Moderate to Good between 2015 and 2018. Table 3 identifies the EPA's two operational monitoring stations within the PAA: one along the Boora_010 and one on the Pollagh Stream_010. The Boora_020 has also been included for completeness. Chemistry sampling is also carried out at these EPA monitoring stations along Boora_010 and the Pollagh Stream_010.

WB Code	WB name	WB Type	Risk	High status obj.	2009	2012	2015	2018	No of pressures	Pressure category	Pressure subcategory	Pressure name	Significant pressure (Y/N)
IE_SH_25B080100	BOORA_010	River	At risk	No	U	M	M	M	3	Extractive Industry	Peat - Harvesting	0	Yes
										Forestry	Forestry	0	Yes
										HYMO	Channelisation	0	Yes
IE_SH_25B080200	BOORA_020	River	Not at Risk	No	P	G	G	G	0				
IE_SH_25P050300	Pollagh Stream_010	River	At Risk	No	M	M	M	G	2	Extractive Industry	Peat - Harvesting	0	No
										Forestry	Forestry	0	No

(AR= At Risk, NAR= Not At Risk, P=Poor, M= Moderate, G=Good, U= Unassigned)

TABLE 2: SUMMARY OF WATERBODIES WITHIN THE PAA (INC. BOORA_020)

Waterbody	Monitoring Point Code	Name	Type	Comments
Boora_010	RS25B080100	Gorteen Bridge	Operational	Q & Chemistry
Boora_020	IE_SH_25B080200	Aqueduct u/d Brosna R	Operational	Q
Pollagh Stream_010	RS25P050300	Br u/s Brosna R confl	Operational	Q & Chemistry

TABLE 3: EPA OPERATIONAL MONITORING POINTS WITHIN THE BOORA PAA (INC. BOORA_020)

4. Receptor Information and Assessment

4.1. WFD Information

Waterbody		<i>BOORA_010</i>	<i>Boora_020</i>	<i>POLLAGH STREAM (BROSNA)_010</i>
Risk Category		<i>At risk</i>	<i>Not At Risk</i>	<i>At risk</i>
HYMO				
Monitoring station		<i>Gorteen Br</i>	<i>Aqueduct u/s Brosna R</i>	<i>Br u/s Brosna R confl</i>
Monitoring station type		<i>Operational</i>	<i>Operational</i>	<i>Operational</i>
Biological Status				
Variations/trends in Q values	2009	0	0	0
	2010	0	0	0
	2011	3-4*	4	4
	2012	0	0	0
	2013	0	0	0
	2014	3-4	4	4
	2015	0	0	0
	2016	0	0	0
	2017	3-4	4	4
2018				
Water chemistry				
Monitoring station		<i>Gorteen Br</i>	<i>N/A</i>	<i>Br u/s Brosna R confl</i>
PO ₄ ⁺	2010	0.023		0.006
	2011	0.006		0.003
	2012	0.008		0.009
	2013	0.004		0.017
	2014	0.012		0.011
	2015	0.003		0.008
	2016	0.005		0.005
	2017	0.014		0.013
	2018	0.005		0.005
	2019	0.005		0.001
Comments		<i>No exceedance of mean EQS 0.035mg/l</i>		<i>No exceedance of mean EQS 0.035mg/l</i>
NH ₄ ⁺	2010	0.089		0.286
	2011	0.072		0.266
	2012	0.069		0.260
	2013	0.090		0.424
	2014	0.084		0.182
	2015	0.100		0.217
	2016	0.088		0.272
	2017	0.217		0.118

	2018	0.079		0.078
	2019	0.066		0.052
Comments		<i>Continuous exceedance of mean EQS 0.065mg/l</i>		<i>Continuous exceedance of mean EQS 0.065mg/l</i>
NO ₃ ⁻	2010	1.2		2.6
	2011	1.2		2.9
	2012	1.3		2.3
	2013	0.9		2.1
	2014	1.2		2.4
	2015	1.2		2.5
	2016	1.0		2.1
	2017	0.9		2.1
	2018	1.5		2.8
	2019	1.3		3.4
Comments		<i>No exceedance of surrogate EQS (3.5mg/l)</i>		<i>No exceedance of surrogate EQS (3.5mg/l)</i>
BOD	2010	2.14		2.05
	2011	1.77		1.93
	2012	2.46		1.86
	2013	1.51		1.94
	2014	2.02		2.19
	2015	1.85		1.76
	2016	2.18		1.70
	2017	1.68		1.06
	2018	1.63		0.60
	2019	1.60		1.08
Comments		<i>Continuous exceedance of mean EQS 1.5mg/l</i>		<i>Continuous exceedance of mean EQS 1.5mg/l, with the exception of 2019</i>
Conceptual model required (Y/N)		N		N
Ecological Status		M	G	G
EPA Biologist comments		<i>The lack of sufficient numbers of pollution sensitive macroinvertebrate species indicated unsatisfactory moderate ecological conditions at Gorteen Bridge (0100) in 2017. Good ecological conditions continue on the lower station (0200) surveyed.</i>		<i>The macroinvertebrate fauna continues to indicate good ecological conditions on the Pollagh Stream in 2017.</i>
Significant issue: monitoring point		Ammonia & BOD	N/A	Ammonia & BOD
Significant issue: Waterbody		Ammonia & BOD	N/A	Ammonia & BOD

TABLE 4: OUTLINE OF PARAMETERS INFLUENCING WATER QUALITY IN THE PAA (INC. BOORA_020)

3.1.1 Boora_010

3.1.1.1 Ecology

Boora_010 is monitored at Gorteen bridge. The invertebrate status was poor in 1999 and improved to Moderate in 2002 and has remained there since. This waterbody reached Good status once in monitoring history in 1996. Therefore, the waterbody may have the ability to recover and meet the WFD objective of Good status depending on the impacts. There was an asterisk recorded with the Q value in 2011 by the EPA biologists, indicating sediment was an issue at the sampling location. Upstream of the sampling point is Boora bog, activities within this area included forestry and historic peat harvesting, either of which may have been the source of sediment at Gorteen bridge in 2011.

3.1.1.2 Annual Averages

Ammonia annual averages at Gorteen bridge exceeded the mean EQS of 0.065mg/l every year between 2010 and 2019. In 2017 the 95%ile EQS 0.14mg/l was exceeded. BOD was also elevated above the mean EQS between 2010 and 2019. Nitrate and Ortho P concentrations were all below their respective mean EQS.

3.1.1.3 Temporal Data

The ammonia temporal data (Figure 3) shows the majority of the samples within the assessment period were above the mean EQS, there were 6 elevations above the 95%ile EQS between 2010 and 2019. In the last 4 years there has been just one elevation above the 95%ile EQS, this occurred in 2017 and is the cause of the 95%ile breach in the annual averages as mentioned above. On the 9th of October 2017 the ammonia concentration recorded was 0.78mg/l. The closest weather station is Clonmacnoise. Rainfall data for up to 3 days before this event was assessed. There was just 4.5mm of rain on the 9th October and a total of 1.3mm fell within the three previous days. Therefore, indicating this exceedance is likely not associated with high rainfall events.

The BOD temporal data has shown improvements from 2010 to 2019 (Figure 4). The number of 95%ile EQS exceedances have dropped, there has been none since 2016. The concentrations between 2017 and 2019 vary between above and below the mean EQS (1.5mg/l). There is no seasonal pattern to elevations above the mean EQS.

Ortho P concentrations along this waterbody are low, just 6 sample events exceeded above the mean EQS between 2010 and 2019. There has been just 1 exceedance since 2015, this correlated with the exceedance noted in the ammonia concentrations on the 9th of October 2017 (Figure 5).

Nitrate is not an issue in this waterbody, the temporal data all remains below 0.05mg/l which is significantly lower than the surrogate mean EQS of 3.5mg/l.

There are potential anthropogenic pressures along one tributary of the Boora_010 associated with Bord Na Mona workshop, visitor centre and Bord na Móna offices. Wastewater treatment systems may be subject to shock loadings because of high numbers of tourists. All treatment systems will be assessed to ensure that they are working properly.

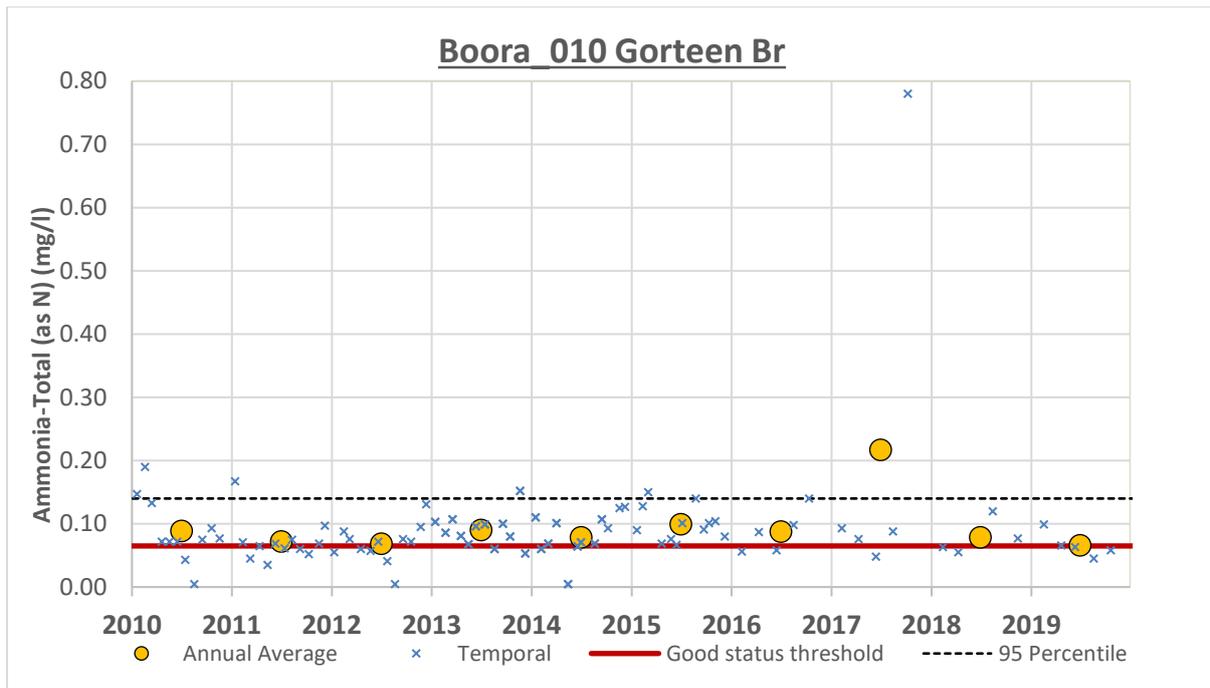


FIGURE 3: AMMONIA CONCENTRATIONS AT GORTEEN BRIDGE BOORA_010

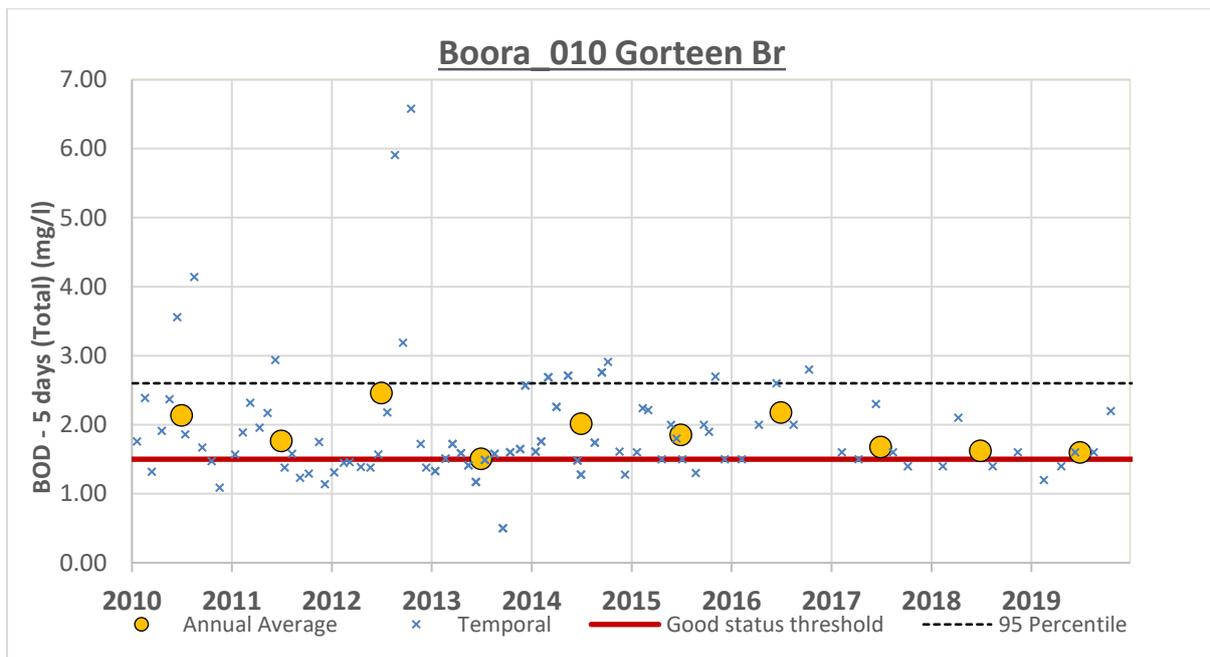


FIGURE 4: BOD CONCENTRATIONS AT GORTEEN BRIDGE BOORA_010

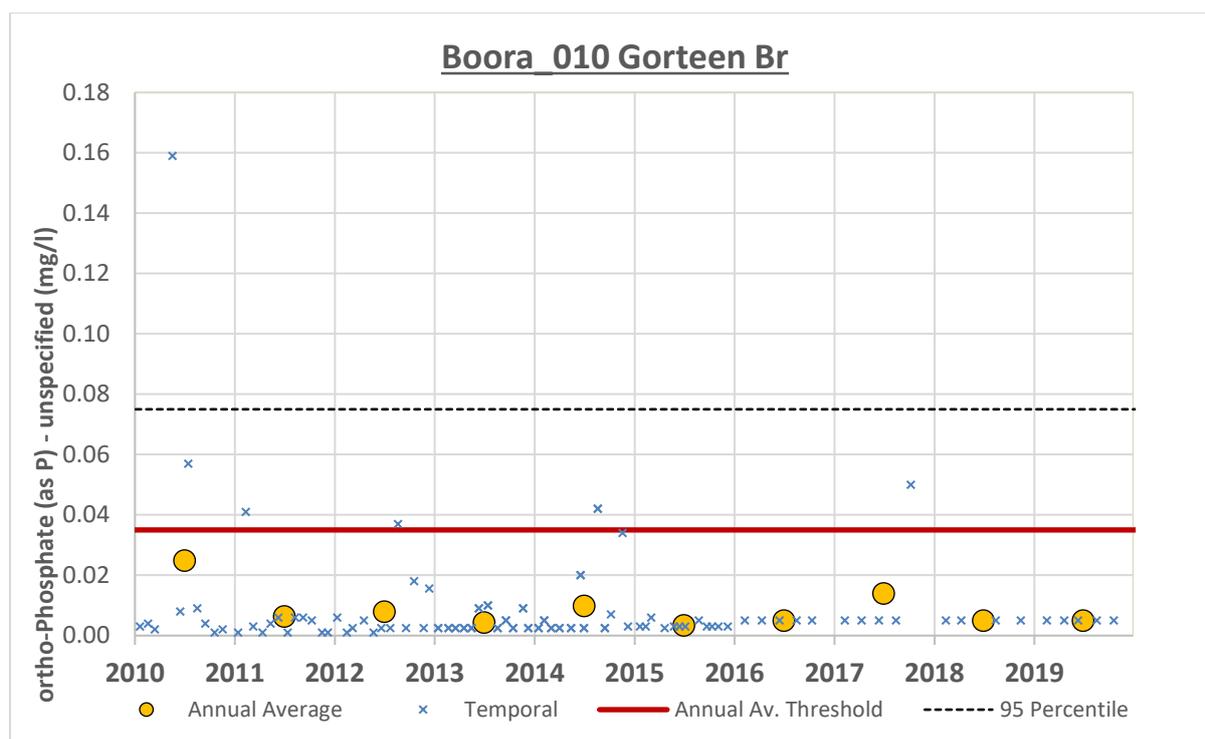


FIGURE 5: ORTHO P CONCENTRATIONS AT GORTEEN BRIDGE BOORA_010

3.1.2 Boora_020

3.1.2.1 Ecology

Boora_020 is monitored at the aqueduct u/s Brosna river. This monitoring location has fluctuated between Poor, Moderate and Good status between 1988 and 2017. The monitoring location was Poor in 2008, it improved to Good in 2011 and has remained at Good status since.

3.1.2.2 Annual Averages

There is no chemical data available for the Boora_020.

3.1.3 Pollagh Stream_010

3.1.3.1 Ecology

Pollagh Stream_010 is monitored at Br u/s Brosna R confluence for both invertebrates and chemistry. The invertebrate status has fluctuated at this site between Moderate and Good status between 1989 to 2017. The invertebrate status was last classified as Moderate status in 2008. In 2011 the waterbody improved to Good invertebrate status and has remained there since. Although the invertebrate status was good over the last number of iterations, this waterbody had Moderate ecological status up to 2015 due to poor DO concentrations and nutrients (ammonia). The most recent ecological status (2013-2018) showed improved DO concentrations and reduced ammonia and the sampling location is now classified as Good ecological status.

3.1.3.2 Annual Averages

On the Pollagh Stream_010 Ammonia and BOD concentrations were elevated. Ammonia exceeded the 95%ile EQS between 2010 and 2016, there was a drop in 2017 and 2018, however concentrations

remained above the mean EQS (0.065mg/l). In 2019, the ammonia annual average concentrations had fallen below the mean EQS.

The annual averages for BOD were above the mean EQS (1.5mg/l) between 2010 and 2016. In 2017, they dropped below the mean EQS and have not elevated since. The annual averages showed no exceedances of the mean EQS for Ortho P (0.035mg/l) and nitrate (3.5mg/l). There has been a steady increase in Nitrate, since 2017, concentrations in 2019 were just below the surrogate mean EQS (3.5mg/l).

3.1.3.3 Temporal Data

The number of sampling events per annum at this monitoring location reduced in 2016 from once a month to 4/5 times per year. There is a clear downward trend in the ammonia data. The number of exceedances of the 95%ile EQS has reduced significantly, with just one exceedance in 2017 and 2018. Elevations above the mean EQS continued to occur between 2017 and 2019, however not during each sampling event, as per Figure 6 below.

BOD was a persistent issue along this waterbody over previous years, however, a downward trend became visible in 2015 (Figure 7). In 2015, the number of exceedances above the 95%ile dropped, dropping further in 2018 to below the mean EQS.

Ortho P is not an issue within this waterbody. This can be seen in Figure 8 below. There were two elevations above the mean EQS between 2010 and 2019. These elevations occurred in September 2013 and October 2017. Rainfall data was assessed for both occasions and there was no correlation between high rainfall events and elevations in ortho P on these dates.

Nitrate concentrations in the Pollagh stream are much higher than that seen in the Boora_010. The annual averages are below the surrogate EQS, however, as per Figure 9 below, there are some elevations in the temporal data above the surrogate mean EQS. There was a decline in 2016 and 2017 before rising again in 2018 and 2019. Although the concentrations seem relatively low, a visible upward trend is noted and therefore this should continue to be reviewed.

The downward trend in ammonium and improvements in the chemistry are likely to be linked to the fact that Bord Na Mona is shifting away from production to the rehabilitation in this peatland, which would reduce ammonium, DON, BOD, and suspended solids in the drains discharging into the Pollagh 010.

Due to their predominately anoxic conditions, peatlands are expected to respond to changes in hydrological conditions, such as successive drying and rewetting periods. As peatlands are rich in organic matter, any major changes in water table may influence the decomposition of it. The hydrological conditions may also influence release of dissolved organic nitrogen, ammonium and BOD from peat profiles as well as affect their transport to waterbodies. Ammonium and BOD levels are consistent at the monitoring point, suggesting that there is a natural background level of BOD, DON and Ammonium as a result of the oxidation of peat.

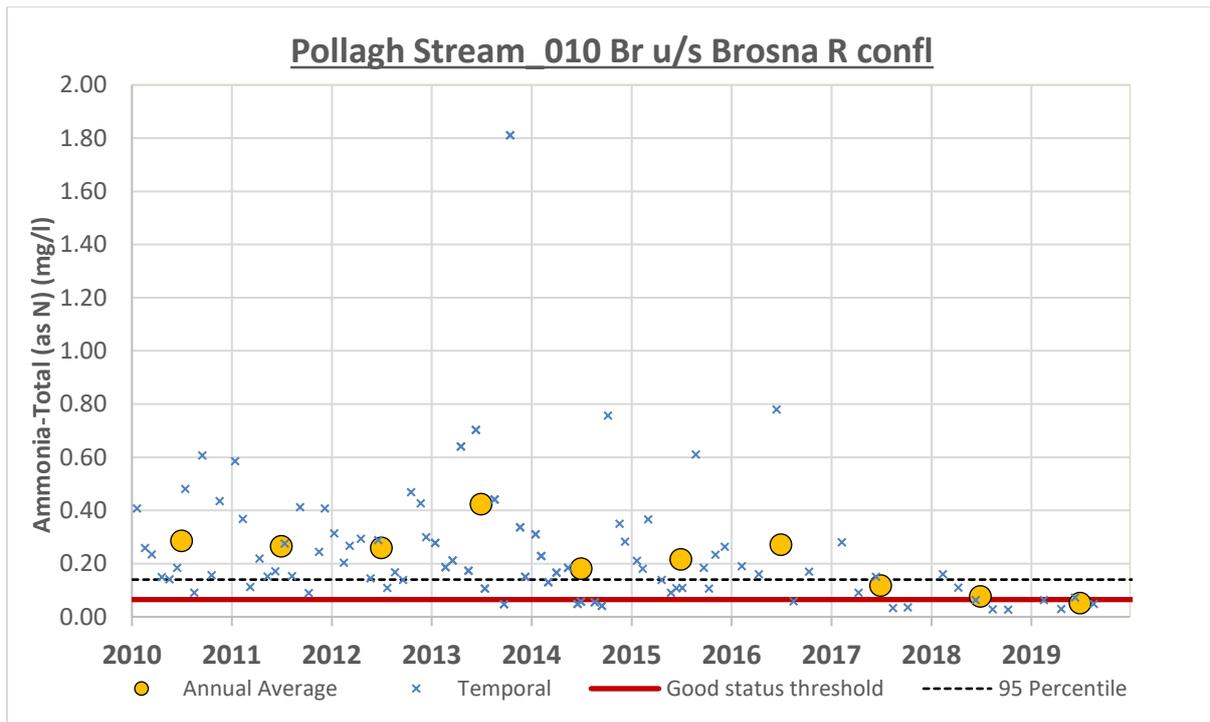


FIGURE 6: AMMONIA CONCENTRATIONS AT BRU/S BROSNA R CONFL POLLAGH STREAM_010

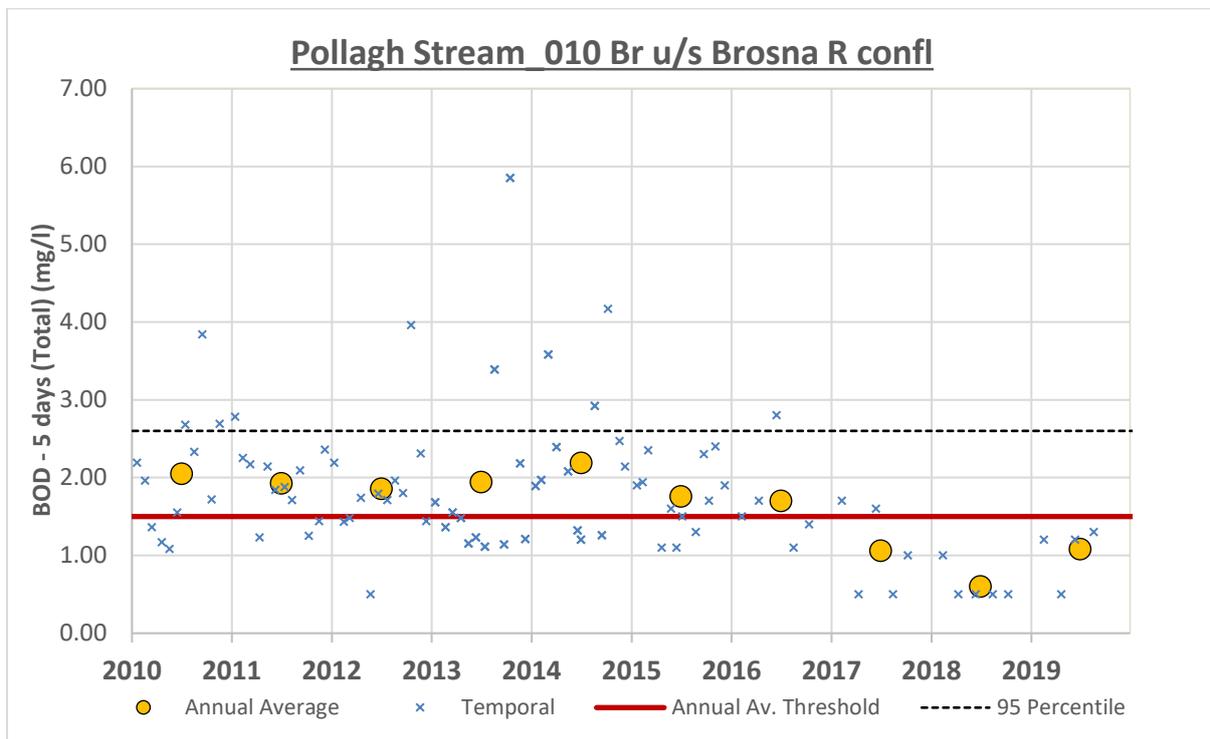


FIGURE 7: BOD CONCENTRATIONS AT BRU/S BROSNA R CONFL POLLAGH STREAM_010

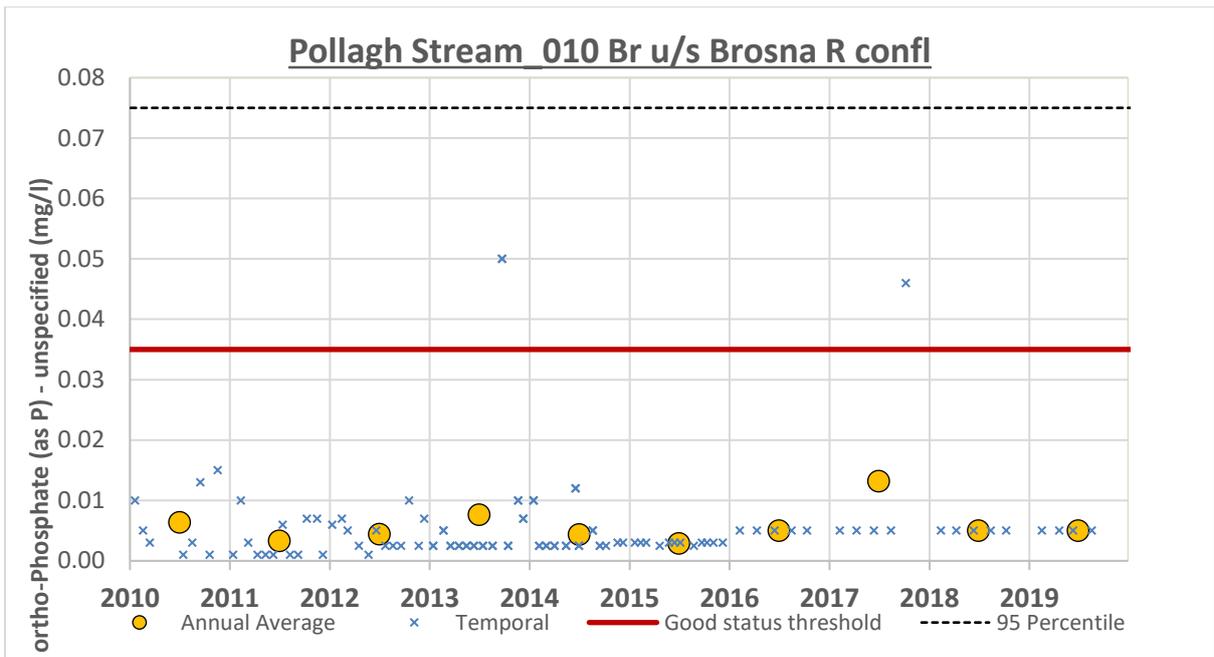


FIGURE 8: ORTHO P CONCENTRATIONS AT BRU/S BROSNA R CONFL POLLAGH STREAM_010

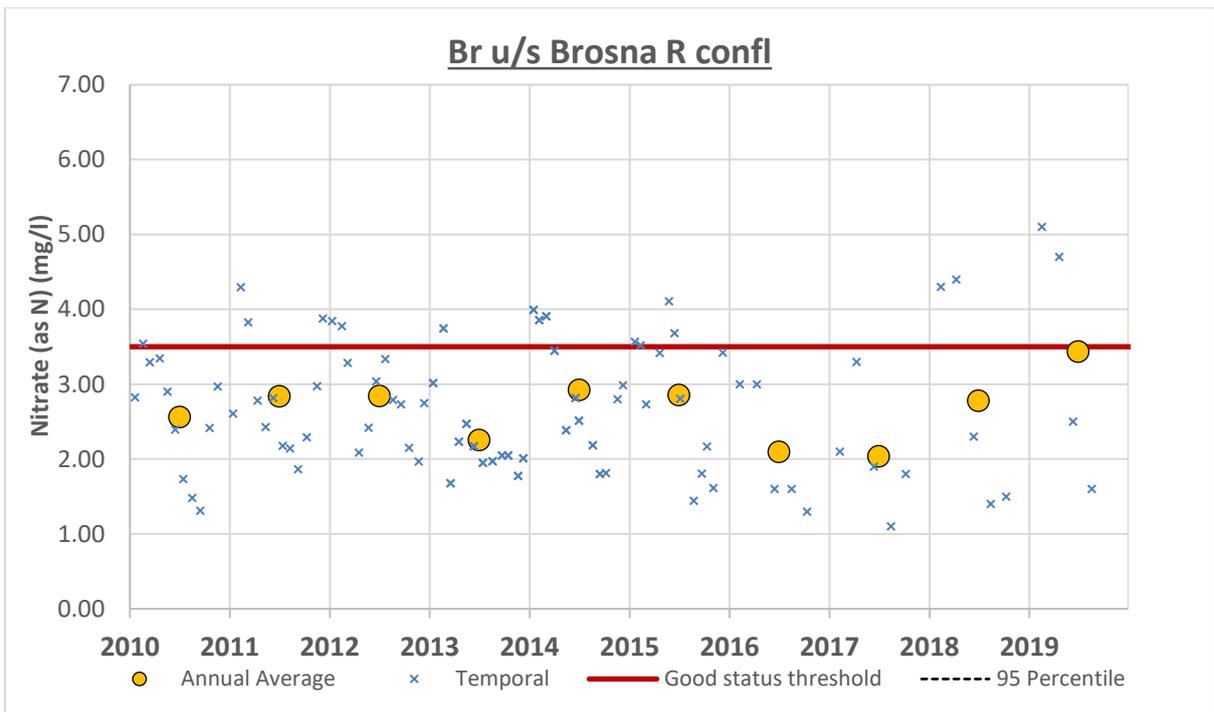


FIGURE 9: NITRATE CONCENTRATIONS AT BRU/S BROSNA R CONFL POLLAGH STREAM_010

4.2. Supplementary information

Bord Na Móna have three bogs which discharge into the Pollagh Stream_010. These bogs are 3 of 15 bogs which fall under the EPA license Boora PO500-01. These include the Turraun, Pollagh and Oughter bogs. All discharges flow through a silt pond before joining the Pollagh Stream_010. BnM have provided chemical data taken at the silt ponds between 2014 and 2019, gathered as part of their license.

Location	Bog	Date	pH	SS	TS	Ammonia	TP	COD	Colour
SW-16	Turraun	Q2 2014	7.2	5	392	2.1	0.05	29	111
		Q4 2017	7.4	7	258	0.82	0.05	70	212
		Q2 2019	7.5	<2	467	0.069	<0.05	45	127
SW-17	Pollagh	Q2 2014	7.7	7	444	1.6	0.05	33	55
		Q4 2017	7	5	212	1.9	0.05	63	231
		Q2 2019	7.6	4	484	0.646	<0.05	26	95.8
SW-18	Oughter	Q2 2014	7.4	80	514	0.26	0.07	99	73
		Q4 2017	7.4	8	288	0.46	0.05	64	223
		Q2 2019	7.1	<2	424	0.188	<0.05	36	110

TABLE 5 : CHEMICAL DATA FROM BNM SILT PONDS DISCHARGING INTO POLLAGH STREAM_010 2014-2019

The Boora EPA license PO500-01 has set limits for suspended solids, COD and ammonia. The limits are as follows: Suspended solids 35mg/l, COD 100mg/l, Ammonia 3.7mg/l. The chemical data above is compliant with the licence, with the exception of suspended solids in Qtr 2 2014. This location recorded concentrations below the licence limits in 2017 and 2019.

The pH is within the expected ranges at all three locations. Suspended solids were below the limit of detection in 2019 at Turraun and Oughter silt ponds, both of these bogs are decommissioned. Turraun bog began to go through rehabilitation in the 1990's and Oughter ceased operations between 2014 and 2017. Pollagh bog had SS concentrations of 4mg/l in 2019.

Ammonia levels are above the surface water mean EQS (0.065mg/l) at all three locations. Turraun ammonia concentration in 2019 was just above the mean EQS, in the same year at Oughter bog the concentration was higher exceeding the 95%ile EQS. However, as can be seen from Figure 2 below the ammonia levels have dropped significantly from 2014 data to 2019 at all locations. This is likely as a result of the Turraun and Oughter bogs being decommissioned and Pollagh bog coming to the end of production.

The Total Phosphorus was elevated in 2014 and 2017 at all three locations, it dropped below the limit of detection at the 3 sites in 2019. It was noted there was an elevation in the raw data along the Pollagh stream which showed a concentration above the mean EQS of 0.035mg/l in October 2017. This may be linked with the Qtr 4 2017 data above, the discharges may have contributed to this elevation however it can't be verified.

Additional chemical data was provided for SW_11 this is a silt pond on the West side of Boora Bog. SW_11 discharges into the Silver river and therefore does not impact Boora_010.

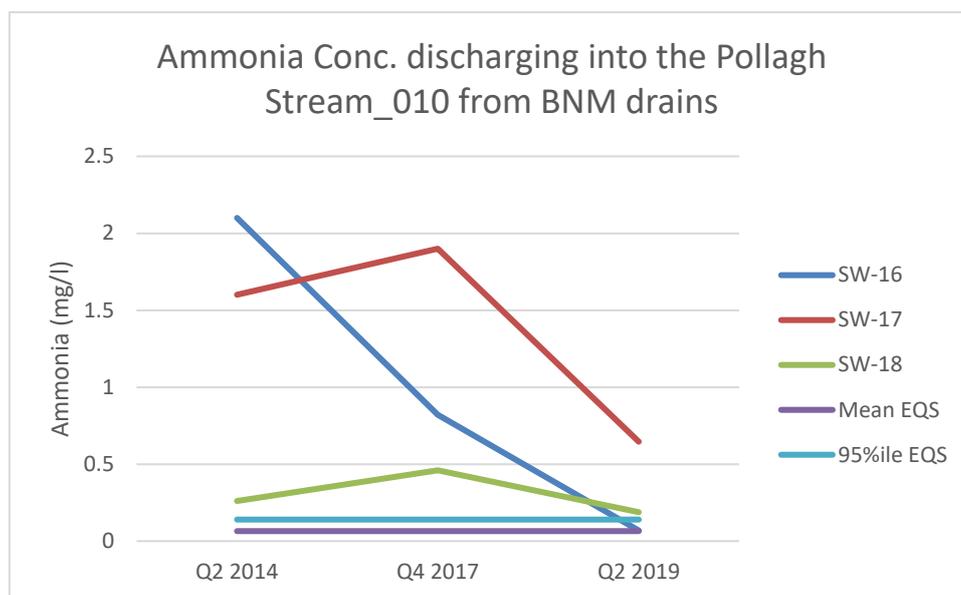


FIGURE 10 AMMONIUM LEVELS AT THE SILT PONDS BEFORE DISCHARGING INTO THE POLLAGH STREAM_010 (2014-2019)

As ammonium was a driving factor in the ecological status on the Pollagh Stream_010 (2010-2015) Figure 10 above shows a downward trend in the ammonia levels coming from each silt pond, this reduction in ammonia correlates with the improvement from Moderate to Good ecological status between 2015-2018.

4.3. Conclusions on Significant issues

Boora_010

In Boora_010 the significant issue is Ammonia and BOD. Ammonia concentrations exceeded the mean EQS (0.065mg/l) for each annual average between 2010 and 2019. BOD exceeded the mean EQS 1.5mg/l between 2010 and 2019. There were no exceedances of the annual averages for nitrate or Ortho P during this timeframe. It is likely the ammonia and BOD correlate with the soil type which is peat and can be elevated due to the activities such as historic peat extraction. Ammonia arises from lowering the water table in the peat when it is drained, which breaks down the peat and releases ammonium. BOD can be raised from the breakdown of organic matter such as peat, therefore when peat harvesting occurs the peat is disturbed and enters the water column and begins to break down.

Boora_020

Boora_020 is meeting Good ecological status, this is based on macroinvertebrate status. No chemistry is available for this waterbody. However, based upon the macroinvertebrate status alone there are no significant issues within this waterbody.

Pollagh Stream_010

The Pollagh Stream_010 chemistry data indicates ammonia and BOD were previous issues within the waterbody, the annual averages for both parameters dropped below the mean EQS in 2019. The ecological status for this waterbody was previously based on nutrients and DO failures. These have since improved and therefore the waterbody is now at Good ecological status. Therefore, a full local catchment assessment is not required along this waterbody as it is now achieving the WFD objective of Good status.

5. Significant pressure information

5.1. Initial EPA Characterisation

WB name	Significant Pressures		Impact
	No.	Type	
Boora_010	3	Extractive Industry (Peat Harvesting)	Altered habitat due to Morphological changes and Nutrient Pollution
		Forestry	Altered habitat due to Hydrological changes
		Hydromorphology (Channelisation)	Altered habitat due to Morphological changes
Pollagh Stream_010	2	Extractive Industry	n/a
		Forestry (Peat Harvesting)	n/a

TABLE 6 : SIGNIFICANT PRESSURES ASSIGNED BY THE EPA

Peat harvesting, forestry and hydromorphology have been highlighted as significant pressures within Boora_010. Forestry and Peat harvesting have been assigned as pressures to the Pollagh Stream_010, however are not deemed significant by the EPA, as it is now achieving good status. There are no significant pressures applied to the Boora_020 as it has Good ecological status. Figure 10 below illustrates the land uses within the PAA boundary and Boora_020, therefore, giving a scale of the level of impact associated with these pressures.

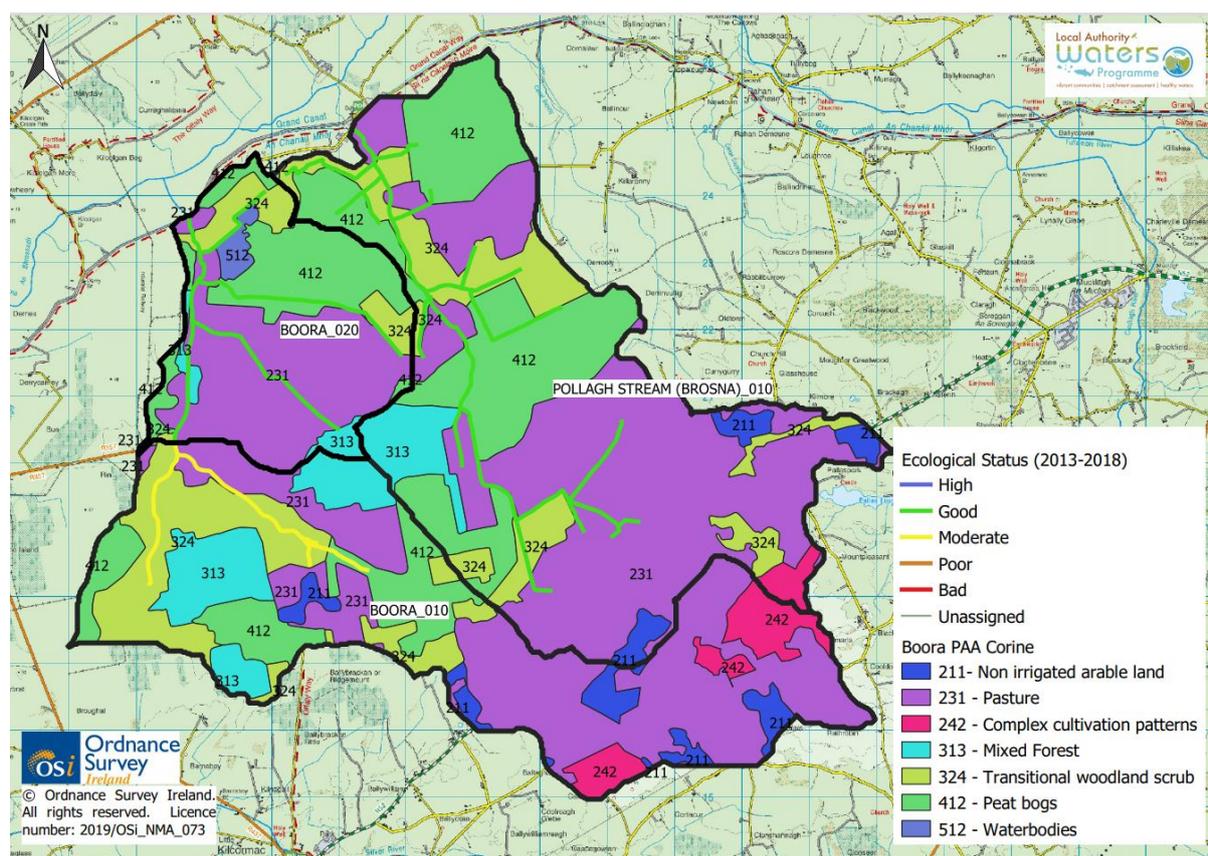


FIGURE 11 : CORINE LAND USE MAP FOR THE BOORA PAA (INC. BOORA_020)

Extractive Industry (Peat Harvesting)

Boora_010 rises within Boora bog, this bog is split into 2 parts, east and west Boora. Peat production in the east part of the bog has ceased, however there is still some production in west Boora. The east is mainly Lough Boora and this has been out of production since the early 1990's, with the park starting development in 1994. Production on west Boora is pending approval from An Board Pleanala, if this is approved there will be production. The discharge from this section of bog (West) flows into the Silver river and therefore would not impact Boora_010.

Peat Harvesting was selected as a pressure affecting the Pollagh Stream_010 by the EPA, however it was not deemed significant. Three Bord Na Móna bogs, which include the Turraun, Pollagh and Oughter discharge into the Pollagh Stream_010. Prior to entering the Pollagh Stream_010 the discharges go through a silt pond, which are sampled in accordance with its license PO500-01. Turraun bog has been out of production for a number of years. Oughter came out of production between 2014 and 2017. Pollagh bog was in production up until the end of September 2019, currently Bord Na Móna have no plans to bring this into production going forward. Bord Na Móna are currently working on a rehabilitation plan for both the Oughter and Pollagh bogs. The ceasing of production in Oughter bog may have resulted in a reduction in ammonium losses and in turn resulted in an improvement in ecological status from Moderate to Good status in 2018. LAWPRO propose to conduct a small study within the PAA looking at ammonium levels being released from the bog after periods of high rainfall.

Forestry

The Boora PAA contains both Coillte and privately-owned forestry as can be seen below in figure 12. Forestry has been identified as a pressure in both Boora_010 and the Pollagh Stream_010. In

Boora_010 the pressure has been deemed significant by the EPA. The Coillte plots were planted within the PAA between 1988 and 2006, therefore adequate buffers for the protection of water quality may not be present in some areas planted pre the mid 1990's as regulations were only approved in 1991 and codes of practise produced in 1996 and 1998. The private forestry was planted between 2000 and 2017 and therefore it is expected that the correct buffer zones were implemented. The types of forestry planted by both Coillte and the private owners throughout the PAA are listed below in table 7.

Coillte	Private
BHF – Broadleaf high forest	BHF – Broadleaf high forest
MHF – Mixed high forest	MHF – Mixed high forest
CHF – Conifer high forest	CHF – Conifer high forest

TABLE 7 : LIST OF FORESTRY WITHIN COILLTE AND PRIVATELY OWNED FORESTRY.

The Boora_010 sub catchment area consists predominantly of Coillte plots, there is a small plot of private forestry located upstream of the source of one of the Boora_010 tributaries. In the Boora_010 it is unlikely these forested areas are having an impact on the receiving waters based on the timing of the Coillte planting as these plots are well established. This will need to be verified with the Forest Service. Based on the timing of planting it is expected tree felling may occur in the coming years, a protect referral may need to be issued to prevent impact on the receiving waters when the felling is scheduled.

Forestry was not deemed a significant pressure by the EPA along the Pollagh Stream_010. However just as in the review of the Pollagh Stream_010 there is a combination of Coillte and privately-owned forestry. The upper and lower reaches are dominated by private forestry. The middle reaches are predominantly Coillte plots. Similar water quality protective approaches to clear felling as mentioned above in Boora_010 must be applied to the Pollagh Stream_010.

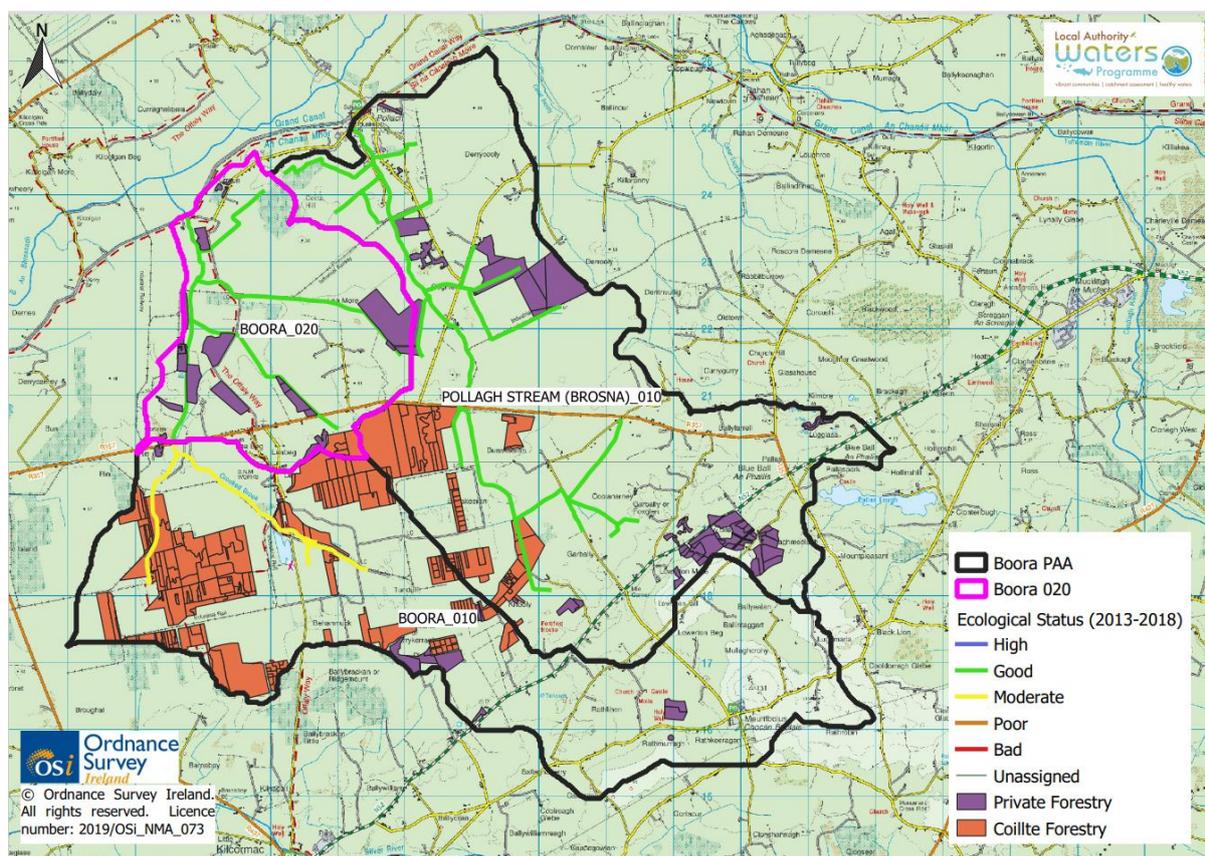


FIGURE 12 : MAP IDENTIFYING THE PARCELS OF PUBLIC AND PRIVATELY FORESTRY WITHIN BOORA PAA (INC. BOORA_020).

Hydromorphology

Hydromorphology was selected as a significant pressure in the Boora_010. The hydromorphological issue is channelisation. Boora_020 is part of the OPW arterial drainage scheme, there are two OPW stations, one on the South East tributary and the other on the main channel. Boora_010 is not part of the OPW arterial drainage scheme. The MQI assessment shows that the reach associated with the EPA monitoring point is at Moderate status. The overall waterbody is also Moderate status and the MQI weighting group is Peat. The right trib is affected by F3 : river-corridor connectivity, which is consideration of development (e.g. buildings, roads) impacting the interaction between the river corridor and channel, including sediment and wood delivery, this is based on a median level of impact. Associated hydromorphological issues include buildings, embankments, fishery enhancement (bank protection), pavements, roads, rail, bridge walls and OPW flood protection structures.

The left tributary is highly affected by A8 - artificial changes of the river course. This is the assessment of the extent of modification to the channel of the reach (e.g. meander cut-offs, channel straightening, diversions, dredging). Such changes will alter the natural channel morphology (e.g. alter level of sinuosity), hydromorphological processes and in turn loss or degradation of physical habitat. Associated hydromorphological issues include drainage scheme spatial data, navigation channel management spatial data, changes to the channel based on Cassini 6" historic map (and OS 6" map for reaches downstream of dams).

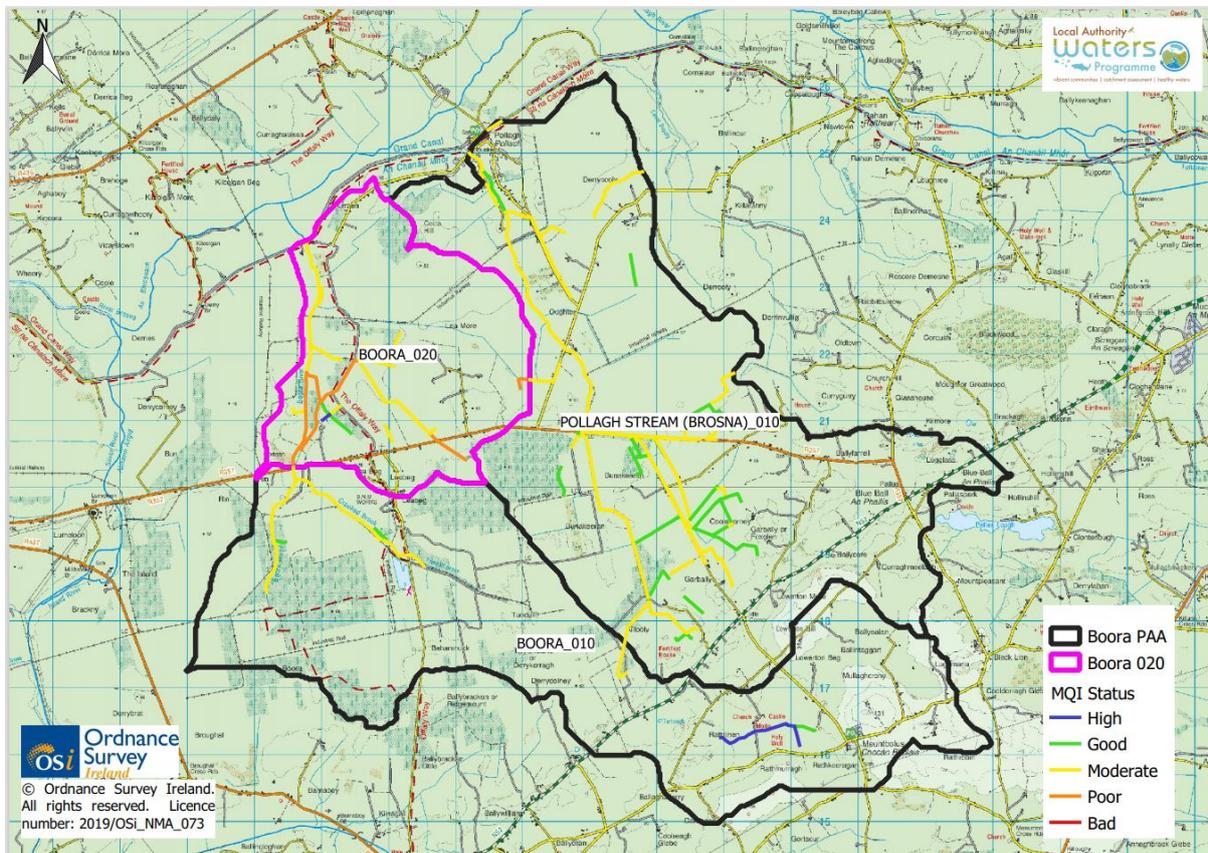


FIGURE 13 : EPA MQI REACHES WITHIN THE BOORA PAA (INC. BOORA_020)

The historical maps from 1837-1842 and 1888-1913 were compared and there were visible changes to the waterbody. Below the current EPA maps and the historical maps were compared. It is evident there have been some alterations of the waterbody. As can be seen below in red, the loch was removed, this is likely to do with draining of the peatland for extraction. Similarly, in green the historically branched section has now been channelised. This bog was previously used for peat extraction and therefore would have been drained. Draining peatlands changes the hydromorphological condition of the river, by modifying the channel bed and riparian area, river channel diversions alter the river network and can increase the connectivity of land drains to the river network and can alter the flow and sediment regime. Sediment was highlighted as an issue at the monitoring point Gorteen Br in 2011 by the EPA biologists. Sediment can be elevated due to peat extraction. Peat harvesting creates loose peat particles which can be washed and blown into streams. The installation of drainage pathways can result in:

- Flow pathways for sediment reaching water bodies; and,
- Erosion following heavy rainfall.

Although peat extraction has ceased on this bog a number of decades and the bog had undergone rehabilitation, impacts are likely to remain as the river network and catchment area have been altered significantly from past activities.

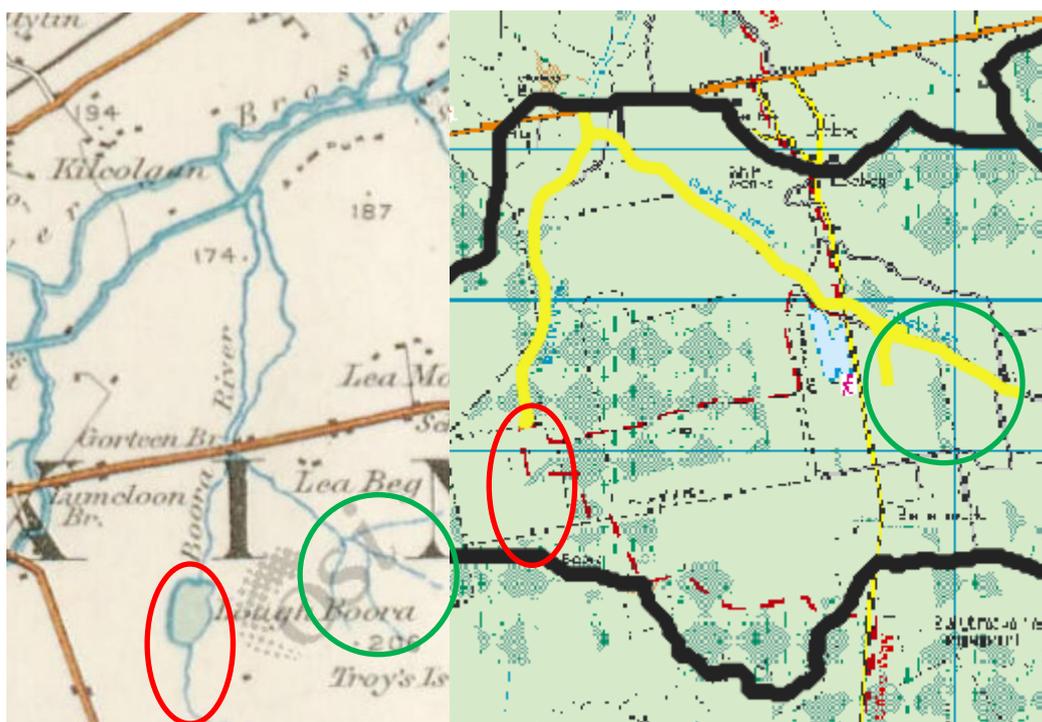


FIGURE 14 : COMPARISON BETWEEN HISTORIC AND CURRENT MAPS

Conclusions on Significant Pressures

Peat harvesting is deemed to be a significant impact on water quality in the Boora_010, however this activity has ceased for the last number of decades. However, historic alterations of the bog due to harvesting activities may continue to be the source of impact on this waterbody. As seen under section 4.4 above, there is evidence of channelisation in Boora_010 within the Bord na Móna owned boglands. The area is being rehabilitated, however, in order to rectify the channelisation issues instream works may be required. Although it is unclear whether these works would be effective in improving the water quality results or whether there are other influencing factors. Gorteen bridge achieved Good biological

status in 1996, therefore this waterbody did have the potential to reach good status after the hydromorphological changes had occurred.

In regard to the Pollagh Stream_010 it is expected the impact of peat extraction has reduced as the number of active bogs has declined. There was an improvement in water quality along the Pollagh Stream between 2014 and 2017 from Moderate to Good status. Production on Oughter bog ceased during this timeframe and therefore there is a potential correlation with the change in status.

The forestry in the PAA is a mix of public and privately owned. The Coillte plots date back to 1988 and therefore buffers may not have been adhered up until the mid 90's, based on the issuing of regulations in 1991 and codes of practise in 1996 and 1998. The private forestry was more recent, with planting beginning in the 2000's. Forestry drains may need to be assessed during the local catchment assessment within Boora_010. As Pollagh Stream is meeting the WFD objective of Good status, a full local catchment assessment is not necessary within this waterbody.

Boora_020 is achieving good ecological status and therefore no pressures have been applied. However it must be noted activities such as peat extraction and forestry occur within this waterbody area.

6. Pathway information & analysis

No Conceptual Model (CM) was prepared as there were no indications of diffuse pollution sources based upon the chemical data assessment above. Also the significant pressures assigned to the waterbodies include peat harvesting, forestry and hydromorphology. A CM may need to be developed if following initial assessment agricultural pressures are identified as a significant pressure.

7. Interim Story on the Priority Area for Action based on the desk study

Boora 010

Boora_010 is *At Risk* of failing to meet the WFD objective of Good status, as the 2015-2018 ecological status is Moderate. There is one EPA monitoring point along this waterbody, Gorteen bridge. The EPA assigned significant pressures associated with this waterbody include hydromorphology, forestry and peat extraction. The issues in the waterbody based on chemistry data include ammonia and BOD. The soil in the catchment area is predominantly peat and therefore, poorly draining. Well-draining soils are located in the south east of the sub catchment area, however, the river does not flow through this section. The pathways associated with poorly draining and peaty soils are point and diffuse sources through overland flow for the potential transport of phosphorus, sediment, ammonia and pesticides. Forestry and peatlands are the dominant land use types in which the river flows through. Agriculture is present in the south east well-draining area, however, at present is not of concern as nitrates or ortho phosphorous are not issues within the waterbody. LCA work will be carried out to confirm the significant pressures and the appropriate mitigation measures identified to improve water quality.

Pollagh Stream 010

The Pollagh Stream_010 is *At Risk* of failing to maintain the WFD objective of Good status, the waterbody improved to good ecological status between 2015 and 2018. There is one operational EPA monitoring point along this waterbody bridge u/s Brosna river confluence. The pressures associated with this waterbody include forestry and peat extraction. These pressures have been deemed not significant by the EPA, as the waterbody has achieved good status. The issues in the waterbody based

on chemistry data up to 2018 include ammonia and BOD. There were improvements in 2019 with no exceedances of any parameters analysed above (Table 4). The soils in the catchment area are predominantly peat and therefore poorly draining. Well-draining soils are located in the south of the sub catchment area, upstream of where the river rises; the river does not flow through this section. The pathways associated with poorly draining and peaty soils are point sources and overland flow for the potential transport of phosphorus, sediment, ammonia and pesticides. Forestry and peatlands are the dominant land use types in which the river flows through, there are a few pockets of agriculture adjacent to the waterbody. Agriculture dominates in the South of the catchment, upstream of where the river rises. However, at present this activity is not of concern as nitrates or ortho P are not an issue within the waterbody based upon the chemistry data.

Boora_020

Boora_020 has Good ecological status and is *Not At Risk* of failing to maintain the WFD objective of Good status. The waterbodies ecological status is based solely on macroinvertebrates. No chemistry sampling is taken on this waterbody. Activities within the area include peat extraction, forestry and agriculture. None of these activities are deemed pressures on the waterbody as it is achieving its WFD objectives.

8. Work Plan

The following information is needed to be addressed in order to further develop an understanding of what pressures are impacting this PAA:

- Seek information from the EPA regarding their IA1 which is as follows *Peat harvesting impacting the water body. This is an issue across a number of water bodies in Ireland - a Review is to be carried out to determine how to resolve these issues at a national scale.*
- Participate on the steering committee for a peat research project (SWAMP – Strategies to Improve Water Quality in Managed Peatlands)
- Require the 1996 and current Q rating assessment sheets from the EPA, to review the type of macroinvertebrates present to determine the waterbodies ability to recover.
- Hydromorphology (channelisation) has been listed as a significant pressure, this is most likely as a result of the peat extraction. This area will have to be assessed to determine the impact on macroinvertebrate assemblages.
- Forestry has been identified as a significant pressure by the EPA, the forestry will have to be assessed to determine impact and to see are practises used effective to prevent water quality impact.
- Meet with Bord na Móna as a large area within this catchment is dominated by the extractive industry.
- Review any monitoring data BNM may have gathered over the years
- Due to the land type and activities, bridge hops can't be used to narrow down the impact area due to lack of accessible roads, a project will be designed looking at the ammonium concentrations being released from the bogs drainage network in order determine source.

9. Review of Mitigation Options

As the specific pressures/impacts influencing the Moderate ecological status at Gorteen bridge are not clear from the desktop assessment, it is difficult to assign targeted mitigation measures. The chemistry indicates an issue with Ammonia and BOD. These have likely associated with the land type and the historic harvesting activities as the land had been drained. It would also be expected there

would be high volumes of fine sediment in the waterbody from the peat particles. Measures could include rewetting of the bog to reduce the concentrations of ammonium and BOD. Historic hydromorphology changes are unlikely to be the issue as the waterbody achieved Good status in 1996 after the changes were made to the waterbody. However, channel maintenance in inactive bogs does occur, although it would not be regular it could still affect water quality. This will need to be considered during the local catchment assessment. Coillte forestry is well established in the PAA, therefore clear felling is likely to occur in the coming years. A referral to the forest service regarding the implementation of measures prior to felling practises for the protection of water quality is proposed.

Currently no mitigation measures are necessary along the Boora_020 and Pollagh Stream_010 as they are already achieving Good status. The rivers will be assessed to ensure there is no deterioration in status.

10. Communications

Community Information Meetings

A community information meeting was held virtually via Zoom on the 31st of August 2020. This meeting could not be held publicly due to Covid 19 concerns. Kate Tynan presented on behalf of the catchment Science team, Basil Mannion delivered a presentation on the Community Water Officer's. A breakout meeting was held, 4 attended the meeting. The no issues were raised; however, a participant informed the attendees of an EU Life project application in which they were involved in. This project is in relation to rewetting the bogs in the midlands. Participate to follow up further with Margaret Keegan and Ray Spain.

DATE of completion of Desk study: 14th December 2020