

Lough Rinn Forbes Priority Area for Action

Midlands & Eastern Region

Desk Study Report

22nd November 2019

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1 Non-Technical Summary

The Lough Rinn Forbes Priority Area for Action (PAA) consists of six waterbodies. These include the Rinn_010, Rinn_020, Rinn_030, Shannon (Upper)_080, Annaghcooleen_010 and Drumbad_010. The Annaghcooleen_010 and Drumbad_010 waterbodies are under *Review*; the remaining 4 waterbodies are categorised as *At Risk*. The Rinn_020, Rinn_030, and Shannon (Upper)_080 are at Moderate Ecological Status (2010-2015) this is driven by biological status. Rinn_010 is at Poor Ecological Status and this is driven by both biological and phosphorus status. Both Lough Rinn and Lough Forbes are of Moderate Ecological Status.

Based on the review of the conceptual model for the PAA and aerial imagery, the waterbodies typically overlay locally important aquifers, Lough Forbes and the Shannon (Upper)_080 however, overlay a regionally important aquifer. There is also a poor aquifer located in the south east of the catchment at the upper reaches of the Annaghcooleen_010. The geology consists of limestones with varying degrees of purity, Dinantian sandstone, shales and Ordovician metasediments. The soils are predominantly poorly draining and peaty, with small pockets of well-draining in the north and the south of the catchment. As per the aerial imagery it is evident that a large portion of the peatland has been reclaimed and is now used for agriculture. The following pollutants have the potential to enter the waterbody, phosphorus, sediment and pesticides, as their main pathways are overland flow and along drains and ditches, where poorly draining soils exist. Also, nitrate may leach through the well-draining soils into the groundwater and discharge in the surface waters elsewhere, however, due to the small volume of free draining soils within this catchment nitrate is not expected to be a significant issue.

Chemistry data is available for two of the waterbodies, Rinn_010 and Shannon (Upper)_080. Rinn_010 is the receiving waters for the Mohill WWTP and therefore has the greater number of parameters tested on a monthly basis. The Shannon (Upper)_080 data is limited and as a result it does not give an adequate indication of the pressures within the waterbody. There is no chemical data for the remainder of the waterbodies.

The significant pressure identified (from the WFD App) was agriculture within the Rinn_020, Rinn_030, Shannon (Upper)_080, Annaghcooleen_010 and Drumbad_010. The significant pressure on the Rinn_010 was Urban Wastewater (UWW). Diffuse and small point source pollution from agriculture will be the focus of the field assessment, as the surface water phosphorus (P) Pollution Impact Potential (PIP) map indicates the PAA is predominantly in the highest risk category for P, sediment and pesticide losses.

Instream biological assessments such as Small Stream Risk Scoring (SSIS) will be conducted where suitable in the PAA to aid in narrowing down impact in the waterbodies and identifying where to focus our efforts. Where SSIS is not suitable and further information is necessary, chemical analysis will be undertaken.

Depending on the pressure identified, specific mitigation measures will be implemented. Mitigation options for P, sediment and pesticide pressures should focus on pathway interception measures to target overland flow and along drains and ditches. Critical source areas will need to be identified and buffer zones implemented. Point source nutrient issues may need to be addressed at farmyard level with the assigned ASSAP advisor.

2 Background

2.1 Background to the Priority Area for Action (PAA)

The Lough Rinn Forbes PAA flows within the Upper Shannon Catchment and the Shannon [Upper]_SC_050 Subcatchment. The Midlands and Eastern catchment assessment workshops were held in Ballycoolin, Dublin from the 9th to 12th May 2017. They were attended by representatives of local authority staff (operational staff on all days and both operational and senior staff on 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 Marine, Bord na Mona, Waterways Ireland and Environmental Protection Agency. The workshop was facilitated jointly by LAWCO and EPA. The Lough Rinn Forbes PAA was selected as a PAA in the 2nd cycle. The EPA report includes the following reasons:

- Lough Rinn is a centre of excellence for rowing (1million euro invested).
- Lough Rinn is important for tourism.
- Building on improvements: Lough Rinn has improved from Bad to Moderate.
- Building on planned improvements at Mohill WWTP.
- Lough Rinn is drinking water protected area (DWPA) with MCPA issues.
- River water bodies are headwaters to Lough Rinn.

As part of the characterisation process each waterbody has been assigned investigative actions (IAs) to assist in the overall WFD objective of meeting good status. These actions have been assigned accordingly based upon the action required. Within this PAA all actions have been assigned to LAWPRO, and therefore must be completed as part of the assessment process. The following IAs apply to this PAA:

Waterbody	Investigative Assessment No.	Assigned Organisation	Description of IA
Rinn_010	IA1	LAWPRO	Watching Brief WWTP is due to be upgraded - watching brief assigned to look for improvement once the upgrade works at WWTP are completed.
Rinn_020	IA7	LAWPRO	Local catchment assessment to be carried out with a focus on nutrients. Also, need to check whether there are any impacts from activities/ pressures close to the monitoring points before carrying out the rest of the assessment.
Rinn_030	IA7	LAWPRO	Local catchment assessment needs carried out, with a focus on nutrients and agriculture. Before carrying out the LCA, liaison with Longford County Council

Lough Rinn Forbes PAA

			would help to identify areas and co-ordinate resources for the assessment.
Shannon (Upper)_080	IA1	LAWPRO	This is a watching brief for Roscommon. No particular pressure of note here. Several potentially significant pressures with the most likely including agriculture and peat. However, no action will be taken here until the actions in the upstream sections of the Shannon (Upper) have been completed. These should result in improvements for the sections downstream. If there is no improvement, then local catchment assessment may be required.
Annaghcooleen_010	IA3	LAWPRO	IA3 to focus on the high PIP area along the stream. Suggestion to use the old investigative monitoring point as the sampling location (Scry Br).
Drumbad_010	IA3	LAWPRO	Local catchment assessment needed, to include a water sample.
Lough Rinn	IA9	LAWPRO	Local catchment assessment needed to determine what is driving the status of the water body - whether it is mainly the water levels or nutrients, and what pressures are causing greatest impact. Note that zebra mussels are present.
Lough Forbes	IA9	LAWPRO	IA9 for At Risk lake. Focus on IP and peat, following local knowledge. Main P load would be from agriculture.

Table 1: Investigative assessment actions required within each waterbody

Description of catchment

Lough Rinn Forbes is a recommend PAA as detailed in the River Basin Management Plan 2018-2021. It is divided into six river waterbodies the Rinn_010, Rinn_020, Rinn_030, Annaghcooleen_010, Drumbad_010 and Shannon (Upper)_080. All of which are *At Risk* of not achieving their environmental objectives except for the Annaghcooleen_010 and Drumbad_010 waterbodies, as these are under *Review*. It also contains two lake waterbodies: Lough Rinn and Lough Forbes both are *At Risk* (Figure 1).

The Lough Rinn Forbes PAA is a low-lying catchment. One branch of the Rinn_010 rises at 60m OD North of Mohill, running through the town. Four other branches rise west of the town before merging and entering Lough Rinn west of the lake. Rinn_020 rises at 75m OD east of Mohill town. The main channel flows into Creenagh lake before entering Lough Rinn to the East of the lake. A small tributary of the Rinn_020 enters Lough Rinn to the north of the lake. Rinn_030 is the stretch of river leaving lough Rinn. It travels south before entering the north of Lough Forbes. Drumbad_010 rises east of Lough Rinn. The main channel branches into two just east of Lough Rinn, one enters Clooncoe Lough and the other enters Lough Errew. Annaghcooleen_010 flows into Lough Forbes from the east just north of Newtown Forbes. Shannon (Upper)_080 enters Forbes to the west after traveling south from Roosky. The Shannon (Upper)_080 is also the exiting waterbody of Lough Forbes continuing down to Tarmonbarry.

Mohill Urban Wastewater Treatment Plant discharges into Rinn_010. Rinn_010 is the only waterbody within the PAA, which is at Poor status (2015). The plant is designed for a population equivalent (PE) of between 1001 and 2000, currently the population is 1488. The treatment type in the plant is tertiary with P removal. The treatment plant is due upgrades, which are to be completed in 2019 as per the Irish Water forecast within the RBMP.

2.2 Information Sources Consulted

Several information sources were consulted during the preparation of the desk study for the Lough Rinn Forbes PAA including:

- WFD web application – EPA characterisation data
- Data from Longford County Council
- Data from Leitrim County Council
- Data from Irish Water
- Data Animal & Plant Health Association
- Data from the National Parks & Wildlife Services
- Data from Inland Fisheries Ireland

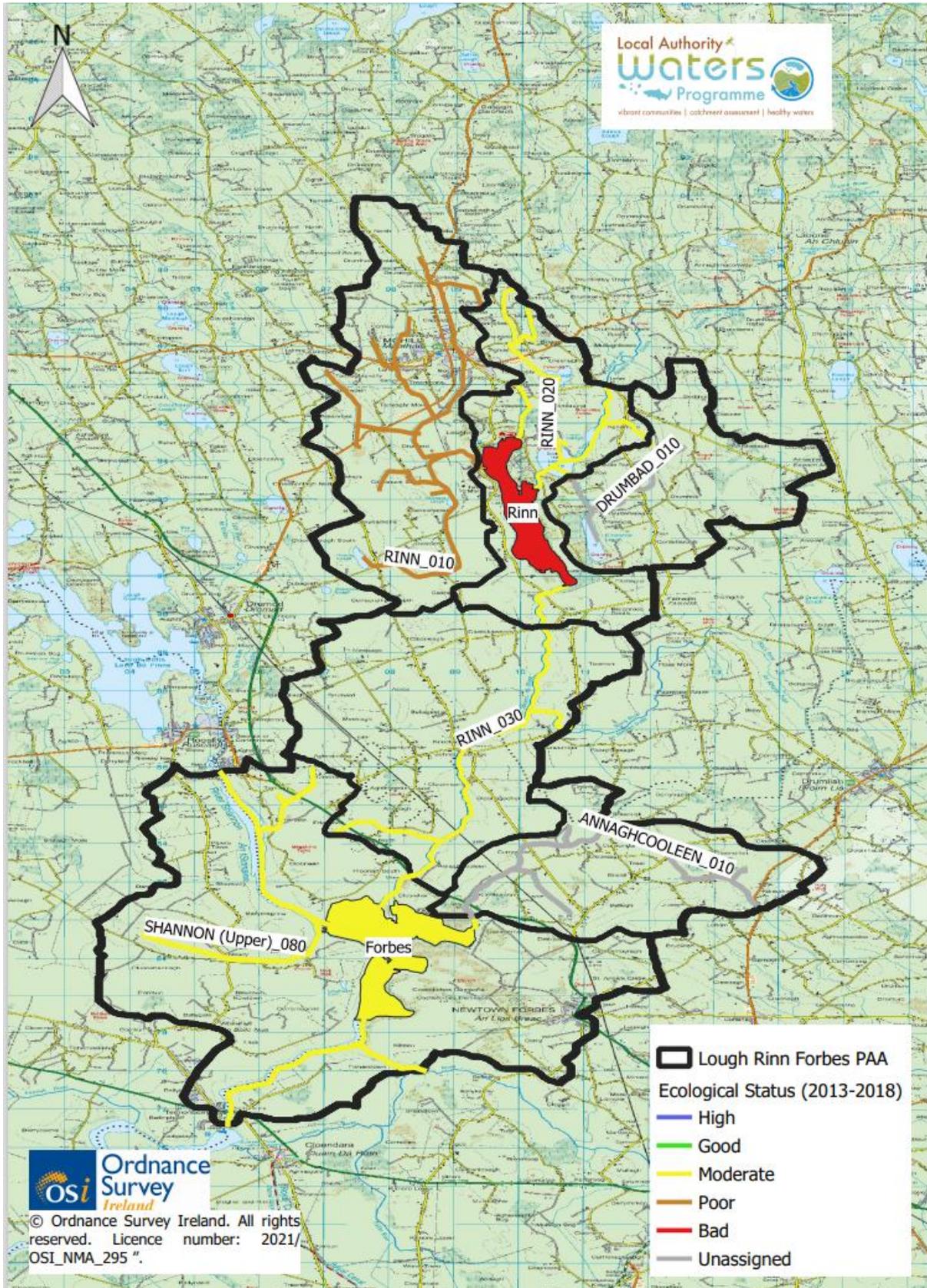


Figure 1: Lough Rinn Forbes Priority Area for Action location map

2.3 PAA Summary Information

A summary of risk, ecological status, known pressures and associated significance for the Lough Rinn Forbes PAA are presented in **Table 2** below. The Drumbad_010 and Annaghcooleen_010 waterbodies are under *Review*, the remaining waterbodies within the PAA are characterised as *At Risk*. The ecological status within Lough Rinn Forbes PAA includes 5 Moderate (3 rivers & 2 lakes), 1 Poor and 2 unassigned status waterbodies.

Table 3 identifies the EPA's monitoring stations within the PAA, the data collected varies from chemistry sampling to biological sampling or both: there are 5 stations along the Rinn_010, one on the Rinn_020 and Rinn_030, two on the Shannon (Upper)_080 and there are no monitoring locations along the two unassigned waterbodies. Lough Rinn has several monitoring stations and Lough Forbes has one.

The factors contributing to the characterisation are described in **Table 4**. Rinn_010, Rinn_030 and Lough Forbes ecological status has not changed in the last three ecological assessment iterations (**Table 4**). Lough Rinn has improved from Bad to Moderate status, the Shannon (Upper)_080 has dis-improved from Good to Moderate status and Rinn_020 has gone from unassigned to Moderate status.

Lough Rinn Forbes PAA

WB Code	WB name	WB Type	Risk	High status obj.	2009	2012	2015	No of pressures	Pressure category	Pressure subcategory	Pressure name	Significant pressure (Y/N)
IE_SH_26R020100	RINN_010	River	At risk	No	P	P	P	1	UWW	Agglomeration PE of 1,001 to 2,000	Mohill	Yes
IE_SH_26D560860	DRUMBAD_010	River	Review	No	U	U	U	1	Agriculture	Pasture	0	Yes
IE_SH_26R020200	RINN_020	River	At risk	No	M	U	M	1	Agriculture	Pasture	0	Yes
IE_SH_26R020400	RINN_030	River	At risk	No	M	M	M	1	Agriculture	Pasture	0	Yes
IE_SH_26A430910	ANNAGHCOOLEEN_010	River	Review	No	U	U	U	1	Agriculture	Pasture	0	Yes
IE_SH_26S021510	SHANNON (Upper)_080	River	At risk	No	M	G	M	1	Agriculture	Pasture	0	Yes
IE_SH_26_700	Rinn	Lake	At risk	No	B	B	M	4	Industry	Section 4	0	Yes
									Agriculture	Agriculture	0	Yes
									Hydromorphology	Dams, barriers, locks, weirs	0	Yes
									Invasive Species	Invasive Species	0	Yes
IE_SH_26_723	Forbes	Lake	At risk	No	M	M	M	4	Abstractions	Water Supply	0	No
									Agriculture	Pasture	0	Yes
									Invasive Species	Invasive Species	0	Yes
									Extractive Industry	Peat	0	Yes

Table 2: Summary of waterbodies within the PAA

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

Lough Rinn Forbes PAA

Waterbody	Monitoring Point Code	Name	Type	Comments
Rinn_010	RS26R020060	Br 1.6 km d/s Mohill*	Operational	Q & chemistry
	RS26R020100	RINN – Br u/s Lough Rinn	Operational	Q only
	RS26R0200006	Upstream at Mohill Business Park	Investigative	Chemistry Only
	RS26R020057	Downstream 90M from WWTP	Investigative	Chemistry Only
	RS26R020058	RINN - 0.8 km d/s Br in Mohill (d/s WWTP)	PreWFD	Chemistry Only
Rinn_020	RS26R020200	Annaghveagh Br	Operational	Q only
Rinn_030	RS26R020400	Cloonart Br	Operational	Q only
Shannon (Upper)_080	RS26S021510	d/s Tarmonbarry Weir (LHS)	Operational	Q & chemistry
	RS26S021500	SHANNON (Upper) - Tarmonbarry Br	PreWFD	Chemistry Only
Annaghecooleen_010	<i>Not sampled</i>			
Drumbad_010	<i>Not sampled</i>			

Table 3: Identifying the EPA river monitoring locations within the Lough Rinn Forbes PAA

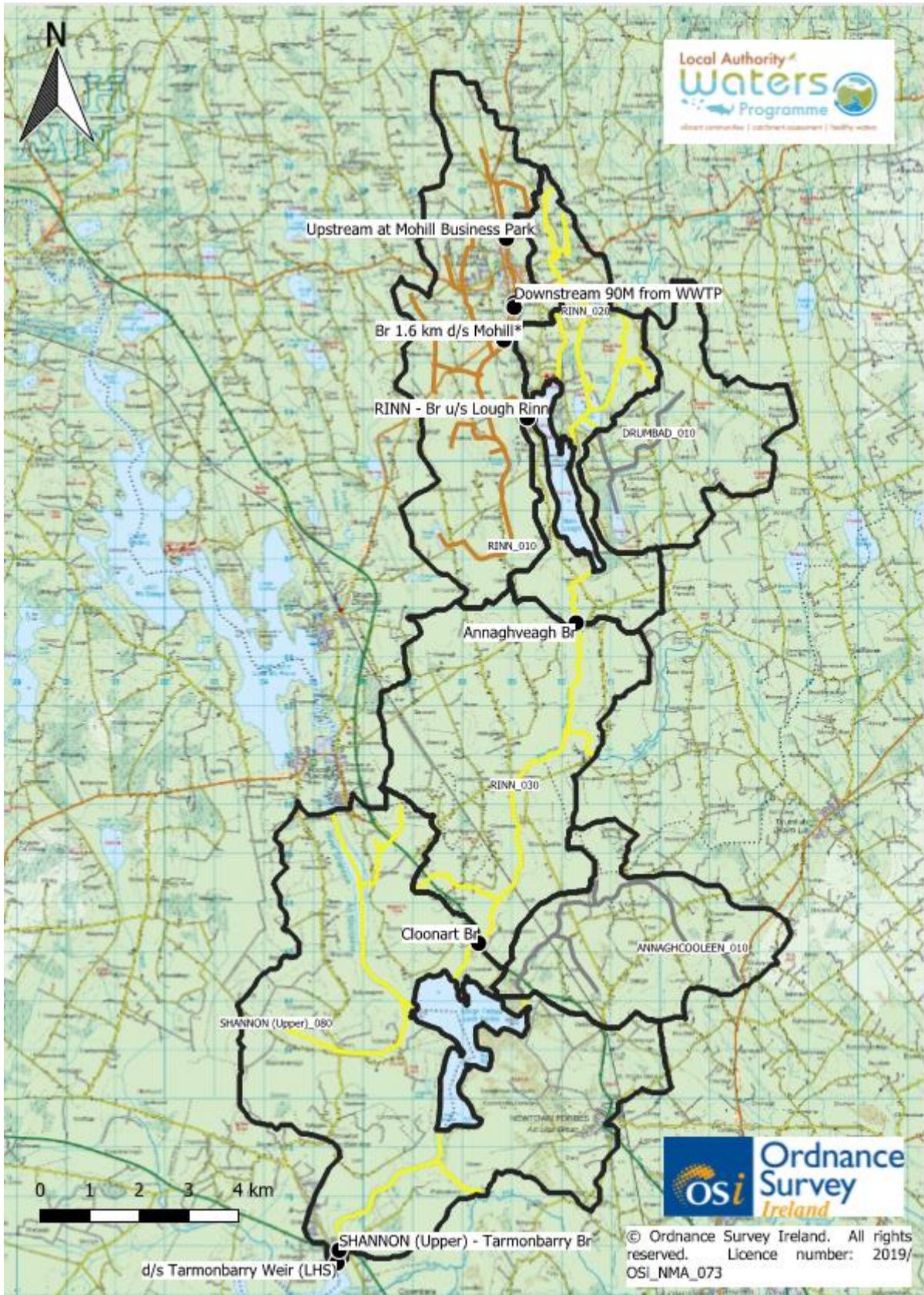


Figure 2: EPA active chemical and biological monitoring locations within the PAA

3 Receptor information & assessment

3.1 Context and Setting

Lough Rinn Forbes was selected as a PAA as none of the EPA monitoring stations are meeting the WFD objective of Good status. Lough Rinn forms the Rinn Lough proposed Natural Heritage Area (pNHA) and is bounded by the Clooncoe Wood and Lough and the Lough Errew pNHAs (National Research Survey Lakes 2018, IFI) Programme. The Rinn Natural Heritage Area NHA (NHA) which flows from Lough Rinn to Lough Forbes is also part of the PAA. Lough Forbes falls within the Lough Forbes Complex SAC (site 001818) and Ballykenny-Fisherstown Bog SPA (site 004101). The PAA also feeds into the Longford Central drinking water supply, abstracted from Lough Forbes, this supply has been on the EPA remedial action list since 2017 for persistent pesticide exceedances.

3.2 WFD Information

River Data

Table 4 below provides the latest river data available from 2018. The 2017 Q value data for the two biological monitoring stations on Rinn_010 (Br 1.6km d/s Mohill* and Br u/s Lough Rinn), show no change in status at either monitoring point when compared to the 2014 monitoring. The Q value data for the station along the Rinn_020 (Annaghveagh Br) and Rinn_030 (Cloonart Br) remained at Moderate between 2014 and 2017. The biological monitoring station d/s Tarmonbarry Weir (LHS) along the Shannon (Upper)_80 showed a deterioration in Q rating from Moderate to Poor in 2017. All river waterbodies within the PAA are characterised as *At Risk* of failing to meet WFD objective of Good status. Currently none of the 5 biological monitoring stations within the catchment are meeting the requirements. Local catchment assessments are needed to prevent further deterioration and to improve water quality within the catchment.

Lough Rinn Forbes PAA

Waterbody	Rinn_010					Drumbad_010	Rinn_020	Rinn_030	Annaghcooleen_010	Shannon (Upper)_080	
Risk Category	At risk					Review	At risk	At risk	Review	At risk	
Monitoring station	Upstream at Mohill Business Park	Downstream 90M from WWTP	Br 1.6 km d/s Mohill*	RINN - 0.8 km d/s Br in Mohill (d/s WWTP)	<i>RINN - Br u/s Lough Rinn</i>		Annaghveagh Br	Cloonart Br		SHANNON (Upper) - Tarmonbarry Br	d/s Tarmonbarry Weir (LHS)
Monitoring station type	Investigative	Investigative	Operational	PreWfd	Operational	#N/A	Operational	Operational	#N/A	PreWfd	Operational
Biological Status											
Q values	2009		0				0	0			3-4
	2010		0				0	0			0
	2011		2-3				0	3-4			4
	2012		0				0	0			0
	2013		0				0	0			0
	2014		2-3			2-3	3-4	3-4			3-4
	2015		0				0	0			0
	2016		0				0	0			0
	2017		2- 3*		3		3- 4*	3- 4*			3
Water chemistry											
Monitoring station	Upstream at Mohill Business Park	Downstream 90M from WWTP	Br 1.6 km d/s Mohill*	RINN - 0.8 km d/s Br in Mohill (d/s WWTP)						SHANNON (Upper) - Tarmonbarry Br	
	2010		0.182								
	2011		0.206								
	2012	0.101	0.214	0.134							
PO4+	2013	0.099		0.225	0.279					0.014	

Lough Rinn Forbes PAA

	2014	0.085	0.306	0.206								
	2015	0.101	0.143	0.264							0.011	
Ecological Threshold	2016	0.108	0.157	0.196							0.051	
0.035	2017	0.112	0.191	0.220							0.021	
mgP/L	2018	0.085	0.135	0.162							0.010	
Baseline PO4		0.099	0.191	0.199	0.279						0.021	
	2010			0.178								
	2011			0.931								
	2012	0.039	0.481	0.375								
NH4+	2013	0.039		0.602	0.104						0.036	
	2014	0.040	0.362	0.096								
	2015	0.075	0.139	0.113							0.028	
Ecological Threshold	2016	0.077	0.225	0.190							0.024	
0.065	2017	0.043	0.205	0.145							0.049	
mgN/L	2018	0.080	0.337	0.200							0.074	
Baseline NH4		0.056	0.292	0.314	0.104						0.042	
	2010			1.40								
	2011			1.11								
	2012			1.41								
NO3-	2013			1.38							0.19	
	2014			1.07								
	2015			2.83								
Ecological Threshold	2016			1.61								
3.5	2017			0.89								
mgN/L	2018			2.84								

Lough Rinn Forbes PAA

Baseline NO3				1.61							0.19	
BOD	2010			2.1								
	2011			3.6								
	2012	1.7	5.4	3.8								
	2013	1.8		4.3	12.205 ²							
	2014	1.8	2.9	1.8								
	2015	1.6	2.4	3.1								
Ecological Threshold	2016	1.7	2.2	3.4								
	2017	1.6	2.6	3.2								
Mg/l	2018	1.5	3.3	2.1								
HYMO	Not identified as an issue during the EPAs initial characterisation											
Conceptual model required (Y/N)	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ecological Status	Poor	Unassigned	Moderate	Moderate	Unassigned	Moderate						
EPA Biologist comments	The Rinn River was in an unsatisfactory ecological condition at all four sites surveyed in 2017. The biologically monitored sites along the Rinn_010 remained in poor ecological condition characterised by a complete lack of sensitive macroinvertebrate taxa and low dissolved oxygen concentration						Rinn_020 & Rinn_030 remain at moderate ecological condition.			Tarmonbarry (1510) has declined from moderate to poor ecological condition.		
Significant issue: monitoring point	Ortho P, Ammonia & BOD						Unknown				Ammonia & Ortho P	
Significant issue: Waterbody	UWW						Agriculture					

Table 4: Outline of parameters influencing water quality in the Lough Rinn Forbes PAA

1: * Represents sediment detected by the EPA biologists in the water column.

2: 17/09/2013 BOD concentration at RINN - 0.8 km d/s Br in Mohill (d/s WWTP) was recorded at 104mg/l. Treat with caution.

There are 5 EPA biological monitoring points throughout the PAA. None of the monitoring stations are reaching the WFD objective of “Good” status. Two water bodies are unassigned, therefore no monitoring has been carried out along these stretches. Along the Rinn_010 one of the two stations has improved slightly between 2014 and 2017 going from Q2-3 to Q3. There has been a deterioration at monitoring locations “d/s Tarmonbarry Weir” along the Shannon (Upper)_080 from Moderate to Poor status. Rinn_020 and Rinn_030 have shown no change in status and remain below the WFD water quality standards.

There is no chemical data available along the Rinn_020, Rinn_030, Annaghcooleen_010, or Drumbad_010 waterbodies. There are four chemical monitoring stations along the Rinn_010 and one along the Shannon (Upper)_080.

Along the Shannon (Upper)_080 annual averages do not show a significant issue regarding Ortho-P or ammonia, the mean EQS was exceeded in 2016 for Ortho-P and the ammonia mean EQS exceeded in 2018. These results were as a result of one sampling event within those years, which was above the 95%tile EQS therefore driving up the overall annual average above the Mean EQS.

Nitrate concentrations along both Rinn_010 and the Shannon (Upper)_080 do not indicate an issue within the water body.

Mohill Wastewater Treatment Plant discharges into the Rinn_010. As per **Table 4** the Rinn_010 has two biological monitoring locations, which are downstream of the treatment plant. Both stations are classified as Poor status. The chemistry data in **Table 4** above indicates the Mohill wastewater treatment plant may be having a significant impact on the water quality within the Rinn_010. Ortho-P levels are predominantly exceeding the 95%ile EQS (0.075mg/l) at all four locations along the Rinn_010 (see Appendix 1 - **Figures 11 to 14**). The significant pressure along this stretch is the Mohill WWTP, and the highest concentrations of Ortho-P were recorded at the monitoring location “Downstream 90m from WWTP” (**Figure 12**), it must be noted that upstream of the treatment plant the 95%ile EQS is also being exceeded (**Figure 11**). This indicates that there is an additional pressure source impacting on the water quality other than the WWTP. Ammonia concentrations upstream of the WWTP, are predominantly below the mean EQS 0.065mg/l, however there are a few elevations above this and on three monitoring events the 95%ile EQS was exceeded (**Figure 15**). Downstream of the treatment plant the mean EQS is exceeded regularly with “Downstream 90M from WWTP” showing the highest number of sampling events above the 95%ile EQS (**Figure 16**).

BOD is present at all four monitoring points along the Rinn_010 in high concentrations. The monitoring location “Upstream at Mohill Business Park” annual averages are on/above the mean EQS of 1.5mg/l, however, the individual monitoring events showed concentrations rising to 4mg/l. Monitoring locations “Downstream 90M from WWTP” and “Br 1.6 km d/s Mohill” recorded annual averages above the 95%ile EQS (2.6mg/l). Immediately downstream of the plant concentrations of 17.5mg/l were recorded, concentrations dropped further downstream with the highest recording of 11.3mg/l. This may be due to a dilution factor. Such concentrations would have significant negative impacts on the

biological assemblages within the water column. BOD was only tested along the “RINN - 0.8 km d/s Br in Mohill (d/s WWTP)” in 2013 and a concentration of 104mg/l was recorded, this concentration is very unlikely as the concentrations that year ranged between 1-3mg/l, this is most likely an outlier (e.g. lab or typo error).

Lake Data

Lough Rinn is *At Risk* of not meeting the WFD objective of Good status. It was at Moderate Ecological status between 2010-2015, deteriorating to Bad status in the most recent EPA assessment (2017). Phytoplankton improved to Good status, whilst macrophytes deteriorated to Bad status in 2013-2018.

Waterbody		Lough Rinn (IE_SH_26_700)	
Risk Category		At Risk	
Environmental Objective		Good	
Environmental Objective Date		2021	
Monitoring Type		Operational	
(Figure 3)		Littoral	LIT_0010 Surrogate Shore
		Macrophytes	M_1 to M_4
		Chemistry	Site 1 to Site 3
Lake type		Type 10: Low altitude, high alkalinity, shallow and large lakes	
Biological Status			
Phytoplankton	2007-2009	Moderate	
	2010-2012	Moderate	
	2010-2015	Moderate	
	2013-2018	Good	
Other Aquatic Flora			
Macrophytes	2007-2009	Bad	
	2010-2012	Bad	
	2010-2015	Moderate	
	2013-2018	Bad	
Comments		Plants and Total Phosphorus are driving the status. Zebra mussels are also present within this lake.	
Conceptual model required (Y/N)		Y	
Ecological Status			
2013-2018		Bad	
Observations from Macrophyte Report		The total records of plants increased from 47 in 2014 to 65 in 2017. The % RF of three plant taxa; filamentous algae, Sparganium emersum and Nitella sp. increased by more than five percentage points in 2017 compared to 2014. The increase in these three tolerant taxa caused a decrease in the % RF elodeids metric score, which contributed to the change in status from	

Lough Rinn Forbes PAA

Waterbody	Lough Rinn (IE_SH_26_700)
Risk Category	At Risk
Environmental Objective	Good
Environmental Objective Date	2021
Monitoring Type	Operational
	moderate to bad. Also the % RF of <i>Potamogeton lucens</i> , <i>Lemna minor</i> and <i>Elodea canadensis</i> decreased by at least five percentage points in 2017 compared to 2014. The maximum and average depth of colonization also decreased.
Significant issue: monitoring point	Total P/ammonia/ <i>chlorophyll a</i> , see Table 6
Significant issue: Waterbody	Total P/ammonia/ <i>chlorophyll a</i> , see Table 6

Table 5 : Receptor Information for Lough Rinn

The EPA carry out chemistry sampling at 3 sites within Lough Rinn. The locations are tested for Total Phosphorus, Total Ammonia and Chlorophyll a. **Table 6** below includes the annual averages for each parameter between 2007 and 2018.

The EPA Macrophyte Report (2016-2018) Lough Rinn did state “the change in status in 2014 was mainly due to an increase in water levels most likely associated with increased rainfall, temporarily changing lake conditions and impacting the depth metric scores. A permanent improvement in the lake macrophyte community will not occur until TP levels are subject to a long-term reduction below the high/good class boundary.” Therefore, the improvement in 2014 is expected to be an anomaly and is likely not linked to any improvements or a reduction of pollutant sources entering the lake. Based upon this, the lake’s environmental objective of 2021 would not be a realistic target to achieve.

Waterbody		Lake (IE_SH_26_700)		
Risk Category		At Risk		
Environmental Objective		Good		
Monitoring Station		Site 1	Site 2	Site 3
Water chemistry				
Total Phosphorus (mg P/l) High status ≤ 0.010 (mean) Good status ≤ 0.025 (mean)	2007	0.125	0.107	0.105
	2008	0.074	0.058	0.056
	2009	0.075	0.064	0.073
	2010	0.084	0.058	0.063
	2011	0.069	0.057	0.057
	2012	0.078	0.078	0.075
	2013	0.075	0.080	0.085
	2014	0.113	0.158	0.118
	2015	0.123	0.123	0.118
	2016	0.090	0.083	0.080
	2017	0.087	0.073	0.070
	2018	0.082	0.067	0.065
Baseline TP (2016-2018)		0.086	0.074	0.072
Total Ammonia (mg N/l) High status ≤ 0.040 (mean) and ≤ 0.090 (95%ile) Good status ≤ 0.065 (mean) and ≤ 0.140 (95%ile)	2007	0.070	0.075	0.044
	2008	0.039	0.037	0.032
	2009	0.035	0.028	0.033
	2010	0.023	0.033	0.034
	2011	0.048	0.042	0.048
	2012	0.064	0.065	0.067
	2013	0.083	0.100	2.655
	2014	0.060	0.053	0.061
	2015	0.068	0.085	0.084
	2016	0.049	0.053	0.062
	2017	0.048	0.026	0.038
	2018	0.061	0.049	0.053
Baseline NH₃ (2016-2018)		0.053	0.042	0.051
Chlorophyll a (µg/l) Lake type 10 HG: 6.4 GM: 10.9 MP: 21.8 PB: 43.6	2007	8.8	21.0	13.6
	2008	17.9	11.1	9.0
	2009	14.4	12.8	6.9
	2010	10.3	8.0	17.7
	2011	12.7	17.8	25.2
	2012	8.3	9.4	13.1
	2013	7.9	6.0	7.4
	2014	12.3	19.3	36.9
	2015	15.7	15.1	15.7
	2016	10.7	7.2	7.1
	2017	19.3	9.4	8.6
	2018	11.8	7.5	5.6
Baseline Chlorophyll a (2016-2018)		13.9	8.0	7.1

Significant issue: monitoring point	TP, NH ₃ & Chlorophyll	TP, NH ₃ & Chlorophyll	TP, NH ₃ & Chlorophyll
Significant issue: waterbody	TP, NH ₃ & Chlorophyll	TP, NH ₃ & Chlorophyll	TP, NH ₃ & Chlorophyll

Table 6 : EPA monitoring data for Lough Rinn

Total Phosphorus was significantly above the good status mean EQS 0.025mg/l at all 3 sites based on the annual averages between 2007 and 2018. The raw data for each site shows concentrations were above the good status mean EQS of 0.025mg/l on all monitoring events between 2007 and 2018. There appears to be slight improvements since 2015. Phosphorus can be stored in the sediments in lakes and can become resuspended at different times during the year. This typically occurs in lakes which are stratified. If Lough Rinn is stratified this means the recovery of the lake would be much longer even after the pressures have been removed. Further assessments into the impact of sediments within the lake will be conducted during the local catchment assessment.

In 2007, the ammonia concentrations were above the mean EQS for good status (0.065mg/l) at site 1 and 2. There were further exceedances in 2012 at Site 2 and Site 3. Site 1 in 2012, however, was just 0.01mg/l away from the EQS. Indicating an issue with ammonia throughout the lake that year. 2013 and 2014 also saw exceedances at all three locations. However, in 2013 site 3 had an exceptionally high annual average of 2.655mg/l. No further exceedances were noted in the annual averages between 2016 and 2018 for ammonia. Based upon the raw data concentrations of ammonia have varied above and below 0.065mg/l in recent years at all 3 sites. The raw data has shown on two occasions the 95%ile EQS (0.14mg/l) was exceeded at Site 2 & 3 in 2013 and Site 1 in 2017.

Chlorophyll a concentrations at Site 1 were predominantly between Moderate and Poor classifications (10.9mg/l to 21.8mg/l). Good to Moderate conditions were recorded in 2007, 2010, 2012 and 2013. At Site 2 Moderate to Poor concentrations of *Chlorophyll a* were recorded in the earlier years of sampling, Good to Moderate conditions are more frequent in the last number of years. Site 3 had concentrations above 21.8 (Poor to Bad range) in 2011 and 2014. However, there seems to be a downward trend since 2015. In 2018, this site was below 6.4mg/l, which is classified as High to Good status. A downward trend has been noted in the raw data in 2018 at all sites, with just Site 1 showing one exceedance.

Based on the data assessed, it is evident all three parameters *chlorophyll a*, Total Phosphorus and Ammonia have been an issue within this waterbody in previous years.

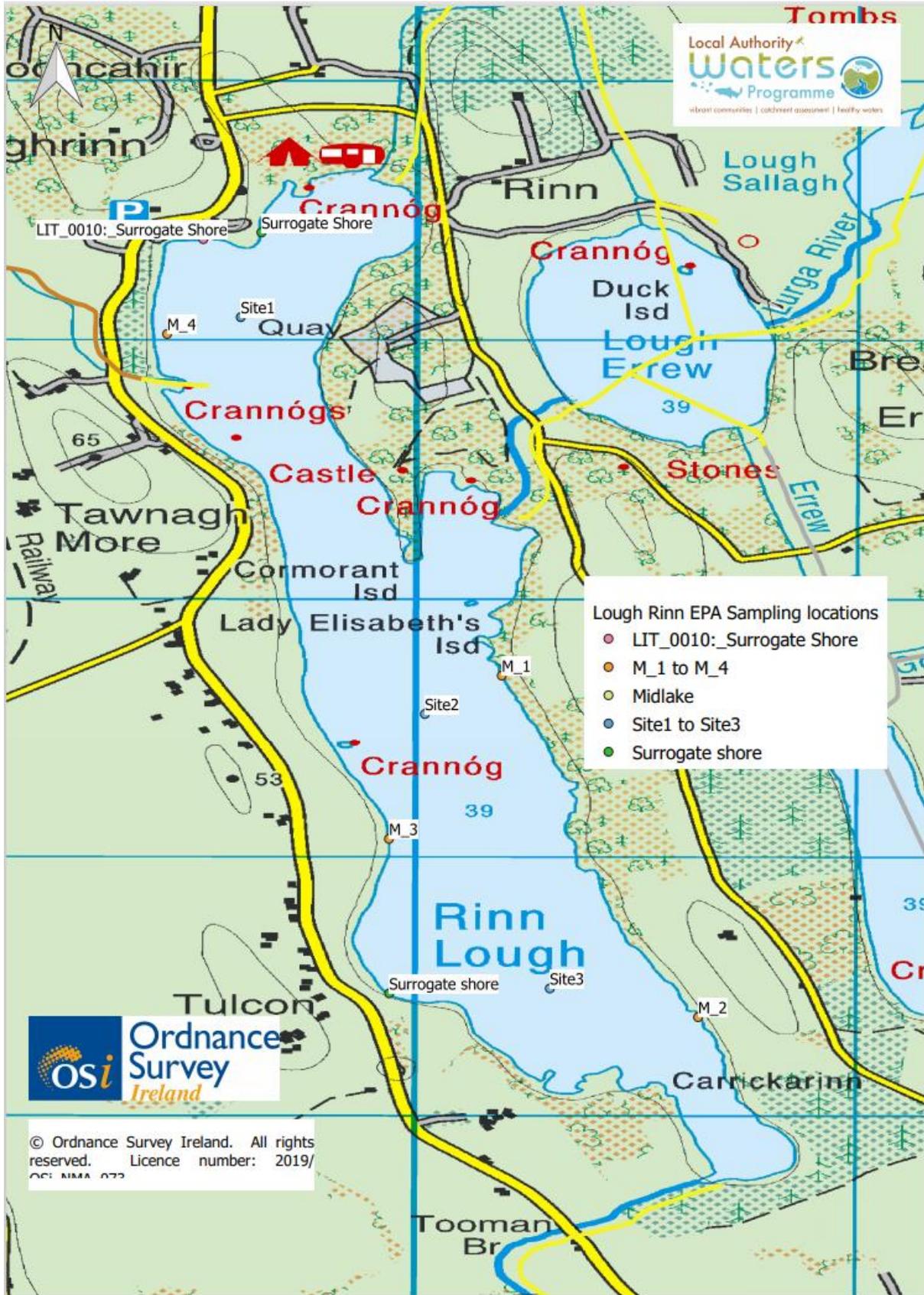


Figure 3 : EPA monitoring locations within Lough Rinn

Lough Forbes is *At Risk* of not meeting the WFD objective of Good status. Its ecological status is currently at Moderate status. The phytoplankton status is High, macrophytes and hydromorphology are at Moderate status.

Waterbody		Lough Forbes (IE_SH_26_723)	
Risk Category		At Risk	
Environmental Objective		Good	
Environmental Objective Date		2027	
Monitoring Type		Operational	
Monitoring stations (Figure 4)		Macrophytes	M_1 to M_5
		Chemistry	Midlake
Lake type		Type 10: Low altitude, high alkalinity, shallow and large lakes	
Biological Status			
Phytoplankton	2007-2009	High	
	2010-2012	Good	
	2010-2015	High	
	2013-2018	High	
Other Aquatic Flora			
Macrophytes	2007-2009	Moderate	
	2010-2012	Moderate	
	2010-2015	Moderate	
	2013-2018	Moderate	
Hydromorphological Conditions			
Hydromorphology	2013-2018	Moderate	
Comments		Plants and Total Phosphorus are driving the status. Zebra mussels are also present within this lake.	
Conceptual model required (Y/N)		Y	
Ecological Status			
2013-2018		Moderate	
Observations from Macrophyte Report		The counts and numbers of sensitive taxa increased in 2017, which resulted in a decrease in the %RF of tolerant taxa and thus an increase in the corresponding metric. The trophic score metric score increased in 2017 due to the inclusion of a number of low scoring taxa which reduced the average trophic score. The maximum depth of colonization increased which caused the corresponding metric score to increase also. These metric score changes led to an increase in the EQR but there was no change from moderate status.	
Significant issue: monitoring point		Total P, see Table 8	

Lough Rinn Forbes PAA

Waterbody	Lough Forbes (IE_SH_26_723)
Risk Category	<i>At Risk</i>
Environmental Objective	Good
Environmental Objective Date	2027
Monitoring Type	Operational
Significant issue: Waterbody	Total P, see Table 8

Table 7 : Receptor Information for Lough Forbes

The EPA carry out chemistry sampling at 1 location within Lough Forbes, this monitoring point is in the middle of the lake. The location is tested for Total Phosphorus, Total Ammonia and *Chlorophyll a*.

Table 8 below includes the annual averages for each parameter between 2007 and 2018.

Waterbody		Lough Forbes (IE_SH_26_723)
Risk Category		At Risk
Environmental Objective		Good
Monitoring Station		Midlake
Water chemistry		
Total Phosphorus (mg P/l) High status ≤ 0.010 (mean) Good status ≤ 0.025 (mean)	2007	
	2008	0.034
	2009	0.026
	2010	0.031
	2011	0.028
	2012	0.026
	2013	0.040
	2014	0.023
	2015	0.029
	2016	0.041
	2017	0.028
2018	0.026	
Baseline TP (2016-2018)		0.032
Total Ammonia (mg N/l) High status ≤ 0.040 (mean) and ≤ 0.090 (95%ile) Good status ≤ 0.065 (mean) and ≤ 0.140 (95%ile)	2007	0.008
	2008	0.006
	2009	0.015
	2010	0.033
	2011	0.013
	2012	0.005
	2013	0.025
	2014	0.010
	2015	0.010
	2016	0.016
	2017	0.014
2018	0.018	
Baseline NH₃ (2016-2018)		0.016
Chlorophyll a (µg/l) Lake type 10 HG: 6.4 GM: 10.9 MP: 21.8 PB: 43.6	2007	4.5
	2008	2.6
	2009	4.7
	2010	10.6
	2011	5.7
	2012	2.5
	2013	4.6
	2014	4.8
	2015	4.9
	2016	4.6
	2017	4.9
2018	4.9	
Baseline Chlorophyll a (2016-2018)		4.8

Significant issue: monitoring point	TP
Significant issue: waterbody	TP

Table 8 : EPA monitoring data for Lough Forbes

The ammonia annual averages and raw data were all below the mean EQS for high status within the mid-lake sample.

Chlorophyll a annual averages were between high and good status with the exception of 2010, which was elevated to 10.6 µg/l (good to moderate status). The raw data was also between high and good status with the exception of two monitoring events, one in September 2010 and another in April 2011.

The Total Phosphorus annual averages were all above the good status EQS of 0.025mg/l with the exception of 2014, which was just 0.002mg/l away from this EQS. The raw data similarly reflects what is seen in the annual averages, Total P was above 0.025mg/l on all sampling events. There is no visible downward trend in Total P in the raw and annual averages, the concentrations vary with no visible pattern.

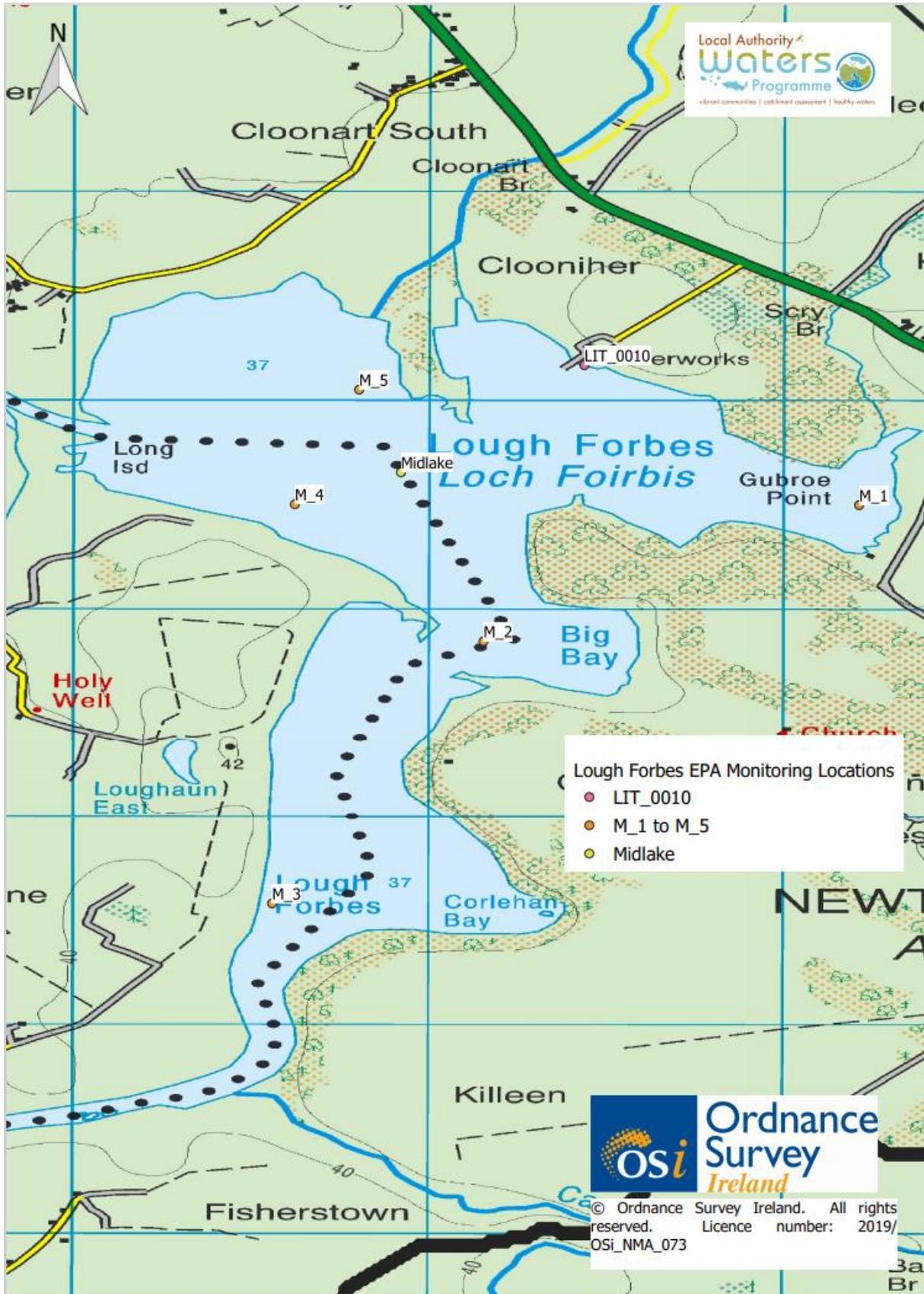


Figure 4 : EPA monitoring locations within Lough Forbes

3.3 Supplementary Information

The Longford Central Drinking Water Supply (DWS) has detected pesticides on different occasions throughout the spraying season over the last number of years, this supply serves a population of 15,427 within Longford Central and its intake is from Lough Forbes. The pesticides issue in this water supply first became known to the EPA by the detection of MCPA above the drinking water limit of 0.1µg/l in April 2010 (see **Table 9** below). As a result of these detections the supply was placed on the EPA Pesticide Remedial Action List (RAL) in 2017, as MCPA had been detected in the supply above the DW limit within 4 months of a spraying season. All exceedances in treated water were at the tap; as this is the point of compliance under the EU Drinking Water Regulations. The limit is 0.1 µg/l and the exceedances detected have been just above this limit and up to concentrations of 0.41 µg/l. Irish Water (IW) informed all supply users in late 2018 of the presence of both trihalomethanes (THM's) and pesticides within their drinking water supply and what measures they were taking to rectify these issues.

	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. of exceedances	1	3	2	2	4	6	4	12	2
No. of months with exceedances	1	2	2	2	4	5	4	6	1

Table 9: Longford Central Drinking water supply exceedances for pesticides

Due to the ongoing and increasing number of pesticide exceedances above the drinking water limit in supplies nationally the Department of Agriculture Food and the Marine (DAFM) stipulated a regulatory requirement for industry to carry out monitoring and placed the responsibility on industry to decide how the programme would be coordinated. Industry decided that the Animal Plant & Health Association (APHA) would co-ordinate the monitoring programme. The APHA monitoring programme is funded by industry. The overall size and scope of the programme was specified by DAFM. Specific details such as the catchments where monitoring is to be undertaken, the locations of sampling points and the duration and timing of sampling are agreed among APHA, Irish Water and DAFM, with support from NPDWAG members, including the EPA Catchments Unit and LAWPRO.

The APHA monitoring programme began in 2018, the catchment monitoring was carried out in four drinking water supplies, one of which included the Longford Central supply. The Lough Rinn Forbes PAA feeds into the Longford Central water supply catchment area. A number of the 13 sampling locations selected are within the PAA boundary (see **Figure 6** below).

The objective of the sampling was to aid in identifying the source of pesticides within the catchment, in order to reduce/eliminate them and therefore reducing presence and exceedances within the drinking water supplies. There were a number of locations sampled and results obtained and reviewed. Based upon this the locations were re-assessed at the end of 2018 and any potential information gaps were reviewed and the sampling locations were amended accordingly.

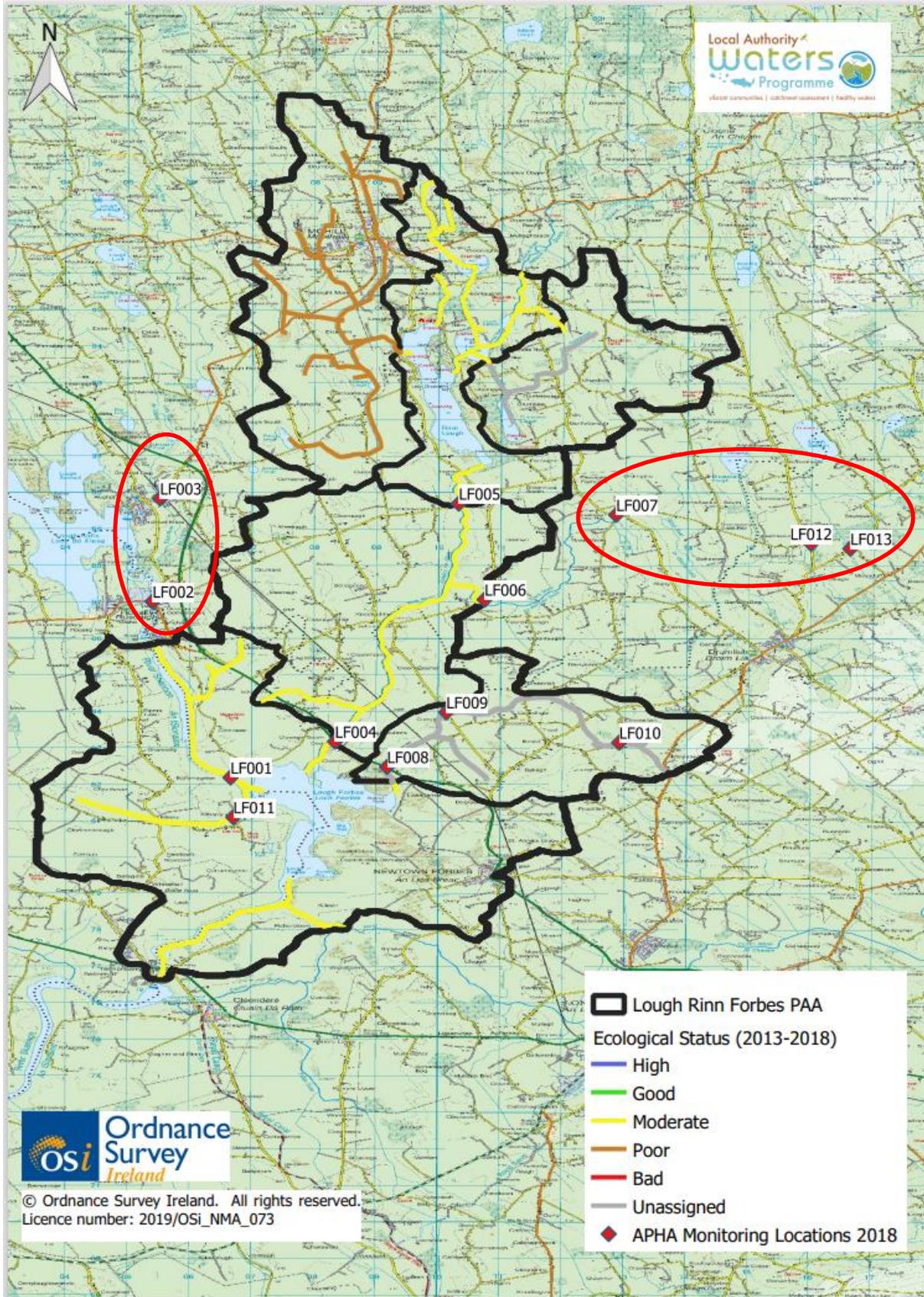


Figure 5: APHA 2018 monitoring points in relation to the Lough Rinn Forbes PAA

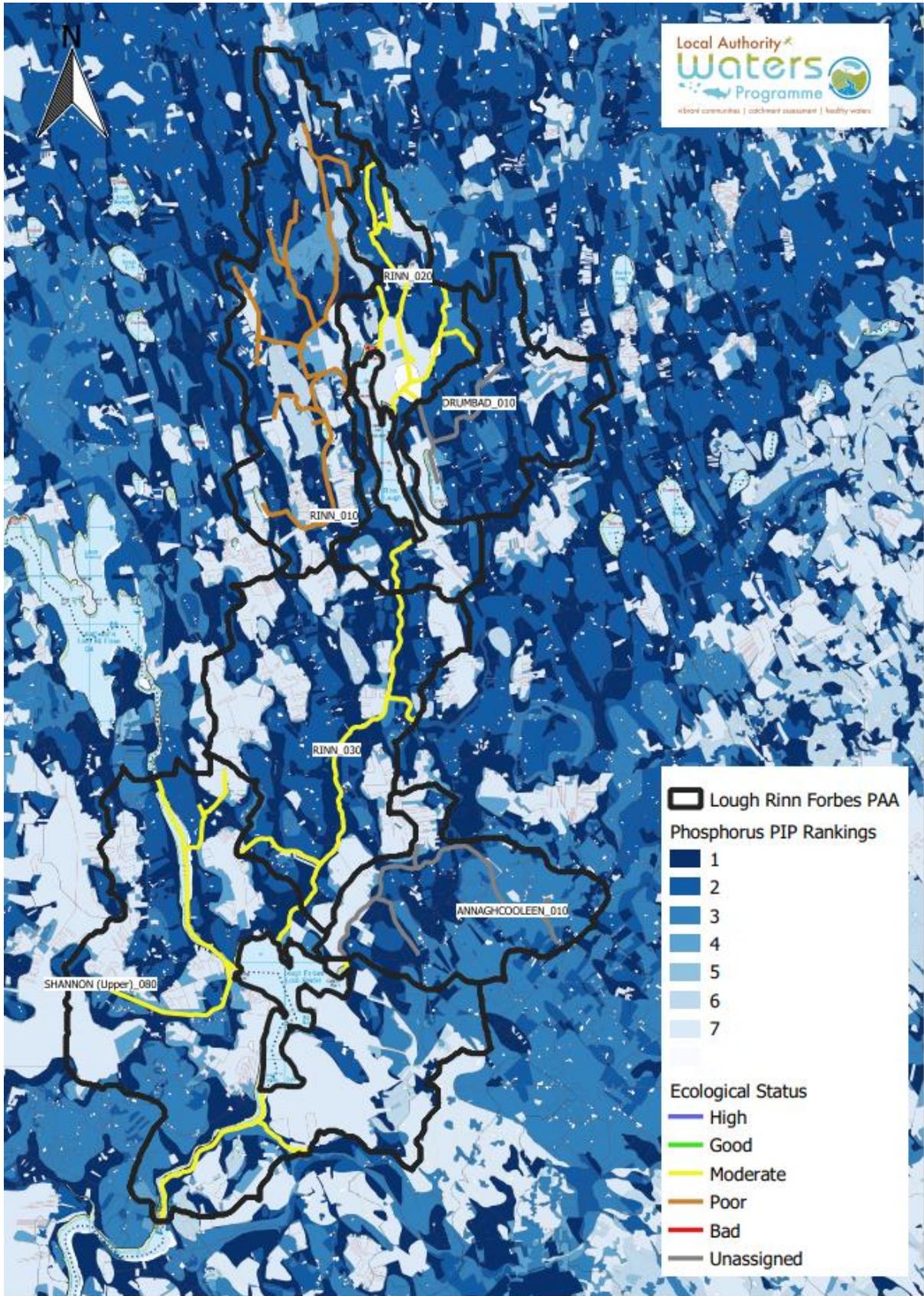


Figure 6: Phosphorus PIP map, showing PAA boundary and waterbody status

At the end of the 2018 monitoring period the data was assessed, and conclusions were drawn, for example it was deemed this catchment was complex and there was a possibility of both slow and fast

pathways for pesticide distribution. Fast pathways were deemed as overland flow to the receiving waters. Slow pathways included pesticides, which may have been bound up in soils or may be stratified in anaerobic layers of the lake which have slowed down the decomposition process, it is thought that this source of pesticides can be sporadically released into the receiving waters. As MCPA was detected before the spraying period commenced in March and that combined with the hypothesis of slow pathways it was decided that the APHA monitoring would be carried out from April 2019 to April 2020 taking in a full calendar year. This would identify if there were any patterns outside of the spraying period. At the end of 2018 the monitoring locations were reassessed some decommissioned and others commissioned to assist in providing clarity to the data set recorded.

Mohill Wastewater Treatment Plant

EPA Inspection

The Mohill WWTP has been assigned as the sole pressure along the Rinn_010. The EPA's most recent inspection of the plant was on the 13/02/2018. The following points were noted from the inspector's reports:

- The mixed liquor appeared dilute and light brown in colour which was attributed to recent heavy rainfall and hydraulic overloading of the WWTP. Irish Water advised that a contract had been awarded with regard to upgrade works primarily for the provision of a purpose-built storm water storage tank and sludge thickening/storage tank. The contractor was due to be onsite on the following day, February 15th, 2018 to commence the works and assume responsibility for operation of the waste water treatment plant (WWTP) in the interim period.
- A dosing rate had been established but was fixed and was not being actively managed. It is noted that significant breaches of the orthophosphate (as P) emission limit value were again recorded in 2017 and 2018. Irish Water advised that the matter would be fully addressed as part of the upgrade programme and that the contractor was due to assume responsibility for operations on 14/02/2018.
- The inspector also noted operational problems, as clumps of floc were visible in the effluent collection channel on the outside of the weir. This operational problem may be attributed to hydraulic overloading which is to be addressed as part of the upgrade works.

The plant also accepts leachate. In the 2017 EPA inspectors report, it was noted a detailed assessment of the impact on the performance of the WWTP had not been carried out. The WWTP did not have adequate hydraulic capacity to accept such additional loading. IW were to report to the EPA by way of Licensee Return on a detailed assessment of the impact of leachate acceptance on the treatment process, and details of any proposals to review the current arrangements in light of inadequate hydraulic capacity and ongoing breaches of Emission Limit Values (ELVs) notably ammonia. IW provided evidence to support the acceptance of leachate, as the 2017 inspector's report stated that Leitrim Co Co advised that the additional organic and hydraulic loading arising due to leachate acceptance had been considered at the design stage of the upgrade programme.

The EPA inspector's report for 2017 did note similar issues as seen in the 2018 report, such as issues regarding the control of mixed liquor, suspended solids and P removal adjustment. All of the above issues were due to be dealt with as a result of proposed treatment plant upgrade works.

The following Annual Environmental Report (AER) data is from Irish Waters 2017 AER for Mohill WWTP (**Tables 10 to 14**). **Table 10** identifies that effluent being discharged to Rinn_010 is failing compliance for BOD, TSS, Ortho P and ammonia. All of which can have a negative impact on the biological communities in the receiving waters. **Table 11** states that the current hydraulic capacity is almost 3 times above the designed capacity for the plant. **Tables 12 and 13** show the concentrations of parameters tested for both up and downstream of the treatment plant discharge. However, **Table 14** summarises the data based on the averages. Based on this, the concentrations of Ortho-P and ammonia being discharged are accounting for 90% and above of the EQS allowance within the waterbody. This leaves little or no capacity in the receiving waters to accommodate the background concentrations, therefore resulting in breaches in the EQS. As seen from the ambient water quality data below, the Mohill WWTP had a significant impact on the water quality in 2017.

2.2.1 Effluent Monitoring Summary	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	Ortho P / MRP (mg/l)	Ammonia N (mg/l)	pH (Range)	Temp (°c)
WWDL ELV (Schedule A) where applicable	2.00	125.00	10.00	0.10	0.20	6 to 9	25.00
ELV with Condition 2 Interpretation included	4.00	250.00	25.00	0.20	0.40		
% Reduction (Schedule A)							
Number of sample results	6	6	6	6	6	6	6
Number of sample results above WWDL ELV	6	1	6	6	3	0	0
Number of sample results above ELV with Condition 2 Interpretation	2	0	3	4	1	0	0
Annual Mean (for parameters where a mean ELV applies)							
Overall Compliance (Pass/Fail)	Fail	Pass	Fail	Fail	Fail	Pass	Pass

Table 10: Effluent Monitoring Summary for the Mohill WWTP 2017 AER

Hydraulic Capacity – Design / As Constructed (dry weather flow) (m3/day)	400
Hydraulic Capacity – Design / As Constructed (peak flow) (m3/day)	400
Hydraulic Capacity – Current loading (m3/day)	1,196
Hydraulic Capacity – Remaining (m3/day)	-796
Organic Capacity - Design / As Constructed (PE)	2,000
Organic Capacity - Collected Load (PE)	1,488
Organic Capacity – Remaining (PE)	512
Will the capacity be exceeded in the next three years? (Yes / No)	No

Table 11: Hydraulic and organic capacity of the Mohill WWTP

Upstream

Date	Ammonia (mg/l)	Ortho P (mg/l)	BOD (mg/l)	Total N (mg/l)	D.O. (% Sat)	D.O. (mg/l)	pH (mg/l)
17-Jan-2017	0.04	0.07	1.30	1.10	95.80	11.36	7.90
16-Feb-2017	0.03	0.09	1.10	1.10	99.00	11.82	7.95
2-Mar-2017	0.03	0.07	1.00	1.10	97.40	11.95	7.62
18-Apr-2017	0.03	0.07	1.00	0.60	103.60	11.40	7.58
8-May-2017	0.03	0.06	1.20	0.80	118.60	11.51	7.59
14-June-2017	0.05	0.15	2.90	1.10	89.60	8.70	7.41
12-July-2017	0.11	0.29	2.30	1.20	59.10	5.51	7.35
8-Aug-2017	0.03	0.13	1.70	1.30	95.10	9.73	7.89
13-Sep-2017	0.02	0.11	1.30	1.30	98.00	9.80	7.52
3-Oct-2017	0.08	0.12	2.20	3.10	92.90	10.18	8.85
13-Nov-2017	0.06	0.09	1.50	2.40	97.70	12.06	7.93
Mean	0.05	0.11	1.59	1.37	95.16	10.37	7.78
95%ile	0.10	0.22	2.60	2.75	111.10	12.01	8.40

Table 12: Chemical analysis upstream of Mohill WWTP discharge

Downstream

Date	Ammonia (mg/l)	Ortho P (mg/l)	BOD (mg/l)	Total N (mg/l)	D.O. (% Sat)	D.O. (mg/l)	pH (mg/l)
17-Jan-2017	0.24	0.12	3.13	2.60	90.40	10.56	7.79
16-Feb-2017	0.17	0.11	2.02	2.40	90.40	10.84	7.84
2-Mar-2017	0.05	0.08	1.30	1.60	91.60	11.36	7.60
18-Apr-2017	0.08	0.15	1.30	3.10	126.70	14.08	7.94
8-May-2017	0.87	0.50	6.00	6.50	67.70	6.57	7.14
14-June-2017	0.18	0.19	3.70	3.00	77.20	7.61	7.26
12-July-2017	0.27	0.38	1.50	2.10	75.60	7.15	7.42
8-Aug-2017	0.11	0.20	2.70	2.70	90.50	9.26	7.88
13-Sep-2017	0.02	0.11	1.00	1.30	99.10	9.88	7.48
3-Oct-2017	0.04	0.09	1.80	0.90	89.60	9.80	8.08
13-Nov-2017	0.06	0.08	1.30	2.60	94.50	11.68	7.95
Mean	0.19	0.18	2.34	2.62	90.30	9.89	7.67
95%ile	0.57	0.44	4.85	4.80	112.90	12.88	8.02

Table 13: Chemical analysis downstream of Mohill WWTP discharge

Ambient Monitoring Point from WWDL (or as agreed with EPA)	Current WFD Status	cBOD	0-Phosphate (as P)	Ammonia (as N)	Nitrogen	D.O.%	
Upstream Monitoring Point	Poor	1.59	0.113	0.046	1.372	95	
Downstream Monitoring Point	Poor	2.34	0.181	0.189	2.618	90	
Difference between Upstream and Downstream		0.75	0.068	0.143			
EQS		2.6	0.075	0.14			
% of Eqs		28.85%	90.67%	102.14%			

Table 14: EQS capacity based upon the Mohill WWTP discharge

The IW upgrade works have been completed and the commissioning certificate will be signed-off in late 2019. The works were completed by Coffey Water Ltd. and they will continue to operate the plant for a further one-year period up to November 2020. The plant will then be handed over to Leitrim County Council to run on behalf of Irish Water under the Service Level Agreement. Based upon the

first month of operation all ELV's have been met for all parameters as set on in the licence. The upgrades at the Mohill WWTP included:

- Installation of grit tap in primary works
- Installation of a 145 meters cubed storm tank
- Aeration tanks have been updated to fine bubble diffuse air (FBDA) with anoxic zones for nitrogen breakdown
- Clarifier has been upgraded
- Ferric dosing system has now been upgraded to flow proportional dosing
- Flow meter on storm water overflows and is monitored

The monitoring results from the plant will be reviewed over the coming years to assess whether the upgrades resulted in improvements in water quality within the receiving waters (Rinn_010).

Lough Rynn Castle – Section 4

Lough Rynn Castle has a Section 4 discharge into Lough Rinn authorised by Leitrim Co. Co. The discharge is monitored using a grab and composite technique once a month for the following parameters: BOD, Suspended Solids, Total Phosphorus, Total Nitrogen and Fats Oils and Greases (FOG's). Lough Rinn's effluent treatment system is a package plant constructed by Butlers, which services both the castle and approx. 150 holiday homes in the estate. They have a combination of both full and part-time occupants, resulting in varying volumes of effluent entering the plant throughout the year, which may impact the efficiency of the plant. All parameters are exceeding the ELV's on a regular basis, both in the grab and the composite samplers.

The Section 4 load contributing to the lake is unknown as it varies depending on season and weekly usage. As a result, it is difficult to determine the level of pressure this is causing on an already pollutant influx lake.

3.4 Conclusions on Significant Issues

Ortho P, ammonia and BOD are the significant issues within the Rinn_010, predominantly arising from the WWTP. A review of the upgrade to the WWTP plant is required. There is no chemical data on Rinn_020, Rinn_030, Annaghcooleen_010 or Drumbad_010, however, based on the Pollution Impact Potential (PIP) maps, the main issue within the catchment is phosphorus (see map 3.3.) due to poorly draining and peaty soils. This creates overland flow pathways which have the potential to distribute phosphorus, sediment, and pesticides. The issue along the Shannon (Upper)_080 is not clear at desk study stage and catchment assessment will be required. Lough Rynn Castle section 4 license parameters are being breached on a consistent basis, this effluent is providing additional loading of nutrients to the lake and will be further investigated.

4 Significant Pressures Information

4.1 Initial EPA Characterisation

Under the initial characterisation process, the EPA catchments unit assigned significant pressures and associated impacts to each waterbody (see **Table 15** below). The associated impact in all river waterbodies is nutrient pollution, with the exception of the Rinn_010, which also includes organic pollution.

WB Name	Significant Pressures		Impact
	No.	Type	
RINN_010	1	UWW (Mohill Agglomeration PE of 1,001 to 2,000)	Nutrient & organic Pollution
DRUMBAD_010	1	Agriculture (Pasture)	Nutrient Pollution
RINN_020	1	Agriculture (Pasture)	Nutrient Pollution
RINN_030	1	Agriculture (Pasture)	Nutrient Pollution
ANNAGHCOOLEEN_010	1	Agriculture (Pasture)	Nutrient Pollution
SHANNON (Upper)_080	1	Agriculture (Pasture)	Nutrient Pollution
Lough Rinn	4	Industry (Section 4)	Nutrient & organic Pollution
		Agriculture	Nutrient Pollution
		Hydromorphology (Dams, weir, barriers, locks)	Altered habitat due to hydrological impacts
		Invasive Species	Other significant impacts
Lough Forbes	4	Abstractions (Water supply)	
		Agriculture (Pasture)	Nutrient Pollution
		Invasive Species	Altered habitat due to Morphological changes
		Extractive Industry (Peat)	Nutrient Pollution

Table 15: Significant pressures assigned to each waterbody as part of the initial characterisation

4.2 Urban Waste water

The Mohill wastewater treatment plant discharges into the Rinn_010. **Table 14** above reviews the ambient river water quality in association with the Mohill wastewater treatment plant discharge license. The chemistry and biological data provide clear evidence the WWTP discharge was having a significant impact on water quality in the receiving waters in 2017. The IW treatment plant upgrade works were completed in 2019 and are awaiting a commission certificate. The monitoring results will be reviewed over the coming years to determine whether the upgrades have resulted in an improvement in water quality.

4.3 Industry (Section 4)

A section 4 license has been identified as a significant issue within Lough Forbes. There is just one section 4 discharge license on this lake, and this is for Lough Rynn Castle. The 2017 and 2018 effluent

data was reviewed, and all parameters exceeded the ELV's on a regular basis, both in the grab and the composite samplers. Variable wastewater loadings are likely to be having an impact on the efficiency of the plant.

4.4 Hydromorphology

Hydromorphology was selected as a significant pressure within Lough Rinn. The issues included the presence of locks, weirs, dams, and barriers. The associated impact with these issues is altered habitats due to hydrological impacts. These can all change the movement of water significantly throughout the lake, by either speeding up or slowing down the flow. By doing this, it creates different habitats, which may be positive or negative towards the ecology within the lake. In some cases, ecological communities can adapt to these changes, for example movement within the lake etc. in other circumstances, this can remove communities from the lake. Also, by slowing down the movement in the lakes, it allows for nutrients and sediment to settle out and therefore can dis-improve the water quality.

4.5 Invasives

Invasive species have been identified as significant issues within Lough Rinn & Lough Forbes. Zebra mussels are present in both lakes. Zebra mussels can change the nutrient cycles in lakes. They cause a reduction of phytoplankton and zooplankton. They increase water clarity and plant growth around lake margins. The native mussel populations decline as the zebra mussel colonise their shells. Zebra mussels can also have an impact on changes in fish populations due to food source, light, oxygen levels etc. They tend to block water intake pipes, this would possibly be a concern for the Longford Central drinking water plant located on the shores of Lough Forbes.

4.6 Abstractions

Abstractions were identified as issue within Lough Forbes, however it was not deemed significant. This is the drinking water abstraction plant for the Longford Central supply. This scheme serves Longford town and surrounding areas such as Clondara, Ballinalee, Drumlish, Edgeworthstown and Newtownforbes. The water is supplied from the Lough Forbes treatment plant. It is operated by Irish Water and abstracts 6970 m³/day. This supply is currently on the EPA remedial action list due to persistent detections of pesticides.

4.7 Extractive Industry (Peat)

Peat extraction has been identified as a significant issue in Lough Forbes. From reviewing aerial images (**Figure 7**) and the conceptual model (**Figure 8 & 9**) the lake is surrounded by peatlands. Peatland drainage can influence the quality of the receiving waters in relation to changes in dissolved oxygen and organic carbon, increased nutrients and sedimentation. Any potential impacts associated with this pressure will be investigated in the field assessment.

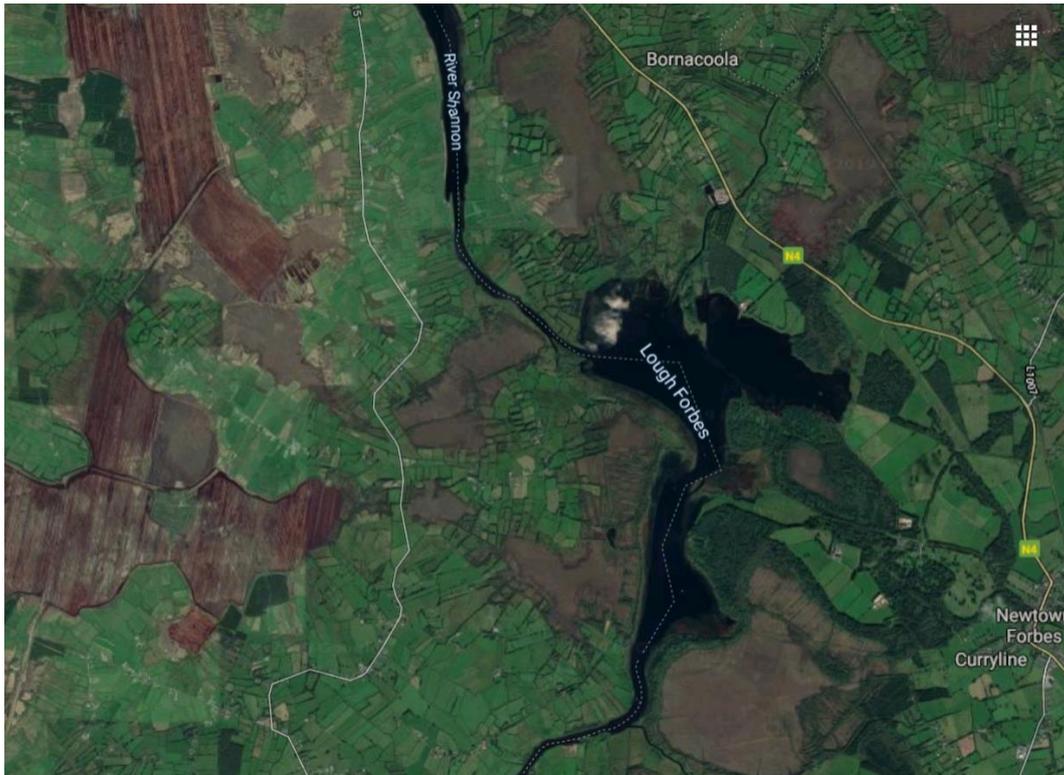


Figure 7: Aerial image of Lough Forbes

4.8 Conclusion on Significant Pressures

The Pollution Impact Potential map for phosphorous shows high rankings throughout the catchment. Therefore, Ortho-P, sediment and pesticides will be the focus within the PAA. Along the Rinn_010 the Mohill WWTP upgrades were completed in 2019. We will carry out a watching brief to see whether water quality improvements are seen. The section 4 at Lough Rynn Castle needs to be addressed as this is likely impacting the lake. In Lough Forbes, the abstraction is not deemed significant. Also, along Lough Forbes peat extraction will be considered during the catchment assessments. Invasive species are a growing issue in Ireland due to poor biosecurity standards, LAWPRO will continue to put all biosecurity measures in place and will record invasives, when identified. The hydromorphological pressures will also be assessed.

5 Pathways information and analysis

Although there is limited chemical data available for assessment, a conceptual model has been developed to aid in assessing any potential impacts associated with agricultural as this has been assigned as a significant pressure in each of the waterbodies within the PAA, with the exception of the Rinn_010. Pollutants can move through the catchment based upon factors such as topography, geological, hydrogeological and pedological characteristics. These elements create pathways, for the Lough Rinn Forbes CM as seen below we assessed the bedrock, aquifer and soil types within the catchment to try and identify how pollutants could potentially enter the water column through diffuse sources. Pathways may occur as follows:

- Free draining soils can cause a potential Nitrate issue, leaching into the gw and infiltrating into the surface waters elsewhere.
- Poorly draining soils and peat can distribute phosphorus due to overland flow pathways.
- Sediment transport can occur through overland flow pathways and cattle access points can impact bank stability.

Lough Rinn Forbes: Understanding the water pathways

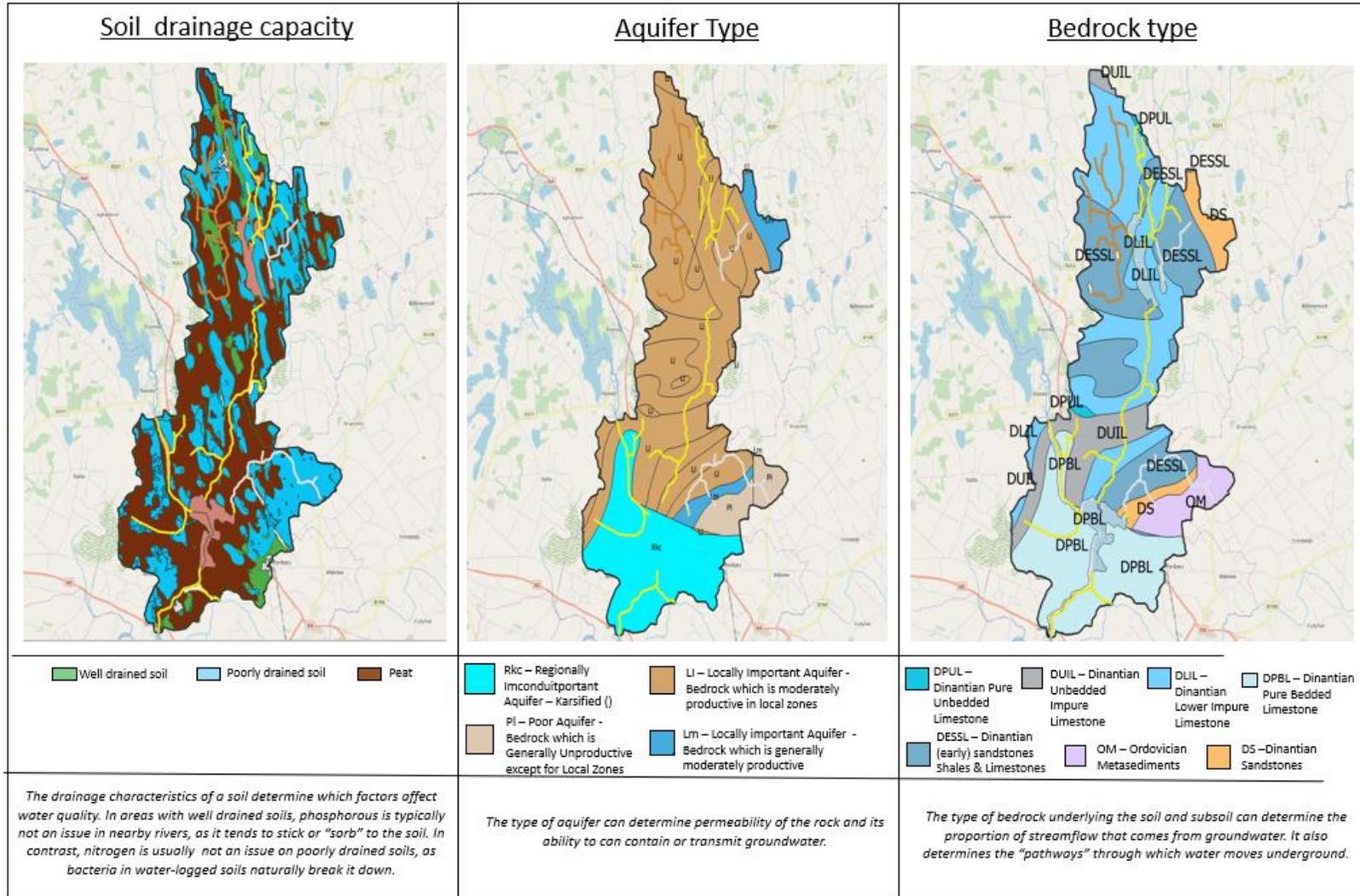


Figure 8: Pathways identified within the Lough Rinn Forbes PAA

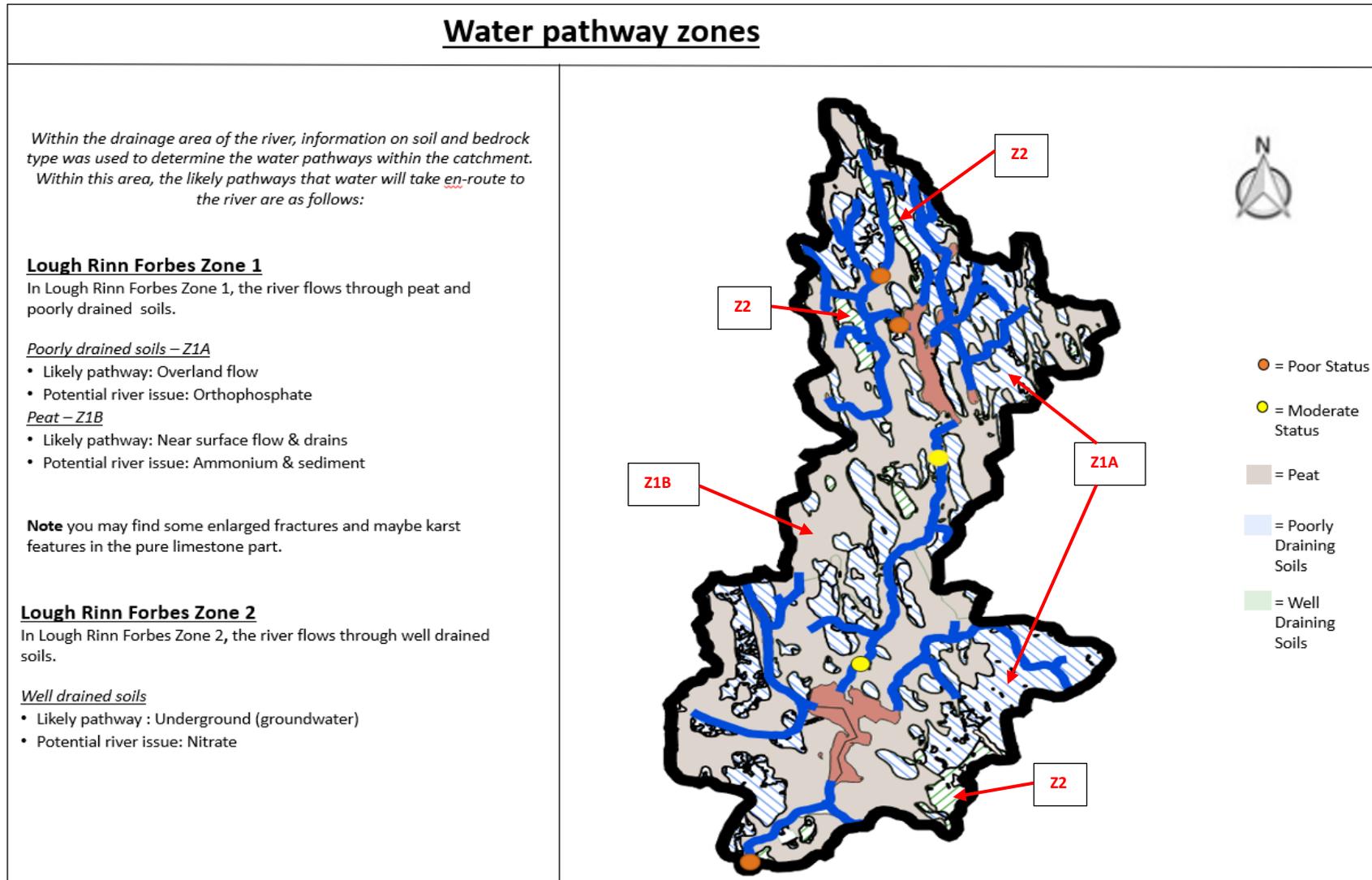


Figure 9: Pathway conceptual model for Lough Rinn Forbes PAA; Z1A represents poorly draining soils with overland flow, Z1B represents peaty soils with near surface flow and Z2 represents free draining settings.

Conceptual Model Breakdown

Based upon the conceptual model, Drumbad_010, Rinn_020 and Annaghcooleen_010 would be susceptible to overland flow pathways, with the potential to deliver phosphorus, sediment, and pesticides to the receiving waterbody. Rinn_030 and Shannon (Upper)_080 flow predominantly through peaty soils, these soils could transport ammonia and suspended solids. If the peatlands are reclaimed, phosphorous may also be an issue within the watercourse due to overland flow, ammonia may also be an issue in cutaway peat. Chemical sampling is required throughout the catchment to validate the CM. In the interim our assessment will be focusing on possible diffuse pollution sources.

Lough Rinn Forbes PAA

Lough Rinn Forbes PAA			
	Zone 1A	Zone 1B	Zone 2
Topography	Low lying catchment from North to South. Falls from the higher area just North of Mohill, Co. Leitrim (60m OD) to the lowest point of the catchment (41m OD) near Tarmonbarry Br, Co. Roscommon.		
Soil	<ul style="list-style-type: none"> • AminPDPT - Derived from mainly acidic parent materials • AminPD - Mineral poorly drained surface/ ground water gleys • BminSRPT - Peaty shallow reasonable drained mineral soil derived from mainly basic parent materials • BminSP - Shallow poorly drained mineral soil derived from mainly basic parent material 	<ul style="list-style-type: none"> • Cut 	<ul style="list-style-type: none"> • AminDW - Deep well drained mineral acid brown earths/ brown podzolics • AlluvMin - Mineral alluvium • BminSW – Derived from mainly basic parent materials

Lough Rinn Forbes PAA

<p>Subsoil</p>	<ul style="list-style-type: none"> • TLPSS - Till derived from lower Palaeozoic sandstones and shale • TDCSs -Till derived from Devonian and Carboniferous sandstone • TLPCSsS - Till derived from lower Palaeozoic and Carboniferous sandstones and shales • TLS - Tills derived from limestones • Rck- Bebrock outcrop or subcrop • TLSCh - Till derived from Silicified Limestone and cherts • TNSSs - Till derived from Namurian sandstones and shales 	<ul style="list-style-type: none"> • Cut • FenPt – Fen Peat 	<ul style="list-style-type: none"> • Rck – Bebrock outcrop or subcrop • TLPSSs - Till derived from lower Palaeozoic sandstones and shale • KaRck – Karsified bedrock outcrop or subcrop • TLPCSsS - Till derived from lower Palaeozoic and Carboniferous sandstones and shales
<p>Bedrock</p>	<ul style="list-style-type: none"> • DUIL Dinantian Upper Impure Limestones • DPUL Dinantian Pure Unbedded Limestones • DLIL Dinantian Lower Impure Limestones • DPBL Dinantian Pure Bedded Limestones • DESSL Dinantian (early) sandstones Shales & Limestones • OM Ordovician Metasediments • DS Dinantian Sandstones <p>All limestones with varying degrees of purity.</p>		
<p>Aquifer</p>	<p>In the PAA the aquifer is predominantly Locally Important Aquifer (LI)– Bedrock which is moderately productive only in local zones. There is a section in the lower catchment which includes the Shannon (Upper)_080 and Lough Forbes these waterbodies lie on a regionally important aquifer. There is also a small area which is a Poor Aquifer (PL) – this is generally unproductive except for local zones. This poor aquifer is located in the south east of the PAA, along the upper reaches of the Annaghcooleen_010.</p>		

Lough Rinn Forbes PAA

Groundwater vulnerability	Catchment groundwater is dominated by low vulnerability. The upper reaches of the Annaghcooleen_010 and lower reaches of the Shannon (upper)_080 show X-extreme, extreme, high and moderate groundwater vulnerability. There are also some additional small pockets of the PAA which vary in their level of vulnerability, however, are not significant on a catchment basis.
PIP PO4 to SW	Dominant throughout the catchment
PIP NO3 to SW	No vulnerable areas identified within the PAA boundary
Likely main pathway(s)	Main Pathway: Overland flow
Possible S-P-R linkages	Main SPR1: agriculture (P) – infiltration excess/ overland flow – PO4 / pesticide contribution to SW SPR2: agriculture/forestry (sediment) – infiltration excess/ overland flow/ drains – sediment contribution to SW SPR3: agriculture (N and P) – bedrock outcrop/GW flow – NO3 / PO4 /pesticides contribution to SW

Table 16: Pathway Information for the Lough Rinn Forbes PAA

6 Interim Conclusions on the Priority Area for Action based on the desk study

Drumbad_010 - IE SH 26D560860

Drumbad_010 is *At Risk* of failing to meet the WFD objective of Good status. It is an unassigned waterbody, therefore there is no chemical or biological data available. This waterbody must be assessed biologically over two seasons (one must be summer) to aid in determining the potential status of the waterbody. Agriculture has been listed as the significant pressure within this waterbody. As per the conceptual model (**Figure 8 & 9**) the waterbody flows over poorly draining and peaty soils. Therefore, is susceptible to water quality issues such as phosphorus, sediment, pesticides and ammonia. The Surface Water Phosphorus PIP map (**Figure 6**) identifies the potential pathways along the waterbodies at highest risk (dark blue/navy) of overland flow to surface waters. As per **Figure 6** the entire Drumbad_010 waterbody is classified as at high risk for phosphorus transport. Therefore, stream walks and chemistry sampling will be required to assist in narrowing down the sources of impact within the waterbody.

Annaghcooleen_010 - IE SH 26A430910

Annaghcooleen_010 is *At Risk* of failing to meet the WFD objective of Good status. Annaghcooleen_010 is an unassigned waterbody, therefore it must be assessed biologically over two seasons (one must be summer) to aid in determining the potential status of the waterbody. Agriculture has been listed as the significant pressure within this waterbody. There is no biological or chemical monitoring data available for this waterbody. As per the conceptual model (**Figure 8 & 9**) the waterbody flows over poorly draining and peaty soils. Therefore, is susceptible to water quality issues such as phosphorus, sediment, pesticides and ammonia. The surface water phosphorus PIP map (**Figure 6**) above identifies the potential pathways along the waterbodies at highest risk (dark blue/navy) of overland flow to surface waters. The middle to lower reaches of the Annaghcooleen_010 show highest susceptibility to overland flow, this area will be focused on during field analysis, this will include stream walks and chemistry sampling to assist in narrowing down the sources of impact within the waterbody where necessary.

Rinn_010 - IE SH 26R020100

Rinn_010 is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Poor. This is driven by its Poor biological status at monitoring locations Rinn - Bridge upstream of Lough Rinn (RS26R020100) and Bridge 1.6km downstream of Mohill (RS26R020060). The significant pressure along this waterbody is urban wastewater. The Mohill WWTP is discharging into the Rinn_010. It is evident from the chemistry data that Mohill WWTP had a negative impact on the water quality in Rinn_010 in terms of ammonia, BOD and phosphate up to 2017 and this can be seen by the poor biological status. The Mohill WWTP upgrade as part of the IW investment plan, as set out in the RBMP 2018-2021, has been completed. This waterbody stretch will be reviewed over the coming years to determine potential water quality improvements.

The chemical analysis also indicates there is additional nutrient loading occurring upstream of the wastewater treatment plant, which will require further assessment. As per the conceptual model, the Rinn_010 flows predominantly through peaty and poorly draining soils, with some small pockets of well-draining soils located in the upper and middle reaches of the waterbody. The surface water

phosphorus PIP map (**Figure 6**) above identifies high risk areas for overland flow in the upper and lower reaches of the waterbody, potentially transporting phosphorus, sediment, ammonia and pesticides. Therefore, point and diffuse sources will be the focus in these areas to assist in identifying the additional load of pollutants within the waterbody upstream of the WWTP. The area will be assessed through stream walks and chemistry sampling, if necessary, in narrowing the source.

Rinn_020 - IE SH 26R020200

Rinn_020 is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Moderate. This is driven by its Moderate biological status at Annaghveagh Br (RS26R020200). The significant pressure associated with this waterbody is agriculture (pasture). There is no chemistry data available for the waterbody. As per the conceptual model (**Figure 8 & 9**) this waterbody flows through peaty and poorly draining soils, overlaid on a locally important aquifer. The peaty soils run parallel to the waterbody, however, the sub catchment area is predominantly poorly draining soils. As per aerial imagery, it is likely the peaty land has been reclaimed for agricultural purposes. The pathways associated with these conditions are point sources and overland flow for the transport of phosphorus, sediment, ammonia, and pesticides.

Agriculture is the dominant land use and both diffuse and point source pollution from agriculture will be the focus of the field assessment, as per the Surface Water Phosphorous PIP map (**Figure 6**) the entire waterbody has been assigned within the highest risk categories and therefore chemistry sampling and stream walks will be required.

Rinn_030 - IE SH 26R020400

Rinn_030 is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Moderate. This is driven by its Moderate biological status at Cloonart Bridge (RS26R020400). The significant pressure associated with this waterbody is agriculture (pasture). There is no chemistry data available for the waterbody. As per the conceptual model (**Figure 8 & 9**) this waterbody flows predominantly through peaty and poorly draining soils, overlaid on a locally important aquifer. The likely pathways associated with these conditions are point sources and overland flow for the transport of phosphorus, sediment, ammonia, and pesticides.

Agriculture is the dominant land use and both diffuse and point source pollution from agriculture will be the focus of the field assessment, as per the Surface Water Phosphorous PIP map the entire waterbody has been assigned within the highest risk categories and therefore chemistry sampling and stream walks will be required.

Shannon Upper_080 IE SH 26S021510

The Shannon (Upper)_080 is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Moderate. This status is driven by its Moderate biological status at EPA sampling location d/s Tarmonbarry Weir (LHS) (RS26S021510). The biological status at this station has deteriorated further to Poor status in 2017. The significant pressure associated with this waterbody is agriculture (pasture). There is chemistry available at one location along this waterbody, although there are no clear water quality issues as per **Table 4**. The ammonia annual averages were above the EQS in 2016 and the phosphorus annual averages were above the EQS in 2018, however the exceedances were not consistent. The soils in this area are a combination of both peaty and poorly draining. The

surface water phosphorus PIP map (**Figure 6**) classifies the entire waterbody within the at-risk category for phosphorus transport and therefore stream walks and chemistry sampling may be used for a more targeted approach.

Lough Rinn - IE_SH_26_700

Lough Rinn is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Moderate. This is driven by its Moderate biological, flora, and chemistry status at the EPA sampling locations within the lake. This lake has shown improvement since the 2010-2012 Poor ecological status. The significant pressures within the lake include industry discharges, agriculture, hydromorphology and invasive species. The Lough Rynn section 4 discharge license results were reviewed and show consistent breaches of the limits set out in the license and therefore requires further assessment. As per the surface water phosphorus PIP map, there are specific areas (middle and lower sections to the west of the lake and the middle section on the East) to focus on point and diffuse sources relating to agriculture. Zebra Mussels are present within the lake, contact will be made with the NPWS and biosecurity measures will be applied during sampling. Regarding hydromorphology, the lake levels intend to fluctuate regularly as it is a relatively shallow lake. A weir was in place at Tooman bridge, however this has been decommissioned. The weir allowed for the lake levels to be regulated keeping a consistent depth. Further investigations will be required during assessment to identify the impacts of low levels during warmer months in the year.

Lough Forbes - IE_SH_26_723

Lough Forbes is *At Risk* of failing to meet the WFD objective of Good status, as the 2010-2015 ecological status is Moderate. This status is driven by its Moderate biological, flora, and chemistry status at EPA sampling locations within the lake. The significant pressures within the lake include abstractions, agriculture, extractive industry, and invasive species. The Longford central drinking water supply abstracts from Lough Forbes, however, the EPA did not deem this a significant issue on the lake. This supply is on the EPA pesticide remedial action list due to persistent pesticide detections above the drinking water limit. Zebra Mussels are present within the lake, contact will be made with the NPWS, and biosecurity measures will be applied during sampling. The soils surrounding the lake are predominantly peaty and poorly draining, the surface water phosphorus PIP map identifies the north west of the lake at highest risk of overland flow. Point and diffuse sources from agricultural activities will be the focus within this area. Visual and chemistry (ammonia) sampling is required to assist in identifying whether the extractive industry is impacting the water quality within Lough Forbes.

7 Work Plan

- The Rinn_010 will be assessed to determine whether the upgrade works to the Mohill WWTP have shown water quality improvements.
- Catchment assessments will focus on nutrient loading upstream of the EPA monitoring locations along the Rinn_020 and Rinn_030, taking chemical samples where required.
- The Shannon (Upper)_080 will continue to be monitored, as potential improvements upstream are likely to have positive knock on effects.
- Chemical sampling is required along the Rinn_020 and Rinn_030 as there is an information gap.

Lough Rinn Forbes PAA

- Assessment along the Annaghcooleen_010 should begin at the old investigative monitoring location Scry Bridge (coordinates Easting 209164.30 Northing 282462.85)
- Assessment along the Drumbad_010 will begin near the outlet of the waterbody.
- SSIS sampling will be carried out along the Drumbad_010 and Annaghcooleen_010 waterbodies to get a baseline within two different seasons (one must be summer), as no monitoring has been completed previously. Based upon the information gathered, chemical sampling may be necessary to identify the issue if biological assessment deems the water quality impacted.
- Carry out local catchment assessments on Lough Rinn. Assess whether good status within Lough Rinn is associated with water levels or nutrients.
- Focus on the impacts of both P and peat within Lough Forbes.
- Hydromorphology was selected as a significant issue within Lough Rinn. Evaluate the lakes bathymetry data and the impact of the weir on water levels.
- Discussions with NPWS regarding the presence of invasive species (Zebra Mussels) in Lough Rinn & Lough Forbes.
- Further investigation into the possible storage and re-suspension of Phosphorus from the sediments in Lough Rinn.
- Gather additional information from Leitrim and Longford County Council if available, such as SSIS, chemical, previous complaints, drainage, overflows, section 4's etc.
- Continue to provide assistance to the DAFM regarding pesticides awareness within the catchment area.
- Review all data provided by APHA for the 2019/2020 monitoring season.
- Carryout winter sampling and flow measurements within the PAA where necessary.

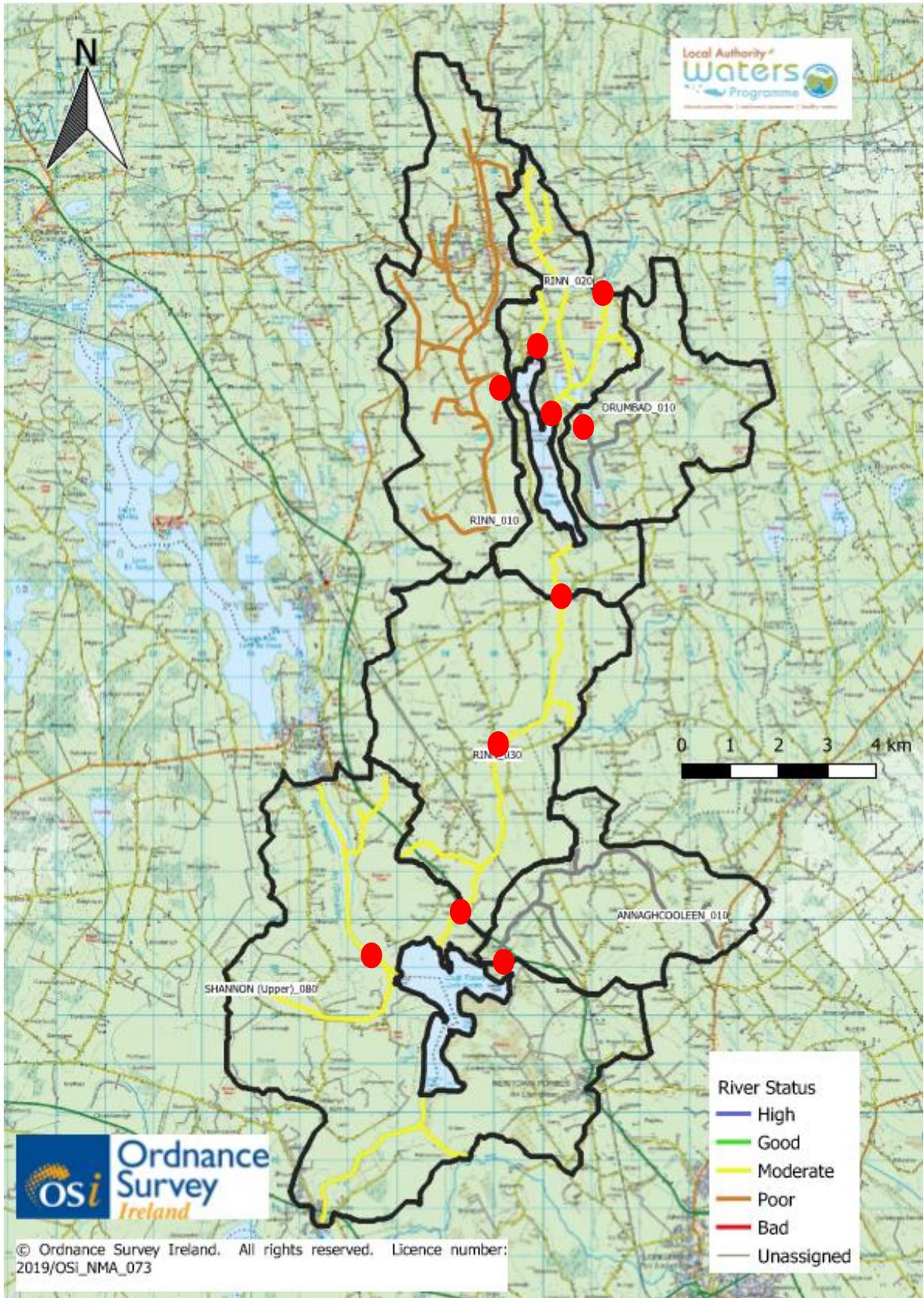


Figure 10 : Proposed initial assessment locations

8 Review of Mitigation Options

As per the conceptual model it is a poorly draining catchment, overland flow pathways and critical source areas need to be identified as agriculture has been highlighted as a significant issue. Some measures may include buffers, riparian zones, fencing, right application and timing of fertilisers and manures etc. Catchment walks will be required to identify these sources of pollutants. LAWPRO will aim assist stakeholders such as IW, DAFM, Teagasc, ASSAP and any other stakeholders in providing awareness campaigns for the correct use and storage of pesticides.

9 Communications

- The community meeting was held in the Bornacoola Community Centre, located within the PAA therefore targeting the required audience.
 - Community information meeting held on the 02/04/2019 in the Cloonmorris Community Centre, Cloonmorris, Bornacoola in County Leitrim. Number of attendees excluding LAWPRO and ASSAP representatives: 12

Appendix 1

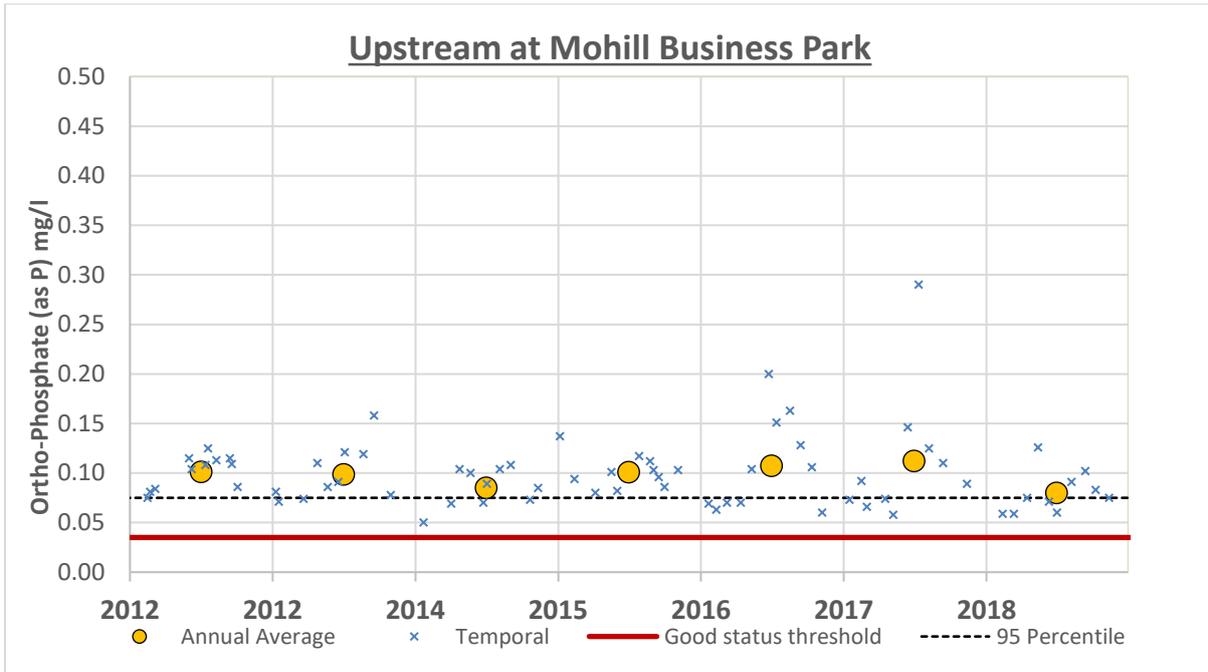


Figure 11: Graph of Ortho-P concentrations recorded Upstream at Mohill Business Park

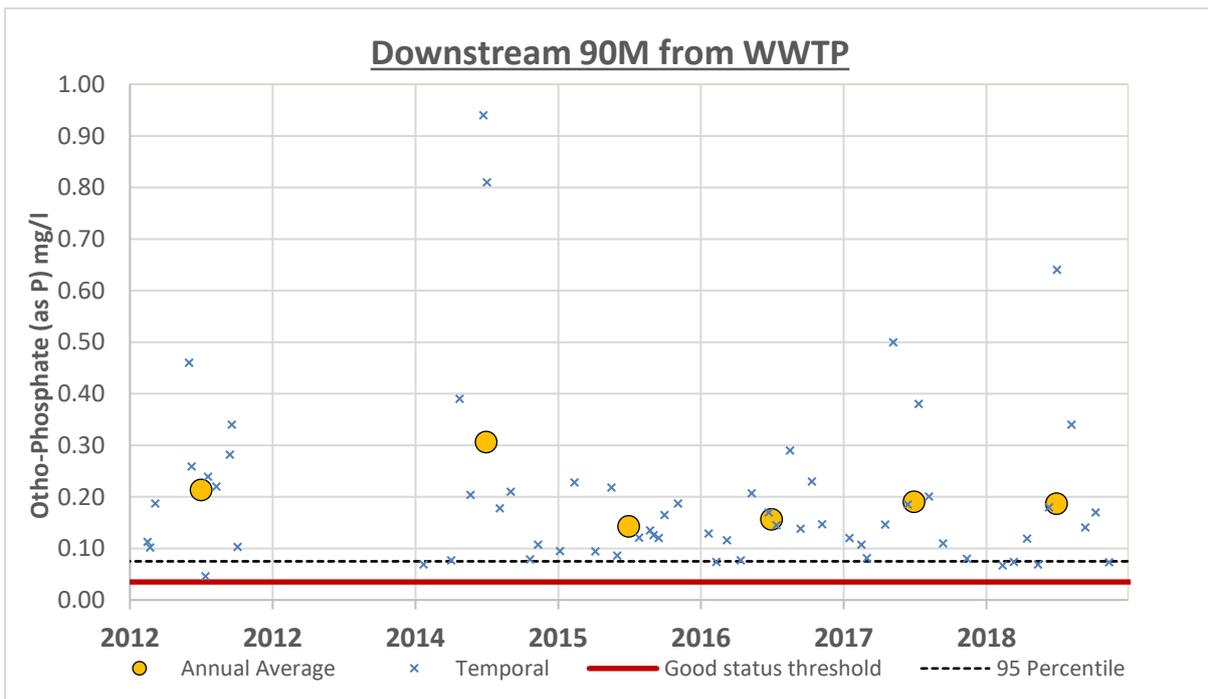


Figure 12: Graph of Ortho-P concentrations recorded 90m downstream of Mohill WWTP

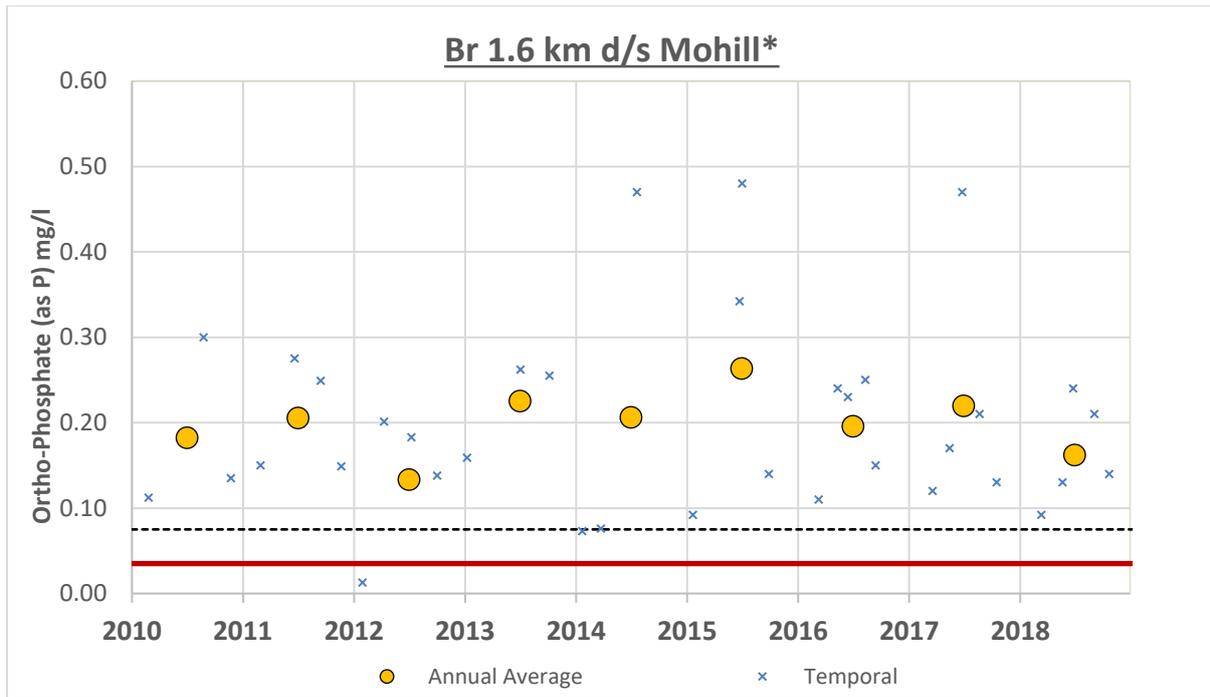


Figure 13: Graph of Ortho-P concentrations recorded 1.6km downstream of Mohill

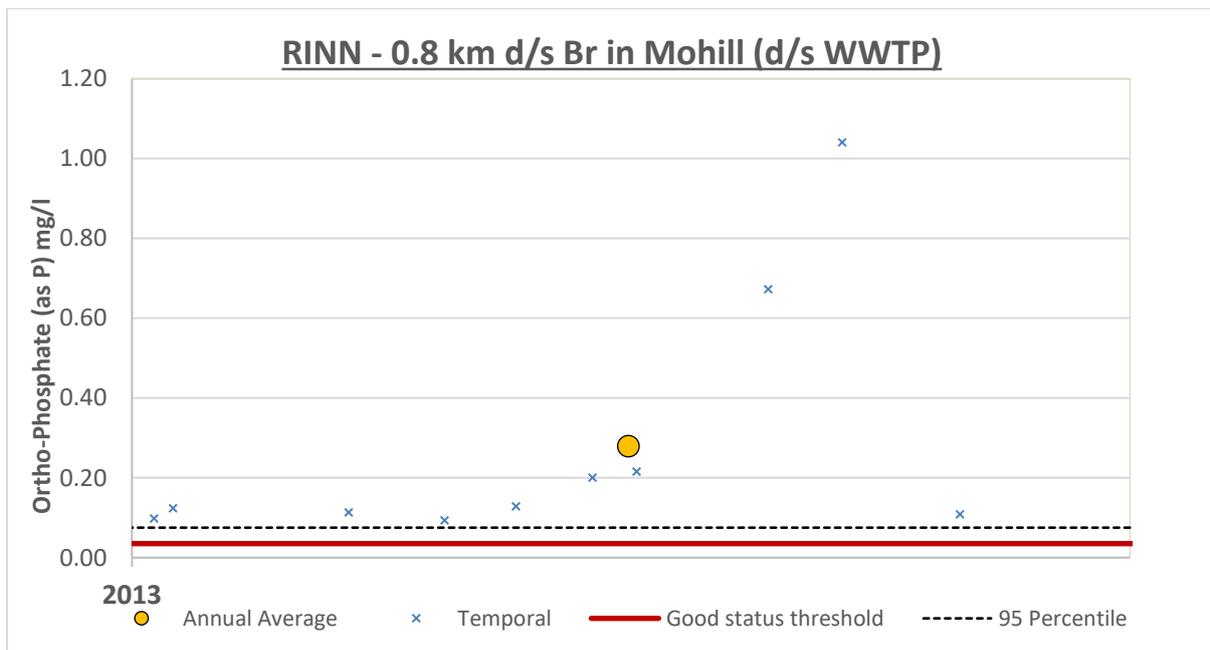


Figure 14: Graph of Ortho-P concentrations recorded 0.8km downstream bridge in Mohill (d/s WWTP)

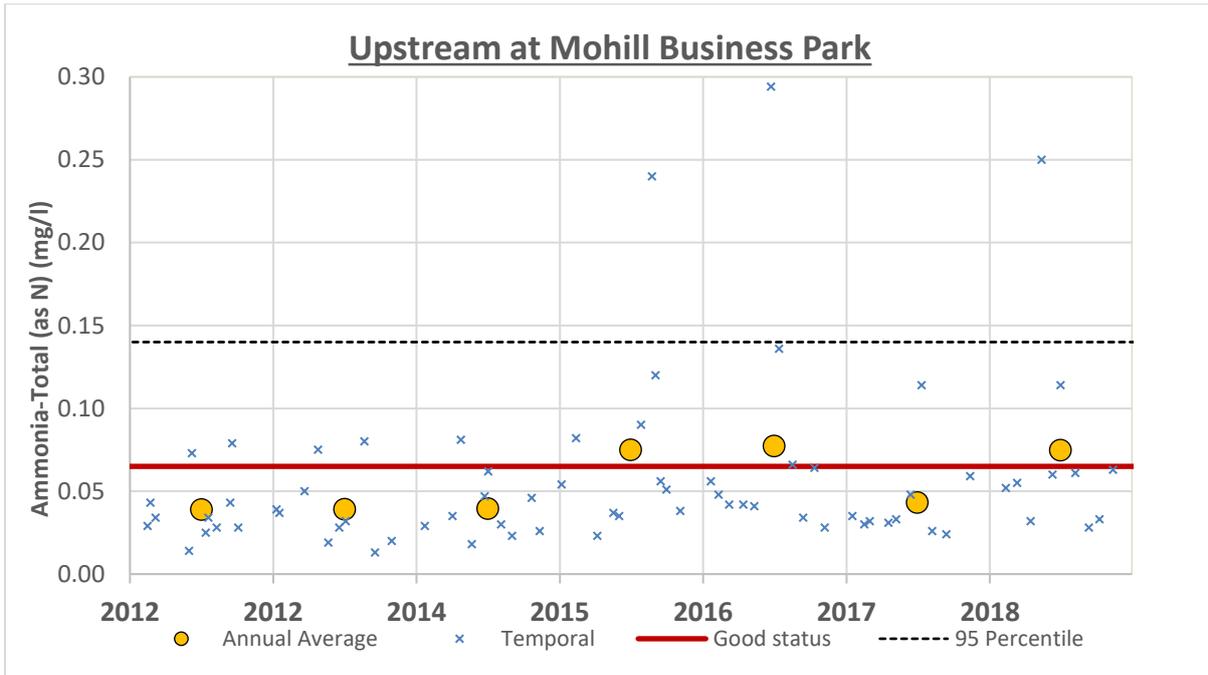


Figure 15: Graph of Total Ammonia N concentrations recorded Upstream at Mohill Business Park

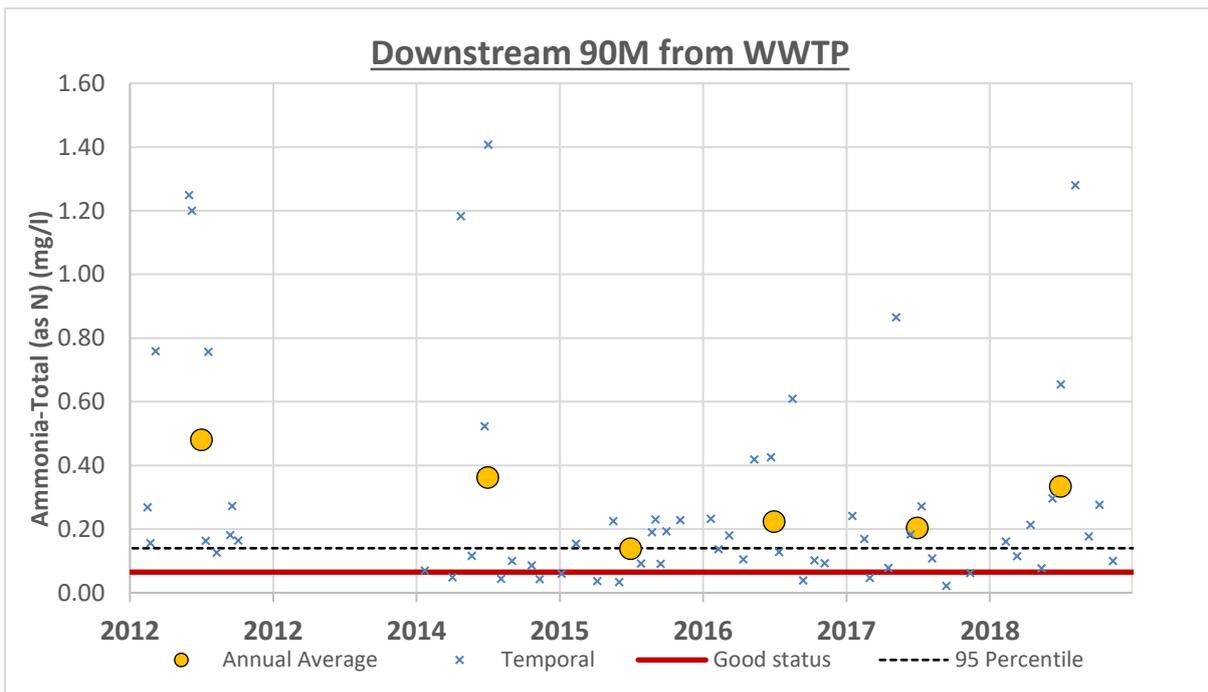


Figure 16: Graph of Total Ammonia N concentrations recorded 90m downstream of Mohill WWTP

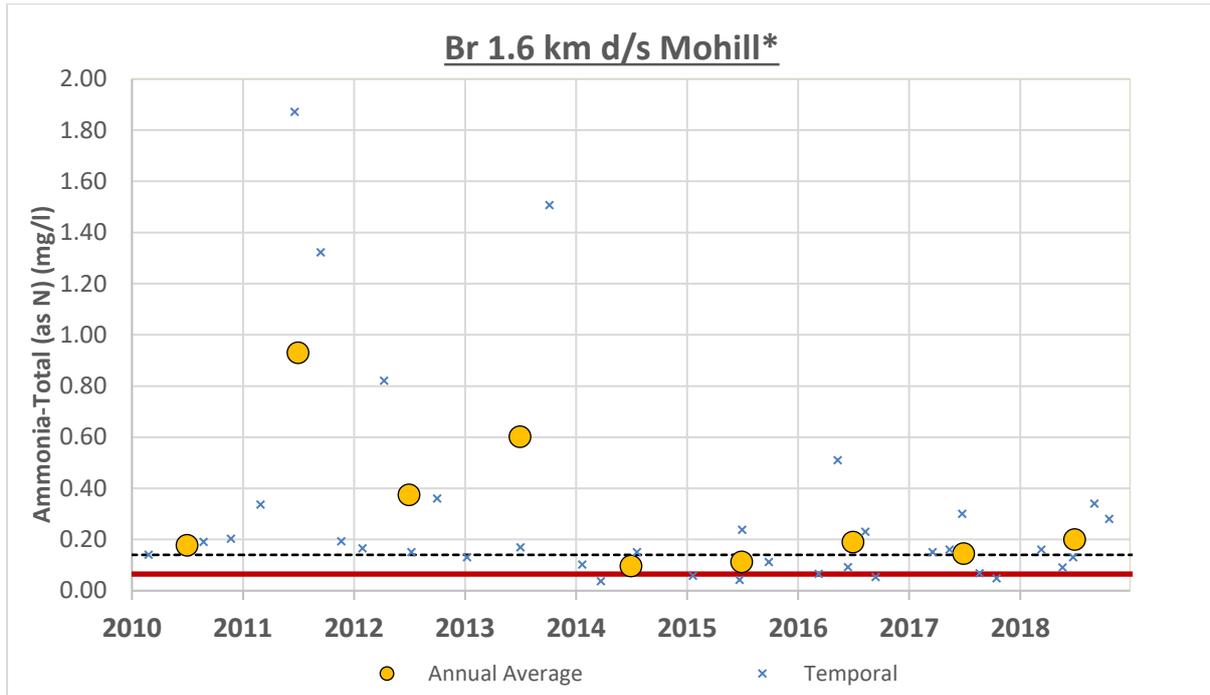


Figure 17: Graph of Total Ammonia N concentrations recorded 1.6km downstream of Mohill

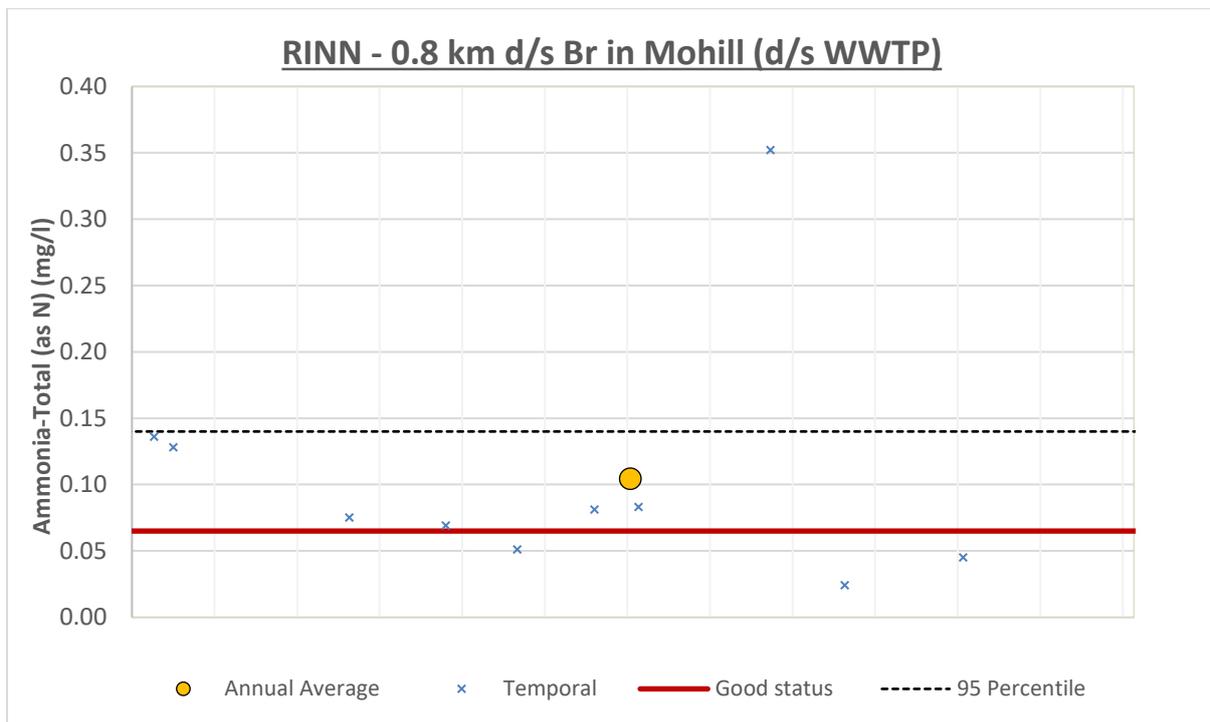


Figure 18: Graph of Total Ammonia N concentrations recorded 0.8km downstream bridge in Mohill (d/s WWTP)