



Failmore

Desktop Assessment

Western Region

(AFA0076)





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1 Introduction

1.1 Background to PAA

The Failmore PAA is in the West of Ireland in county Galway in Connemara, within the sub – catchment 30_15 Joyce's_SC_010 within the 30 Corrib. This PAA is very rural and urban settlements are small, and there are two main centres in the area, which are Maam Cross and the Maum Village. There is one river water body included in the PAA, which is the Failmore_010. An additional river water body which is not included in the PAA but is important to properly assess the lakes included in the PAA is the Owenwee (Corrib)_010. There are four lakes within the PAA, Maumwee lake, Loughanillaun Maam Cross, Shannagrena and the Loughaunieran Maam Cross. The Owenwee (Corrib)_010 links all these lakes together.

There is one special area of conservation in the Failmore PAA, the Maumturk Mountains SAC. There are several habitats within this SAC area, such as blanket bog, wet heaths, and oligotrophic waters, while species in this area include the salmon and slender naiad.

The Failmore PAA is dominated by Poor Aquifer – bedrock which is generally unproductive except for local zones. Peat/poorly drained soil also dominates the PAA. Agriculture is the main land use in the area, there is also peat extraction and a small area of forestry. A large percentage of the agricultural area is commonage land.

In the 2016 census there were 264 people in the area of Maam Cross and Maum Village.

A catchment assessment workshop was held in Castlebar on 26th – 28th of April 2017. It was attended by representatives of the local authorities (Galway, Mayo, Roscommon, Leitrim, Sligo) LAWCO, Irish Water, IFI, Forest Service, Coillte, Teagasc, GSI, DAFM, Marine Institute and EPA. Based on the draft River Basin Management Plan priorities, a set of agreed principles and the local priorities of the workshop attendees, 34 areas were recommended for action, of which the Failmore PAA was one of these

The Western Regional Operational Committee (WROC) identified the following reasons for the selection of the PAA:

- It is a blue dot catchment.
- There is one river and two lakes not meeting their high ecological status, and
- The headwaters of the river flows into the Corrib.

The LCAs assigned to these water bodies based on initial characterisation undertaken by the EPA were:

- Failmore_010
- IA8 High status RWB pressures – LAWPRO

- Maumwee
- IA1 Provision of Information – Inland Fisheries Ireland
- IA8 High status RWB pressures – EPA

- Loughanillaun Maam Cross
- IA8 High status RWB pressure – LAWPRO

- Loughaunieran Maam Cross
- IA1 Provision of Information

- Shannagrena
- IA1 Provision of Information.

1.2 PAA Summary

Table 1 summaries the risk classification, environmental objectives, ecological status, significant pressures (and subcategory) and local catchment assessments (LCA) actions proposed. **Figure 1** and **Figure 2** illustrate the risk classification and status classification for Failmore PAA Catchment water bodies.

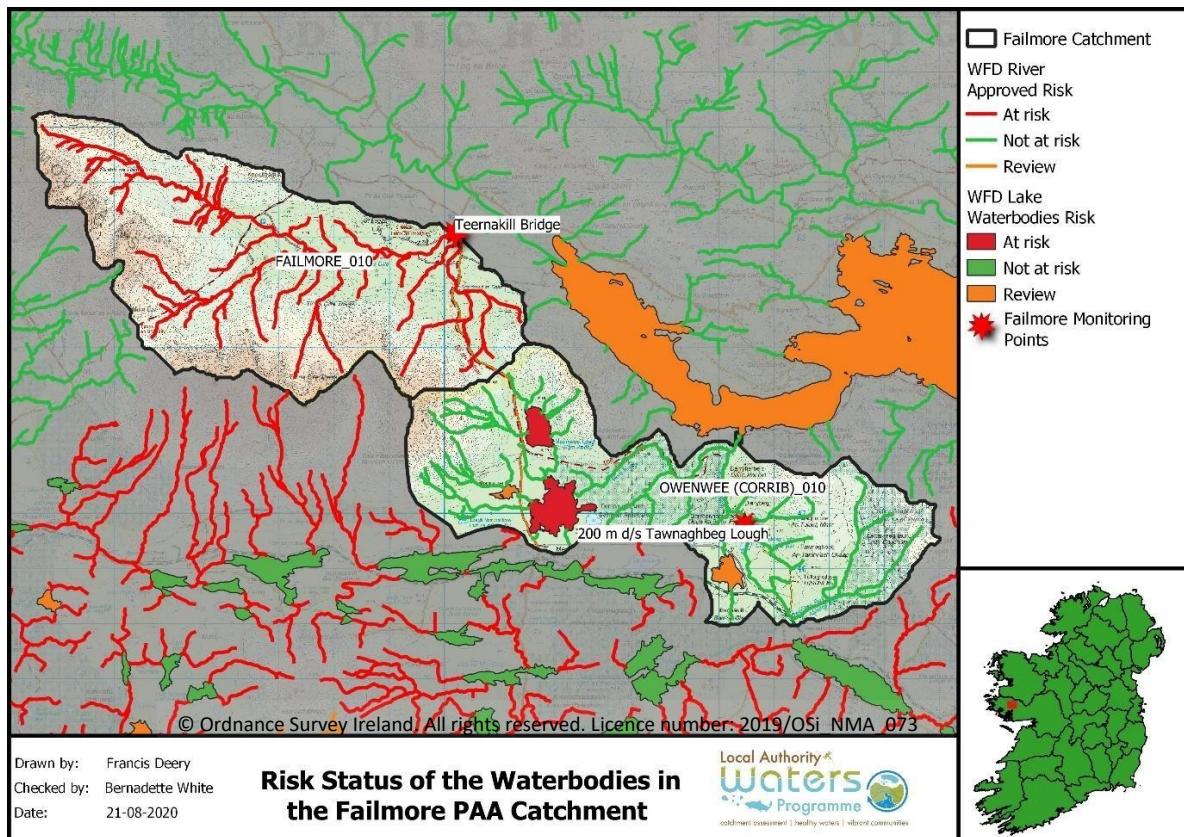


Figure 1: Risk Status of the Waterbodies in the Failmore PAA Catchment

Failmore PAA Desktop Assessment

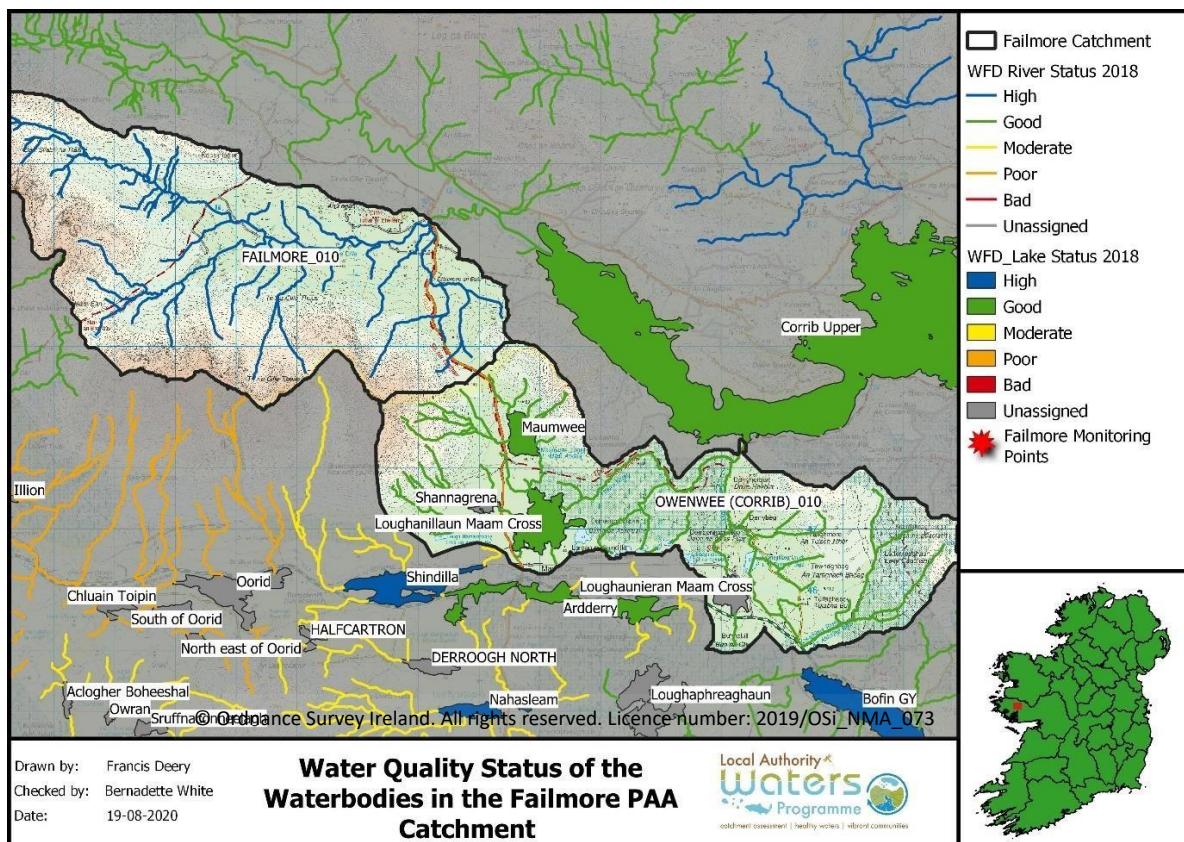


Figure 2: Water Quality Status in the Failmore PAA Catchment

1.3 Information consulted

- <https://www.cso.ie/en/census/census2016reports/>
- WFD web application
- Water Framework Directive fish report stock survey of Maumwee lough, August 2013
- LPIS data 2014
- Loughanillaun EPA Macrophyte report 2016 – 2018
- Maumwee EPA Macrophyte report 2016 – 2018

Table 1: Summary of Waterbodies in the PAA

WB_Name	WB_Code	WB_Type ¹	Risk ²	High status obj. ³	Ecological Status ⁴				Pressure Category	Pressure Subcategory	Sig. Pressure	LCA ⁵
					2007 - 2009	2010 - 2012	2012 - 2015	2013 - 2018				
Failmore_010	IE_WE_30F010100	RWB	AR	Yes	HES	GES	GES	High	HYMO	Channelisation	Yes	IA8 – Lawpro
									Extractive Industry	Peat		
									HYMO	Over-grazing		
Maumwee	IE_WE_30_343	LWB	AR	Yes	HES	HES	GES	GES	HYMO	Land Drainage	Yes	IA1 – IFI & IA8 – LAWPRO
Loughanillaun Maam Cross	IE_WE_30_348	LWB	AR	Yes	HES	GES	GES	GES	HYMO	Land Drainage	Yes	IA8 – LAWPRO
Loughaunieran Maam Cross	IE_WE_30_313	LWB	RE	No	U	U	U	Unknown	HYMO	Land Drainage	Yes	IA1 – EPA
Shannagrena	IE_WE_30_326	LWB	RE	No	U	U	U	Unknown	HYMO	Land Drainage	Yes	IA1 – EPA

2 Receptor Information and Assessment

2.1 Context and Settings

The Failmore Priority Area for Action lies in Connemara, near Maam, Co. Galway. The PAA consists of 5 waterbodies; the Failmore_010 which is a river waterbody and four lake waterbodies, which are the Maumwee, Shannagrena, Loughanillaun Maam Cross and the Loughaunieran Maam Cross. There are two unassigned lake waterbodies in the PAA, the Shannagrena and the Loughaunieran Maam Cross. The Failmore_010 river water body and the Maumwee and Loughanillaun Maam Cross lakes all have a high-status objective.

The Failmore_010 headwaters are in the Maumturk SAC mountains, and flows down the hills towards Maum village, through commonage areas and privately-owned agricultural land. It flows through the Teernakill bridge where it is monitored by the EPA (**Figure 3**) and enters the Bealanabrack_020 river waterbody which outflows to the upper Lough Corrib.

All the lake waterbodies are hydrologically linked by the river waterbody Owenwee (Corrib)_010. The river is not part of the PAA but is included in this desktop assessment as all the lakes in the PAA are linked by this river. The Owenwee (Corrib)_010 is at good ecological status, and is monitored at the EPA monitoring point “200m D/S Tawnaghbeg Lough” as seen in **Figure 3**. The Owenwee (Corrib)_010 headwaters are located beside the Maumwee lake and flow out of the lake and flow into Loughanillaun. It then flows past Maam Cross and flows through Coillte forestry for about 4km and enters lough Corrib at the townland of Derryherbert. The Maumwee lake is situated in the Maum Valley, 2km from Maam cross and Shannagrena lake is to the right of the Maumwee lake. Loughanillaun Maam Cross is to the left of the Maumwee lake. The Loughaunieran Maam Cross is on the southeast side of the PAA.

Failmore PAA Desktop Assessment

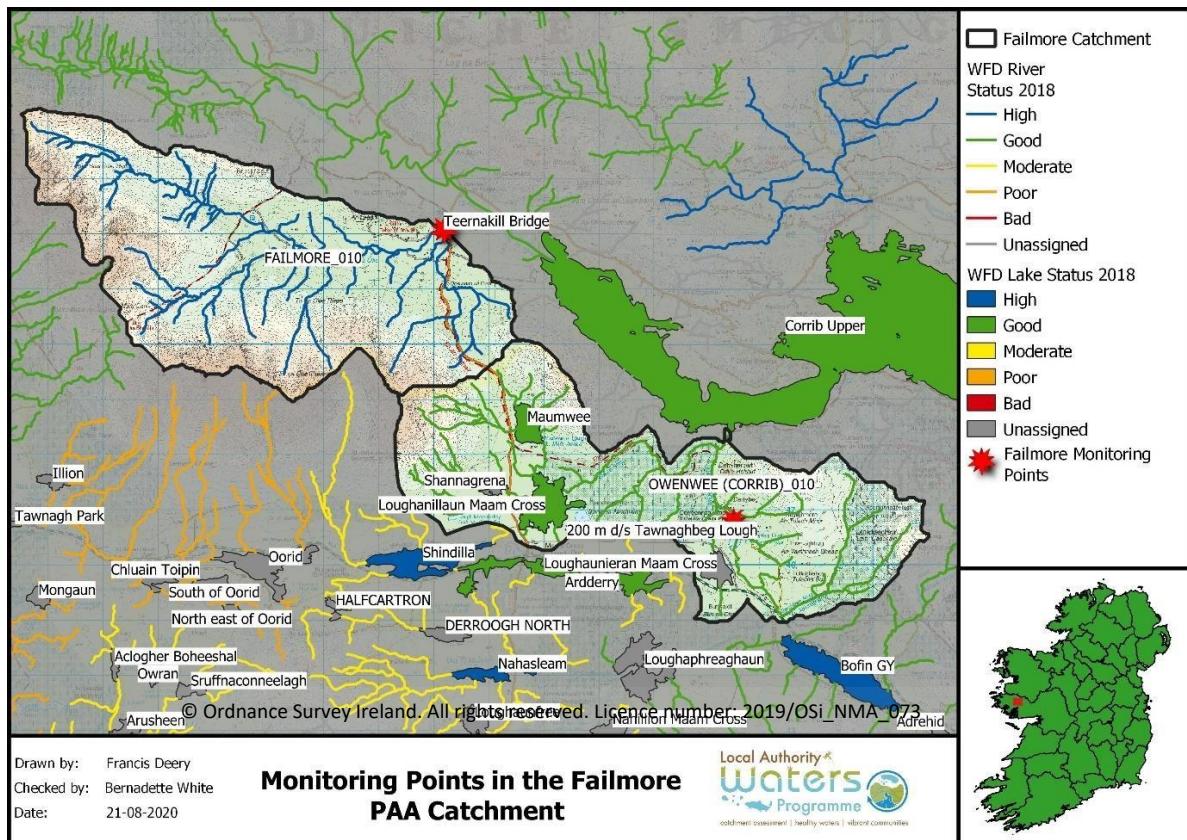


Figure 3: River Monitoring Points in the Failmore PAA Catchment

2.2 Receptor Information

Table 2: Outline of the Water Quality in the Failmore_010 and Owenwee (Corrib)_010

Waterbody		Failmore_010	Owenwee (Corrib)_010
Risk Category (from 2013-2015)		At risk	Not at Risk
Monitoring station		Teernakill Bridge (RS30F010100)	200m D/S Tawnaghbeg Lough (RS30O030180)
Monitoring station type		Operational	Operational
Biological Status		High	Good
Q values/Lake Status Assessment	2009	4-5	
	2010	0	
	2011	0	
	2012	4	Good
	2013	0	
	2014	0	
	2015	4	Good
	2016	0	
	2017	0	
	2018	4-5	4
Fish		No data	No data
WFD Objective		High	Good
Monitoring station		Teernakill Bridge	200m D/S Tawnaghbeg Lough
PO4+ or TP for Lakes	2010	0.010	No Data
	2011	0.008	
	2012	0.015	

Waterbody		Failmore_010		Owenwee (Corrib)_010
Risk Category (from 2013-2015)		At risk		Not at Risk
Monitoring station		Teernakill Bridge (RS30F010100)		200m D/S Tawnaghbeg Lough (RS30O030180)
Ecological Threshold 0.025 (high status) 0.035 (good status) mgP/L.	2013	0.006		
	2014	0.005		
	2015	0.005		
	2016	0.005		
	2017	0.005		
Lake Ecological Threshold.Total Phosphorus ≤ 0.010 (High Status) ≤ 0.025 (Good Status) mg P/l	2018	0.016		
Baseline PO4		0.008		
NH4+ Ecological Threshold ≤ 0.040 (high status) ≤ 0.065 (good status) as an annual mean mg N/L	2010	0.015	No Data	
	2011	0.015		
	2012	0.015		
	2013	0.025		
	2014	0.010		
	2015	0.014		
	2016	0.010		
	2017	0.010		

Waterbody		Failmore_010		Owenwee (Corrib)_010
Risk Category (from 2013-2015)		At risk		Not at Risk
Monitoring station		Teernakill Bridge (RS30F010100)		200m D/S Tawnaghbeg Lough (RS30O030180)
	2018	0.010		
Baseline NH4		0.014		
NO3-/ or Chlorophyll for lakes Ecological Threshold 3.5mgN/L	2010	0.2		No Data
	2011	0.2		
	2012	0.2		
	2013	0.2		
	2014	0.1		
	2015	0.4		
	2016	0.2		
	2017	0.1		
Chlorophyll Ecological Threshold <u><6</u> (high status) and <u><9</u> (good status) as an annual mean µg/L	2018	0.3		
Baseline NO3		0.198		
Supporting conditions:		BOD is all below the EQS, however there was a spike in Oct 19. (Figure 4)		No Data
Protected Areas		Yes: Maumturk Mountains SAC		Yes: Maumturk Mountains SAC
HYMO		Yes: There is no Drainage District or OPW drainage schemes in this waterbody, however information taken from QGIS shows there is number of land drains feeding into the Failmore_010. From a review		There are some new channels opened since the 1800s.

Waterbody	Failmore_010	Owenwee (Corrib)_010
Risk Category (from 2013-2015)	At risk	Not at Risk
Monitoring station	Teernakill Bridge (RS30F010100)	200m D/S Tawnaghbeg Lough (RS30O030180)
	of the historical Geohive maps there would appear to be new channels opened.	
RHAT (2013 – 2015)	No Data	No Data
Evidence of Arterial Drainage	No Scheme or District but there is evidence of arterial drainage.	There is no arterial drainage scheme present. From viewing the GeoHive map there would appear to new channels opened since the 1800s, straightening and constructing new channels in order to join up existing river channel to drain the adjacent land.
Conceptual Model	Yes	Yes
Biological Status	High	Good
Overall Ecological Status	Good (2015)	Good
	High (2018)	
Comments	The status driver of this high-status waterbody is macroinvertebrates. At the time of the initial characterisation they were at good status, however, in 2018 they moved up to high status. The main pressures noted in the WFD App are in relation to hydromorphology, there are number of drains leading into the main river channel and there appears from the Geo hive map that new channels have been constructed over the years. Chemistry is all below the EQS, however the BOD exceeded the limits in June 2014 (1.6mg/l) and October 2019 (7.4mg/l).	This RWB is at good ecological status, it is not at risk, however it is the hydrological link between all the LWBs in the Failmore PAA and flows into the Upper Corrib. It must be considered in this desk study to properly understand the processes that may impacting the upon the four LWBs.
EPA Biologists Comments	The Failmore river improved to High ecological quality in August 2018.	
Significant issue: monitoring point	Unknown. Potentially BOD given spike in 2019, plus sediment, given land drainage of peat soils.	No issues at the monitoring point.

Failmore PAA Desktop Assessment

Waterbody	Failmore_010	Owenwee (Corrib)_010
Risk Category (from 2013-2015)	At risk	Not at Risk
Monitoring station	Teernakill Bridge (RS30F010100)	200m D/S Tawnaghbeg Lough (RS30O030180)
Significant issue: Waterbody	The generation of sediment loss from land drainage, bank erosions and peat extraction.	No significant issues.

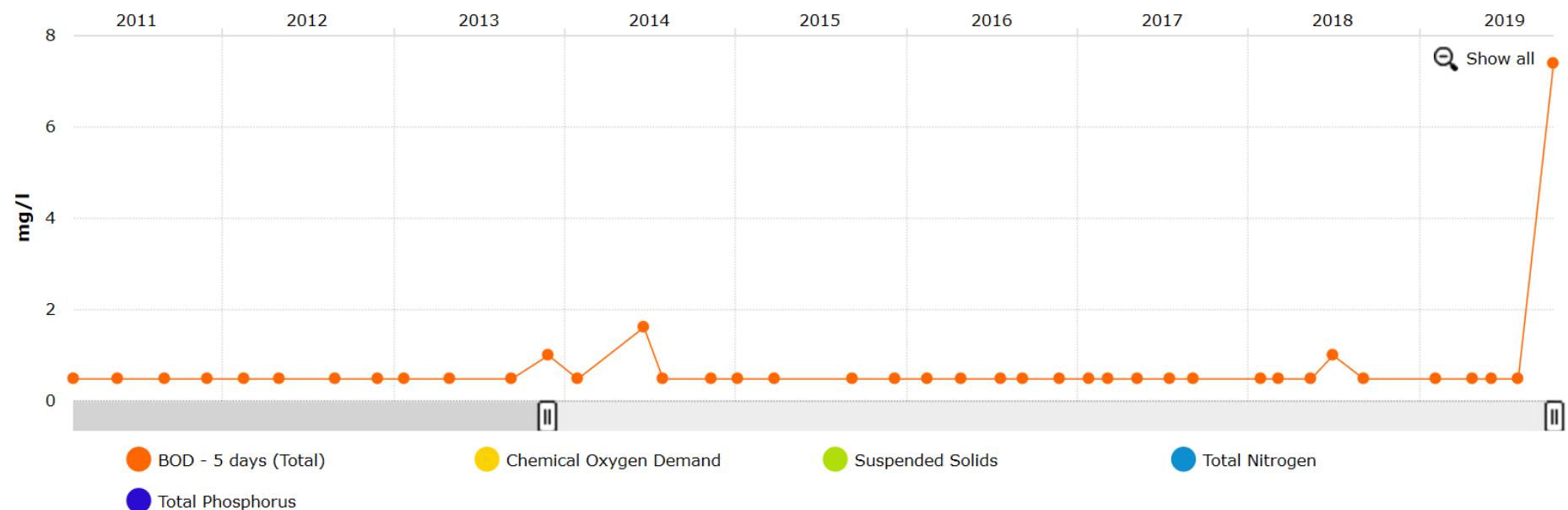


Figure 4: BOD graph for the Failmore_010

Table 3: Water Quality of Loughanillaun Maam Cross and Maumwee

Waterbody	Loughanillaun Maam Cross (IE_WE_30_348)		Maumwee (IE_WE_30_343)	
Risk Category	At Risk		At Risk	
Environmental Objective	High		High	
Environmental Objective Date	2027		2027	
Monitoring Type	Investigative and Operational		Investigative and Operational	
Monitoring stations	Midlake	LS300014313600010	Midlake	LS300014314600010
	Shore Site 1	LS300014313600020	Maumwee Surrogate Shore Site 1a	LS300014314600020
Lake type	2 – Low altitude, low alkalinity, shallow and large lakes		1 – Low altitude, low alkalinity, shallow and small lakes	
Biological Status				
Phytoplankton	2007-2009	High		High
	2010-2012	Good		High
	2010-2015	Good		High
	2013-2018	High		High
Other Aquatic Flora				
Macrophytes	2007-2009	High		High
	2010-2012	High		High
	2010-2015	High		High
	2013-2018	High		High
Phytobenthos	2007-2009	No Data		High
	2010-2012	No Data		High
	2010-2015	No Data		High
	2013-2018	No Data		High
Invertebrate Status	Monitored but no standard has been developed and/ or the quality element is not used for status assessment.		Monitored but no standard has been developed and/ or the quality element is not used for status assessment.	
Fish	2007-2009	No Data		High
	2010-2012	No Data		High

Waterbody		Loughanillaun Maam Cross (IE_WE_30_348)	Maumwee (IE_WE_30_343)
Risk Category	At Risk		At Risk
Environmental Objective	High		High
Environmental Objective Date	2027		2027
Monitoring Type	Investigative and Operational		Investigative and Operational
2010-2015	No Data		Good
2013-2018	No Data		Good
Hydromorphological Conditions			
Hydromorphology	2007-2009	No Data	High
	2010-2012	High	High
	2010-2015	High	High
	2013-2018	Good	High
Evidence of arterial drainage	There are no arterial drainage schemes in the area.		There are no arterial drainage schemes in the area.
Comments	Loughanillaun Maam Cross is a high-status lake waterbody, which is currently at good ecological status due to the hydromorphology characteristics.		Maumwee is a high-status lake waterbody, which is currently at good ecological status due to the fish status of the lake.
Conceptual model required (Y/N)	Y		Y
Ecological Status			
2013-2018	Good		Good
Observations from Macrophyte Report	The 2016-2018 ecological status of Loughanillaun is good and this was determined by total phosphorus. Total phosphorus levels are often above the high/good boundary. This indicates a level of pressure in terms of nutrients that may have a future deleterious effect on the macrophyte community.		The 2016-2018 ecological status of Maumwee Lough is good. The status is determined by the fish population. This means that the fish population needs to improve for ecological status to be 'high'.
Significant issue: monitoring point	Total Phosphorus and Chlorophyll – see table 4		Fish

Waterbody	Loughanillaun Maam Cross (IE_WE_30_348)	Maumwee (IE_WE_30_343)
Risk Category	<i>At Risk</i>	<i>At Risk</i>
Environmental Objective	High	High
Environmental Objective Date	2027	2027
Monitoring Type	Investigative and Operational	Investigative and Operational
Significant issue: Waterbody	Total Phosphorus, Ammonia and Hydromorphology – see table 3	Fish

Table 4: Chemical Parameters of Loughanillaun Maam Cross and Maumwee

Waterbody		Loughanillaun Maam Cross (IE_WE_30_348)				Maumwee (IE_WE_30_343)		
Risk Category		At Risk				At Risk		
Environmental Objectives		High				High		
Environmental Objective Date		2027				2027		
Monitoring Station		Site 1 – Midlake	Site 2 – Shore Site	Mean		Site 1 – Midlake	Site 2 – Maumwee Surrogate Shore Site 1a	Mean
Total Phosphorus (mg P/l)	2007	0.010		0.010		0.010		0.010
	2008	0.009		0.009		0.011 (0.022 – Aug & 0.031 – Nov)		0.011
	2009	0.006		0.006		0.004		0.004
	2010		0.008 (0.01 – Feb, July & Aug)	0.008		0.005		0.005
	2011		0.009 (0.02 – April) (0.01 – Feb & July)	0.009		0.006		0.006
	2012		0.013 (0.01 – Feb) (0.02 – April, July & Sept)	0.013		0.005		0.005

Waterbody		Loughanillaun Maam Cross (IE_WE_30_348)				Maumwee (IE_WE_30_343)		
Risk Category		At Risk				At Risk		
Environmental Objectives		High				High		
	2013		0.007 (0.01 – Feb) (0.013 – July)	0.007		0.005		0.005
	2014		0.010 (0.01 – Mar) (0.014 – July, 0.017 – Aug & 0.011 – Nov)	0.010			0.005	0.005
	2015		0.009 (0.01 – Jan, May, Aug, Oct) (0.011 – Aug)	0.009			0.005	0.005
	2016		0.009 (0.01 – Jun, 0.015 – Sept & 0.011 – Nov)	0.009		0.005	0.005	0.005
	2017		0.014 (0.019 – Feb, 0.011 – Mar, Apr, July, 0.017 – Aug & 0.016 – Nov)	0.014			0.006	0.006
	2018		0.011 (0.01 – Apr, 0.011 – July, 0.015 – Aug & 0.02 – Nov)	0.011			0.005	0.005

Waterbody		Loughanillaun Maam Cross (IE_WE_30_348)				Maumwee (IE_WE_30_343)		
Risk Category		At Risk				At Risk		
Environmental Objectives		High				High		
	2019		0.013 (0.011 – Feb, 0.014 – Apr, 0.024 – Aug & 0.013 – Nov)	0.012			0.005	0.005
Baseline TP (2007-2019)		0.008	0.010			0.005	0.005	
Total Ammonium (mg N/l) High status ≤ 0.040 (mean) and ≤ 0.090 (95%ile) Good status ≤ 0.065 (mean)	2007	0.020 (0.040 – July)		0.020		0.010		0.010
	2008	0.015		0.015		0.018		0.018
	2009	0.015		0.015		0.004		0.004
	2010		0.015	0.015		0.005		0.005
	2011		0.015	0.015		0.005		0.005
	2012		0.015	0.015		0.005		0.005
	2013		0.014	0.015		0.005		0.005
	2014		0.010	0.015			0.005	0.005
	2015		0.010	0.015			0.005	0.005
	2016		0.013	0.015		0.014	0.005	0.009
	2017		0.010	0.015			0.006	0.006
	2018		0.010	0.015			0.005	0.005
	2019		0.013	0.015			0.011	0.011
Baseline Ammonium (2007-2019)		0.016	0.012			0.008	0.006	
Chlorophyll a (µg/l)	2007	5.375 (17 – July)		5.375		2.660		2.660
	2008	1.350		1.350		2.520		2.520

Waterbody		Loughanillaun Maam Cross (IE_WE_30_348)				Maumwee (IE_WE_30_343)		
Risk Category		At Risk				At Risk		
Environmental Objectives		High				High		
Ecological Threshold <u><6</u> (high status) and <u><9</u> (good status) as an annual mean	2009	6.525 (7.7 – Feb, 6.4 – Mar)		6.525		1.660		1.660
	2010		3.817 (8.9 – July)	3.817		2.233		2.233
	2011		6.900 (9.3 – Feb, 12 – Apr & 8.5 – Nov)	6.900		1.700		1.700
	2012		4.833 (7.3 – July & 8.5 – Sept)	4.833		4.050 (6.4 – Feb & 7.7 – Apr)		4.050
	2013		3.400	3.400		2.550		2.550
	2014		5.700 (6 – Apr & 16 – Aug)	5.700			1.800	1.800
	2015		5.500 (21 – Oct)	5.500			2.133	2.133
	2016		11.875 (6.1 – Sept & 35 – Nov)	11.875		1.05	2.712	1.881
	2017		3.733	3.733			2.033	2.033
	2018		3.283 (6.7 – Aug)	3.283			0.983	0.983
	2019		3.933 (6.4 – Feb)	3.933			1.416	1.416
Baseline Chlorophyll (2007 – 2019)		4.416	5.297			2.302	1.846	

2.3 Conclusions

- The Failmore_010 is a river waterbody in the Failmore PAA with a high-status objective. The source of this waterbody is in the Maumturk Mountains and it flows into the Bealanabrack_020, which flows into the Upper Lough Corrib. The Failmore_010 contains the EPA operational monitoring point Teernakill Bridge. Ecological status at this monitoring point is driven by the macroinvertebrate assessment. At the time of the initial characterisation (2013 – 2015) the macroinvertebrates were at good status (Q4); therefore, the water body was not meeting its high-status objective. However, the EPA took a biological sample in 2018, in which it returned a high biological status (Q4–5), and a status assessment covering the timeframe of 2015 – 2018 determined this water body to be at high ecological status. All chemistry parameters are below EQS thresholds for high status, except for the BOD which had a spike in October 2019 – 7.4mg/l. The pressures identified at initial characterisation were hydromorphology from over grazing and channelisation, also peat cutting.
- The Maumwee lake is a lake waterbody in the Failmore PAA, with a high-status objective, but which is currently achieving good ecological status. Fish is the status element driving the lake from high down to good status. Supporting chemistry is achieving high status. Chemical status failed to meet good status in the 2010 - 2015 monitoring period for the ubiquitous chemical mercury and the following Polyaromatic Hydrocarbons - benzo-g,h,i-perylene and indeno(1,2,3-cd)pyrene). However, in the 2013 to 2018 status update, this lake is no longer failing for chemical status.
- The Loughanillaun Maam Cross is a lake waterbody in the Failmore PAA. It is a high-status objective waterbody that is currently achieving good ecological status (2013 – 2018). It is at good ecological condition due to hydromorphology. Total phosphorus concentrations have exceeded the high-status EQS in 2016, 2017 and 2018 and chlorophyll exceeded the EQS thresholds in 2011 and 2016. Hydromorphology, in the form of land drainage was identified as the significant pressure impacting upon this waterbody during initial characterisation, and aerial imagery shows peat drains feeding into the Owenwee (Corrib)_010 which is the inputting and outputting waterbody of this lake.
- The Shannagrena is a lake waterbody in the Failmore PAA. The lake is not monitored as part of the lakes WFD monitoring programme therefore there is no status assessment available. Until further information on the water quality of the lake is available, the lake is placed in the *Review* risk category. LAWPRO will undertake a lake LCA to determine the water quality of this lake. One significant pressure was identified at initial characterisation stage as impacting upon this waterbody – Hydromorphology, specifically land drainage. The Owenwee (Corrib)_010 is the inputting and outputting waterbody of this lake.
- The Loughaunieran Maam Cross is a lake waterbody in the Failmore PAA. The lake is not monitored as part of the lakes WFD monitoring programme therefore there is no status assessment available. Until further information on the water quality of the lake is available, the lake is placed in the *Review* risk category. LAWPRO will undertake a lake LCA to determine the water quality of this lake. One significant pressure was identified at initial characterisation stage as impacting upon this waterbody – Hydromorphology, specifically land drainage. The Owenwee (Corrib)_010 is the inputting and outputting waterbody of this lake.

- The Owenwee (Corrib)_010 is in the sub – catchment 30_15 Joyce's_SC_010. This waterbody is the hydrological link between all the lake waterbodies in the Failmore PAA. it is currently at good ecological status and is not at risk, however it has been included in this desk study to fully understand the processes that may be impacting upon the four lakes in the Failmore PAA.

3 Significant Pressures

3.1 Failmore_010

3.1.1 Hydromorphology (Overgrazing)

Hydromorphology (Overgrazing) is noted as a significant pressure in the Failmore_010, with altered habitat due to morphological changes as the impact. Overgrazing of commonage areas was a significant issue in the late 90s/early 2000s, and Commonage Framework Plans were introduced to resolve significant issues. However, there could still be still isolated problems with overgrazing in the commonage areas of Connemara, but likely not at the same extent as previously seen. It cannot be confirmed from aerial views if over grazing is present in the Failmore_010 area, and the local catchment assessment will be required to confirm this issue. Permanent pasture is the main crop in the Failmore PAA. There are no derogation farms in the PAA and the nitrogen per hectare is 30kg/H is the PAA which is low.

3.1.2 Hydromorphology (Channelisation)

Hydromorphology (Channelisation) is noted as a significant pressure in the Failmore_010, with altered habitat due to morphological changes as the impact. There are no drainage schemes in this area, however there are several land drains leading into the Failmore_010 main channel and there are also new channels constructed to drain the adjacent land. There are also several land drains in the upper reaches of the river that would be transporting sediment to the main channel of the waterbody.

The land drains are generally located around areas where there is distinctive green grass as opposed to the brown heathery vegetation located on the commonages in the Failmore PAA, which dominate the area. In reviewing the morphological quality index¹, there are sections of good and moderate morphological quality immediately upstream of the EPA monitoring point. The sediment accumulation shapefile suggests that there are moderate levels of sediment accumulation throughout the length and the sub basin of Failmore_010. If sediment cover is found in the channel during field survey, then this means that human activities have potentially caused this locally, and this will probably be the case of the levels of sediment found are excessive (>50% cover).

¹ The MQI-Ireland tool has been developed and implemented nationally by the EPA Catchment Science and Management unit to provide an overview of the hydromorphological condition of rivers, at a larger scale to the RHAT assessment. The tool was adapted to suit an Irish setting from the original Italian-derived method, which has been the official morphological assessment in Italy since 2010. To be morphologically meaningful, this assessment considers multiple temporal and spatial scales, where the reach scale is the basic spatial unit (*i.e.* approximately 1-10km). Most importantly, processes are also considered (*e.g.* sediment production, water/sediment/wood flux, river channel adjustment), along with the features, or habitats, that these processes create.

3.1.3 Extractive Industry – Peat

The extractive industry in the form of peat cutting has been identified as a pressure in the Failmore_010, with altered morphology as the impact. There is peat cutting being carried out in the vicinity of the Failmore_010. With these peat cutting areas there are peatland drains, to drain the peatland, therefore the sediment from the peatland is being transported from the peatland to the river via these drains, as can be seen in **Figure 5** and **Figure 6**.

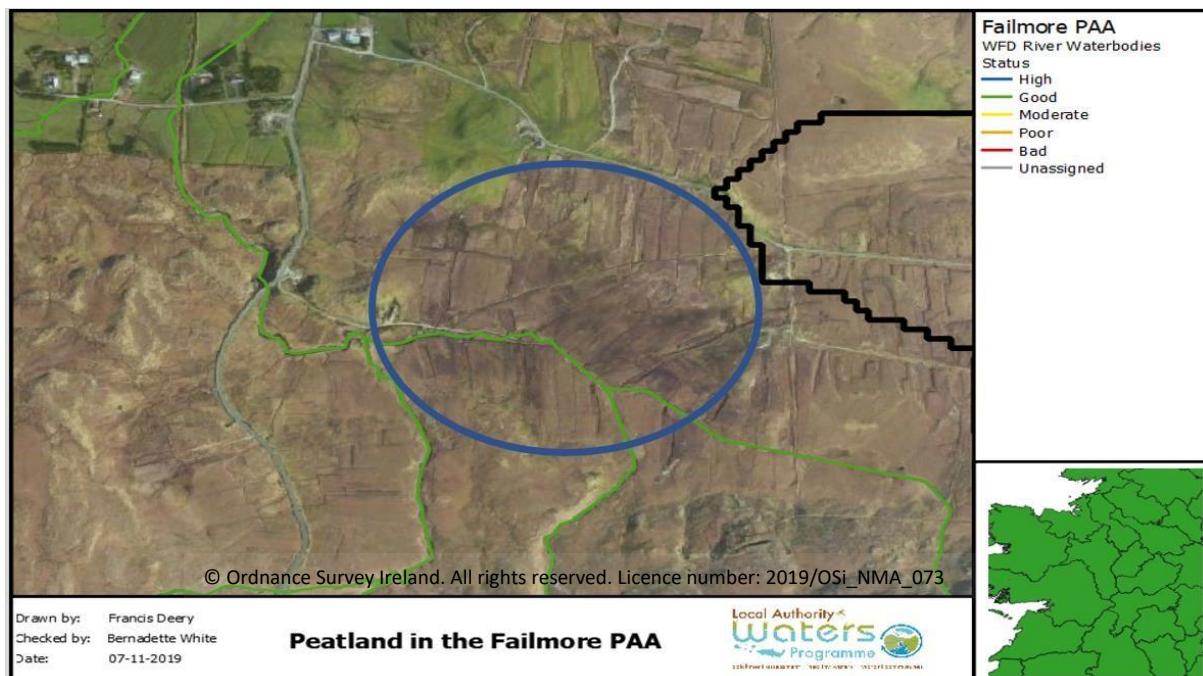


Figure 5: Peat Cutting in the Failmore_010

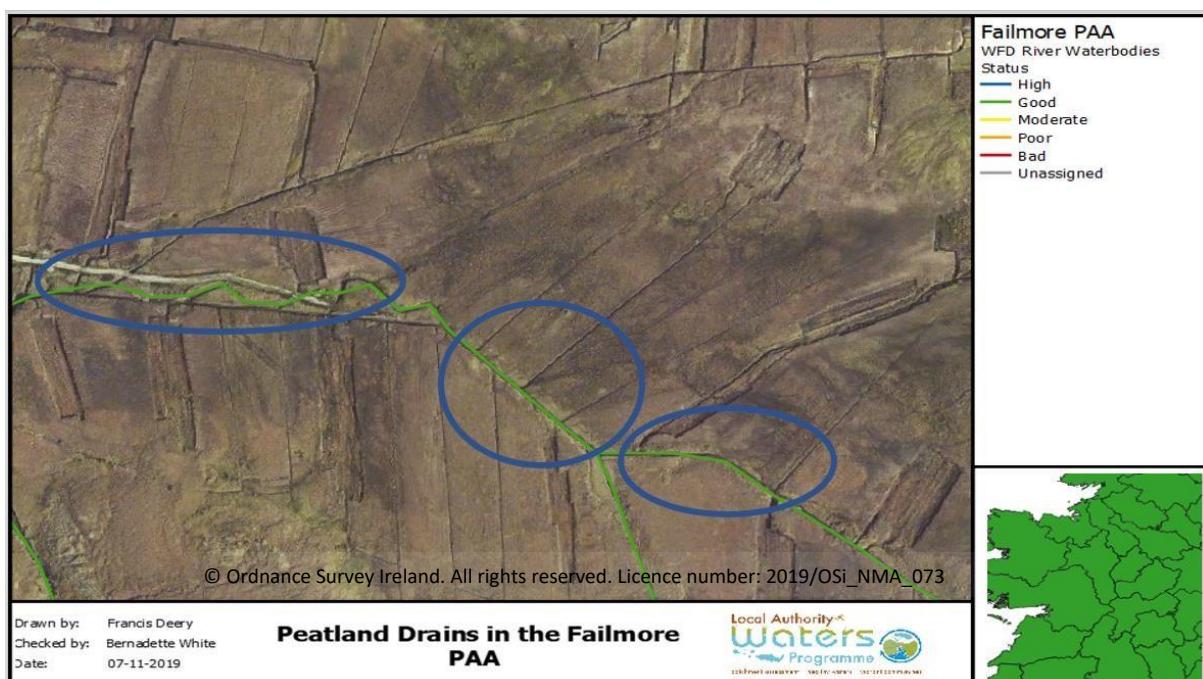


Figure 6: Peatland Drains in the Failmore_010

3.2 Maumwee

3.2.1 Hydromorphology – Land Drainage

Hydromorphology in the form of land drainage is seen to be impacting the Maumwee lake by impacting upon the morphological processes of the lake. There are number of areas around the Maumwee lake, where peat cutting appears to have taken place in the past, with these areas there are peatland drains with some leading into the Maumwee lake itself (**Figure 7**). From viewing the Geohive historical maps from 1800s, the Owenwee (Corrib)_010 has been modified, straightened and channelised to drain the adjacent land as seen in **Figure 8**. There is moderate sediment accumulations around the southern shore of the lake. If sediment cover is found in the channel during field survey, then this means that human activities have potentially caused this locally, and this will probably be the case of the levels of sediment found are excessive (>50% cover). In reviewing the morphological quality index, the natural river flowing into the lake have a high morphological quality.

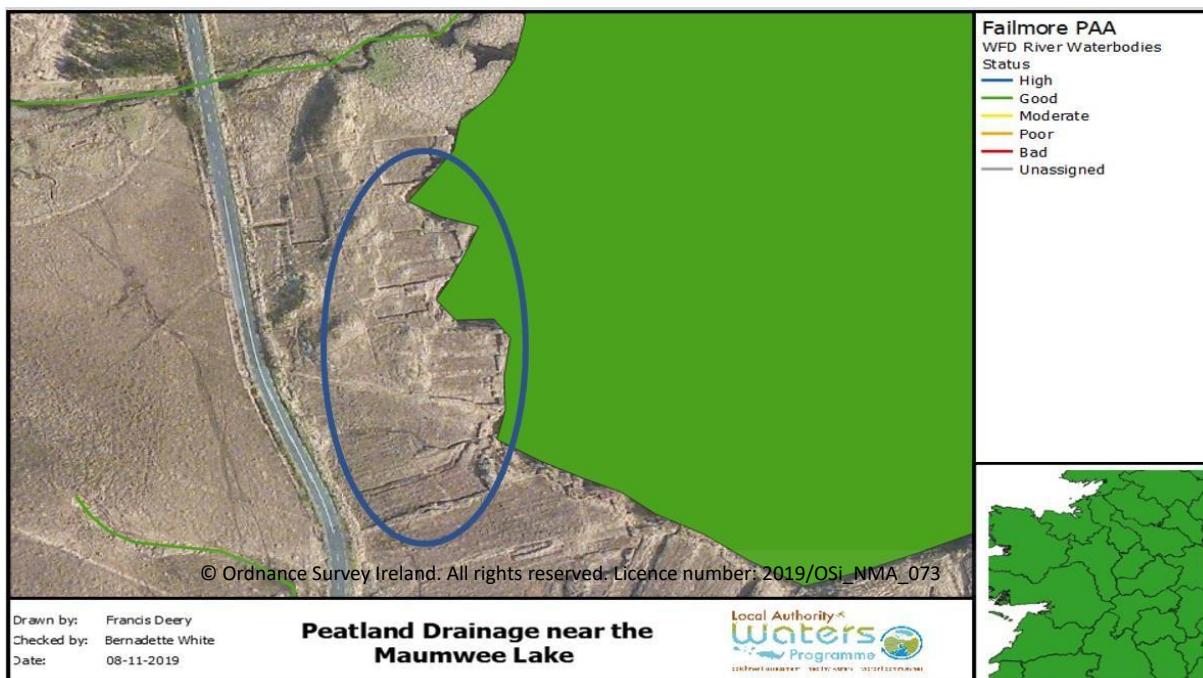


Figure 7: Peatland Drains near the Maumwee Lake

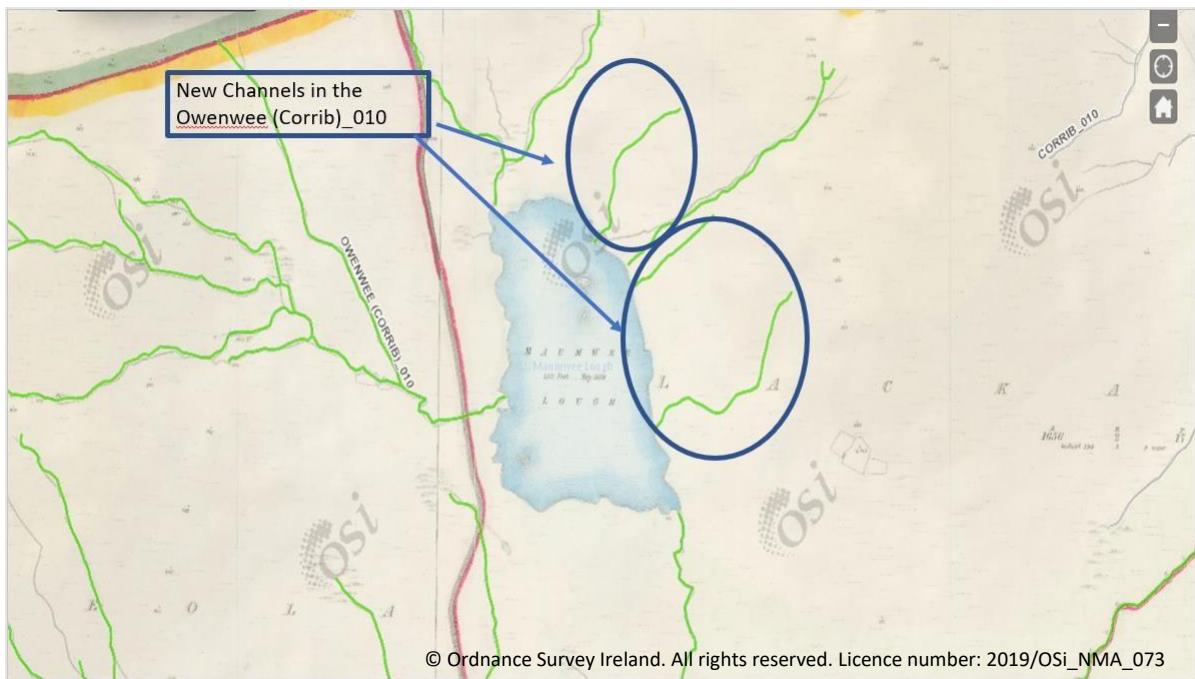


Figure 8: New River Channels in the Owenwee (Corrib)_010

3.3 Loughanillaun Maam Cross

3.3.1 Hydromorphology – Channelisation

Hydromorphology in the form of channelisation is impacting upon the Loughanillaun Maam Cross lake, the habitat is being altered due to morphological changes in the surrounding area of this waterbody. The WFD App also states that the lake may be under pressure from accelerated erosion processes. There are several peatland drains (**Figure 9**) leading into the lake itself which would be transporting sediment and mobilised nutrients, such as ammonium. Naturally, moderate levels of sediment accumulation are expected around the southern and eastern shores of the lake. In reviewing the morphological quality index, there is no morphological alterations to the inflowing rivers. On the outflowing part of the Owenwee (Corrib)_010, no alterations have occurred in this waterbody.

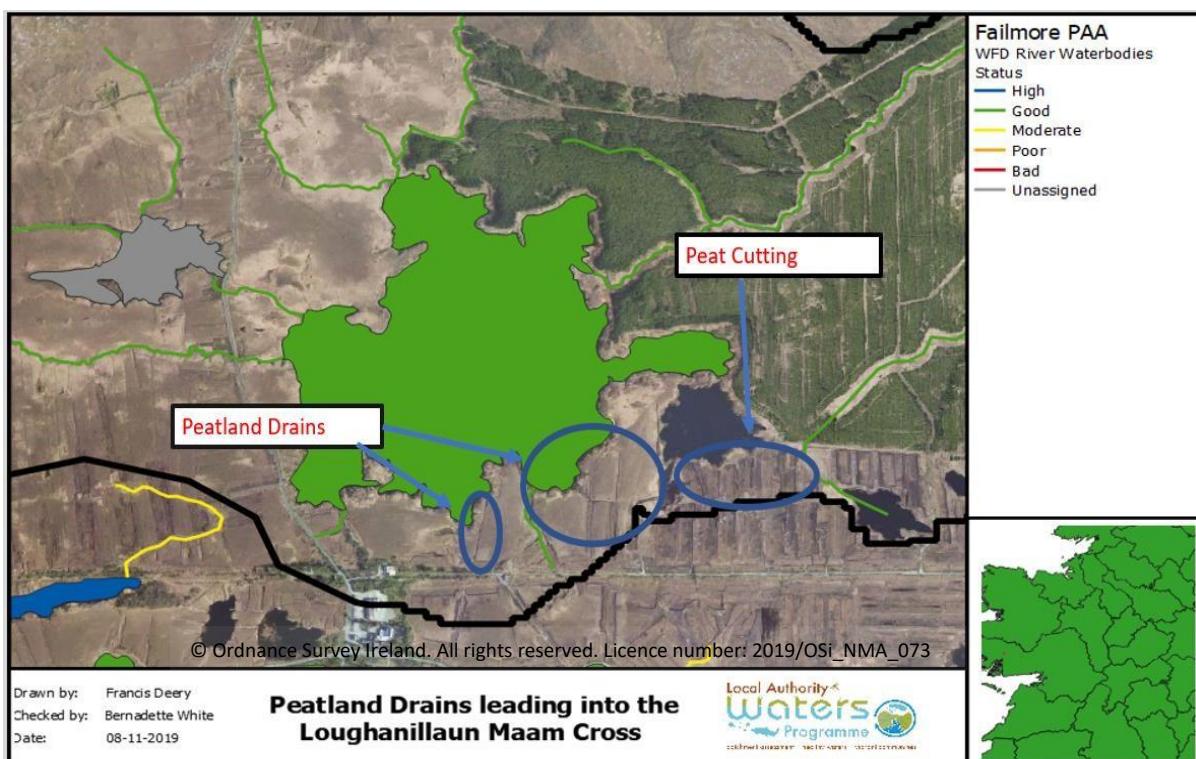


Figure 9: Peatland Drains leading into the Lake

3.3.2 Forestry

Forestry was not identified as a significant pressure during initial characterisation. There are number of forestry plantations located around the Loughanillaun Maam Cross both Coillte and Private forestry (**Figure 10**). The Coillte forestry was planted in 1982, there would appear to be a buffer zone between the lake and the plantations, and dominant species of this plantation is Sitka Spruce. The private forestry was planted in 1992, again there would appear to be a buffer zone between the forest and the lake. The main species are Sitka Spruce and Lodge pole pine.

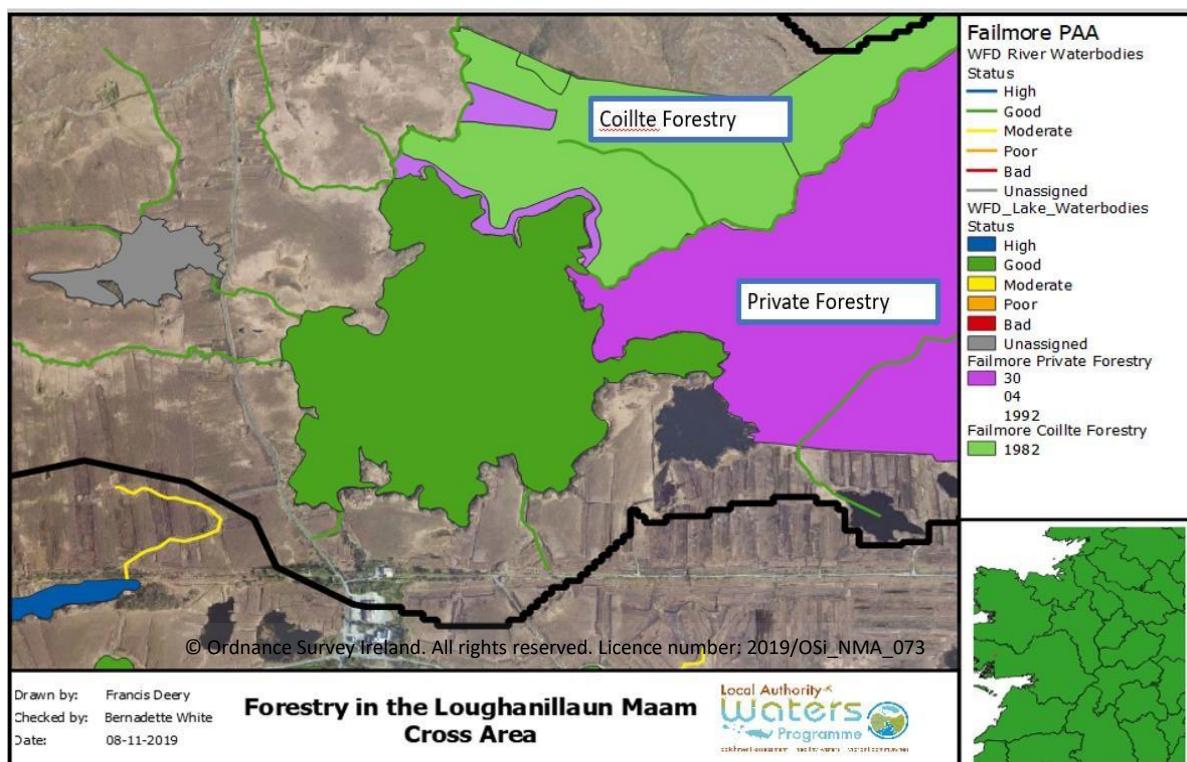


Figure 10: Forestry near Loughanillaun Lake

3.4 Shannagrena

3.4.1 Hydromorphology – Land Drainage

Hydromorphology in the form of land drainage was identified as a significant pressure with impact to habitats caused by morphological changes to Shannagrena lake. The WFD App also states that there is an issue with accelerated erosion and could be impacting upon the status of the lake, which is yet to be determined as this waterbody is unassigned. There are several land drains leading from the peatland into the lake, as seen in **Figure 11**. There is a significant amount of moderate sediment accumulation on the southern and eastern shores of the lake. If sediment cover is found in the channel during field survey, then this means that human activities have potentially caused this locally, and this will probably be the case of the levels of sediment found are excessive (>50% cover).

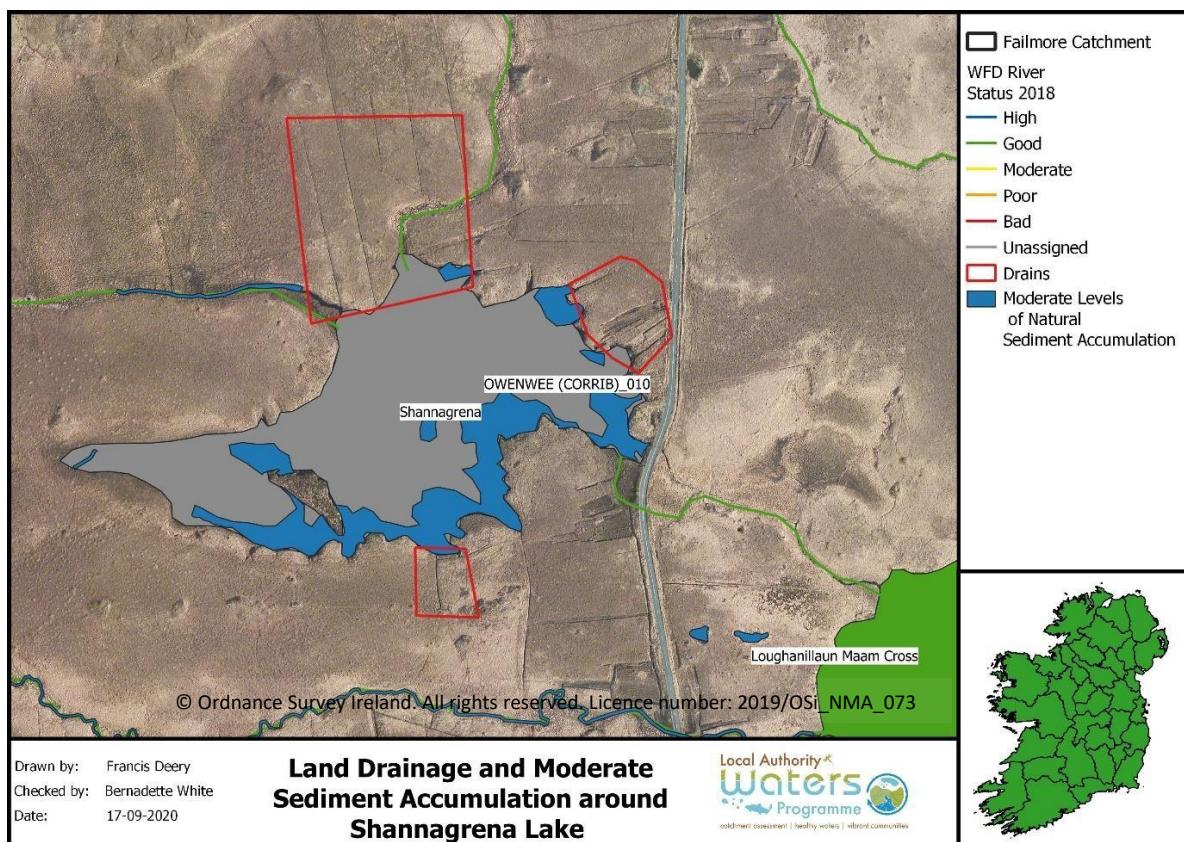


Figure 11: Land Drainage in the Shannagrena Lake

3.5 Loughaunieran Maam Cross

3.5.1 Hydromorphology – Land Drainage

Hydromorphology in the form of land drainage was identified as a significant pressure with impact to habitats caused by morphological changes to Loughaunieran Maam Cross lake. The WFD App also states that there is an issue with accelerated erosion and could be impacting upon the status of the lake, which is yet to be determined as this waterbody is unassigned. There are several land drains leading from the peatland into the lake, as seen in **Figure 12**. Natural sediment accumulation mapping indicates that there is an area located along the eastern shores of the lake where moderate levels of sediment accumulation would be expected.

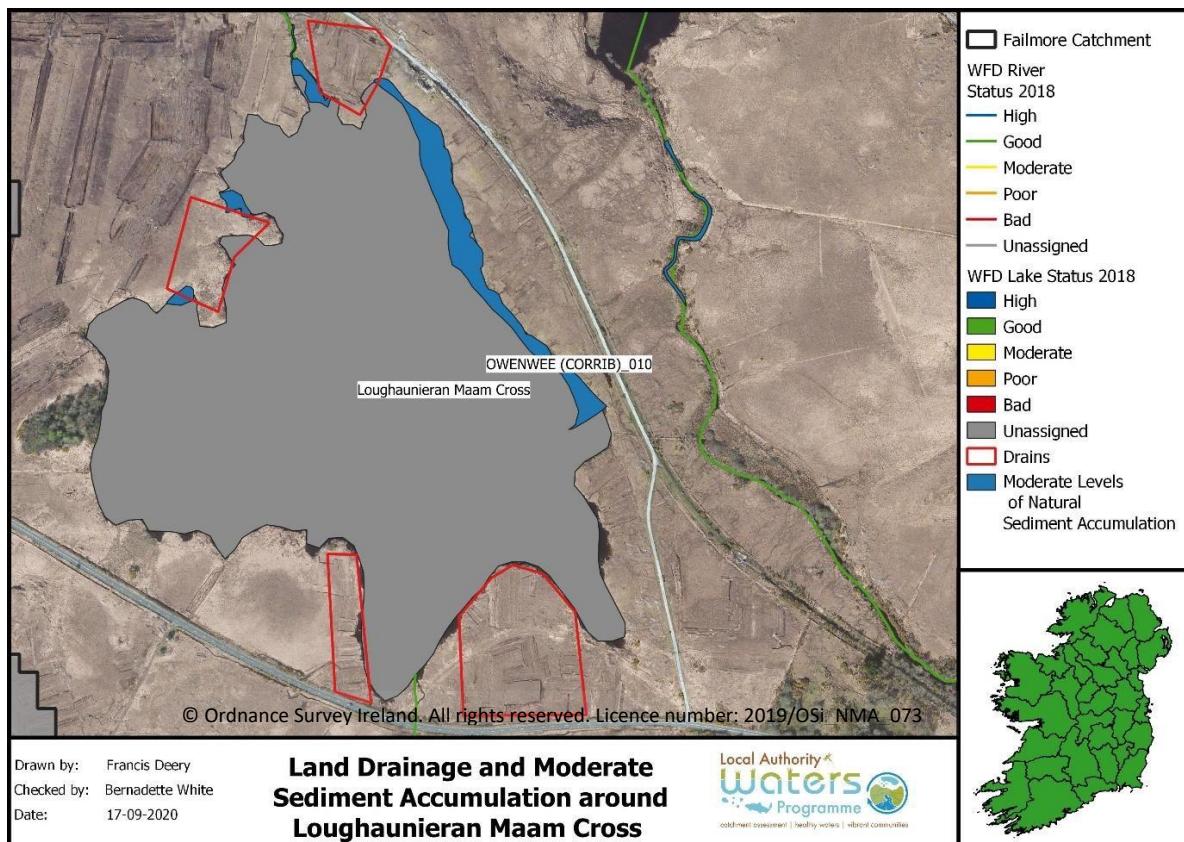


Figure 12: Peatland Drainage in the Loughaunieran Maam Cross Area

3.5.2 Peat Cutting

Peat cutting was not indicated as a significant pressure on this lake during initial characterisation. There are number of areas around the lake where there is peat cutting being carried out, as seen in the **Figure 13**.

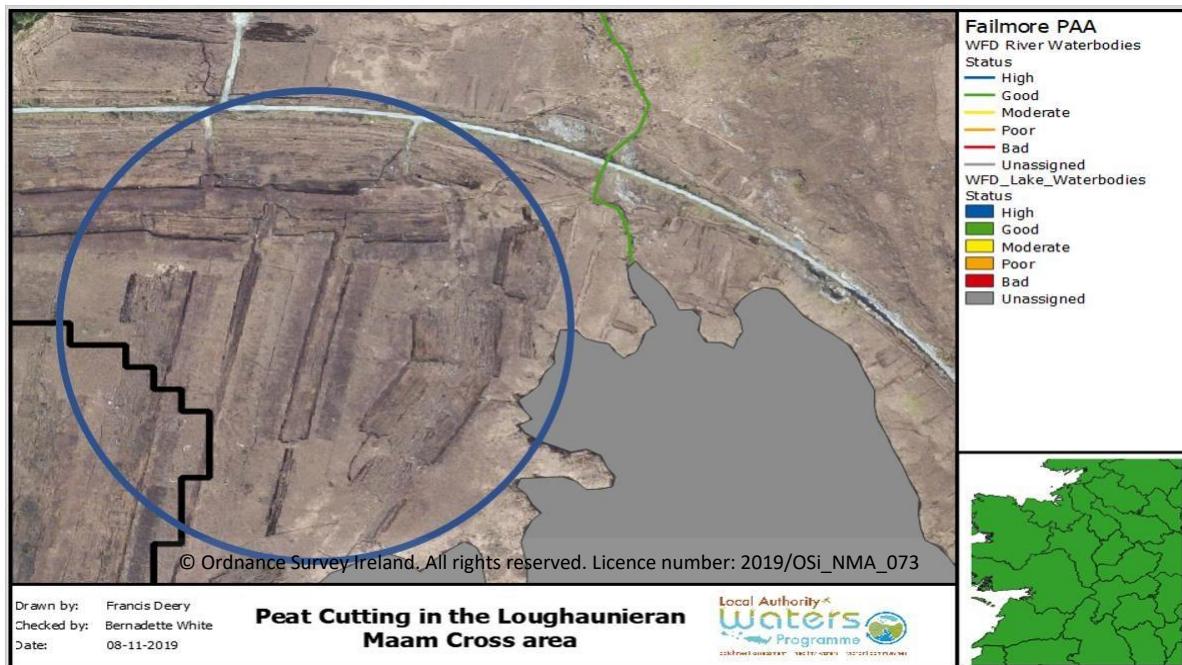


Figure 13: Peat Cutting in the area of the Lake

4 Pathway Information (Diffuse Pollution)

The regional pathway framework is provided by the aquifer in the PAA and sub-compartments are determined by soil drainage and groundwater vulnerability. The Failmore PAA contains one aquifer bedrock type: Poor Aquifer – Bedrock which is generally unproductive except for local zones. The PAA is uniform in its hydrogeological and soil characteristics there one compartment is proposed for the conceptual model.

The compartment is described by the poor aquifer – bedrock which is generally unproductive except for local zones. There are three rocks unit in the compartment which are Granites & other Igneous rocks, Precambrian Quartzites, Gneisses & Schists and Precambrian Marbles. The main flowpaths are in a thin upper fractured zone, groundwater flow is limited and runoff in rivers is flashy and drainage density is high, blanket peat is common. Soils in this compartment are peat/poorly drained soils. Permeability is low around the main channel of the Failmore_010, with a good proportion of low permeability located around Shannagrena, Maumwee and Loughanillaun. The presence of low permeability soils means water cannot move vertically downwards, therefore the dominant flowpath is horizontal, and groundwater is well protected in this area. In these areas if present in excess quantities, phosphate, ammonia, pesticides and pathogens will run off into streams unless the pathway is intercepted. The remainder of the compartment is occupied by DTB<3m. X extreme vulnerability is located in the areas where the bedrock is close to the surface, there is a small area of extreme vulnerability in the Failmore_010 river sub basin, with small areas located around the lakes, and there is also a large area on the east side of Owenwee (Corrib)_010. An area of high vulnerability is located around Shannagrena, Maumwee and Loughanillaun, with a small area in Failmore_010, moderate and low vulnerability is located around the main Failmore_010 channel.

Moderate phosphate susceptibility is present in this compartment, with the exception of directly at and upstream of the EPA monitoring point for Failmore_010 where the susceptibility is high. Nitrate susceptibility is very low throughout the PAA, with small pockets of high areas, one of which is also located at the Failmore_010 EPA monitoring point.

The main pathways in this PAA will be via overland flow and in drains.

Table 5: Pathway Information table

		Compartment 1
		Poorly drained
Pathway Info	Direct (e.g. pipe)	No
	Aquifer	Poor Aquifer
	Topography	
	Soil	Peat/poorly drained
	Subsoil	Blanket Bog, Metamorphic till and Rock
	Subsoil K	Low
	Rock Unit	Precambrian Marbles, Precambrian Quartzites, Gneisses and Schists, Granites and other Igneous rocks.
	Groundwater vulnerability	Moderate to X extreme
	Karst features	None
	PO4 Susceptibility	Moderate
	NO3 susceptibility	Surface: Very Low to Moderate Sub Surface: Very Low
	PO4 PIP	Rank 1 to 7
	NO3 PIP	Surface: Rank 6 to 7 Sub surface: Rank 6 to 7
	Flowpaths	Drains and Overall flow
Location of Monitoring Point		
Significant pressures		Hydromorphology Peat Cutting Forestry

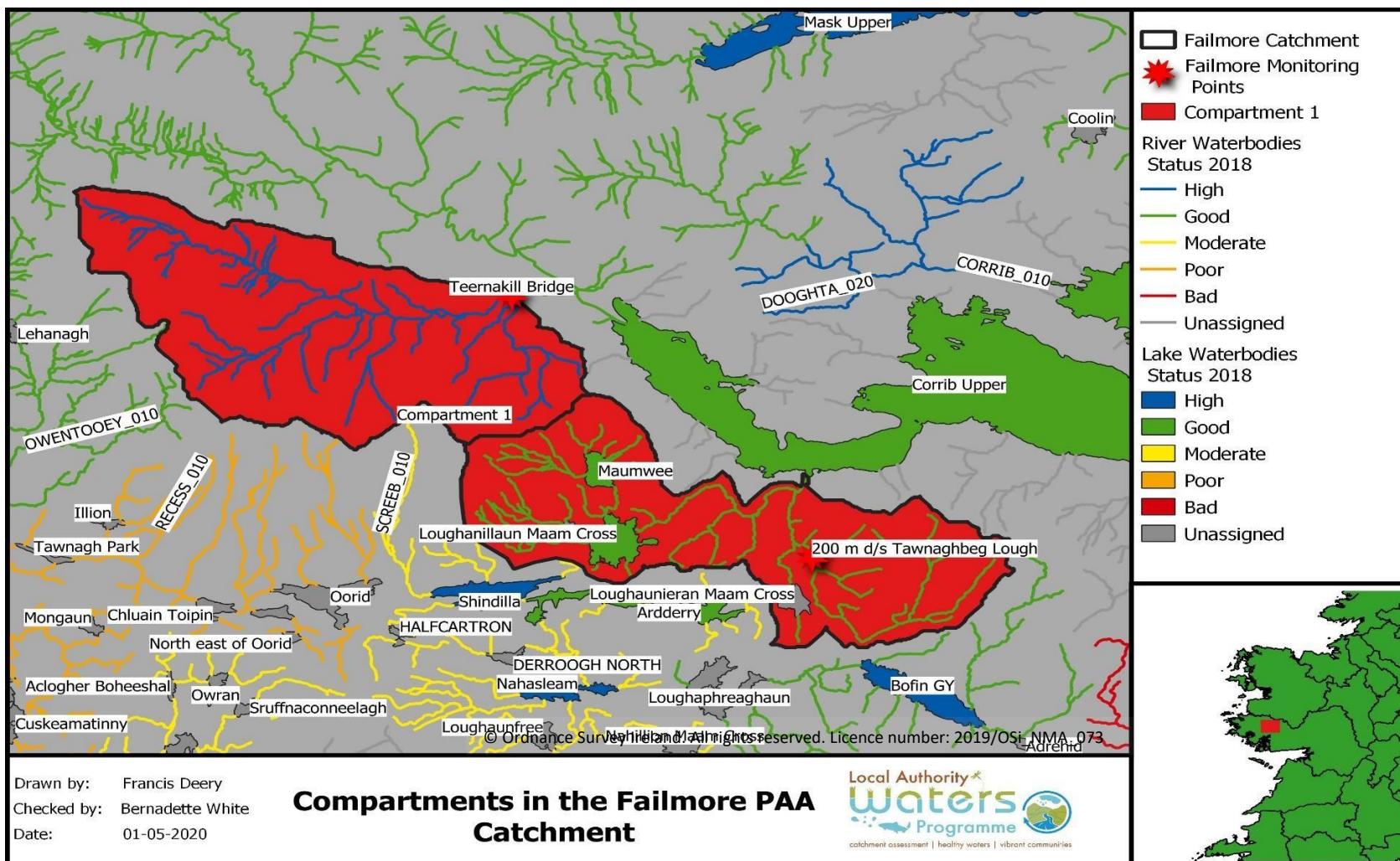


Figure 14: Compartments in the Failmore PAA Catchment

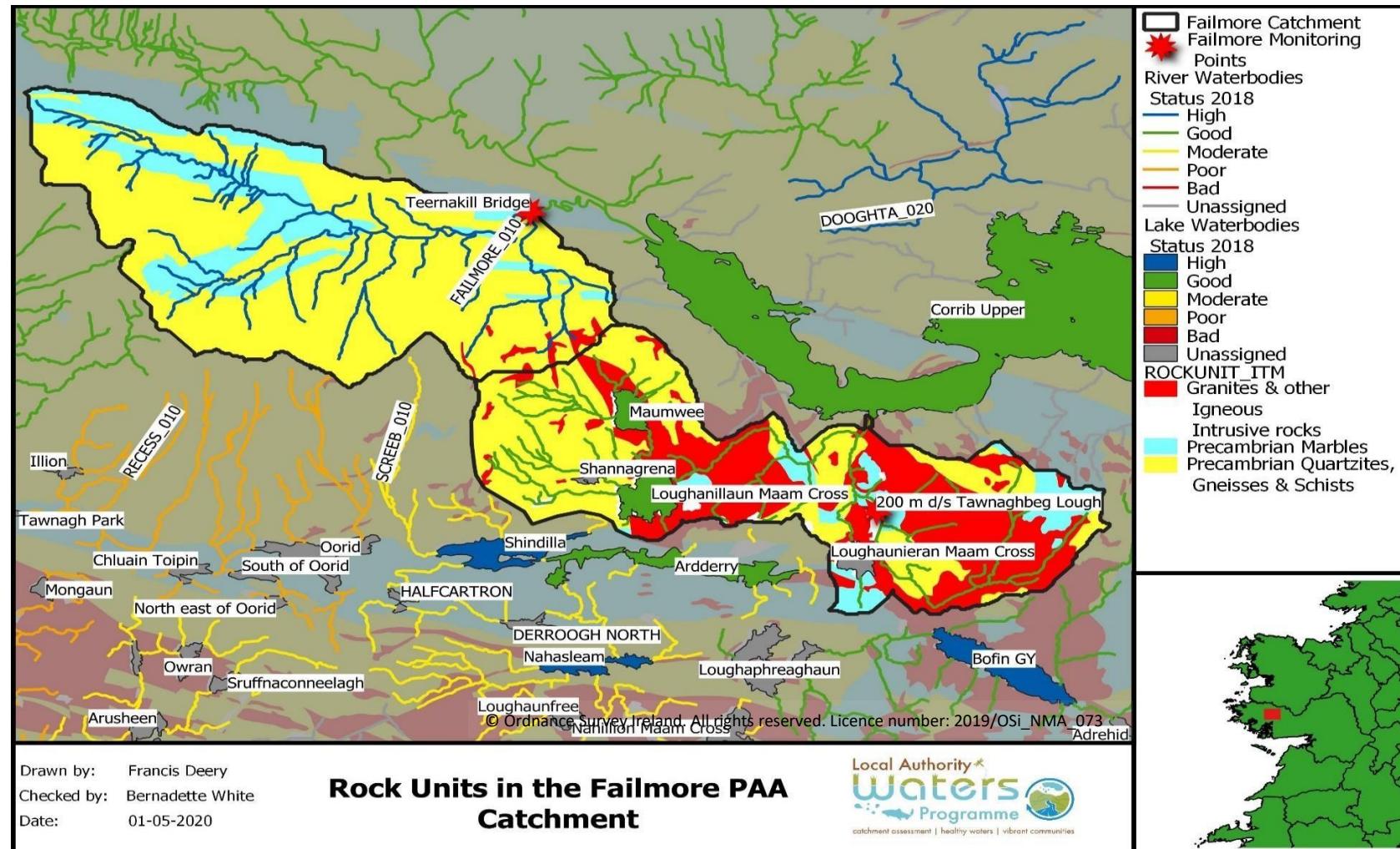


Figure 15: Rock Unit in the Failmore PAA Catchment

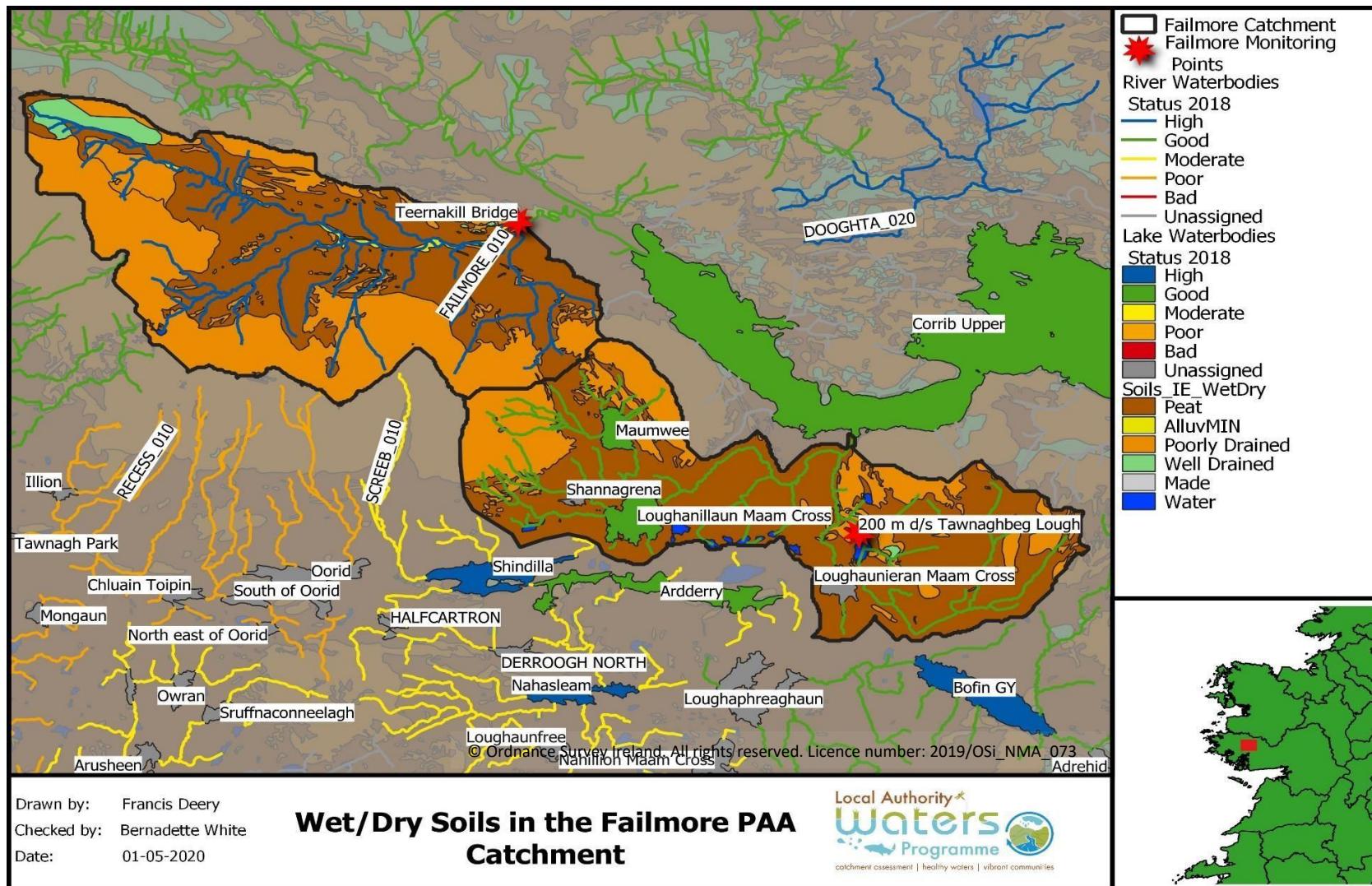


Figure 16: Wet/Dry Soils in the Failmore PAA Catchment

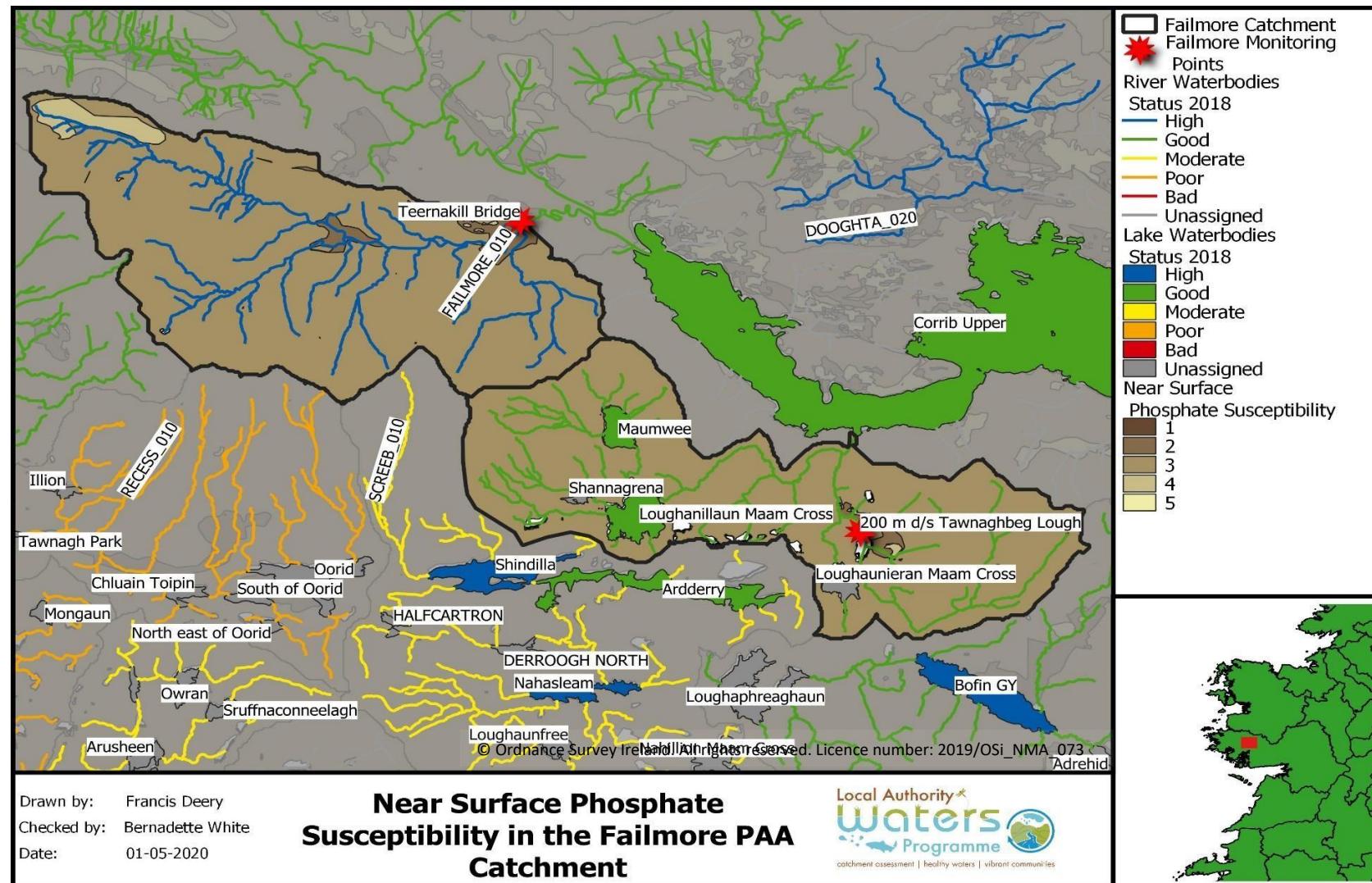


Figure 17: Near Surface Phosphate Susceptibility in the Failmore PAA Catchment

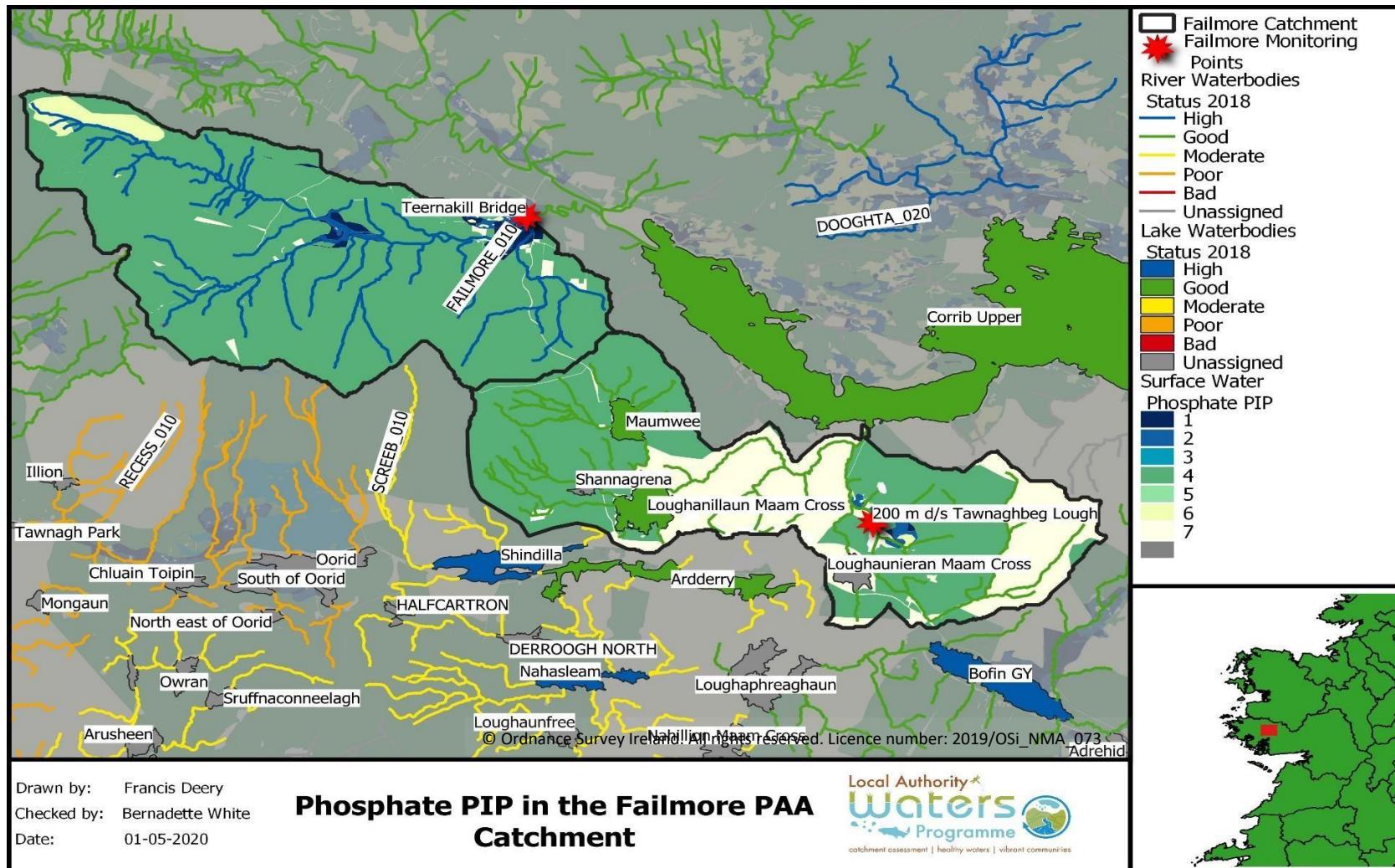


Figure 18: Phosphate PIP in the Failmore PAA Catchment

5 Interim Story of the PAA

5.1 Failmore_010

- The Faimore_010 is a high-status waterbody.
- From the initial EPA characterisation, the Failmore_010 is at good ecological condition due to the macroinvertebrate component. From a sample taken in 2018, the macroinvertebrates have moved up to high, therefore the ecological status of the Failmore_010 has moved back up to high ecological status. This sample was taken at the EPA operational monitoring point Teernakill Bridge (RS30F010100).
- All the chemistry is below the EQS, except for BOD, where there was a spike in 2019.
- Since 1982 up until 2012, the Q - value at this monitoring point was at Q4 – 5.
- The chemistry (Ortho – P, Ammonia and Nitrates) are all below the EQS limits and historically they have been low, these recordings have been taken from the EPA operational monitoring point Teernakill Bridge (RS30F010100).
- The significant pressures impacting upon the Failmore_010 are hydromorphology (Over – grazing and channelization) and peat cutting.
- It is hard to identify areas of over – grazing on the commonage areas, the LCA will help identify areas where over – grazing is taking place.
- There are areas where there are drains (both land drainage and peatland drainage) leading into the main Failmore_010 channel that would be transporting sediment the RWB which would eventually settle on the riverbed.
- The soil type in the Failmore_010 is mainly peat/poorly drained soil, which would indicate there is only one pathway, overland flow.
- There are areas of high phosphate PIP over peat/poorly drained soils indicating a high chance of diffuse phosphate entering the waterbody.
- The LCA will confirm if over – grazing, channelization and peat cutting are having an impact on the ecological status of the Failmore_010.

5.2 Maumwee

- The Maumwee lake is a high-status waterbody. It is currently at good ecological status due to the fish component. The fish was at high status in the previous two surveys and dropped to good in 2013.
- The Owenwee (Corrib)_010 is the inputting and receiving river waterbody, which is at good ecological status.
- The total phosphorus, ammonia and chlorophyll are all below the EQS. Chemical status is failing, mercury, (benzo-g,h,i-perylene)+(indeno(1,2,3-cd)pyrene)).
- The significant pressure impacting upon the Maumwee lake is hydromorphology in the land drainage. The inputting river, Owenwee (Corrib)_010 has been straightened and channelized over the years, there are also new river channels opened and there is a drain leading into the lake.
- The soil type in the region of the Maumwee lake is peat/poorly drained soil, indicating that the main pathway for nutrients or sediment would be overland flow.
- The LCA will confirm if land drainage is having an impact on the lake.

5.3 Loughanillaun Maam Cross

- The Loughanillaun Maam Cross is a high-status waterbody. It is currently at good ecological status due to chlorophyll and phytoplankton. Total Phosphorus and Ammonia are all below the EQS.
- The Owenwee (Corrib)_010 is the inputting and receiving river waterbody, which is at good ecological status.
- The significant pressure impacting upon the lake is hydromorphology in the form of channelization. There are number of peat drains opened to drain the peatland that are leading into the lake.
- There is also coiltte and private forestry plantation near the lake, there are buffer zones located around these plantations, there is also some peat cutting the vicinity of the lake.
- The soil type in this area is peat/poorly drained soil indicating that the main pathway for nutrients or sediment would be overland flow.
- The LCA will confirm if channelization, the forestry or the peat cutting is impacting on the ecological status of this high-status waterbody.

5.4 Shannagrena

- The Shannagrena lake is currently unassigned.
- The main potential pressure is hydromorphology in the form of land drainage, from aerial view there would appear to be several drains in the peatland area surrounding the lake which are leading into the lake.
- The Owenwee (Corrib)_010 is the inputting and receiving river waterbody, which is at good ecological status.
- The soil type in this area is peat/poorly drained soil indicating that the main pathway for nutrients or sediment would be overland flow.
- The LCA will confirm if land drainage is impacting on the ecological status of this waterbody.

5.5 Loughaunieran Maam Cross

- The Loughaunieran Maam Cross lake is currently unassigned.
- The main potential pressure is hydromorphology in the form of land drainage, from aerial view there would appear to be several drains in the peatland area surrounding the lake which are leading into the lake. There are also areas of peat cutting in the vicinity of the lake which may impacting upon the ecological status of this unassigned waterbody.
- The Owenwee (Corrib)_010 is the inputting and receiving river waterbody, which is at good ecological status.
- The soil type in this area is peat/poorly drained soil indicating that the main pathway for nutrients or sediment would be overland flow.
- The LCA will confirm if land drainage is impacting on the ecological status of this waterbody.

5.6 Owenwee (Corrib)_010

- The Owenwee (Corrib)_010 is at good ecological status and is not at risk of failing its WFD objectives. It is considered in the Failmore PAA as it is the waterbody that hydrologically links all the lake in the PAA.
- The Owenwee (Corrib)_010 is monitored at the EPA operational monitoring point at 200 m d/s tawnaghbeg lough, which was sampled in 2018, returning a Q4 result. There is no chemistry data for this waterbody.
- The soil in the Owenwee (Corrib)_010 is peat/poorly drained soil. It has been straightened and channelized over the years.
- The LCA will determine if the Owenwee (Corrib)_010 is having an influence on the ecological status of the 4 lakes in the Failmore PAA.

6 Work Plan

6.1 Failmore_010

An SSIS and chemistry sample will be taken at the EPA monitoring point, to confirm the EPA Q – value taken in 2018. Also, an SSIS and chemistry sample will be taken at points where phosphate is most likely to runoff into the river (**Figure 19**) and (**Table 6**). If impacted, further SSISs and stream walks will be carried upstream of that point, to identify sources of sediment from peat, and over – grazing.

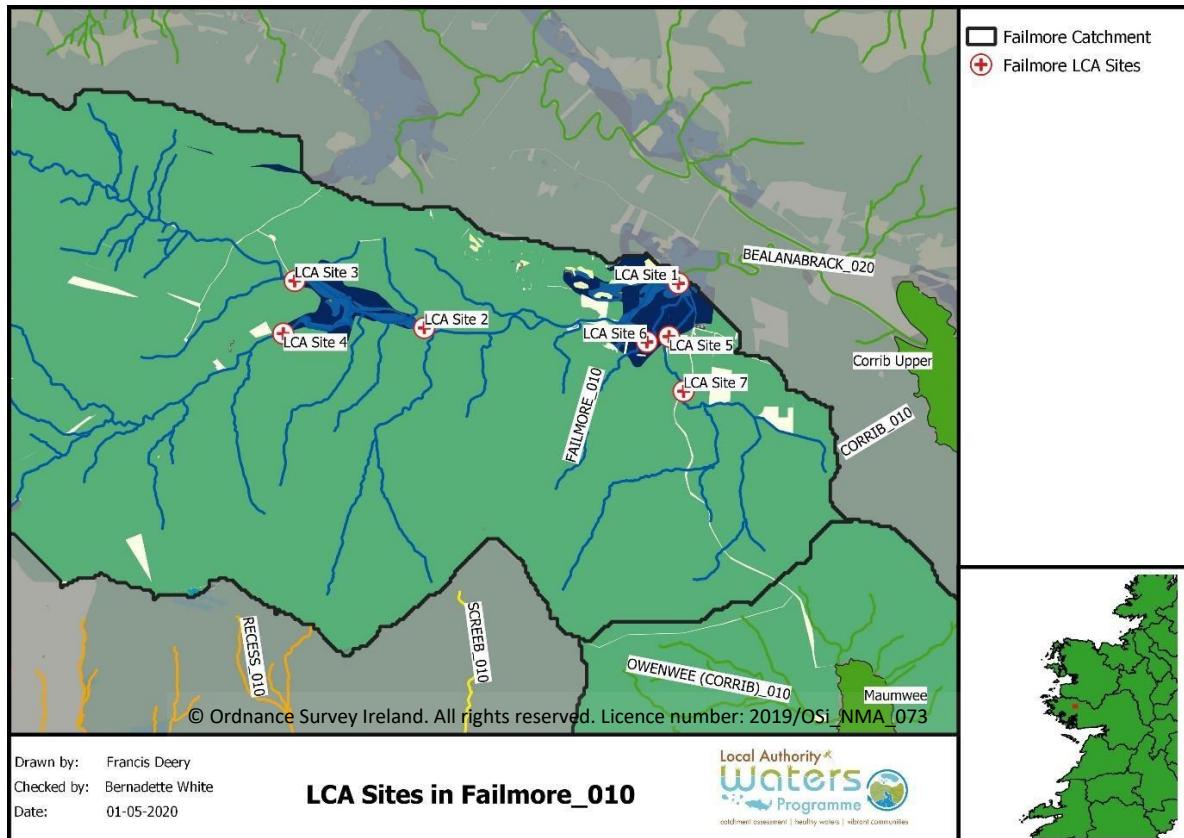


Figure 19: Failmore_010 LCA Sites

Table 6: Failmore LCA Sites Table

Station	Station Name	SSIS/RA	Chemistry	Reason
LCA Site 1	EPA Monitoring Site – Teernakill Bridge	Yes	Yes	<ul style="list-style-type: none"> • Confirm condition at EPA monitoring station using an SSIS. • Collect chemistry to confirm if nutrients are a significant issue. • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 2	Downstream of semi – improved grassland area	Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point. • Downstream of Rank 1 Phosphorus PIP • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 3	Upstream of semi – improved grassland area	Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point. • Upstream of Rank 1 Phosphorus PIP • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 4	Upstream of semi – improved grassland area	Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point. • Upstream of Rank 1 Phosphorus PIP • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 5		Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point. • Downstream of Peatland area and land drains. • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 6		Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point. • Investigate any impacts coming from the land use upstream. • Shuffle test if siltation is suspected as a significant pressure.
LCA Site 7	Bridge on R336	Yes	Yes	<ul style="list-style-type: none"> • Carry out SSIS/RA and collect chemistry at this point.

Station	Station Name	SSIS/RA	Chemistry	Reason
				<ul style="list-style-type: none"> • Investigate any impacts coming from the land use Possible Peat Cutting) upstream. • Shuffle test if siltation is suspected as a significant pressure.

6.2 Maumwee

Contact Inland Fisheries Ireland to enquire why is the fish status at good status, which is the ecological driver of this waterbody.

Liaise with EPA ecologists as to why the chemical status of the lake has failed, as well discuss how to address the impact of accelerated erosion processes on the lake status.

Follow the procedures of sampling lakes as and when these procedures are produced by the LAWPRO/EPA lakes working group.

6.3 Loughanillaun Maam Cross

Discuss with the EPA ecologists as to why chlorophyll and phytoplankton is downgrading this high-status objective waterbody, again as with the Maumwee lake discuss with the EPA how to address the impact of accelerated erosion processes on the lake status.

Follow the procedures of sampling lakes as and when these procedures are produced by the LAWPRO/EPA lakes working group.

6.4 Shannagrena

Follow the procedures of sampling lakes as and when these procedures are produced by the LAWPRO/EPA lakes working group.

6.5 Loughaunieran Maam Cross

Follow the procedures of sampling lakes as and when these procedures are produced by the LAWPRO/EPA lakes working group.

7 Review of possible mitigation options

To be determined once the extent and type of pressures are understood, significant pressures and actions will likely vary between water bodies of this PAA.

8 Communications

Hold a public meeting: A public meeting was held on the 14th of November 2019, in Peacockes Hotel in Maam Cross. A total of 13 members of the public attended the meeting the following questions were asked at the meeting:

- The Council close the roads during events like the Connemara marathon, which has a large impact on locals.
- Tourist park their cars where ever they like causing problems for people living in the area
- Forestry was discussed after the presentations as an issue despite not being an issue in Faillmore itself, it is in nearby catchments where some of the attendees are resident.

Hold a Farmers Meeting: A farmers meeting was held on the 5th of February 2020, also in Peacockes hotel in Maam Cross. A total of 9 member of the public attended the meeting. The following is an example of the questions asked:

- Can I clean old drains that have not been cleaned in years?
- There are several trees falling into the river every winter and blocking the river, who has the responsibility to deal with that?

Contact the EPA in relation to the chemical status of the Maumwee lake and the accelerated processes possibly impacting upon the lakes.

Hold a desktop workshop with Galway County Council

Date of Completion: 25th August 2020

