Bunowen (Louisburgh)

Priority Area for Action

Desktop Assessment

(AFA0034)

Version F03

10th August 2020

Western Region

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Disclaimer

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1 Introduction

1.1 Background to the PAA

The Louisburgh Bunowen Priority Area for Action (PAA) is an area of approximately 50km^2 located adjacent to Clew Bay, south-west Mayo. The PAA is situated within the Erriff-Clew Bay (32) catchment and Bunowen [Louisburgh] sub-catchment (SC_010). The PAA includes one river water body (RWB), the Bunowen (Louisburgh)_030 (IE_WE_32B030150). A catchment assessment workshop was held in Castlebar, Co. Mayo on 26th to 28th April 2017. It was attended by representatives of local authorities (Mayo, Galway, Roscommon, Leitrim, Sligo), Local Authority Waters and Community Office (LAWCO), Irish Water, Inland Fisheries Ireland (IFI), Forest Service, Coillte, National Parks and Wildlife Service (NPWS), Teagasc, Geological Survey of Ireland (GSI), Department of Agriculture, Food and the Marine (DAFM), Marine Institute and the Environmental Protection Agency (EPA). Based on the draft River Basin Management Plan (RBMP) priorities, a set of agreed principles and the local priorities of the workshop attendees, 34 areas were recommended for action, of which the Louisburgh Bunowen PAA was one. The Louisburgh Bunowen PAA was selected, for the following reasons:

- Building on improvements at Louisburgh WWTP;
- Discharges into designated bathing water (Carrowmore Beach, Louisburgh);
- One water body is failing to meet protected area objectives for drinking water.

1.2 Information Sources Consulted

A number of information sources were consulted during the preparation of the desk study for the Louisburgh Bunowen PAA including:

- WFD web application – EPA characterisation data
- Clifden-Castlebar GWB: Summary of Initial Characterisation - https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/ClifdenCastlebarGWB.pdf
- Annual Environmental Report 2017 and 2016 for Louisburgh WWTP http://www.epa.ie/licences/lic_eDMS/090151b2806712e4.pdf
- Louisburgh WWTP Appropriate Assessment Screening Report.
- Detailed drinking water quality results for Louisburgh PWS - https://www.water.ie/water-supply/water-quality/
- LAWPRO/ Mayo County Council (MCC) workshop on 26th September 2018 in the Castlebar, Co. Mayo.
- LAWPRO/ MCC/ ASSAP meeting on 4th October 2018 in MCC, Castlebar.
- LAWPRO meeting with EPA Biologist on the 12th October 2018 in EPA, Castlebar.
- LAWPRO meeting with MCC (EC) on 14th February 2019 in MCC, Castlebar.

1.3 PAA Summary

A summary of risk, ecological status, known pressures and associated significance for the Bunowen (Louisburgh)_030 is presented in **Table 1**. The RWB has been at Moderate Ecological Status for the

past three monitoring cycles and therefore is *At Risk* of failing to achieve its WFD objective of Good Ecological Status. The significant pressures identified for the RWB include extractive industry (peat), domestic waste water treatment systems (DWWTS), agriculture and urban waste water treatment plants (UWWTP). Hydromorphology (dams, barriers and weirs) is identified as an insignificant pressure on the RWB. The risk and status for upstream waterbodies, the Bunowen (Louisburgh)_020 and Bunowen (Louisburgh)_010, are also presented in **Table 1**.

The initial characterisation sub-catchment assessments recommended that the following actions be undertaken:

- IA7 Multiple sources in multiple areas - a full IA7 is required here given the range of different pressures acting within the sub-catchment;
- IA1 Provision of information - Louisburgh WWTP (SLAM v2.04 - Wastewater 10% P) is performing to licence conditions but conditions on assimilative capacity might need reviewed. SWOs can cause issue also.

Table 1: Summary of Risk, Ecological Status, Pressures, Significance, and Actions for the Bunowen (Louisburgh) RWB

WB Code	WB Name	WB Type	Risk	High Status Obj.	Ecological Status			Pressure Category	Pressure Sub Category	Significant Pressure
					2009	2012	2015			
WE_32B030050	Bunowen (Louisburgh)_010	RWB	*Not at Risk*	High	H	H	H	-	-	-
WE_32B030100	Bunowen (Louisburgh)_020	RWB	*Not at Risk*	No	G	G	G	-	-	-
WE_32B030150	Bunowen (Louisburgh)_030	RWB	*At risk*	No	M	M	M	Extractive Industry	Peat	Yes
								HYMO	Dams, barriers, locks, weirs	No
								DWW	Waste Water discharge	Yes
								Agriculture	Pasture	Yes
								UWW	Agglomeration PE of 500 to 1,000	Yes

2 Receptor

2.1 Context and Setting

The Bunowen (Louisburgh)_030 RWB comprises upland and coastal streams and rivers ranging from first to fifth order. The RWB is located downstream of the Bunowen (Louisburgh)_020 and Bunowen (Louisburgh)_010 which are currently at Good and High Ecological Status, respectively. The RWB discharges to Clew Bay coastal water body (CWB) which is at Good Ecological Status.

Land use in the PAA is predominantly peat and pasture with areas of coniferous forests and urban (town of Louisburgh). The Louisburgh Waste Water Treatment Plant (WWTP) discharges to the Bunowen (Louisburgh)_030.

The PAA intersects or is hydrologically connected to a number of protected sites (**Appendix A**). The PAA intersects two Special Areas of Conservation (SAC): Mweelrea/ Sheeffry/ Erriff Complex SAC and Old Woods SAC; two drinking water bodies: Bunowen (Louisburgh)_030 (RWB) and Clifden Castlebar (GWB); one Natural Heritage Area (NHA): Tawnymackan Bog NHA; and four proposed NHAs: Croagh Patrick pNHA, Mweelrea/ Sheeffry/ Erriff Complex pNHA, Cloghmoyle Dunes pNHA, and Oldhead Wood pNHA. The PAA is hydrologically connected to a further seven protected areas via Clew Bay CWB including:

- Clew Bay Complex SAC;
- West Connacht Coast SAC;
- Clare Island Special Protection Area (SPA);
- Clew Bay (East of Old Head) shellfish area;
- Carrowmore Beach, Louisburgh bathing area;
- Old Head Beach, Louisburgh bathing area;
- Clare Island, Louisburgh bathing area.

The Louisburgh Bunowen PAA is located within the Bunowen *Margaritifera* sensitive area (catchments of other extant populations), and is therefore not a priority pearl mussel catchment, i.e. not one of the 27 populations listed in the European Communities (Freshwater Pearl Mussel) Regulations, S.I. No. 296 of 2009.

The Bunowen (Louisburgh)_030 has one operational monitoring station located at the *Bridge in Louisburgh* (RS32B030150) (surveys are carried out upstream of the bridge). There are two investigative monitoring sites on the RWB upstream (RS32B030140) and downstream (RS32B030250) of Louisburgh WWTP. The location of the EPA monitoring station *Bridge in Louisburgh* is displayed in **Figure 1**. The location of the investigate monitoring stations relative to the operational monitoring station is displayed in **Figure 2**.

The Bunowen (Louisburgh)_030 has been at Moderate Ecological Status for the past three monitoring periods (2007-2009; 2010-2012, 2010-2015[1]) (**Figure 3**). The element driving Ecological Status across all monitoring periods is macroinvertebrates (Q3-4 Moderate). The WFD objective for the RWB is Good

[1] Includes the periods 2010-2012 and 2013-2015.

Ecological Status. The Moderate Ecological Status therefore places the RWB *At Risk*[2] of failing to achieve its WFD objective (**Figure 4**).

The significant pressures identified for the RWB include extractive industry (peat), domestic waste water treatment systems (DWWTS), agriculture and urban waste water treatment plants (UWWTP). Hydromorphology (dams, barriers and weirs) is also identified as a pressure on the RWB however it is not deemed to be significant. The local catchment assessments identified for the Bunowen (Louisburgh)_030 are:

- IA1 Provision of information - Louisburgh WWTP (SLAM V2.04-Wastewater 10% P) is performing to license conditions but conditions on assimilative capacity might need to be reviewed. SWO's can cause issue also.
- IA7 Multiple sources in multiple areas - a full IA7 is required here given the range of different pressures acting within the water body.

[2] The risk classification is based on the reporting period 2010-2015. The Biological Status is based on the Q-value assessment 2014 (Q3-4).

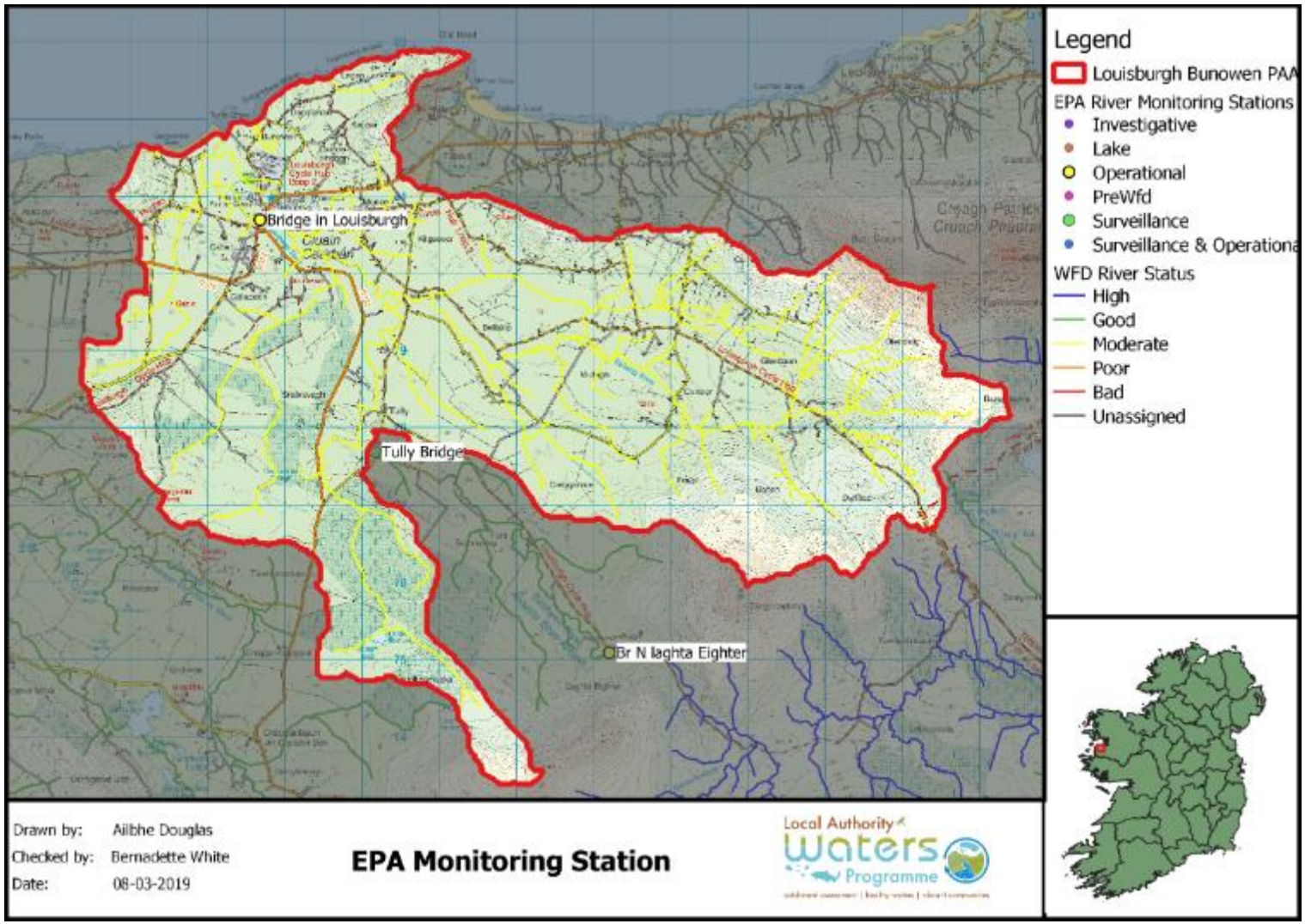


Figure 1: EPA monitoring stations within the Louisburgh Bunowen PAA

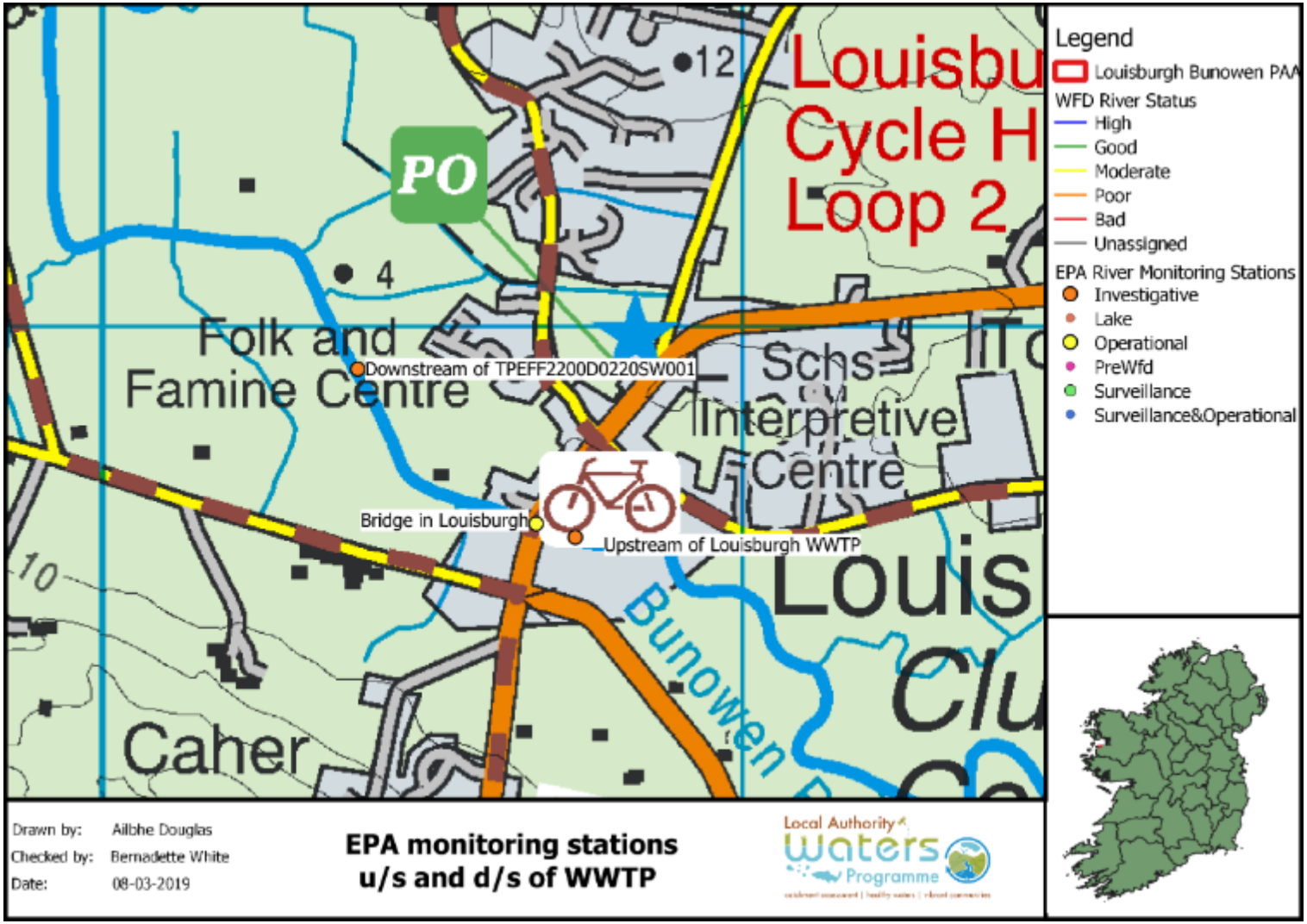


Figure 2: Operational and investigative monitoring sites in the Louisburgh Bunowen PAA

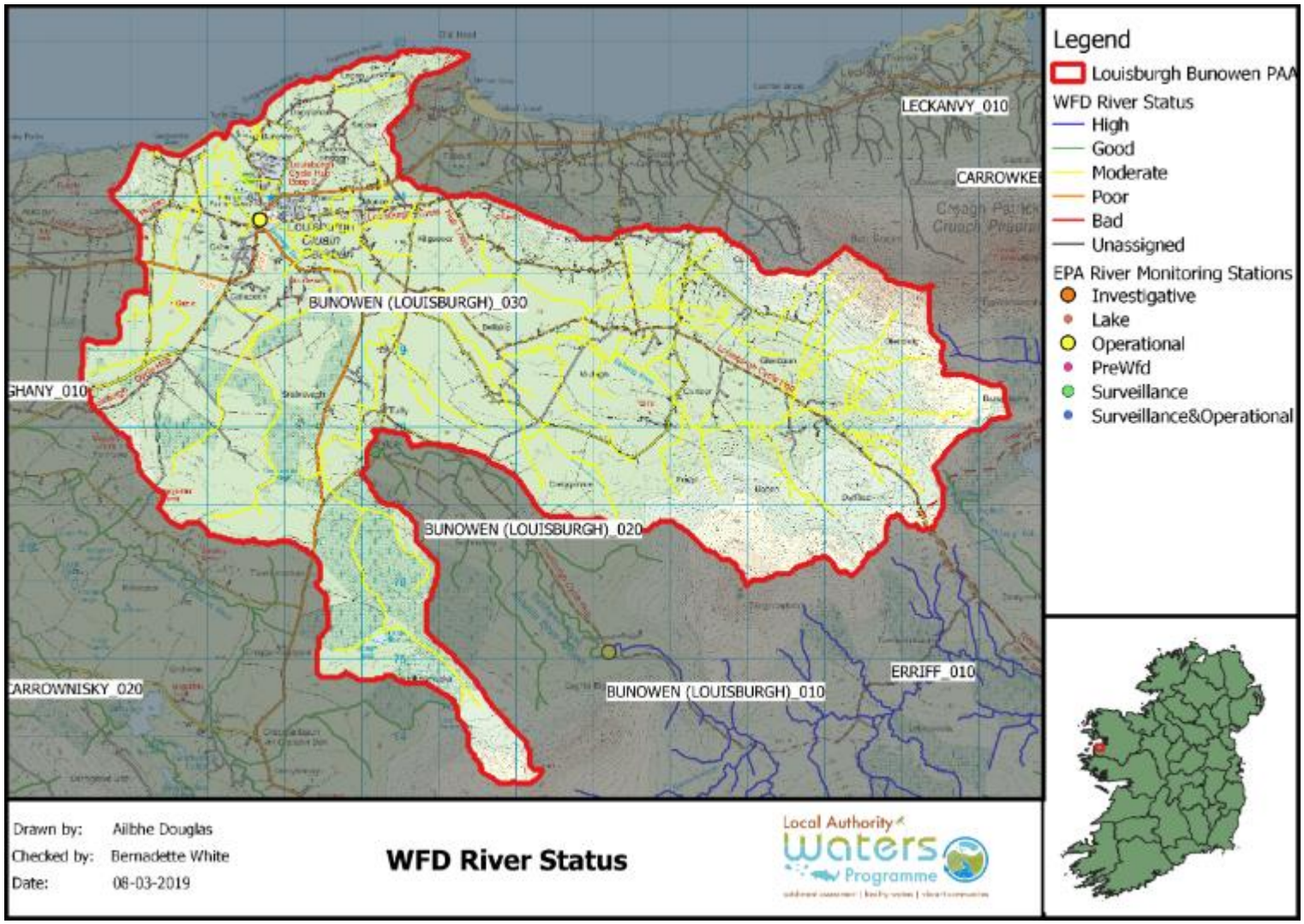


Figure 3: RWB Status within the Louisburgh Bunowen PAA

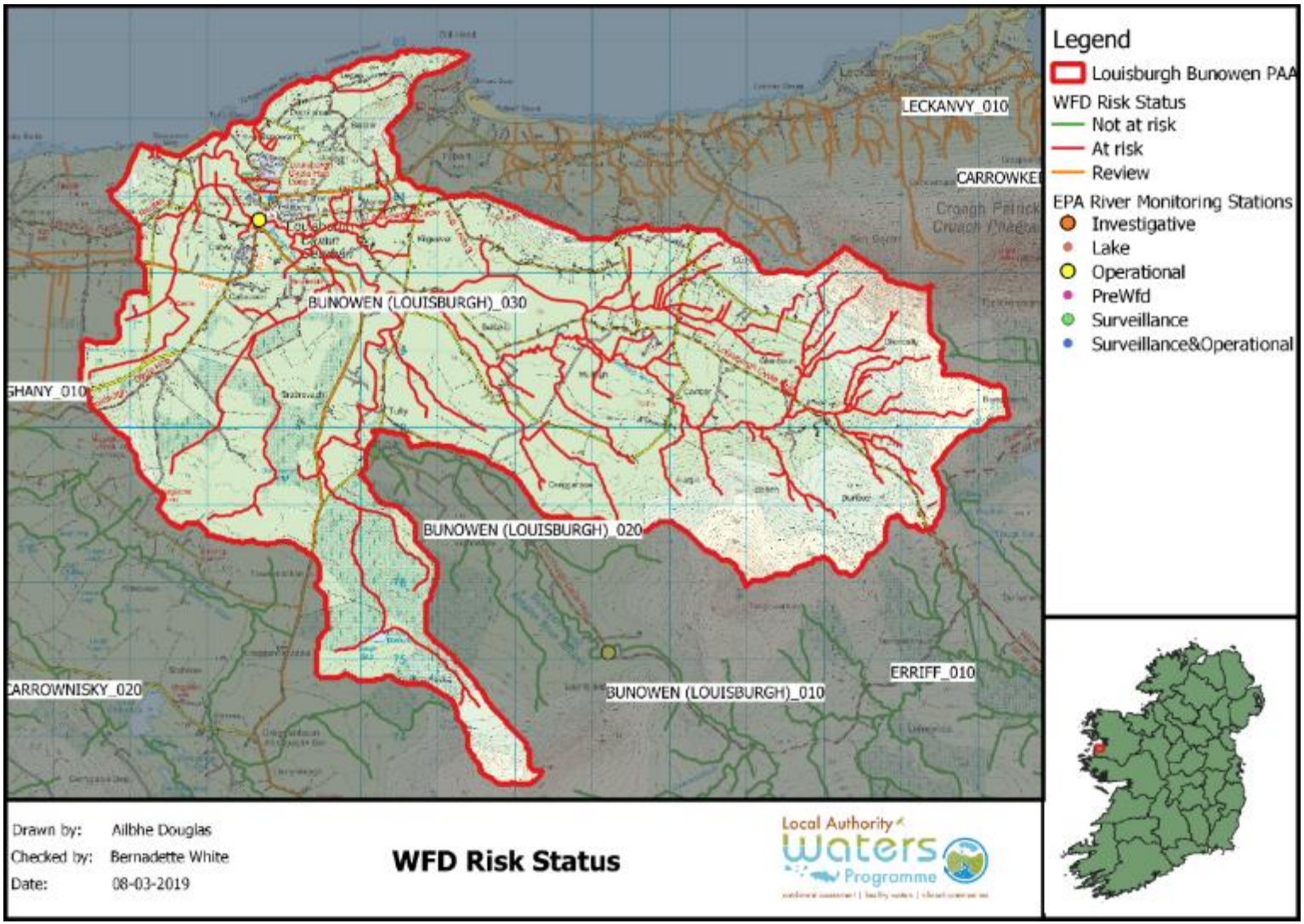


Figure 4: Risk Status within the Louisburgh Bunowen PAA

2.2 Receptor Information

Table 2 presents water quality information on the Bunowen (Louisburgh)_010, 020, and 030 including the status and trends of the quality elements monitored for the RWB, the significant issue identified for the RWB.

Table 2: Receptor Information

Factor		Figures/ Tables	Bunowen (Louisburgh)_010	Bunowen (Louisburgh)_020	Bunowen (Louisburgh)_030
Monitoring Stations		Figure 1	RS32B030050 Br N laghta Eighter	RS32B030100 Tully Bridge	RS32B030150 Bridge in Louisburgh
Risk Category		Figure 4	*Not at Risk*	*Not at Risk*	*At Risk*
Biological Status (2007-2015)[3]			High	Good	Moderate
Q-values	**2009**		5	4-5	3-4
	2010				
	2011				
	2012		4-5	4-5	3-4
	2013				
	2014		4-5	4-5	3-4
	2015				
	2016				
	2017		3-4	4-5	3- 4
Fish			-	Good[4]	-
Hydrochemistry Data					
PO4+ (as P) (mg/l)	**2010**			0.02	
	2011			0.01	0.020
	2012			0.008	0.007
	2013			0.006	0.006
	2014			0.005	0.007
	2015			0.006	0.006
	2016		0.005 (N=1)	0.009	0.010
	2017		0.005 (N=2)	0.005	0.006
	2018			0.008	0.007
	Baseline		0.005	0.007	0.009

[3] Status for the period 2016-2018 is not yet available.
[4] Fish monitored at surveillance sites.

Factor		Figures/ Tables	Bunowen (Louisburgh)_010	Bunowen (Louisburgh)_020	Bunowen (Louisburgh)_030
NH_3 (as N) (mg/l)	**2010**			0.015	0.015
	2011			0.017	0.015
	2012			0.017	0.015
	2013			0.018	0.014
	2014			0.011	0.044
	2015			0.011	0.031
	2016		0.01 (N=1)	0.01	0.010
	2017		0.01 (N=2)	0.015	0.010
	2018			0.012	0.015
	Baseline		0.01	0.01 (2016-2018)	0.019
NO3 - (as N) mg/l[5]	**2010**			0.2	0.2
	2011			0.2	0.2
	2012			0.2	0.2
	2013			0.18	0.2
	2014			0.1	0.1
	2015			0.1	0.1
	2016		0.1 (N=1)	0.16	0.1
	2017		0.1 (N=2)	0.1	0.1
	2018			0.1	0.1
	Baseline		0.1	0.12 (2016-2018)	0.144
Summary & Trends in PO_4, NH_3 and NO_3					NH_3 - consistently low between 2007-2013 (0.015 mg/l). Sharp increase to 0.044 mg/l in 2014 but within the Good EQS. Decrease to 0.031 mg/l in 2015. PO_4 – consistently within the High EQS (≤ 0.025 mg/l). TON - consistently ≤ 0.200 mg/l.

[5] Recommended limit 3.5-4.5mg/l.

Factor		Figures/ Tables	Bunowen (Louisburgh)_010	Bunowen (Louisburgh)_020	Bunowen (Louisburgh)_030
Other water quality data					Irish Water: High NH_3 (0.0765 mg/l) and PO_4 (0.182 mg/l) at upstream ambient monitoring station in 2016.
Baseline Concentration 2014 (mg/l)					NH_3: 0.030 mg/l PO_4: 0.006 mg/l TON: 0.133 mg/l
Other relevant values					-
Distance to threshold					Far from G/M threshold for all parameters.
Indicative Quality					NH_3: High PO_4: High TON: Good
Supporting Conditions			-	Pass	Pass
Chemical				Good (only available for 10-15)	-
Oxygenation Conditions (DO % saturation)	2010			OK	OK
	2011			OK	OK
	2012			OK	OK
	2013			OK	121% on 15/07/2013
	2014			OK	OK
	2015			OK	OK
	2016		91 (N=1)	78% on 31/01/2016 @ 16.38	OK
	2017		120 (N=1)	OK	OK
	2018				OK
	2019				OK (N=1)
Acidification Conditions (pH)	2010			OK	OK
	2011			OK	OK
	2012			OK	OK
	2013			OK	OK
	2014			OK	OK

Factor		Figures/ Tables	Bunowen (Louisburgh)_010	Bunowen (Louisburgh)_020	Bunowen (Louisburgh)_030
	2015			OK	OK
	2016 (N=1)		7.3	OK	OK
	2017 (N=1)		7.4	OK	OK
	2018			OK	OK
	2019				OK (N=1)
Specific Pollutant Conditions				Pass (only available for 2010-2015)	-
Hydromorphology					
RHAT Score			No	High (2014)	-
Evidence of arterial drainage			No	No	No
Ecological Status (2010-2015)		Figure 3	High	Good	Moderate
Protected Areas		Appendix A	Yes	Yes	Yes
WFD Objective			High	Good	Good
EPA biologist notes (if any)			A significant deterioration of a former High ecological condition station in the upper reaches of the Bunowen (0050) to unsatisfactory was apparent in 2017. Station (0050) in the headwaters of the Bunowen was reassessed in 2018 following a marked deterioration in the quality of this former High status waterbody in 2017. Condition was satisfactory with increased density of Ecdyonurus as expected for this river. However, other sensitive taxa recorded previously were absent or found	The middle reach at Tully Bridge (0100) was unaffected and remains phototrophically unimpacted, with an invertebrate community indicative of High ecological condition.	A slight improvement was noted at Louisburgh (0150), but again this station remains unsatisfactory and nutrient enriched. [EPA Biologist noted enrichment – excess biomass of filamentous green algae especially in 2014. Not much better in 2017. In 2017 the RWB was in flood so no biomass calculations for that year. Also noted change in Q value trend between 2002 and 2006.

Factor	Figures/ Tables	Bunowen (Louisburgh)_010	Bunowen (Louisburgh)_020	Bunowen (Louisburgh)_030
		at a reduced density, with the site failing to achieve its former High status classification for invertebrates in 2018.		RWB moved from satisfactory to unsatisfactory @ 2006 when status declined there were reports of agricultural pollution (Brian Kennedy, EPA, pers.comm, 12th October 2018)]
Significant issue		Unknown	None	Although the WFD App chemistry data indicates that there is no nutrient issue in the RWB, according to the EPA biologist conditions at the monitoring station are indicative of nutrient enrichment.

2.2.1 Other Data Sources

Louisburgh WWTP

In the WFD App, NH_3 and PO_4 data are available for the period 2007-2015 upstream of the Louisburgh WWTP monitoring station. At this station PO_4 is consistently at high indicative quality with a non-statistically significant upward trend over both monitoring periods. NH_3 is consistently at good indicative quality with a non-statistically significant downward trend over both monitoring periods.

Other chemical data available for both investigative monitoring stations (upstream and downstream) includes: Biochemical Oxygen Demand (BOD); Total Nitrogen (TN); Total Phosphorus; Chemical Oxygen Demand (COD); and, Suspended Solids (SS). The effluent from Louisburgh WWTP is also monitored for the same chemical parameters. BOD is monitored at the operational monitoring station Bridge in Louisburgh. The chemical data at both investigative stations suggest that a pressure exists upstream of the WWTP (COD, TN and TP is elevated upstream on occasion). On one occasion (15th July 2013) there was an increase in all chemical parameters with the exception of BOD, at the downstream investigative station which suggests an issue with the WWTP. Chemical conditions after this event were consistent with the upstream investigative station (**Table 3**).

Table 3: Chemical data recorded at the investigative stations on the Bunowen (Louisburgh)_030 (Source: WFD App)

Station ID	Station Name	Station Type	Date	BOD	TN	TP	COD	SS
RS32B030150	Br. in Louisburgh	Operational	05/04/2011-11/05/2016	0.5				
			30/06/2016	1.0				
			27/09/2016-16/02/2017	0.5				
			22/05/2017	1.2				
			13/06/2017	1.4				
			26/09/2017-10/04/2018	0.5				
			06/06/2018	1.1				
RS32B030140	US of WWTP	Investigative	14/01/2013	0.5	0.555	0.025	10.0	2
			21/03/2013	0.5	0.250	0.025	10.0	2
			13/05/2013	0.5	0.25	0.025	21	2
			1 5/07/2013	0.5	0.615	0.025	10	2
			16/09/2013	0.5	0.593	0.060	16	2
			12/11/2013-09/11/2015	0.5				
RS32B030250	Downstream of TPEFF2200D0220 SW001	Investigative	14/01/2013	0.5	0.506	0.025	10	2
			21/03/2013	0.5	0.539	0.025	10	2
			13/05/2013	0.5	0.250	0.025	24	2
			15/07/2013	0.5	1.190	0.119	38	22
			16/09/2013	0.5	0.250	0.05	16	2
			12/11/2013	0.5				

According to the latest 2017 AER for the WWTP, the final effluent from the primary discharge point was non-compliant with the Emission Limit Values (ELVs) for:

- BOD (mg/l)
- Ammonia N (mg/l)

There were 7 samples non-compliant with the ELVs in relation to BOD and Ammonia. The non-compliance is due to a WWTP biological sludge issue. The 2017 results for the upstream and downstream monitoring and/or additional monitoring data sets from MCC/IW-(CLS) are presented in **Table 4**[6].

A comparison of the results presented in **Table 4** to Schedule 5[7] of the Surface Water Regulations (2009) was carried out as part of this desk study and showed that PO_4 at the downstream monitoring site exceeded the MRP criteria for Good Status (Good status ≤0.035 (mean) or ≤0.075 (95%ile)) at concentrations of 0.09 mg/l (mean) and 0.38 (95%ile). The exceedance was caused by one high PO_4 measurement in January 2017. Subsequent measurements were within the Good Status EQS.

The downstream monitoring station breached the EQS for orthophosphate (mean only) in 2016 also (0.109 mg/l). However, the elevated orthophosphate observed downstream of the WWTP in 2016 was possibly as a result of the high concentration observed upstream on the same occasion (0.182 mg/l). This suggests that there is a nutrient pressure occurring upstream of the WWTP. The ammonia EQS was also breached at the upstream in 2016 (0.0765 (mean) and 0.315 (95%ile)).

Table 4: 2017 ambient monitoring results upstream and downstream of Louisburgh WWTP

Station ID	Station Name	Date	NH_3 mg/l	PO_4 mg/l	BOD mg/l	TN[8] mg/l	DO %	DO mg/l	pH mg/l	Observations
RS32B030140	US of WWTP	03/01/2017	0.03	0.02	0.50		99.0	12.5	7.0	All ok, nothing unusual to note
		08/03/2017	0.02	0.01	0.50		100		7.6	All ok, nothing unusual to note
		08/05/2017	0.02	0.01	0.50		100		7.8	Clear sample, light yellow colour
		10/07/2017	0.01	0.01	1.00		88.1		7.3	All ok, nothing unusual to note
		01/09/2017	0.03	0.01	0.50		97.0		7.4	All ok, nothing unusual to note
		06/11/2017	0.03	0.01	0.50		91.0		7.3	Water noticeable dark colour with a lot of floating debris ie leaves etc.
		Mean	**0.02**	**0.01**	**0.58**		**95.85**	**12.5**	**7.4**	
		95%ile	**0.03**	**0.02**	**0.88**		**100**	**12.5**	**7.75**	

[6] http://www.epa.ie/licences/lic_eDMS/090151b2806712e4.pdf

[7] Criteria for Calculating Surface Water Ecological Status and Ecological Potential

[8] This table reflects the information provided in the 2017 AER for Louisburgh WWTP. No data was provided for Total Nitrogen (TN).

Station ID	Station Name	Date	NH_3 mg/l	PO_4 mg/l	BOD mg/l	TN[8] mg/l	DO %	DO mg/l	pH mg/l	Observations
RS32B030250	Downstream of TPEFF2 200D0220SW001	03/01/2017	0.01	0.50	0.50		100	12.60	7.10	All ok, nothing unusual to note
		08/03/2017	0.01	0.01	0.50		100		7.20	Water Brown/ Yellow colour, no ss visible
		08/05/2017	0.04	0.01	0.50		106		8.00	Clear sample, light yellow in colour
		10/07/2017	0.01	0.01	0.50		90		7.20	All ok, nothing unusual to note
		01/09/2017	0.02	0.01	0.50		92		7.30	All ok, nothing unusual to note
		06/11/2017	0.02	0.01	0.50		100		7.20	Water noticeable dark colour with alot of floating debris ie leaves etc
		Mean	**0.02**	**0.09**	**0.50**		**98**	**12.60**	**7.33**	
		95%ile	**0.04**	**0.38**	**0.50**		**104.5**	**12.60**	**7.83**	

Louisburgh PWS

The Louisburgh Public Water Supply (PWS) supplies a population of 878. The 2018 drinking water quality results for the PWS indicate that the Exceedance Limit for four parameters were breached (**Table 5**):

- 1* exceedance for Colony count[9] out of a total of 4 results captured.
- 1* exceedance for Aluminium out of a total of 6 results captured.
- 1* exceedance for Free Residual Chlorine out of a total of 5 results captured.
- 1* exceedance for Total Residual Chlorine out of a total of 5 results captured.

Table 5: Exceedances in the Louisburgh PWS in 2018

Parameter	Sample Date	Unit	Result	Limit
Colony Count	01/05/2018	No./ 1ml	>300	100
Aluminium	01/05/2018	µg/ l	216	200
Free Residual Chlorine	01/05/2018	mg/l	0.05	> 0.1- < 2
Total Residual Chlorine	01/05/2018	mg/l	0.06	> 0.1- < 2

[9] Colony Count is a test for naturally occurring environmental bacteria found in soil, air and water. During the water treatment process the Colony Count is kept as low as possible. If large numbers are detected it indicates whether the water treatment system is ineffective. The parameter is a good indicator of the cleanliness of the water infrastructure and reveals how suitable the water is in the manufacture of food and drink products where high counts may lead to spoilage. The EU drinking water directive does not specify a limit for this parameter, however it does specify that no abnormal change should occur. The usefulness of this parameter is that sudden or significant changes in the levels of organisms can indicate problems with the water supply. An exceedance of this parameter indicates an inadequate disinfection system. It may also indicate that there is not enough residual chlorine to deal with the amount of bacteria in the water.

According to the EPA open files on pesticides, the Exceedance Limit for pesticides was breached on 2 occasions in 2018 in the Louisburgh PWS. Concentrations of 0.127 mg/l and 0.247 mg/l were observed in August and September, respectively.

The 2017 drinking water quality results for the Louisburgh PWS indicate that the Exceedance Limit for two parameters were breached:

- 1* exceedance for Individual Pesticides out of a total of 21 results captured.
- 1* exceedance for Aluminium out of a total of 6 results captured.

The 2016 drinking water quality results for the Louisburgh PWS indicate that the Exceedance Limit for one parameter was breached:

- 1* exceedance for Aluminium out of a total of 8 results captured.

The 2015 drinking water quality results for the Louisburgh PWS indicate that the Exceedance Limit for two parameters were breached:

- 1* exceedance for Individual Pesticides out of a total of 32 results captured.
- 1* exceedance for Total Pesticides out of a total of 2 results captured.

The parameter results presented are exceedances in the treated drinking water. Mayo County Council indicated in a PAA workshop on the 26th September 2018 that treated water results only show a limited number of parameters. It was also noted that Irish Water monitor parameters in the raw water abstracted from the Bunowen (Louisburgh)_030 since 2018. MCC also noted that high levels of E. coli in public water supplies will trigger a cryptosporidium monitoring programme. However, cryptosporidium was never observed in the Louisburgh PWS.

There were no failing months for pesticides in the Louisburgh supply up to May 2019 in the supply (DAFM, *pers. comm*.).

2.3 Conclusions

- There is one RWB in the PAA, Bunowen (Louisburgh)_030.
- The RWB has been at Moderate Status for the last 3 monitoring periods (9 years).
- The element driving status is macroinvertebrates.
- EPA chemistry data available for 2007-2018 is consistently within Good EQS thresholds.
- The significant pressures identified on the RWB include: Extractive Industry (Peat); Domestic waste water treatment systems (Waste Water discharge); Agriculture (Pasture); and an Urban Waste Water Treatment Plant (Agglomeration PE of 500 to 1,000).
- 2016 AER results for Louisburgh WWTP suggest nutrient pressures upstream of the WWTP. The EQS for NH_3 and PO_4 has been breached upstream of the WWTP. The breach in the PO_4 EQS also observed downstream of the WWTP, may be related to high concentrations upstream.
- The EQS for PO_4 was breached downstream of the WWTP in 2017, was caused by a single high PO_4 concentration in January.

- The breach in indicator parameter limits at the water supply treated at Louisburgh WTP in 2018 appears to be related to the treatment process.
- The breach in the pesticides limit in 2015 and 2017 suggest agricultural pressures in the PAA, however a marked improvement up to May 2019 has been noted, with no exceedances between January and May 2019.

3 Significant Pressures

3.1 Agriculture

3.1.1 Pesticides

Exceedances in pesticides detected in the Louisburgh PWS[10] in 2015, 2017 and 2018 suggest that agriculture is a potential significant pressure on the Bunowen (Louisburgh)_030. MCPA is the pesticide responsible for the exceedances. **Table 6** lists the months in which the limit for MCPA was breached in the PWS in 2017 and 2018.

Table 6: MCPA concentrations in the Louisburgh PWS in 2017 and 2018 (source: EPA open files on pesticide)

Year	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
2017	MCPA <0.005	MCPA 0.036	MCPA <0.005	MCPA <0.005	MCPA 0.025	MCPA 0.025	MCPA 0.019	MCPA 0.201	MCPA 0.095	MCPA 0.324	MCPA 0.132	MCPA 0.007
2018	MCPA <0.005	MCPA <0.005	MCPA 0.01	MCPA 0.012	MCPA 0.013	MCPA 0.021	MCPA 0.047	MCPA 0.127	MCPA 0.247	MCPA 0.026	MCPA 0.058	MCPA 0.011

Poorly drained land adjacent to the Bunowen (Louisburgh)_030 appears to have been converted to grassland for agriculture. Improved grassland over poorly drained areas can create issues with rushes which require treatment with pesticides such as MCPA. Pesticides will have a similar pathway to phosphorus i.e. overland flow.

A source protection project by MCC is currently underway in Louisburgh due to the consistent breaches in MCPA. The first step in the project is to contact all landowners within a 200m of the Louisburgh PWS (i.e. 200m pesticide buffer zone defined under the Good Agricultural Practice Regulations) (MCC (EC), *pers. comm*., 14th February 2019). A follow-on meeting will be arranged with MCC in June 2019 to discuss the source protection for the Louisburgh PWS. Results between January and May 2019 have indicated a marked improvement in the catchment, with no breaches in the pesticides.

3.1.2 Corine

The Corine Land Cover (CLC) mapping illustrates the types of land use/ land cover in the Louisburgh Bunowen PAA (**Figure 5**). The various land use/ cover types and extent in the PAA are listed in **Table**

[10] There is also a reoccurring issue with Aluminium in the Louisburgh PWS with exceedance in the limit observed in 2018, 2017, 2016, 2014 although this is likely arising from the treatment process which may use Alum floc for coagulation.

7. The main land cover type is peat bogs at approximately 48% of the PAA. This is followed by pasture at 23% and principally occupied by agriculture, with significant areas of natural vegetation at 13%.

Table 7: Land Use/ Land Cover in the Louisburgh Bunowen PAA

Land Use/ Land Cover	Area (m^2)	% of PAA
Bare rocks	43097	0.09%
Coniferous forest	2804077	5.64%
Discontinuous urban fabric	554015	1.11%
Inland marshes	623270	1.25%
Land principally occupied by agriculture, with significant areas of natural vegetation	6467451	13.01%
Moors and heathland	1096703	2.21%
Natural grasslands	672751	1.35%
Pastures	11540267	23.21%
Peat bogs	23914866	48.09%
Sea and ocean	10343	0.02%
Transitional woodland-shrub	2003641	4.03%

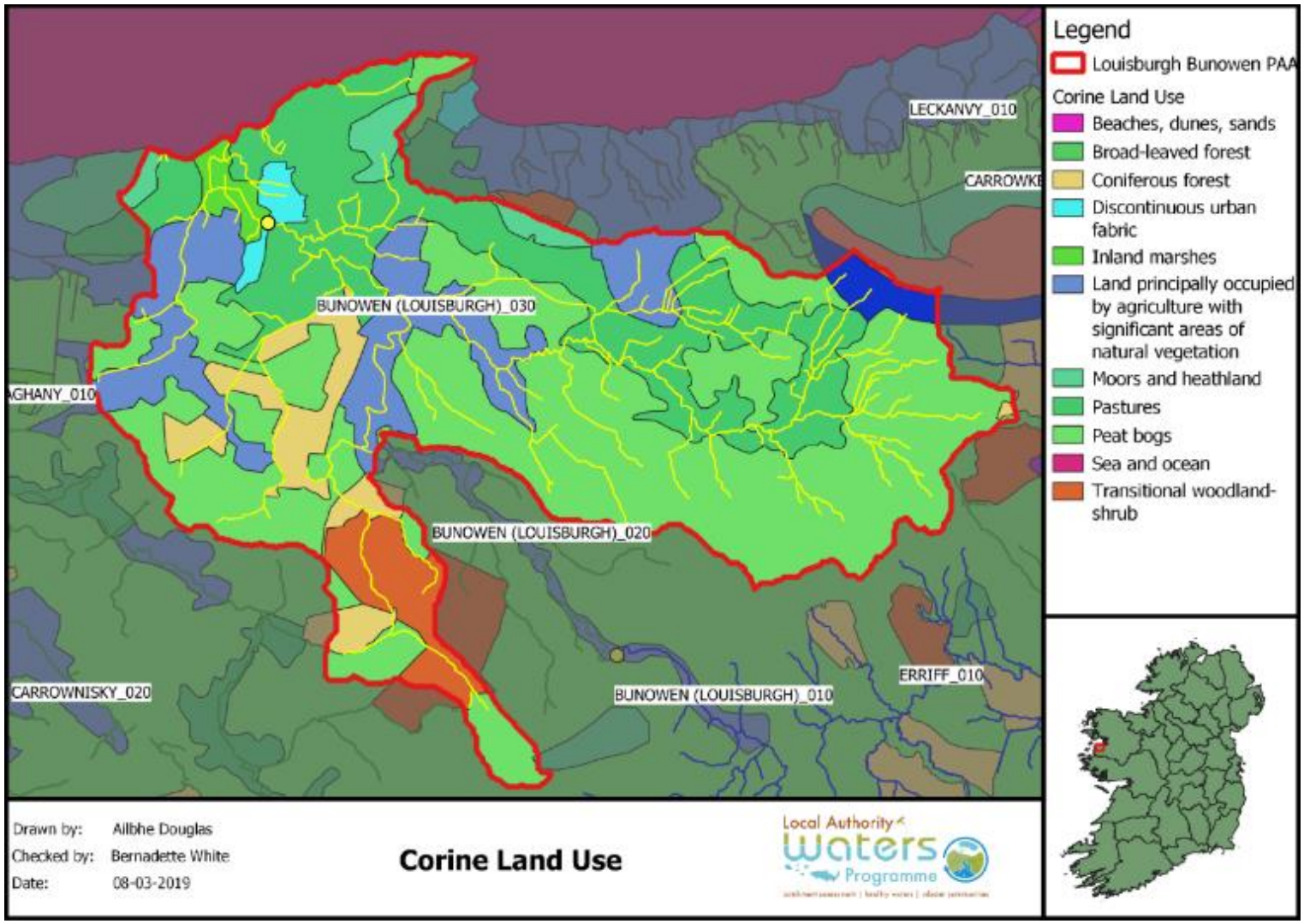


Figure 5: Land use/ land cover in the Louisburgh Bunowen PAA

3.1.3 LPIS

The Land Parcel Identification System (LPIS) is a GIS system that shows the location and outline of all land parcels held by farmers who have applied for support payments from the European Union. The LPIS records production system types, areas utilized and provides a basis for assessing risks associated with payments.

The dominant 'crop' type both inside and outside the PAA is permanent pasture. There are 199 unique herd numbers in the PAA. There are no derogations within the PAA.

3.1.4 Pollution Impact Potential (PIP)

Surface water receptor phosphate PIP Rank 2 (using regional loadings) in the lower catchment over poorly drained soils and alluvium (**Figure 6**).

Surface water receptor nitrate PIP Rank 3 and 4 over well drained soils (**Figure 7**).

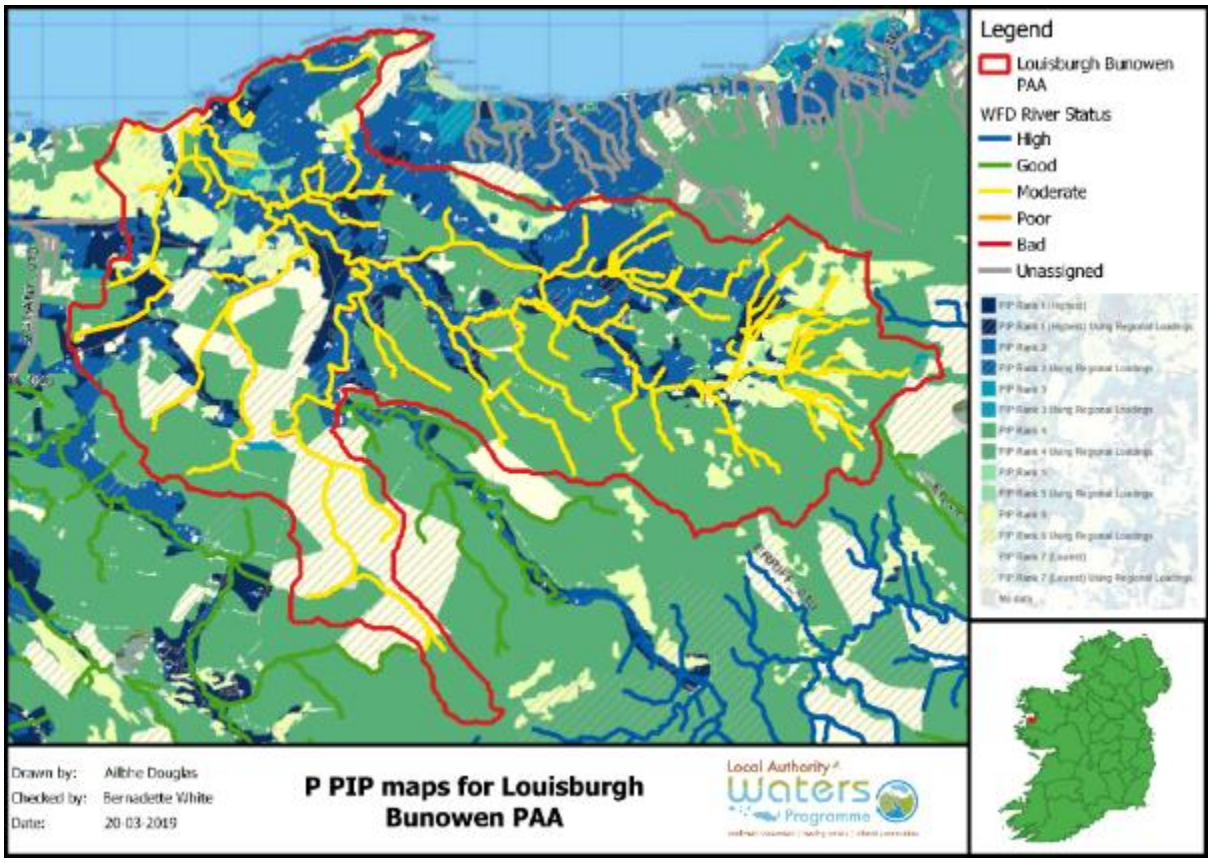


Figure 6: Surface water receptor phosphate PIP in the Louisburgh Bunowen PAA

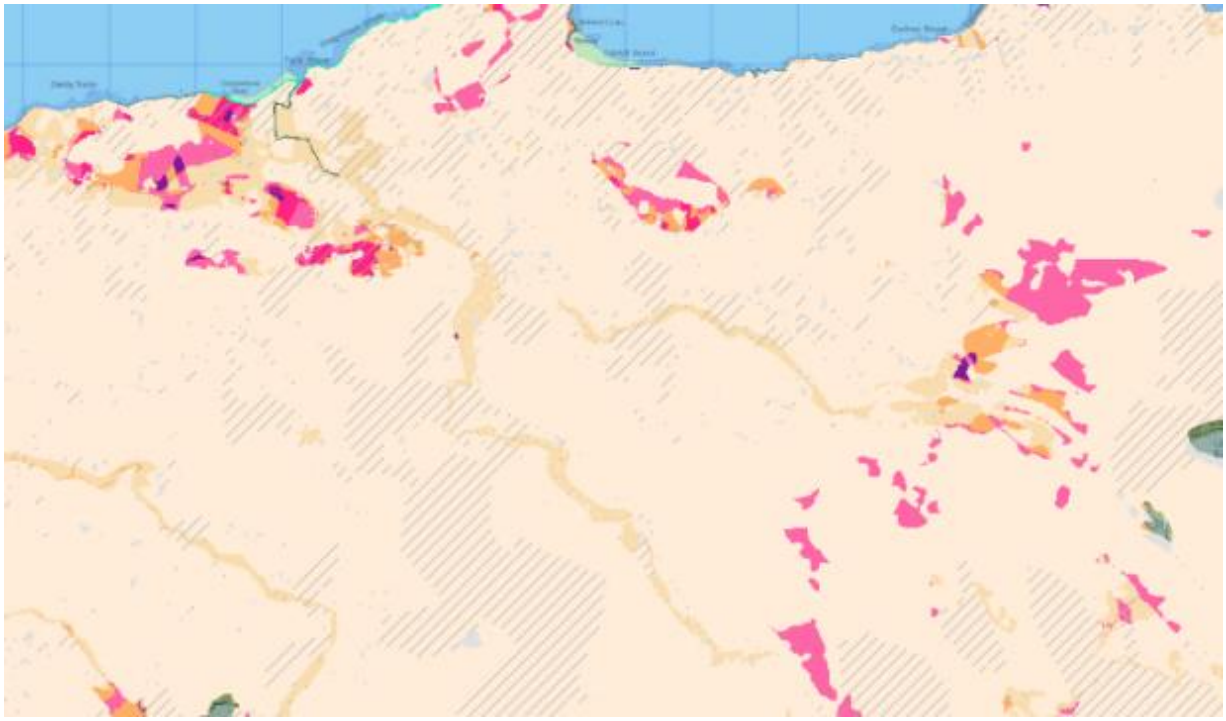


Figure 7: Surface water receptor nitrate PIP in the Louisburgh Bunowen PAA

A review of Google Street View imagery around the catchment presents further evidence of potential agricultural pressures in the Bunowen (Louisburgh)_030. Ring feeders and cattle bank poaching were observed at two separate locations along tributaries of the Bunowen (Louisburgh)_030. There is also a farm road adjacent to a tributary which could create a potential issue during rainfall events. The issue is exacerbated where agricultural effluents/run-off uses an agricultural road as a flow path. Often this leads to deleterious or polluting matter directly discharging to waters.

ASSAP confirmed at a meeting on the 4th October 2018 that there are no large dairy farms within the PAA. The main agricultural activities in the PAA are related to dry stock.

3.2 Extractive Industry (Peat)

Peat extraction occurs throughout the PAA and is visible on the aerial photography for the area (**Figure 8:**). A number of first and second order tributaries of the Bunowen (Louisburgh)_030 intersect and/or run adjacent to peat extraction areas. Peat extraction in the upper Bunowen River is carried out by a contractor. Peat extraction can result in degradation of the physical habitats of streams, elevated levels of fine sediment and nutrient concentrations, primarily ammonia but also phosphate, which can impact on the ecology of rivers and lakes, as well as groundwater quality.

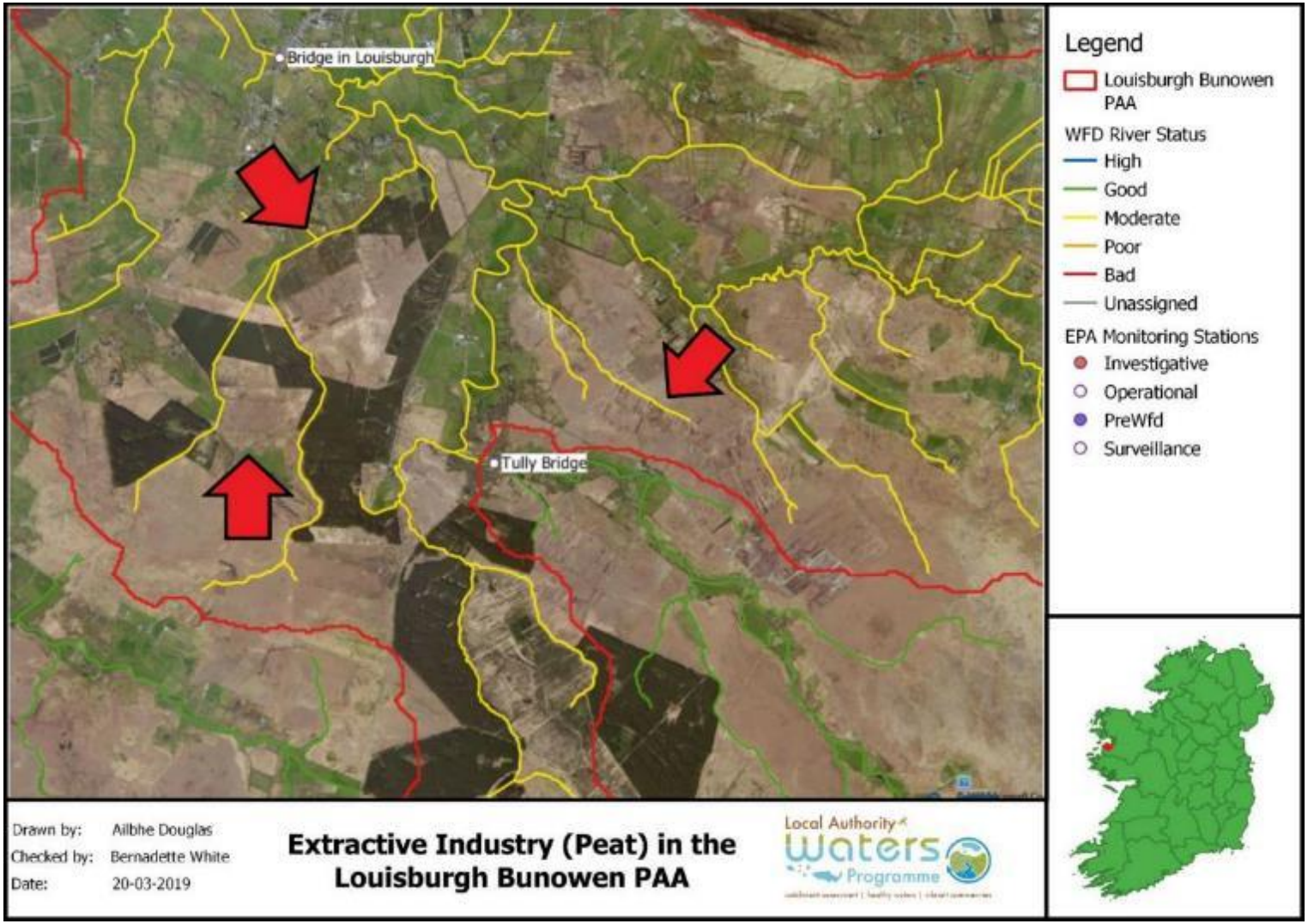


Figure 8: Extractive Industry (Peat) indicated by red arrows

3.3 Urban Waste Water Treatment

Louisburgh WWTP has a capacity of 1000 P.E. The waste water works in Louisburgh consists of a wastewater treatment plant with a collection network consisting of foul sewers, surface water sewers (and combined sewers) with 2 No. pumping stations and 1 No. storm overflows. The municipal treatment works uses biological filtration. This consists of two primary settlement tanks, followed by filtration using a rotating biological contractor treatment unit followed by secondary settlement. There are 2 No. pumping stations, which are located as follows PS1 (80,547E 280,607N) and PS2 (80,685E 281,007N) (**Figure 9**). They are located as topography dictates around the catchment.

Emissions from the treatment works are discharged to the Bunowen River through an outfall labelled SW1 (P). This is the primary discharge point. There is a secondary discharge point labelled SW2 which is located at pumping station PS1 (**Figure 9**).

There is a storm water overflow SW3 which is an emergency overflow from the storm water holding tank. This emergency overflow is provided in case of difficulties, such as power cuts. The discharge exits from the storm water holding tank and subsequently to the Bunowen River via the same outfall pipe as the Primary Discharge. However, before this emergency overflow will be employed, the storm water holding tank has been designed with an 8-hour emergency volume of storage which will need to be filled before any discharges take place from it. This is to give sufficient time for repair to the pumping plant or power supply[11].

Flow meter and composite samplers were installed in 2016 and commissioned in February 2017.

The Louisburgh WWTP is located downstream of the EPA monitoring station 'Bridge at Louisburgh' and therefore is unlikely to affect the status of the Bunowen (Louisburgh)_030. Nonetheless the WWTP is located upstream of a number of protected areas including bathing areas, shellfish areas and European sites (see **Appendix A**). The WWTP is largely compliant with the Surface Water Regulations (2009) (see **Section 2.2.1**)

An outfall to the Bunowen (Louisburgh)_030 upstream of the EPA monitoring station is visible on Google Street View. This may be a potential pathway for impacts and should be investigated during a catchment walk of the Bunowen (Louisburgh)_030 along with any others located on the day of the survey.

[11] http://www.epa.ie/terminalfour/wwda/wwda-view-filter.jsp?regno=D0220-01&filter=b&docfilter=go

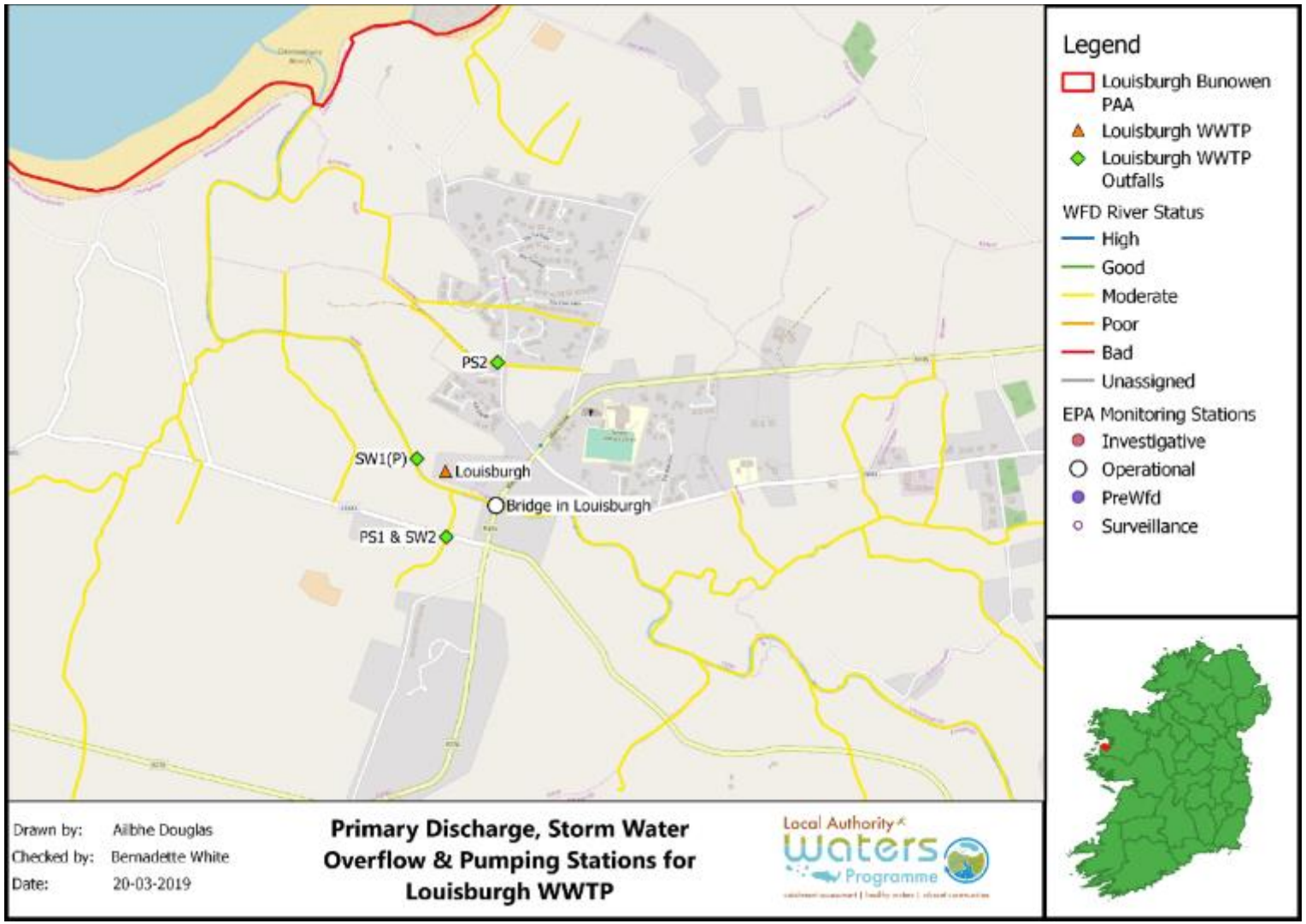


Figure 9: Location of the primary discharge, storm water overflow and pumping stations for Louisburgh WWTP (derived from WWTP licence documents)

3.4 Domestic Waste Water Treatment Systems

There are 412 Domestic Waste Water Treatment Systems (DWWTS) in the Louisburgh Bunowen PAA.

The number of DWWTS with very high; high; medium; low and very low N and P impact potential from DWWTS in Louisburgh Bunowen PAA are listed in **Table 8**.

Table 8: Potential N and P impact from DWWTS in Louisburgh Bunowen PAA

	Very High	High	Medium	Low	Very Low	Total
N Risk	0 (0%)	106 (26%)	0 (0%)	182 (44%)	124 (30%)	412 (100%)
P Risk	66 (16%)	40 (10%)	162 (39%)	76 (18%)	68 (17%)	412 (100%)

According to the Pollutant Impact Potential (PIP) maps for DWWTS based on the EPA SANICOSE model[12], the potential P impact is predominately medium to very low. Very high potential impact DWWTS are concentrated in areas of poorly drained soils where rock is at ground surface. High potential impact DWWTS are concentrated in areas of well drained soils where rock is at ground surface. Groundwater vulnerability in these areas is X extreme. Very low potential impact DWWTS occur in areas of moderate permeability subsoil overlain by well drained soil.

According to the PIP maps, the potential N impact from DWWTS is predominately low to very low. Approximately 26% of the DWWTS in the catchment have a high potential N impact. These DWWTS are concentrated in areas of well drained or poorly drained soils where rock is at ground surface**.**

Mayo County Council noted at a PAA workshop on the 26th September 2018 that they have mapped where DWWTS inspections have been carried out. It was agreed that LAWPRO would liaise with MCC on this. LAWPRO received a copy of the 2013 to 2018 Inspections Master Excel Sheet. The following inspections were carried out in the Louisburgh area:

Year	No. of inspections	No. of failures	Action by LA	Follow up
2016	7	4	Advisory notice issued to failures	3 advisory notices complied with. 1 is outstanding.
2017	4	2	Advisory notice issued to failures	1 advisory notices complied with.
2018	4	3	Advisory notice issued to failures	

[12] A model developed to determine annual nutrient loading from individual domestic wastewater treatment systems (referred to as septic tank systems here) at a catchment scale into rivers in Ireland. Risk maps considered landscape drainage characteristics (based on soils, subsoils and bedrock maps) indicating percolation conditions and the locations and densities of houses, particularly in areas with poor drainage characteristics. These maps were based on the SANICOSE model. For water bodies with nutrient issues, the cumulative amounts of nutrients from all septic tank systems was compared with other nutrient sources including urban waste water and agriculture. Catchment Scientists then interpreted the source apportionment results, considering the base flow conditions and dilution capacity. It was generally found that where over 8% of the annual total phosphorus came from septic tank systems, these had a higher chance of being a significant pressure.

3.5 Forestry

Approximately 11% of the Louisburgh Bunowen PAA is covered by plantation forestry. The forestry is concentrated in the south west of the PAA stretching from the townland of Callacoon to Loughnamucka. Coillte forestry accounts for 9% while private forestry accounts for 2% (**Figure 10**).

Plantation forestry is not identified by the EPA as a pressure on the Bunowen (Louisburgh)_030. However, forestry was raised as a concern of locals that attended the Community Information Meeting on the Bunowen River on the 22nd November 2018. Moreover, two large tributaries of the Bunowen (Louisburgh)_030 intersect the forestry upstream of the EPA monitoring station.

Coillte compartments comprise bare marginal; bare plantable; bare un-plantable; broadleaf high forest; conifer high forest; felled; mixed high forest; undeveloped; water; and, windblown. Conifer high forests compartments in the catchment were planted as early as 1961 to as recent as 2018. No information is available on the presence of drains within forested areas. Therefore, a number of compartments pre-date forestry setbacks and good practice guidelines. The forests are predominantly comprised of Lodgepole pine (south coastal) and Sitka spruce.

The data in the Coillte forestry layer indicates that two compartments in the catchment have been felled. All existing Coillte forestry within the PAA had been planted by 1995 according to aerial photography available on http://map.geohive.ie/mapviewer.html. A review of the 1995, 2000, 2005 and 2012 aerial photography indicated that Coillte activities within the PAA over this timeline has included clear felling and replanting.

In addition to Coillte forestry, approximately 2% of the PAA is covered in private forestry. From the available data on private forestry, planting was undertaken between 1985 and 2014. Similar to Coillte forestry in the PAA, private forestry is predominantly concentrated in the south-west of the PAA. A small number of stands are present along the northern section of the PAA. There is no evidence from the aerial photography up to 2012 that the private forestry stands south-west of the PAA have been felled. One area of private forestry to the north-west of the catchment appears to have felled between 2005 and 2012.

The main species of private forestry includes:

- Additional Broadleaves
- Alder
- Ash
- Beech
- Birch
- Enclosed broadleaves - Ash/Sycamore
- European Larch
- Japanese Larch
- Lodgepole Pine (North Coastal)
- Lodgepole Pine (South Coastal)
- Mature Other Broadleaves (1998)
- Monterey cypress
- Sitka spruce

- Sycamore

To further explore the potential for commercial forestry to impact on the Bunowen (Louisburgh)_030 the following actions should be taken:

- Contact DAFM/ Coillte to discuss what (if any) measures were in place in Coillte forestry to protect waterbodies during felling operations completed to date.
- What measures are currently in place in Coillte forestry to protect waterbodies from forestry operations?
- Is it possible to access the waterbodies in Coillte forestry to undertake SSIS/ RA or catchment walks? If so, do we deal directly with the Inspector for the Mayo district?
- What felling has been undertaken since the 2012 aerial photography?

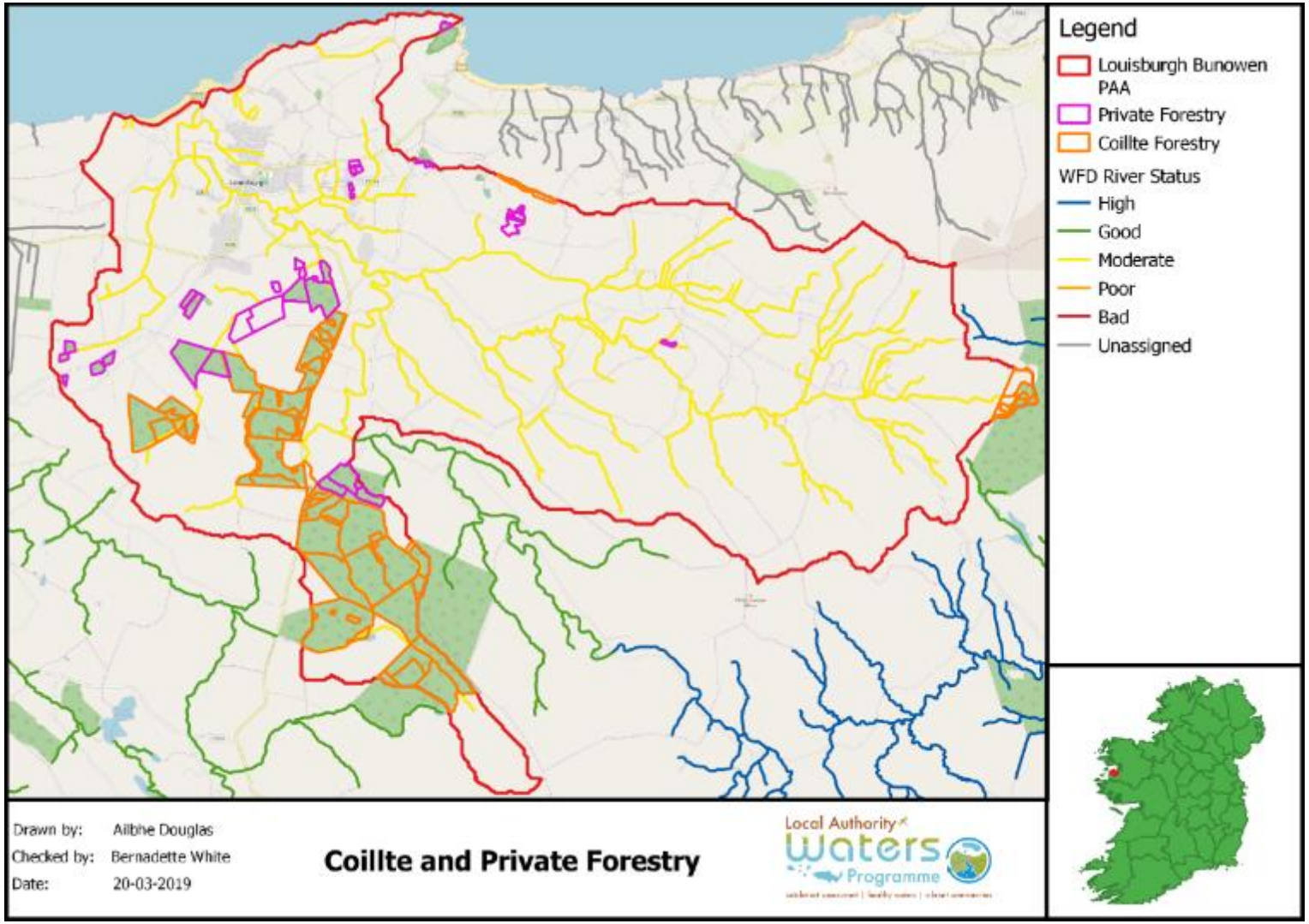


Figure 10: Coillte and private forestry in the Louisburgh Bunowen PAA

4 Pathway Information/ Conceptual Model

4.1 Overview of Pathways in the PAA

The significant issue in the Louisburgh Bunowen PAA is suspected to be phosphorus given the growth of macroalgae at the EPA monitoring point. While the orthophosphate in chemistry sampling is low, the excessive abundance of macroalgae reflects it uptake from the water column. The regional pathway framework is provided by the aquifer in the PAA and sub-compartments are determined by soil drainage and groundwater vulnerability.

- The Louisburgh Bunowen PAA is wholly on a poor aquifer (bedrock which is generally unproductive except for local zones.
- The bedrock is primarily Silurian metasediments and volcanics which Granites and other igneous intrusive rocks and Ordovician metasediments in the upper reaches of the catchment only.
- Soil drainage is predominantly poorly drained and peat with some limited well-draining areas.
- Groundwater vulnerability ranges from X extreme to Low.

Where phosphorus is the significant issue, the main pathway for impact is likely to be point source discharges, overland flow and/ or drains.

4.2 Pathways Conceptual Model

One main compartment with three sub-compartments were identified in the Louisburgh Bunowen PAA (**Table 9** and **Figure 11**).

Table 9: Main pathways identified within each compartment in the Louisburgh Bunowen PAA

	Compartment 1		
	Peat	**Poorly Drained**	**Well Drained**
Topography (map, aerial)	Low	High to low	High to low
Soil	Blanket Peat Cut peat	RckNCa TLPSsS Alluvium	RckNCa TGr
Subsoil	Blanket Peat	Rck TLPSsS Alluvium	RckNCa TGr
Subsoil permeability	Low to Moderate	TLPSsS: Moderate Rck: Not applicable, DTB <3m	TGr: Moderate Rck: Not applicable, DTB <3m
Bedrock	Silurian metasediments and volcanics (small area of granites and other igneous intrusive rocks)	Silurian metasediments and volcanics (small are of Ordovician Metasediments)	Silurian metasediments and volcanics (small are of Ordovician Metasediments)
Aquifer	Poor aquifer	Poor aquifer	Poor aquifer

	Compartment 1		
	Peat	**Poorly Drained**	**Well Drained**
Groundwater vulnerability	Mainly high with some low and moderate areas	X-extreme and Extreme	X-extreme and Extreme
Karst features (if present)	None mapped	None mapped	None mapped
Tracing	None mapped	None mapped	None mapped
Hydrology (drainage density)	No OPW drainage district or schemes within the catchment	No OPW drainage district or schemes within the catchment	No OPW drainage district or schemes within the catchment
Susceptibility PO_4 to SW NO_3 to GW NO_3 to SW			
PIP PO_4 to SW NO_3 to GW NO_3 to SW	PO_4 to SW: Rank 4 and 7 (lowest) using Regional Loadings Others are negligible.	Primarily Rank 2 and Rank 2 using regional loadings over TLPSsS with some areas of Rank1. Others are negligible.	PO_4 to SW: Rank 4 and 6 NO_3 to SW: Rank 3 and 4
Likely main pathways(s)	Overland flow and drains	Overland flow and drains	Shallow sub-surface pathway
Likely CSA(s) [13]	Where PIP is highest; Where there is peat extraction	Where PIP is highest	
Significant issue	NH_3 and PO_4	PO_4	NO_3

[13] CSAs are defined as the places within a catchment where the sources of a contaminant are hydrologically linked to the aquatic receptors of interest and contribute disproportionate amounts of pollutants to receptors.

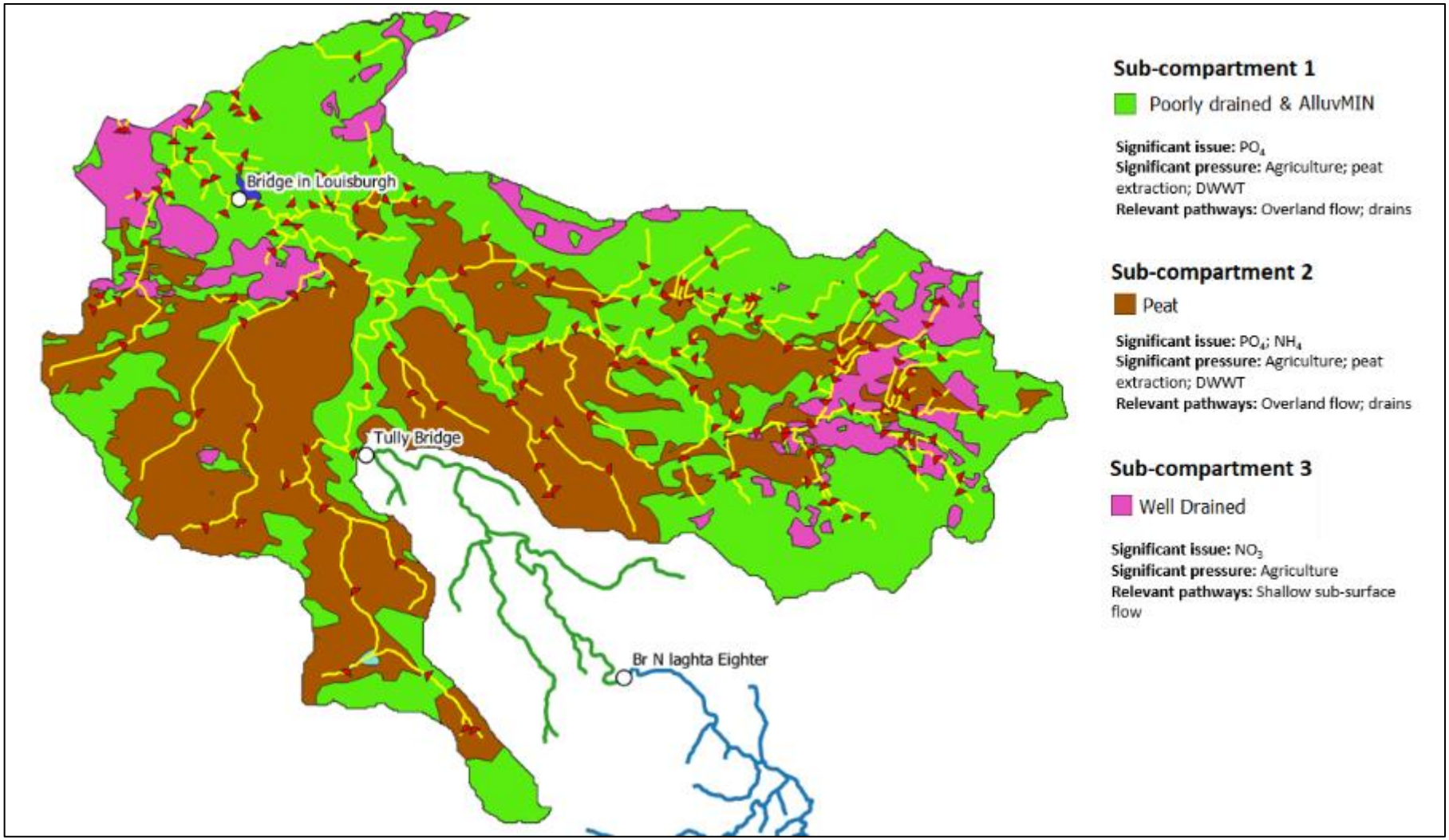


Figure 11: Sub-compartments within the Louisburgh Bunowen PAA

4.3 Pathways Conceptual Model and Likely Critical Source Areas

The significant issue in the Bunowen_030 is nutrients. Although EPA chemical data for the period 2007 – 2018 indicate that PO_4 and NH_3 are consistently within the EQS for each parameter, excessive filamentous algae and moderate invertebrate status at the monitoring station suggest that nutrient enrichment is a significant issue. This is supported by the elevated PO_4 and NH_3 observed by Irish Water upstream of the Louisburgh WWTP.

The main pathway for PO_4 and NH_3 is typically overland flow/ drains. This is consistent with the main pathways identified in the PAA.

Significant pressures identified in the PAA include: Agriculture (Pasture); Extractive Industry (Peat); DWWTS; UWWTS. Forestry was raised as a potential pressure by locals that attended the Community Information Meeting on the Bunowen_030 on 22nd November 2018.

The likely critical source areas for diffuse and small point significant pressures in the Louisburgh Bunowen PAA are listed in **Table 10.**

Table 10: Likely Critical Source Areas (CSAs) in the Louisburgh Bunowen PAA

Pressures	Likely CSA	Pathways	Sub-compartment	Map
Agriculture	PIP Rank 1 and 2 areas	Overland flow/ drains	1	Figure 6
Extractive Industry (Peat)	Peat extraction areas	Overland flow/ drains	2	Figure 8
UWWTS	N/A	N/A	N/A	N/A
DWWTS	Areas of poorly drained and well drained soils where rock is at ground surface	Overland flow and shallow sub-surface flow paths	1 and 3	**Error! Reference source not found. Error! Reference source not found.**

The Louisburgh WWTP is a large point source located downstream of the EPA monitoring station (**Figure 9**).

5 Interim Catchment Story

Introduction

The PAA comprises one RWB, the Bunowen (Louisburgh)_030. It was selected as a PAA by the Western Regional Operational Committee for the following reasons:

- Building on improvements at Louisburgh WWTP;
- Discharges into designated bathing water (Carrowmore Beach, Louisburgh);
- One water body is failing to meet protected area objectives for drinking water.

Land use is predominantly peat and pasture with areas of coniferous forests and urban (town of Louisburgh). The PAA intersects or is hydrologically connected to a number of protected sites including SACs and SPAs; NHAs and pNHAs; drinking waters; and, bathing waters. It is also located within a *Margaritifera* sensitive area (catchments of other extant populations).

The Bunowen (Louisburgh)_030 has one operational monitoring station located at the 'Bridge in Louisburgh' (RS32B030150). There are two investigative monitoring sites on the RWB upstream (RS32B030140) and downstream (RS32B030250) of Louisburgh WWTP.

Risk

The Bunowen_030 has been at Moderate Status for the past three monitoring periods (9 years) and is therefore *At Risk* of failing to achieve its Good Status objective.

Status

The Bunowen_030 is at Moderate biological status (macroinvertebrates are the driving element for status). Support chemistry including nutrient conditions is Pass. Therefore, biological status is driving the Moderate ecological status.

Hydrochemistry

The EPA chemical data for the period 2007 – 2015 indicate that PO_4 and NH_3 are consistently within the EQS for each parameter[14]. More recent chemical data available from Irish Water AER reporting on Louisburgh WWTP (2016) indicate exceedances in the PO_4 and NH_3 EQS at the upstream monitoring station which is located downstream of the EPA monitoring station the 'Bridge in Louisburgh'. No exceedances were observed by Irish Water at the upstream monitoring stations during 2017.

[14] Enrichment can occur even when N&P conc. are below the EQS therefore, low N&P do not necessarily indicate no nutrient issue.

EPA chemistry data collected in 2016, 2017 and 2018 show that concentrations for NH_3 and PO_4 are predominantly low. Concentrations recorded above the limit of detection are within the High EQS limit.

Significant Issues

The EPA chemical data for the period 2007 – 2018 indicates that PO_4 and NH_3 are consistently within the EQS for each parameter. However, excessive filamentous algae at the monitoring station suggests that nutrient enrichment is the significant issue. This is supported by the elevated PO_4 and NH_3 observed by Irish Water upstream of the Louisburgh WWTP (this site is downstream of the EPA monitoring point) in 2016. Irish Water data shows that PO_4 at the site downstream of the WWTP exceeded the MRP criteria for Good Status (Good status ≤0.035 (mean) or ≤0.075 (95%ile)) at concentrations of 0.09 mg/l (mean) and 0.38 (95%ile). The exceedance was caused by one high PO_4 measurement in January 2017. Subsequent measurements were within the Good Status EQS.

The site downstream of the WWTP also breached the EQS for orthophosphate (mean only) in 2016 (0.109 mg/l). However, the elevated orthophosphate observed downstream of the WWTP in 2016 was likely as a result of the high concentration observed upstream on the same occasion (0.182 mg/l). This suggests that there is a nutrient pressure occurring upstream of the WWTP which is being picked up in Irish Water monitoring, and not EPA/Local Authority monitoring. The ammonia EQS was also breached at the site upstream of the WWTP in 2016 (0.0765 mg/l (mean) and 0.315 mg/l (95%ile)).

Significant Pressures

A number of significant pressures were identified in the catchment characterisation process including:

- Agriculture
- DWWTS
- UWWT
- Extractive Industry (Peat)

The elevated PO_4 and NH_3 concentrations could be caused by a range of potentially significant pressures in the catchment including DWWTS, agriculture and extractive industry (peat).

In addition to the elevated PO_4 and NH_3 concentrations, exceedances in pesticides were detected in the Louisburgh PWS in 2015 and 2017. Pesticides will have the same pathway as PO_4. The presence of pesticides in the drinking water supply indicate agricultural pressures in the catchment. There was also one exceedance for Colony count out of a total of 4 results captured in 2018.

The UWWTP is located downstream of the EPA monitoring station and with the exception of one elevated PO_4 concentrations in January, appeared to be largely compliant with the EQS for the various parameters monitored in 2017. The final effluent from the primary discharge point was non-compliant with the ELVs for BOD and Ammonia. The 'Bridge in Louisburgh' EPA monitoring station is located

within the Louisburgh agglomeration and it is possible that there are misconnections[15] within the agglomeration that are discharging to the Bunowen (Louisburgh)_030 and causing deterioration in the waterbody as reflected in the Moderate biological status.

Critical Source Areas

A conceptual model developed for the PAA concluded that the dominate soils are peat and poorly drained soils. The main pathways associated with these soils are overland flow and drains. There is potential for shallow sub-surface flow paths over limited areas of well drained rock. The CSAs in the PAA are listed in **Table 11**.

Table 11: Likely Critical Source Areas (CSAs) in the Louisburgh Bunowen PAA

Significant Pressure	Likely CSA
Agriculture	PIP Rank 1 and 2 areas
Extractive Industry (Peat)	Peat extraction areas
UWWTS	N/A
DWWTS	Areas of poorly drained soils and areas of well drained soils where rock is at ground surface

6 Further Actions

6.1 Louisburgh WWTP

In the WFD characterisation process for the second cycle of the river basin management plan (2015-2021), the EPA identified the following action for further characterisation:

IA1 Provision of information - Louisburgh WWTP (SLAM V2.04-Wastewater 10% P) is performing to license conditions but conditions on assimilative capacity might need reviewed. SWO's can cause issue also.

Irish Water are identified as the responsible organisation.

The assimilative capacity calculations for Louisburgh WWTP are available in an Appropriate Assessment Screening for the WWTP in March 2010[16]. Loadings from the WWTP are summarised in the information box below:

APPENDIX D – WASTE ASSIMILATIVE CAPACITY (WAC) CALCULATIONS

WWTP BOD loading = (2*250)/1000 = 0.5kg/day BOD (within WAC)

[15] i.e. where a foul drain is mistakenly connected to the surface water pipe. Thus, sewage is discharged to the local stream.

[16] http://www.epa.ie/licences/lic_eDMS/090151b280367676.pdf

WWTP SS loading = (13*250)/1000 = 3.3kg/day SS (within WAC)

WWTP Orthophosphorus loading = (0.092*250)/1000 = 0.02kg/day Ortho-P (within WAC)

WWTP Ammonia loading = (0.523*250)/1000 = 0.1 kg/day Ammonia (within WAC)

According to Section 4 of the 2009 licence application[17]:

"*The wastewater treatment works is designed to treat the wastewater treatment to the standards required by the Urban Wastewater Treatment Regulations i.e. BOD 25 mg/l, COD 125mg/l and Suspended Solids 35 mg/l.*

The average volume currently discharged from the municipal effluent stream of the treatment plant is estimated at 250 m³/day (1,000 P.E. @ 225 l/per P.E. day). This is equivalent to an average discharge of 0.5 kg/day BOD, 3.25 kg/day Suspended Solids and 0.06375 kg/day Total Phosphorous per day in the treated effluent.

Limited information is available on the nature and quantities of the discharges from the secondary discharge points and storm overflows. A hydraulic model was prepared for the drainage system in 1991 and this has been used to estimate the volumes discharged from the storm overflows.

All discharges take place to the River Bunowen which is within the Clew Bay Catchment Special Area of Conservation, Site Code 000458. The River Bunowen has a Q rating of 4.

Results were obtained from the EPA for sampling carried out downstream of all the discharge points."

Follow up action: The following queries to be raised with Irish Water:

- In light of the 2017 AER monitoring results which showed a non-compliance for orthophosphate at the downstream monitoring station and non-compliance with the ELVs for BOD and ammonia, will a review of the waste assimilative capacity calculations be undertaken to include the primary discharge, storm water overflow and secondary discharge?
- If so, will the results be made available to the Catchment Assessment Team?

6.2 Other

IA7 Multiple sources in multiple areas - a full IA7 is required here given the range of different pressures acting within the sub catchment.

There are a number of significant pressures identified on the Bunowen (Louisburgh)_030 including:

- Extractive Industry (Peat);
- Domestic waste water (Waste Water discharge);
- Agriculture (Pasture); and,

[17] http://www.epa.ie/licences/lic_eDMS/090151b2803468e2.pdf

- Urban Waste Water (Agglomeration PE of 500 to 1,000).

Observations from the EPA Biologist in 2014 stated: "*Signs of significant eutrophication were again noted in the lower section* [Bunowen (Louisburgh)_030]*, which was disappointing and only at moderate status having a channel bed almost entirely covered in a large biomass of opportunistic algae upstream of Louisburgh (0150)*". The EPA biologist comments on a Q-value undertaken in September 2017 indicated: *"A slight improvement was noted at Louisburgh (0150), but again this station remains unsatisfactory and nutrient enriched."*

The EPA Biologist noted that the enrichment situation at the monitoring station was not much better in 2017. The Bunowen_030 was in flood during the 2017 monitoring survey so no biomass calculations were possible.

While eutrophication indicates a nutrient pressure, supporting chemistry conditions in the monitoring periods 2007-2009 and 2010-2015 were assigned a 'Pass' with trends in PO_4 consistently downwards. This may indicate that the opportunistic macroalgae are absorbing P from the water. 2016 chemical data collected by Irish Water upstream and downstream of the Louisburgh Bunowen WWTP indicate elevated NH_3 and PO_4 at the upstream monitoring site. PO_4 was elevated at the downstream monitoring site only in 2017.

In order to identify the source of the pressures impacting on the RWB and to identify appropriate mitigation measures, a catchment walk including rapid assessments and Small Stream Impact Scores will be required throughout the PAA. A proposed work plan is presented in **Section 7.**

Table 12: Follow up actions

Follow up actions	Action progressed?	Further actions
Discuss monitoring results with the EPA Biologist.	Yes	Desk study updated accordingly.
Query why the WFD app does not provide NH_3 and PO_4 data for the investigative monitoring stations downstream of Louisburgh WWTP.	Yes	Queried with BK but he wasn't aware of why this was the case.
Request biological/ chemical data collected since the 2010-2015 monitoring period.	Yes	Data received.
Consult with EPA biologist on potential sites for catchment walks, SSIS and rapid assessments.	Yes	Field assessment strategy updated accordingly.
Carry out catchment walks, rapid assessments and SSIS throughout the catchment where appropriate.	Yes	Carried out in Nov and Dec 2018. Resurveyed to be carried out in spring 2019.
Query with Irish Water if the 2017 and 2015 exceedances in pesticide in the Louisburgh PWS was caused by the herbicide MCPA.	Yes	Confirmed by EC of MCC that MCPA is the pesticide that is breaching drinking water limit.
MCC indicated in a PAA workshop on the 26th September 2018 that Irish Water also monitor parameters in the raw water abstracted from the Bunowen (Louisburgh)_030. LAWSAT to request this data from Irish Water.	No	IW interactions to be formalised.
MCC noted at a PAA workshop on the 26th September 2018 that they have mapped where DWWTS inspections have been	Yes	Received spreadsheet of inspections carried out

carried out. It was agreed that LAWPRO would liaise with MCC on this.		since 2013. Received SANICOSE database.
Contact DAFM/ Coillte to discuss: • What (if any) measures were in place in Coillte forestry to protect waterbodies during felling operations completed to date. ▪ What measures are currently in place in Coillte forestry to protect waterbodies from forestry operations? ▪ Is it possible to access the waterbodies in Coillte forestry to undertake SSIS/ RA or catchment walks? If so, do we deal directly with the Inspector for the Mayo district? ▪ What felling has been undertaken since the 2012 aerial photography?	No	
A follow-on meeting to be arranged with MCC in June 2019 on the source protection project for the Louisburgh PWS.	No	

7 Work Plan

The graphic below outlines the work plan for carrying out a local catchment assessment in the Louisburgh Bunowen PAA. The catchment assessment will commence at the EPA monitoring station Bridge in Louisburgh (RS32B030150). Here, an SSIS will be undertaken followed by an intense 550m walk from the monitoring station upstream to Stop 1. The purpose of the walk is to locate any point sources discharging close to the monitoring station. If no pressures are observed on the catchment walk the next step is to target large tributaries upstream of monitoring station to rule in/out if they are contributing to the Moderate status of the RWB.

There are four main tributaries of the Bunowen_030.

- Stop 1 is located on the first large tributary upstream of the EPA monitoring station. An SSIS will be carried out at this location and if it is deemed impacted, then a series of rapid assessments will then be carried out at various intervals upstream of Stop 1 to identify major deviations in the tributary conditions. Land use adjacent to this tributary is pasture. It is located primarily on poorly draining and peat soils where the main pathway is overland flow.
- Stop 2 is located upstream of the confluence of another large tributary to the main RWB channel. Similar to St. 1, an SSIS will be carried out at this stop and if the tributary is deemed impacted, then a series of rapid assessments will be carried out at various intervals upstream of Stop 2 to identify major deviations in water body conditions. Land use adjacent to this tributary includes pasture, peat extraction and plantation forestry. It is located primarily on peat soils where the main pathway is overland flow.
- Stop 3 is located on the main channel of the Bunowen (Louisburgh)_030 RWB. An SSIS will determine if this section of the RWB is impacted. If it is deemed to be impacted, then a series of SSIS/ rapid assessments will be carried out at various intervals upstream of Stop 3 (e.g. at Stop 4 and Stop 5, two major tributaries) to identify major deviations in water body conditions. If it deemed to be unimpacted then no further assessment is required upstream of this stop.

The location of the stops within the Louisburgh (Bunowen)_030 are illustrated in **Figure 12**.

The EPA biologist noted that tidal influence can be equivalent to a mild enrichment effect – if local intrusions carry high concentrations of P. Typically, 6 inch maps will have a record of the extent of tidal inflow. The biologist noted that the best time to survey for tidal influence at a monitoring location is during low flow and high spring tide conditions. Conductivity changes should be recorded. Is there potential for tidal influence to carry contaminants from the Louisburgh WWTP upstream? It is unlikely however, it should not be ignored as a potential pathway for contaminants. The 6 inch Cassini map which was produced ca. 1940s indicates the 'Highest point to which Ordinary Tides flow' is at the bridge in Louisburgh (**Figure 13**). The EPA monitoring station is located at this point also.

The Louisburgh WWTP is located downstream of the EPA monitoring station. The 2017 AER for the WWTP showed an exceedance in the EQS for MRP d/s of the plant. The exceedance was caused by one high PO_4 measurement in January 2017. Subsequent measurements were within the Good Status EQS. In 2016, the EQS for MRP was breached u/s and d/s of the WWTP. The EQS for ammonia was also breached u/s of the WWTP only. The results therefore suggest that there is a nutrient pressure occurring u/s of the WWTP however, an SSIS will be carried out u/s and d/s of the WWTP to verify that the plant it not having an impact on the Bunowen River d/s of the EPA monitoring station.

EPA Mon St.
- Carry out an SSIS at the monitoring station RS32B030150.
- Carry out SSIS or RA of channelised tributary to determine if it is impacted.
- Carry out an intense catchment walk as far as Stop 1 (approx. 550m) to id point sources

Stop 1
- Carry out an SSIS to determine if the tributary is impacted.
- If an impact is detected proceed US to Stop 1.1 and 1.2 to carry out RAs.
- If an impact is not detected proceed to Stop 2.

Stop 2
- Carry out an SSIS to determine if the tributary is impacted.
- If an impact is detected proceed US to Stop 2.1. 2.2 etc and carry out RAs.
- If an impact is not detected proceed to Stop 3.

Stop 3
- Carry out an SSIS to determine if the tributary is impacted.
- If an impact is detected proceed US to Stop 4.
- If an impact is not detected do not proceed any further US.

Stop 4
- Carry out an SSIS to determine if the tributary is impacted.
- If an impact is detected proceed US to Stop 4.1 and 4.2 and carry out RAs.
- If an impact is not detected proceed to Stop 5.

Stop 5
- Carry out an SSIS to determine if the tributary is impacted.
- If an impact is detected proceed US to Stop 5.1 and 5.2 and carry out RAs.
- If an impact is not detected the assessment is complete.

Repeat Survey
- The best time to survey impacted sites is in summer but winter surveys cannot be avoided in this programme. The Bunowen River should be resurveyed in summer.

Tidal Influence
- Tidal influence can be equivalent to a mild enrichment effect if saline intrusions carry high conc. of P
- To rule out tidal influence at the mon st. survey the site during low flow, high spring tide conditions. Check for any changes to conductivity.

WWTP
- WWTP located d/s of the EPA monitoring station.
- Carry out an SSIS u/s and d/s of the primary discharge and secondary discharge to rule out impacts of the WWTP on the RWB d/s of the EPA monitoring station.

Figure 12: Proposed catchment Walk and LCA stations in the Louisburgh Bunowen PAA

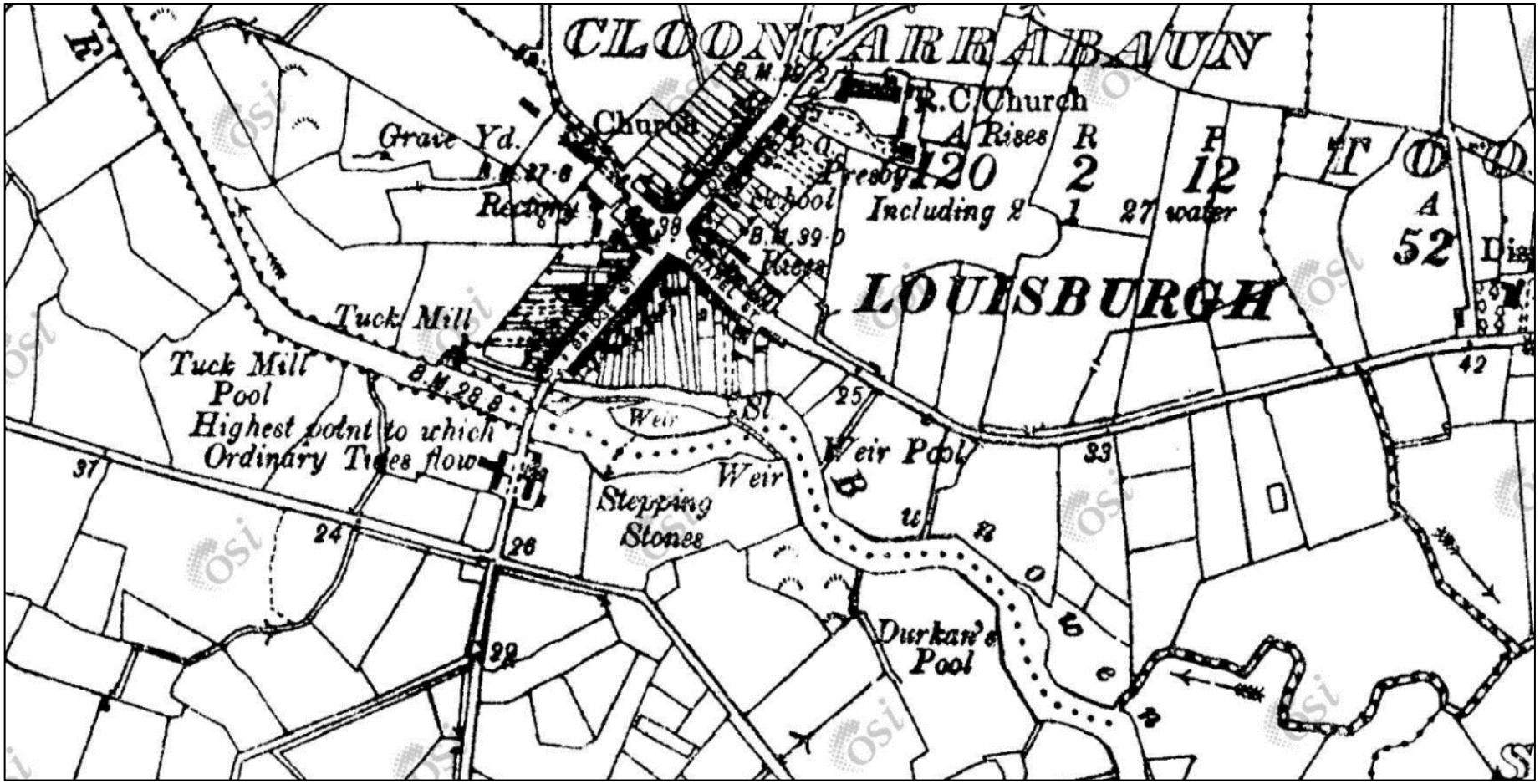


Figure 13: Cassini 6 inch map of Louisburgh with '*Highest point to which Ordinary Tides flow*' mapped (ca. 1940s)

8 Mitigation Measures

One possible mitigation measure may be an upgrade to Louisburgh WWTP to resolve the biological sludge issue or any other issues that are causing the plant to fail to comply with the licence conditions (BOD and ammonia) and the Surface Water Regulations (2009).

Other mitigation measures to be determined once the multiple pressures in multiple areas have been identified.

At the LAWPRO/MCC workshop on the 26th September 2018, MCC indicated that if LAWPRO identify high risk DWWTS areas then MCC may be able to organise inspections and prioritise improvement grants for PAAs.

9 Communications

9.1 Submissions on Draft RBMP

Submissions, observations and comments made by interested parties on the draft River Basin Management Plan (RBMP) for Ireland 2018-2021 were reviewed to identify any significant concerns raised about the Bunowen River during the consultation process. No submissions were made on the Bunowen River.

9.2 Other Significant Points on the PAA

9.2.1 Bathing Waters

It was noted at a workshop with MCC on the 26th September 2018 that potential contentious issues that may arise during the public engagement process in the Bunowen Louisburgh catchment include Bathing Waters. Old Head Beach borders the north-west section of the Louisburgh Bunowen PAA. According to an article published at https://www.midwestradio.ie/index.php/news/23741-mayo-beaches-mostly-of-excellent-water-quality-according-to-new-epa-report on the 16th May 2018:

“Of the 15 Mayo beaches inspected, 14 are of excellent water quality, while Old Head beach in Louisburg is described as “good”. The EPA report says bathing waters in Co Mayo continue to be of a very high quality, with few pollution sources identified. The Mayo beaches described as “excellent” are -

Bertra Beach, Murrisk; Carrowmore Beach, Louisburgh; Carrowniskey, Louisburgh; Clare Island; Dooega Beach, Dugort, Golden Strand, Keel and Keem beaches on Achill Island; Elly Bay, Belmullet;

Mullaghroe Beach, Belmullet; Mulranny; Rinroe beach Carrowtigue, and Ross Beach Killala – all described as excellent while Old Head Beach, Louisburgh is described as Good.”

Carrowmore Beach is located downstream of the Bunowen (Louisburgh)_030. MCC noted during the workshop that Carrowmore Beach had Blue Flag status. It has a high *E.coli* count at times (>2,500).

9.2.2 Drinking Water Supply

It was noted at a workshop with MCC on the 26th September 2018 that drinking water supply may arise as a contentious issue at a public meeting. Residents from Murrisk to Louisburgh currently get their water supply from streams on Croagh Patrick. Residents are concerned with cryptosporidium and e-coli in the water supply and are seeking a connection to the Lough Mask public water system which services Westport (https://www.irishtimes.com/news/environment/dispute-over-mayo-drinking-water-threatens-clew-bay-beach-access-1.3497664).

9.2.3 Flooding

The Catchment Flood Risk Assessment and Management (CFRAM) Programme has examined the flood risk, and possible measures to address the risk, in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk Assessment (PFRA), which was a national screening assessment of flood risk. Among the communities identified through the PFRA process as being at potentially significant flood risk in the Erriff - Clew Bay - Blacksod - Broadhaven River Basin is Louisburgh. Coastal and river flood extents are illustrated in **Figure 14**.

According to the Flood Risk Management Plan for the Erriff-Clew Bay-Blacksod-Broadhaven River Basin[18], Louisburgh has been subject to significant flood events, with the most severe being reported in 1974, causing flooding to several properties in the town centre. The WTP was also reported to have flooded in 1999, 2001 and 2006.

[18] https://www.floodinfo.ie/publications/?t=22&a=659

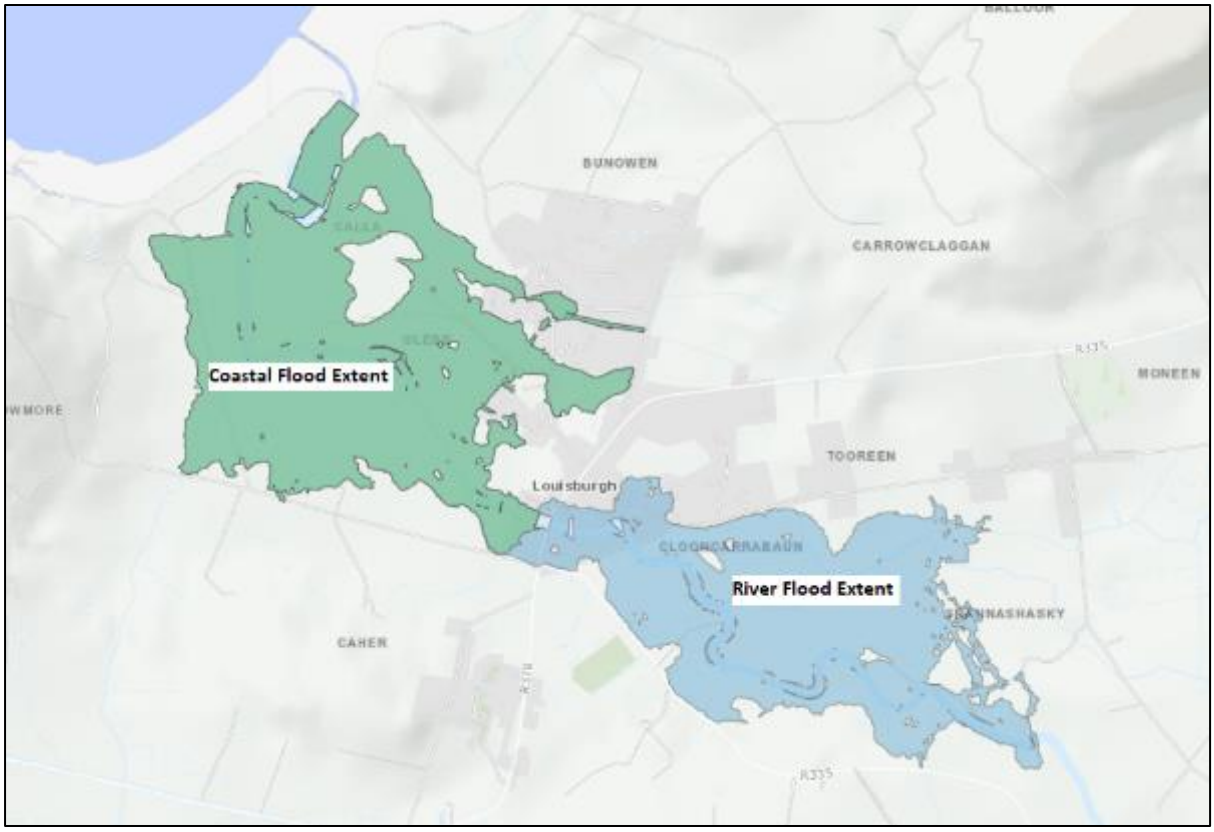


Figure 14: Coastal and river flood extent in Louisburgh (source: https://www.floodinfo.ie/map/floodmaps/)

Potentially viable flood relief works have been investigated for Louisburgh. However, none of these methods were found to be economically viable with respect to current levels of flood risk. The estimated Benefit Cost Ratio is 0.82 and so included in the Plan is a measure to undertake a detailed assessment of costs to determine if an economically viable measure exists.

Measure Name:	Undertake a detailed assessment of the costs of the potential measure for Louisburgh.
Code:	IE-AFA-320526-0001-M33
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	OPW and/ or Mayo County Council
Funding:	OPW and/ or Mayo County Council

Further details of the currently unviable flood relief works, including a full description, environmental considerations and impacts, climate change adaptation and public consultation feedback are in Appendix G of the plan. A summary of the potentially viable flood relief works for Louisburgh is presented in

Table *13*.

Table 13: Summary of the potentially viable flood relief works in Louisburgh

AFA Name	Potentially Viable Flood Relief Works	Conclusion
Louisburgh	Containment structures on the left and right banks and the bridge parapet to the 1% AEP design standard. This involves: • The construction of a wall on the right bank between Louisburgh Bridge and Weir and an embankment upstream of this to tie into high ground on Chapel Street. • The construction of an embankment on the left bank between Louisburgh Bridge and the R335 Road. • The construction of a raised parapet on Louisburgh Bridge and flood gates at either end to tie into the embankment wall on the left and right bank respectively.	Economically Unviable (BCR 0.82)

The justification for flood relief works in Louisburgh is currently marginal and a cost beneficial solution has not been identified for Louisburgh. To progress the flood relief works in Louisburgh it is recommended a cost review be undertaken to see if there are potential savings that can be achieved by progressing elements of the proposal under direct labour by either the local authority or by the OPW.

See the Flood Risk Management Plan for the Erriff-Clew Bay-Blacksod-Broadhaven River Basin[19] for further details on the flood relief works in Louisburgh.

Date of report completion: 10th August 2020

[19] https://www.floodinfo.ie/publications/?t=22&a=659

Appendix A – Protected Areas Within or Downstream of the Louisburgh Bunowen PAA

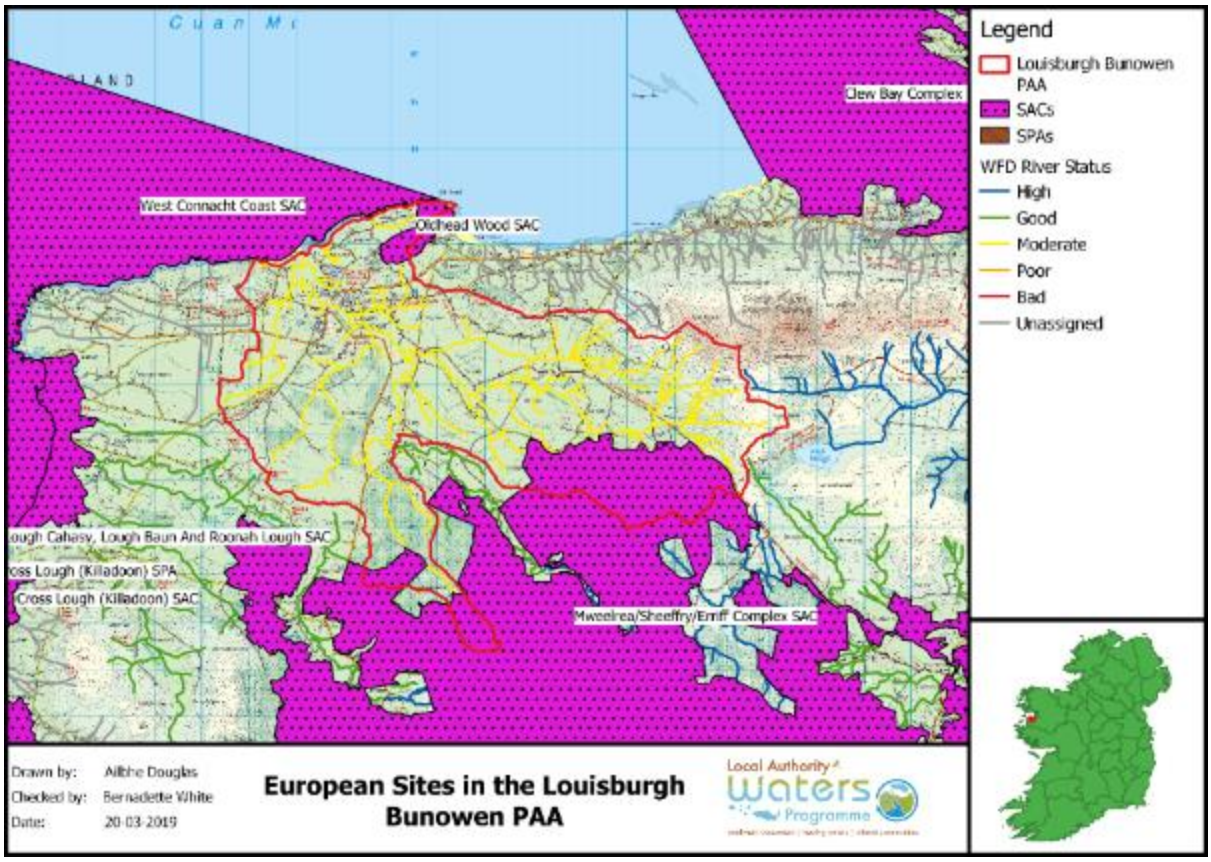


Figure A1: European Sites in the vicinity of Louisburgh Bunowen PAA

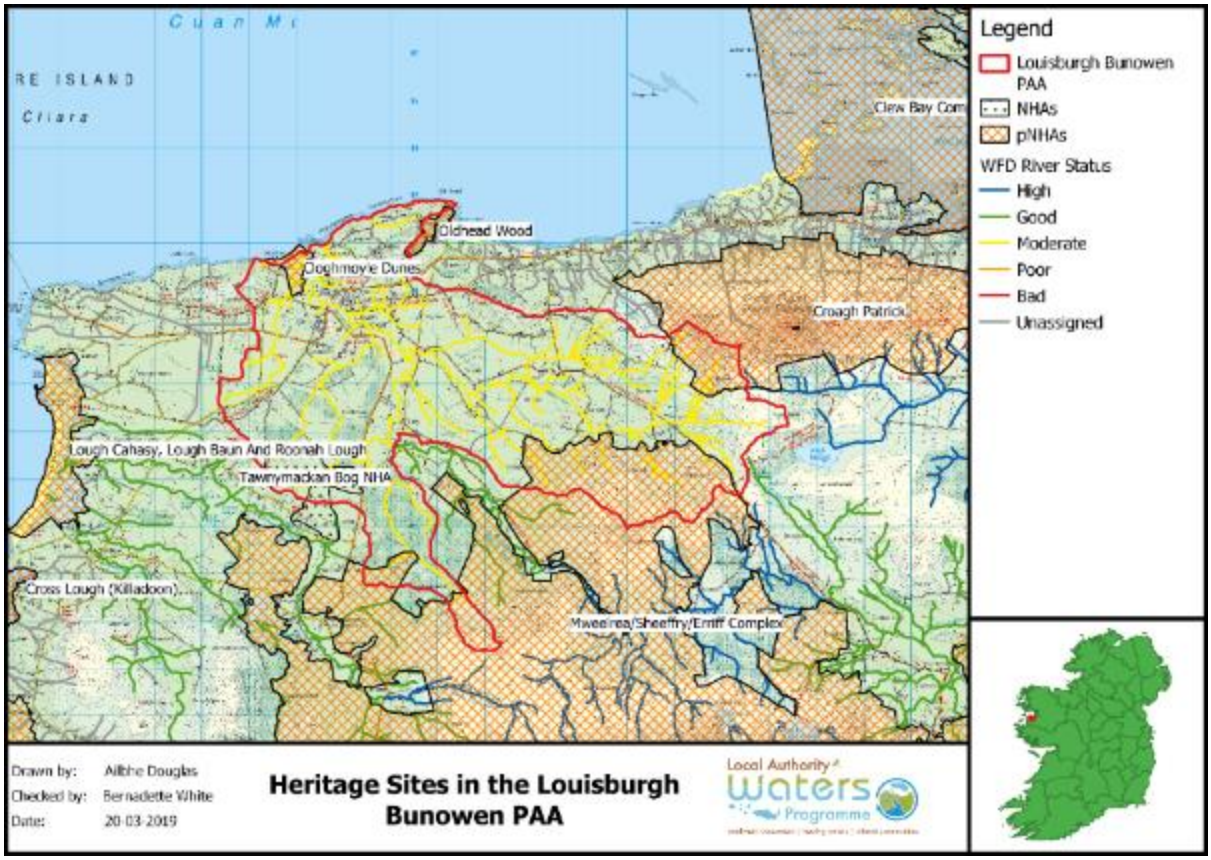


Figure A2: Heritage Sites in the vicinity of Louisburgh Bunowen PAA

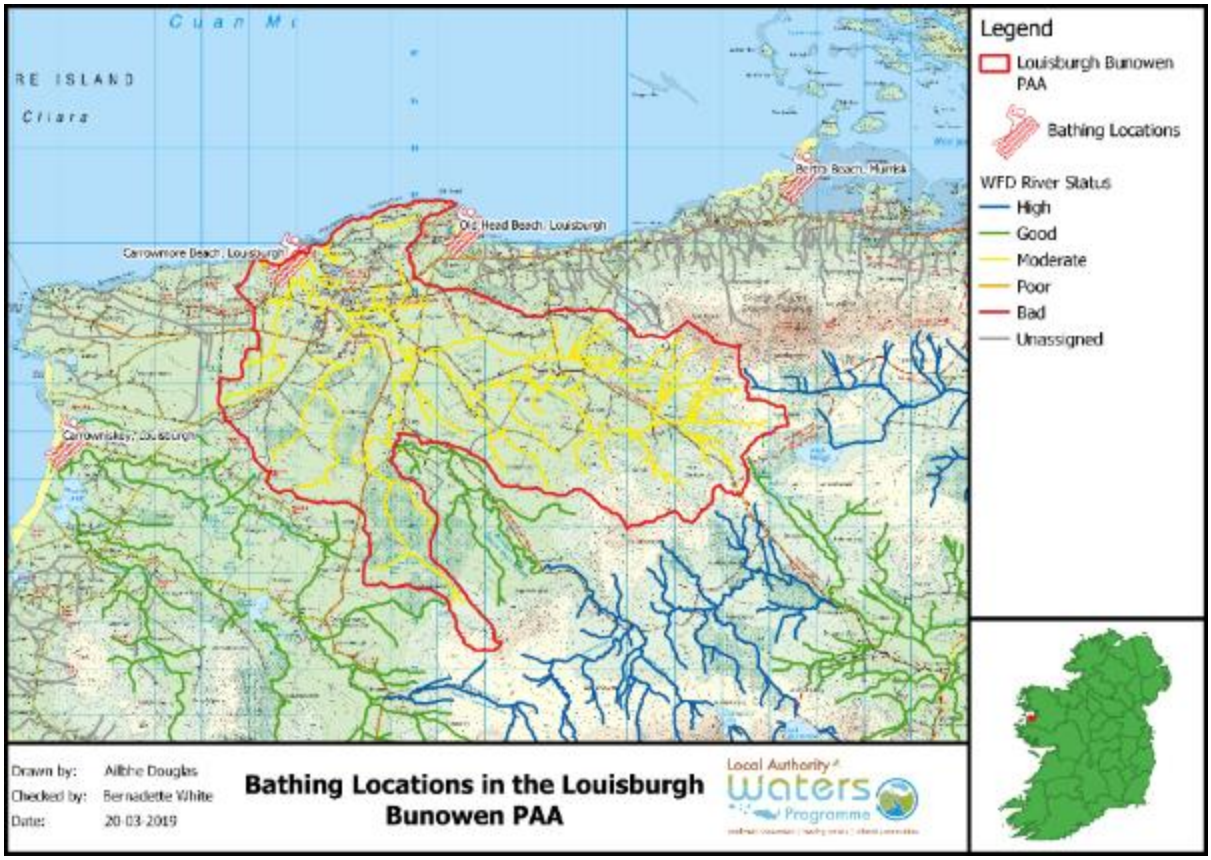


Figure A3: Bathing locations in the vicinity of Louisburgh Bunowen PAA

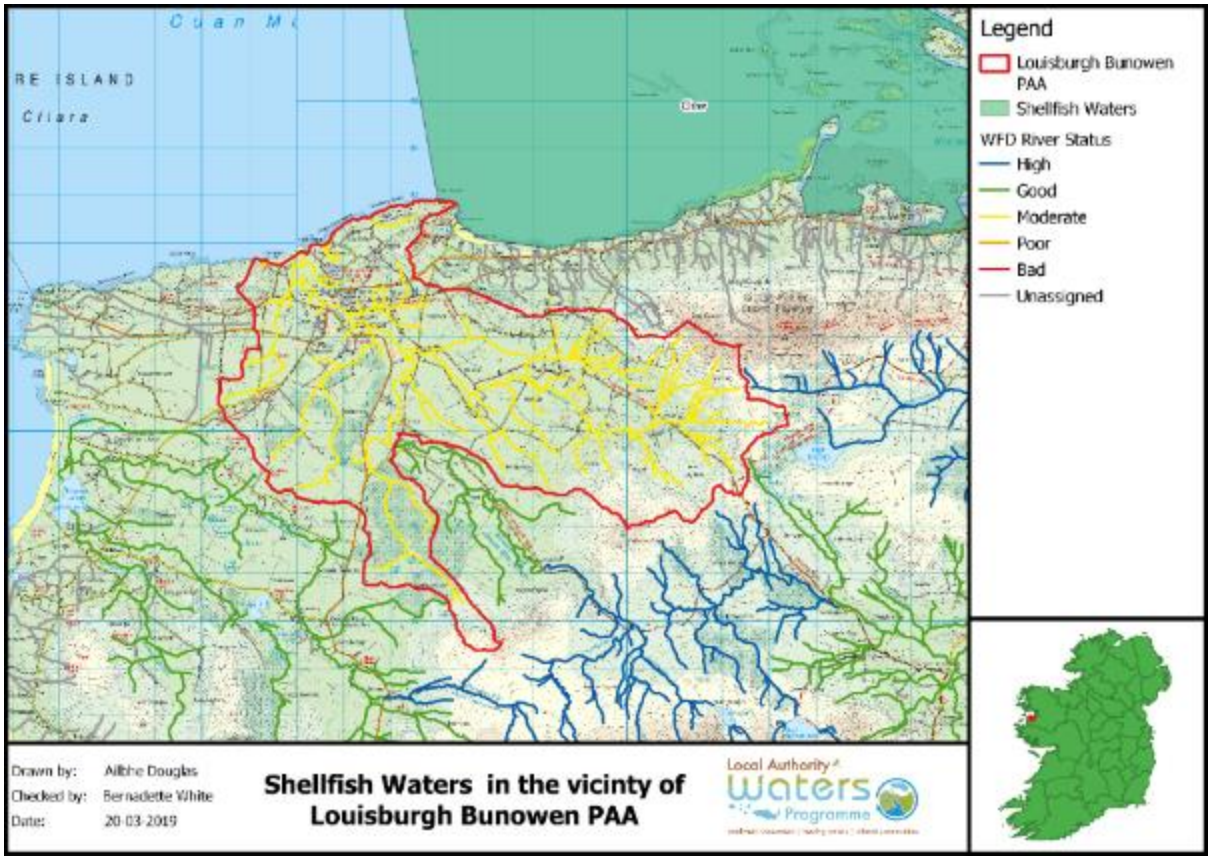


Figure A4: Shellfish waters in the vicinity of Louisburgh Bunowen PAA

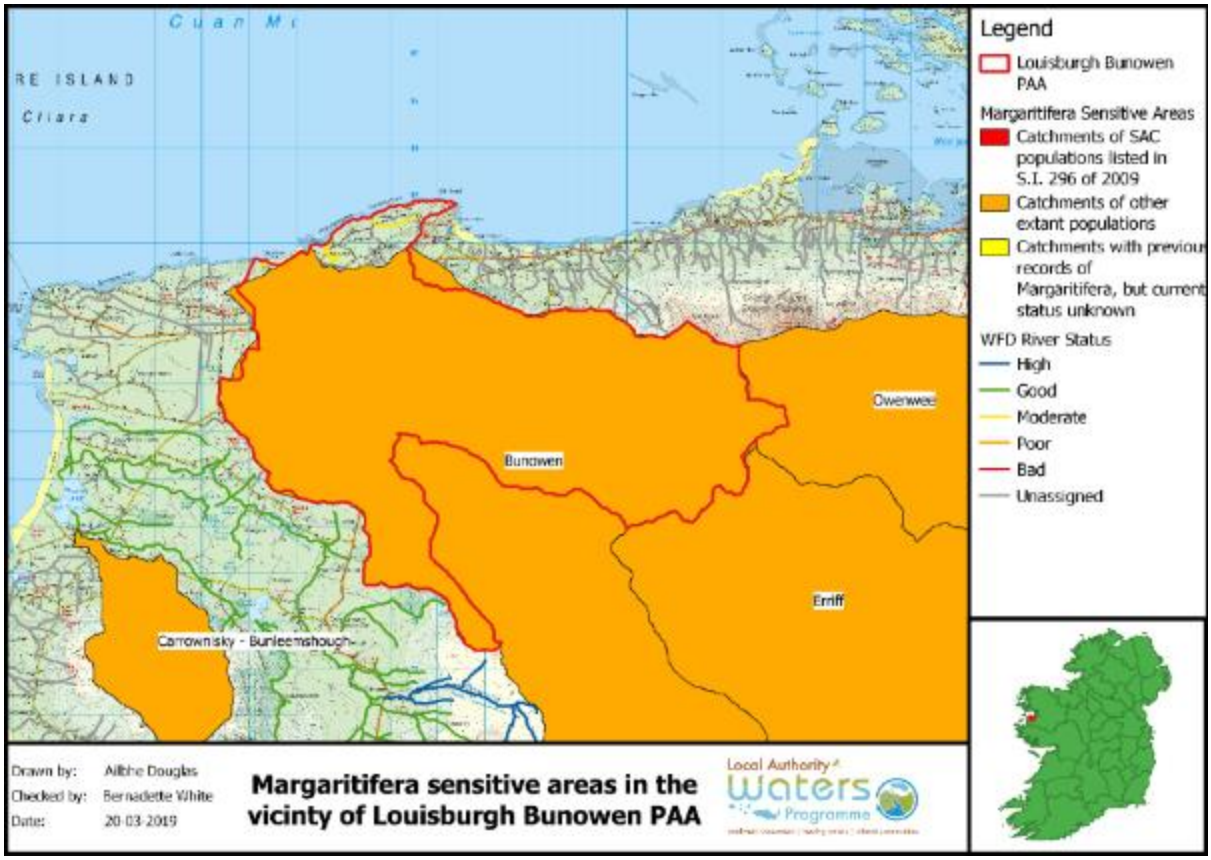
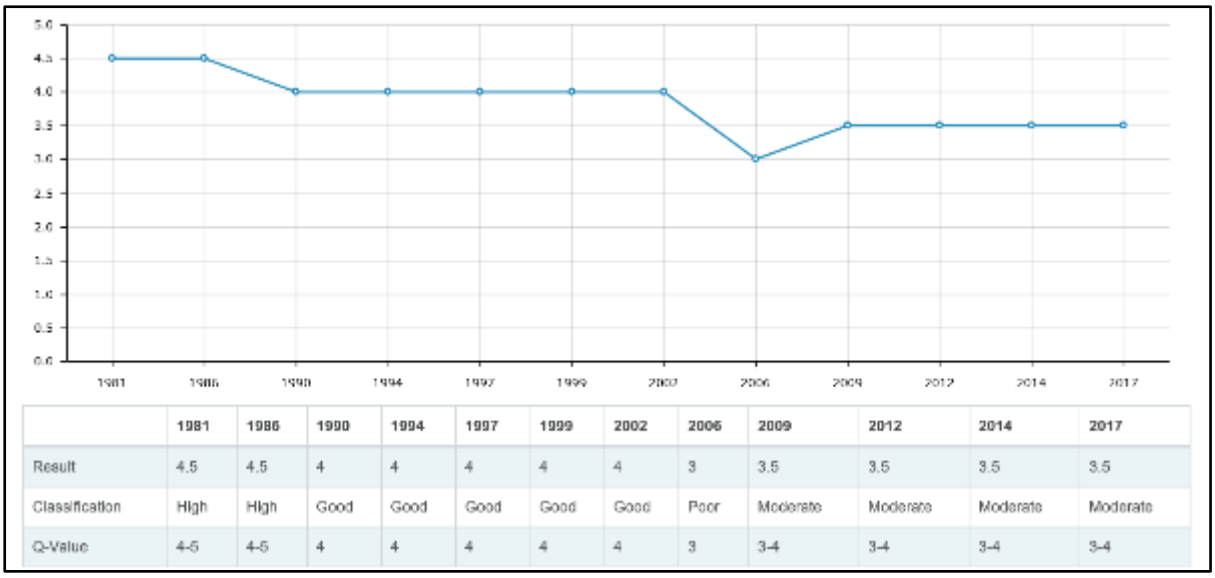


Figure A5: Margaritifera sensitive areas in the vicinity of Louisburgh Bunowen PAA

Appendix B – EPA River Quality Surveys: Biological for Hydrometric Area 32

Bunowen(Louisburgh)_030



	1981	1986	1990	1994	1997	1999	2002	2006	2009	2012	2014	2017
Result	4.5	4.5	4	4	4	4	4	3	3.5	3.5	3.5	3.5
Classification	High	High	Good	Good	Good	Good	Good	Poor	Moderate	Moderate	Moderate	Moderate
Q-Value	4-5	4-5	4	4	4	4	4	3	3-4	3-4	3-4	3-4