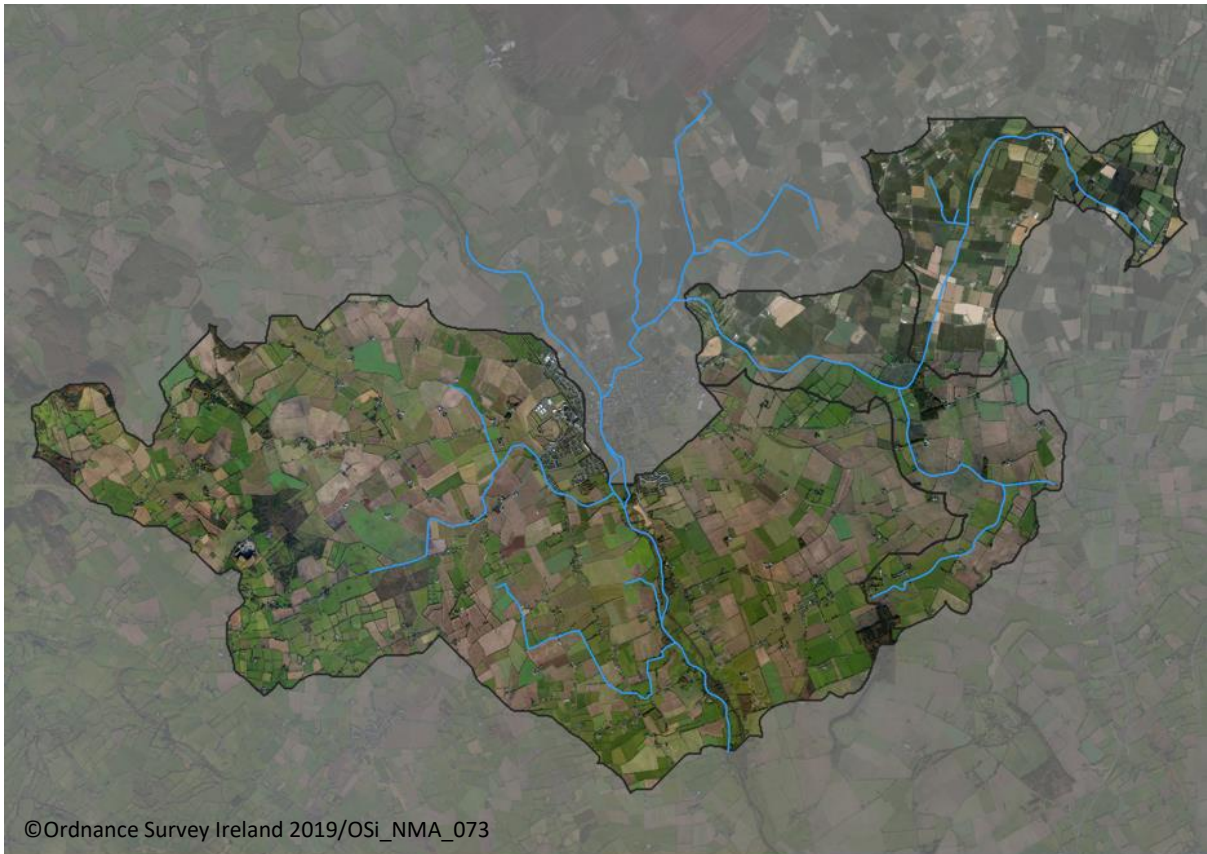


Athy Stream Priority Area for Action

Desk Study

(AFA0010)



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Data attribution

The following data sources were consulted in the preparation of this report:

WFD App – EPA characterisation data

Bing Maps

Catchment boundaries, waterbodies and areas for action: EPA (2018)

Bedrock Unit: GSI (2008)

Aquifer Category: GSI (2015)

Groundwater body: EPA Catchments Unit (2018)

Soils & Subsoils Maps: Teagasc (2015)

IFS Soils: EPA (2006)

Susceptibility and Pollution Impact Potential Maps: EPA (2018)

WFD waterbody status: EPA (2018)

SAC and NHA boundaries: NPWS (2018)

1 Background

The Athy Stream Prioritised Area for Action (AFA) is located on the Kildare/Laois border in the vicinity of Athy Town. The AFA consists of three waterbodies; Athy Stream_010, Athy Stream_020 and Barrow_140. It has been decided that a fourth unassigned waterbody, Athy Stream_030 should also be included at desk study stage as it is in-between the three waterbodies in the AFA (see Fig. 1).

This AFA was selected following the regional workshops which were held in Roscrea on 6-9 June 2017 and were attended by representatives of local authorities (Kilkenny, Tipperary, Waterford City and County, Kildare, Laois, Offaly, Carlow, Wexford & Wicklow), and other agencies (Bord Iascaigh Mhara, DHPLG, EPA, National Dairy Sustainability Forum, National Federation for Group Water Schemes, Sea Fisheries Protection Authority, Waterways Ireland, LAWCO, Irish Water, IFI, Forest Service, Coillte, NPWS, Teagasc, GSI, DAFM, Marine Institute and EPA). Based on the draft River Basin Management Plan priorities, a set of agreed principles and the priorities of the workshop attendees, 34 areas were recommended for action in the South East region and the Athy was selected for the following reasons

- A potential pilot project to examine high nitrates and sediment from tillage (Athy_020).
- Protected area objectives were not met (crayfish).
- Athy_010 declined between the 2010-2012 and 2013-2015 monitoring periods.
- Seen as a potential 'quick win'.

Table 1. Summary table of water bodies within the Athy Stream AFA. Pressures identified by the EPA initial characterisation process.

WB Name	WFD Risk	Status Obj.	Status				Pressure Category	Sig. Pressure
			2011	2014	2017	2018		
Athy Stream_010	At Risk	Good	M	P	M	M	Agriculture	Yes
							Forestry	No
Athy Stream_020	At Risk	Good	M	M	M	M	Agriculture	Yes
Athy Stream_030	Review	Good	U	U	U	U	Agriculture	No
							Anthropogenic pressures	No
Barrow_140	At Risk	Good	G	M	U	P	Agriculture	Yes
							Urban waste water	Yes
							Hydromorphology	Yes

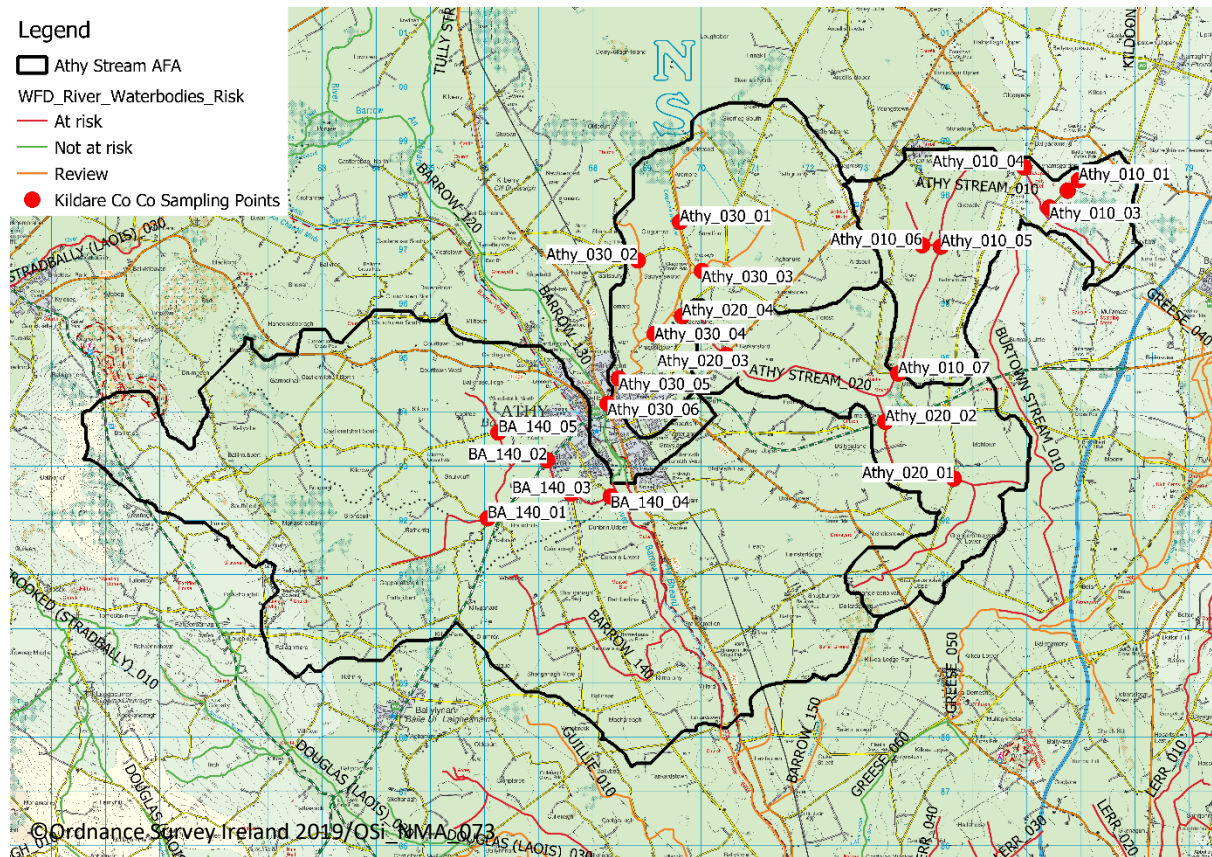


Figure 2. Sites sampled by Kildare County Council from August to December 2018.

2.1 Athy Stream_010

Athy Stream_010 is monitored at Bridge near Glenbaun and is currently in moderate ecological status. It is classified as *At Risk* of failing to meet its WFD objective of good status. It declined from moderate ecological status in 2011 to poor status in 2014, before returning to moderate status in 2017 and remaining at moderate status in 2018. There are no chemistry data available for this waterbody. The EPA biologists have noted significant sedimentation at the Bridge near Glenbaun monitoring station in 2014 and 2017 and as such sediment may be the significant issue in this waterbody.

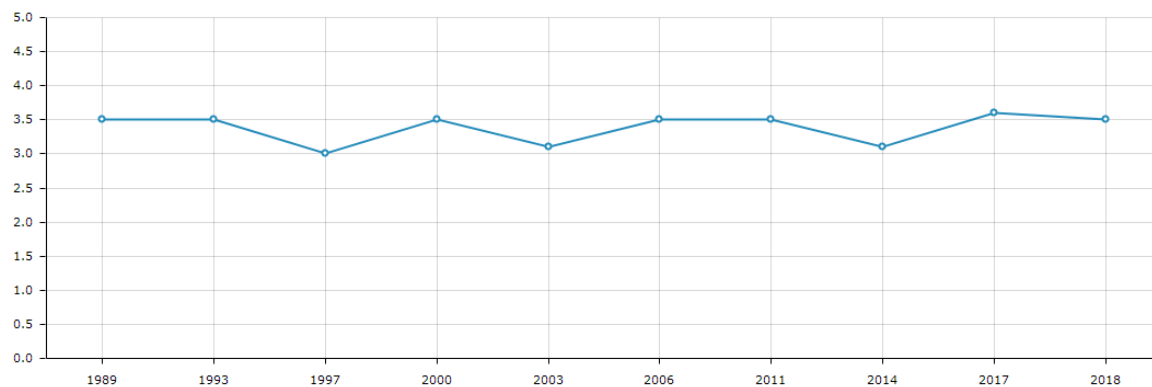
Data collected by Kildare County Council suggests that nitrate and ammonia are also issues at the monitoring point (AS010-07, Table 3). High concentrations of both were recorded at sites in the upper reaches of the catchment and remained high at the monitoring point. Although ortho-phosphate concentrations were above the Environmental Quality Standard (EQS) at sites in the upper section of Athy_010 (AS010-01 & AS010-02), ortho-phosphate concentrations reduce going down through the catchment and did not exceed the EQS at the monitoring point (ASA010-07), therefore while there are localised issues with high ortho-phosphate, it is not considered a significant issue in terms of the Water Framework Directive (WFD) objectives in the Athy Stream_010.

Table 2. Receptor information for the Athy Stream_010.

Factor	Comment/Description
Risk Category	<i>At Risk</i>
Biological Status	
Monitoring Station(s) with Q- Values	Br near Glenbaun
2016-2018 Q value data	Moderate
2009-2015 Status	Poor
Trends in Q value since 2009	Improved
Hydrochemistry Data	
Monitoring Station(s) with data	None
Existing	N/A
New	N/A
Trends in PO4, NH3 and NO3	
In App (until 2015)	N/A
All available data	N/A
Other water quality data	N/A
2013-2015 Baseline Concentration (mg/l)	N/A
Distance to threshold	N/A
Supporting Conditions	
Chemistry Conditions	N/A
Oxygenation Conditions	N/A
Acidification Conditions	N/A
Hydromorphology	
RHAT Score	N/A
Evidence of arterial drainage	None

Athy Stream Desk Study

Factor	Comment/Description
Ecological Status (2010-2015)	Moderate
Trends 2010-2015	Improved from poor to moderate
Protected Areas	None
WFD Objective	Good
EPA biologist notes (2017)	The Athy Stream remains in unsatisfactory condition at both stations sampled. While the ecological quality improved to Moderate at station 0200, the heavy siltation recorded in 2014 was again observed in 2017. Moderate ecological quality was again recorded at the lowermost station (0400) in 2017.
Significant issue/impact for receptor	Sediment, nitrate and ammonia



	1989	1993	1997	2000	2003	2006	2011	2014	2017	2018
Result	3.5	3.5	3	3.5	3.1	3.5	3.5	3.1	3.6	3.5
Classification	Moderate	Moderate	Poor	Moderate	Poor	Moderate	Moderate	Poor	Moderate	Moderate
Q-Value	3-4	3-4	3	3-4	3*	3-4	3-4	3*	3-4*	3-4

Figure 3. Q-values at Bridge near Glenbaun on Athy Stream_010.

Table 3. Kildare County Council physicochemical data for Athy Stream_010 between August and December 2018.

Site	Date	Ortho-P (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	DO (mg/l)	DO %	Temp (°C)	Conductivity (µS)
AS010-01	01/08/2018	0.13	0.04	0.53	7.35	73	14.7	828
AS010-02	01/08/2018	0.19	0.09	1.3	7.21	71.7	14.7	816
AS010-03	01/08/2018	0.03	0.08	6.7	9.54	92.8	13.7	701
AS010-04	01/08/2018	0.05	0.05	5.1	9.64	95.5	14.6	720
AS010-05	01/08/2018	0.09	0.1	2.8	4.49	43.7	14.7	706
AS010-06	01/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-07	01/08/2018	0.02	0.03	6.5	8.74	85.5	14.6	774
AS010-01	12/09/2018	0.14	0.07	<0.2	7.94	75.8	13.3	802
AS010-02	12/09/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-03	12/09/2018	0.01	0.03	7.1	10.37	96.9	12.3	714
AS010-04	12/09/2018	0.04	<0.02	5.5	10.47	98.5	12.5	718
AS010-05	12/09/2018	0.1	0.1	2.7	5.87	54.8	12.9	687
AS010-06	12/09/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-07	12/09/2018	0.02	0.04	5.6	8.31	77.8	12.7	766
AS010-01	25/10/2018	0.58	0.06	0.86	6.25	55.5	10	871
AS010-02	25/10/2018	2.2	0.16	2.2	6.15	54	9.8	886
AS010-03	25/10/2018	<0.01	0.16	6.5	10.5	93.5	10.2	745
AS010-04	25/10/2018	0.02	0.05	5.4	10.9	97	10.3	749
AS010-05	25/10/2018	0.02	0.08	3.1	6.91	61.3	10.5	725
AS010-06	25/10/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-07	25/10/2018	0.01	0.08	5.9	11.45	102.7	10.8	777
AS010-01	26/11/2018	0.04	<0.02	10	10.93	92.3	7.6	9.6
AS010-02	26/11/2018	0.04	<0.02	9.4	11.29	95.1	7.6	883
AS010-03	26/11/2018	<0.01	<0.02	4.4	11.4	95.9	7.5	751
AS010-04	26/11/2018	0.02	0.03	5.7	12.07	101.1	7.4	780
AS010-05	26/11/2018	0.01	<0.02	5.4	10.4	87.7	7.7	794
AS010-06	26/11/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-07	26/11/2018	0.01	0.02	7.4	10.61	91	8.4	816
AS010-01	14/12/2018	0.07	0.04	7.8	10.96	92.3	7.3	845
AS010-02	14/12/2018	0.04	0.04	7.2	11.46	96.1	7.2	827
AS010-03	14/12/2018	0.02	0.03	4.6	11.34	95.3	7.4	731
AS010-04	14/12/2018	0.02	0.03	5.4	11.99	100.2	7.2	753
AS010-05	14/12/2018	0.02	0.04	5.8	10.45	87.6	7.5	775
AS010-06	14/12/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS010-07	14/12/2018	0.02	0.04	8	10.62	89.4	7.6	798

2.2 Athy Stream_020

Athy Stream_020 is monitored at the 1st Bridge D/S of Barkersford Bridge. It is currently in moderate ecological status and has been since 2007. It is classified as *At Risk* of failing to meet its good status objective under the WFD. Nitrate has been identified as the significant issue for the waterbody with a 2013 – 2015 baseline concentration of 6.115 mg/l.

Data collected by Kildare County Council from August to December 2018 supports that nitrate is the significant issue at the monitoring point (AS020-04, Table 4) with nitrate concentrations far exceeding the indicative quality threshold at all sites monitored. Ammonia also exceeded the EQS in October at some sites but not in any other month suggesting a one-off event.

Table 4. Kildare County Council physicochemical data for Athy Stream_020 between August and December 2018.

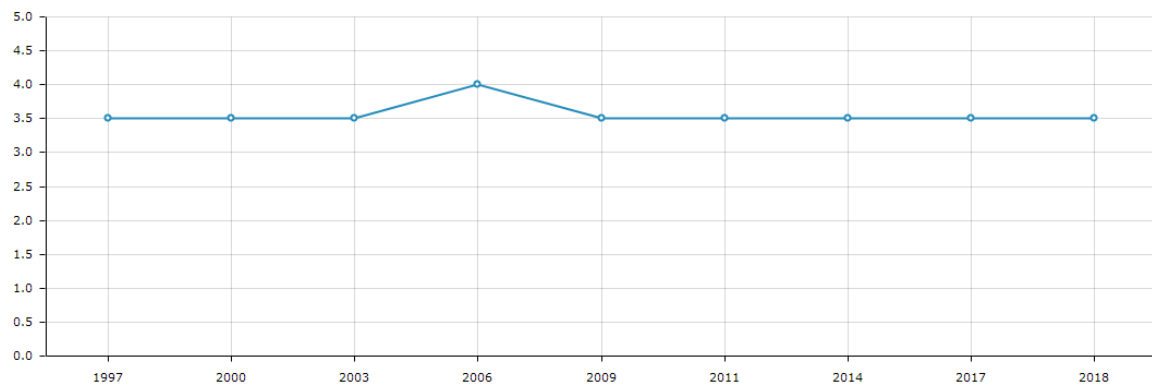
Site	Date	Ortho-P (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	DO (mg/l)	DO %	Temp (°C)	Conductivity (µS)
AS020-01	01/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS020-02	01/08/2018	0.02	0.06	11	7.97	77.3	13.9	77.3
AS020-03	01/08/2018	0.02	0.03	6.7	8.9	87.5	14.7	747
AS020-04	01/08/2018	0.03	0.04	2.8	8.57	84.6	14.7	765
AS020-01	12/09/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS020-02	12/09/2018	<0.01	<0.02	9.3	8.96	83.6	12.6	801
AS020-03	12/09/2018	0.01	<0.02	5.6	9.41	89.4	13.6	721
AS020-04	12/09/2018	<0.01	<0.02	5.5	8.88	83.1	12.7	693
AS020-01	25/10/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS020-02	25/10/2018	0.05	0.22	11	8.1	72.5	10.6	827
AS020-03	25/10/2018	<0.01	0.15	5.8	9.84	86.7	10.2	753
AS020-04	25/10/2018	<0.01	0.08	5.8	9.31	81.8	10.1	739
AS020-01	26/11/2018	<0.01	<0.02	12	10.55	90.3	8.4	843
AS020-02	26/11/2018	<0.01	0.03	16	9.92	85.2	8.5	903
AS020-03	26/11/2018	<0.01	0.02	9.4	11.07	93.2	7.8	819
AS020-04	26/11/2018	<0.01	0.02	9.5	11.64	96.5	7.1	822
AS020-01	14/12/2018	0.06	0.06	14	10.41	88.5	8	853
AS020-02	14/12/2018	0.03	0.04	15	10.01	85.4	8.1	871
AS020-03	14/12/2018	0.02	0.03	9.9	10.62	89.1	7.7	804
AS020-04	14/12/2018	0.02	0.04	9.6	10.93	91.5	7.5	800

Table 5. Receptor information for Athy Stream_020.

Factor	Comment/Description
Risk Category	<i>At Risk</i>
Biological Status	
Monitoring Station(s) with Q-values	1st Bridge d/s of Barkersford Bridge
2016-2018 Q-value data	Moderate
2009-2015 Status	Moderate
Trends in Q-value since 2009	No change
Hydrochemistry Data	
Monitoring Station(s) with data	1st Bridge d/s of Barkersford Bridge
Existing	Ammonia, ortho-phosphate, TON, BOD
New	
Trends in PO4, NH3 and NO3	
In App (until 2015)	NH3: none
	PO4: Downwards
	TON: Upwards
All available data	
Other water quality data	BOD: spike in May 2017 to 3mg/l
2013-2015 Baseline Concentration (mg/l)	NH3: 0.022 mg/l
	PO4: 0.014 mg/l
	TON: 6.115 mg/l
Distance to threshold	NH3: far
	PO4: far
	TON: far
Supporting Conditions	
Chemistry Conditions	Pass
Oxygenation Conditions	Pass
Acidification Conditions	Pass
Hydromorphology	
RHAT Score	N/A
Evidence of arterial drainage	None
Ecological Status (2017)	Moderate
Trends 2010-2017	No change
Protected Areas	None

Athy Stream Desk Study

WFD Objective	Good
EPA biologist notes (2017)	The Athy Stream remains in unsatisfactory condition at both stations sampled. Moderate ecological quality was again recorded at the lowermost station (0400) in 2017.
Significant issue/impact for receptor	Nitrate



	1997	2000	2003	2006	2009	2011	2014	2017	2018
Result	3.5	3.5	3.5	4	3.5	3.5	3.5	3.5	3.5
Classification	Moderate	Moderate	Moderate	Good	Moderate	Moderate	Moderate	Moderate	Moderate
Q-Value	3-4	3-4	3-4	4	3-4	3-4	3-4	3-4	3-4

Figure 4. Q-values at 1st Bridge downstream of Barkersford Bridge on Athy_020.

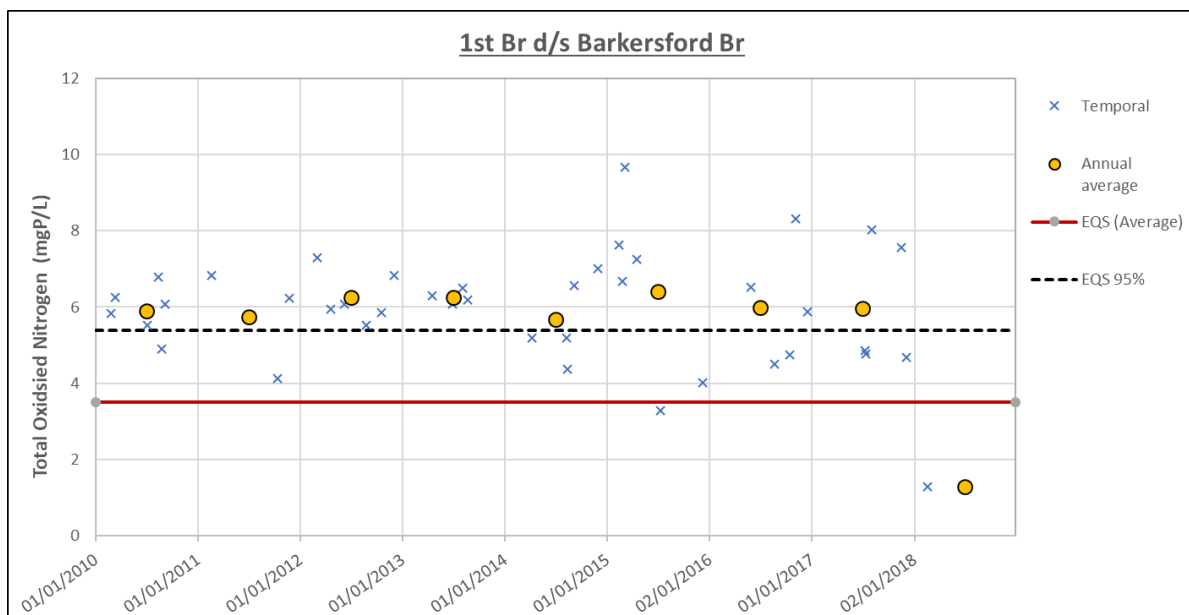


Figure 5. TON concentrations at 1st Bridge downstream of Barkersford Bridge on Athy Stream_020.

2.3 Athy Stream_030

The status of Athy Stream_030 is under review and no data in relation to its status are available.

Data collected by Kildare County Council (Table 6) indicate that both nitrate and ammonia are potentially significant issues in this waterbody. If ecological sampling indicates that the stream is significantly impacted, then sources of nitrate and ammonia should be investigated. The upper reaches of the waterbody are the most likely to contain sources of both as the concentrations are very high in these areas (Table 6). (This water body is not part of the AFA and is not part of LAWPRO's work programme, however it has been included in the desk study to improve the understanding of the Athy catchment).

Table 6. Kildare County Council physicochemical data for Athy Stream_030 between August and December 2018.

Site	Date	Ortho-P (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	DO (mg/l)	DO %	Temp (°C)	Conductivity (µS)
AS030-01	01/08/2018	0.03	0.86	2.3	5.79	56.1	14.5	435
AS030-02	01/08/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS030-03	01/08/2018	0.02	0.05	6.1	8.08	78.3	14	729
AS030-04	01/08/2018	0.02	0.06	5.1	8.61	84.4	14.4	679
AS030-05	01/08/2018	0.04	0.08	4.3	8.16	80.2	14.5	665
AS030-06	01/08/2018	0.02	0.03	4.4	8.26	81.1	14.5	669
AS030-01	12/09/2018	0.03	<0.02	2	6.89	64.1	12.6	406
AS030-02	12/09/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS030-03	12/09/2018	<0.01	<0.02	3.9	9.5	88.3	12.5	721
AS030-04	12/09/2018	<0.01	<0.02	4.4	8.57	80.8	13.1	657
AS030-05	12/09/2018	0.01	0.02	3.9	7.82	72.5	12.7	664
AS030-06	12/09/2018	0.01	<0.02	3.6	8.07	75.3	12.8	668
AS030-01	25/10/2018	0.01	0.18	2.4	4.53	39.4	9.9	527
AS030-02	25/10/2018	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AS030-03	25/10/2018	<0.01	0.15	6.1	10.27	90.3	10.1	790
AS030-04	25/10/2018	<0.01	0.07	4.5	9.4	83.2	10.4	706
AS030-05	25/10/2018	0.01	0.09	4.3	9.24	80.4	10.1	706
AS030-06	25/10/2018	0.01	0.06	4.2	9.4	83	10.2	709
AS030-01	26/11/2018	<0.01	0.28	5.1	7.47	59.6	5.8	565
AS030-02	26/11/2018	0.03	0.03	26	9.21	75.5	6.5	1076
AS030-03	26/11/2018	<0.01	0.02	13	11.42	95.5	7.3	907
AS030-04	26/11/2018	0.01	0.06	8.4	10.45	85.8	6.8	747
AS030-05	26/11/2018	0.01	0.04	9.1	10.58	86.9	6.7	756
AS030-06	26/11/2018	0.01	0.04	9.1	10.7	88	6.8	755
AS030-01	14/12/2018	0.01	0.27	5.5	7.89	64.4	6.4	585
AS030-02	14/12/2018	0.03	0.04	14	9.19	76.7	7.4	865
AS030-03	14/12/2018	<0.01	0.04	12	10.5	88.7	7.9	851
AS030-04	14/12/2018	0.02	0.07	8.9	10.35	86.2	7.3	754
AS030-05	14/12/2018	0.02	0.08	9.6	10.41	86.4	7.2	757
AS030-06	14/12/2018	0.04	0.06	9.8	10.54	87.6	7.3	756

Table 7. Receptor information for Athy Stream_030.

Factor	Comment/Description
Risk Category	<i>Review</i>
Biological Status	
Monitoring Station(s) with Q-values	None
2016-2018 Q-value data	N/A
2009-2015 Status	N/A
Trends in Q-value since 2009	N/A
Hydrochemistry Data	
Monitoring Station(s) with data	None
Existing	N/A
New	N/A
Trends in PO4, NH3 and NO3	
In App (until 2015)	N/A
	N/A
	N/A
All available data	N/A
Other water quality data	N/A
2013-2015 Baseline Concentration (mg/l)	N/A
Distance to threshold	N/A
Supporting Conditions	
Chemistry Conditions	N/A
Oxygenation Conditions	N/A
Acidification Conditions	N/A
Hydromorphology	
RHAT Score	N/A
Evidence of arterial drainage	None
Ecological Status (2017)	
Trends 2010-2017	N/A
Protected Areas	River Barrow and Nore SAC (inputting waterbody)

WFD Objective	Good
EPA biologist notes (if any)	
Significant issue/impact for receptor	Nitrate and ammonia

2.4 Barrow_140

The Barrow_140 is monitored at Tankardstown Bridge and is currently at poor ecological status as monitored in 2018. This represents a further decline from the moderate status recorded in 2014. It is classified as *At Risk* of failing to meet its good status objective under the WFD. Nitrate and phosphate have been identified as the significant issues for the waterbody although both are close to their respective quality thresholds.

Bert Bridge on the Barrow_120 is the closest upstream monitoring point with a Q-value and in 2017 was found to be at good status. The 2013-2015 baseline nutrient concentrations at Bert Bridge (Fig. 1) were:

- Ammonia: 0.045 mg/l
- Ortho-phosphate: 0.026 mg/l
- TON: 2.689 mg/l

Although no biological data are available, chemistry data are also available from the Athy Bridge monitoring point on the Barrow_130. This monitoring point is downstream of the confluence with the Athy Stream_030 and as such may be influenced by it. The 2013-2015 baseline nutrient concentrations at Athy Bridge were:

- Ammonia: 0.040 mg/l
- Ortho-phosphate: 0.052 mg/l
- TON: 2.931 mg/l

Although the 2013-2015 baseline ortho-phosphate concentration was above the EQS of 0.035 mg/l this was mainly due to a very high annual mean in 2013 of 0.108 mg/l while mean concentration in 2014 and 2015 were below the EQS. Therefore, there are likely to be additional sources of both phosphate and nitrate originating in the Barrow_140 catchment.

Data collected by Kildare County Council suggests that nitrate is a significant issue on the uppermost tributary of the Barrow_140 (Table 8) but it is unclear if this is having a significant impact on the monitoring point due to the distance from it and the relative load contribution of this tributary.

The significant issues identified for the Barrow_140 are nitrate and phosphate. Nitrate concentrations increased in 2018 (Fig. 7) while phosphate concentrations decreased (Fig. 8). Therefore, nitrate may be the main significant issue in the waterbody posing the greatest threat to the waterbody failing to meet its 2021 objectives.

Table 8. Kildare County Council physicochemical data for Barrow_140 between August and December 2018.

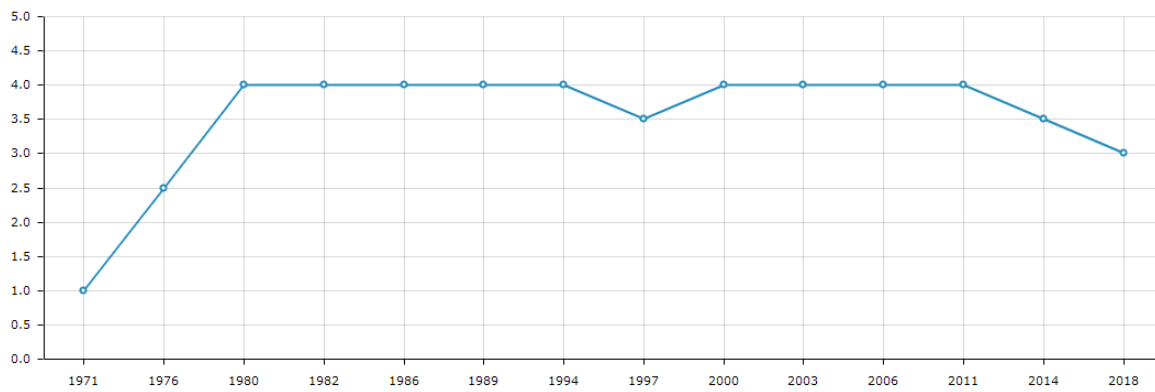
Site	Date	Ortho-P (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	DO (mg/l)	DO %	Temp (°C)	Conductivity (µS)
Barrow140-1	03/07/2018	<0.01	0.02	6.8	8.47	91.8	19.2	723
Barrow140-2	03/07/2018	<0.01	0.03	6.3	9.71	103.9	18.6	704
Barrow140-3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barrow140-4	03/07/2018	<0.01	<0.02	5.8	10.14	109.5	19	664
Barrow140-1	31/07/2018	0.01	0.02	5.7	8.38	82.6	14.7	728
Barrow140-2	31/07/2018	0.02	0.04	5.2	10.04	98.9	14.6	708
Barrow140-3	31/07/2018	0.02	0.05	4.8	9.47	93	14.6	708
Barrow140-4	31/07/2018	0.02	0.02	4.8	9.7	95.3	14.5	701
Barrow140-1	12/09/2018	<0.01	<0.02	5.6	8.53	78.7	11.9	723
Barrow140-2	12/09/2018	<0.01	<0.02	5	10.47	96.8	12.1	681
Barrow140-3	12/09/2018	<0.01	<0.02	4.7	9.6	88.3	12.1	672
Barrow140-4	12/09/2018	<0.01	<0.02	4.4	10.33	95.1	12.2	644
Barrow140-1	25/10/2018	<0.01	0.07	5.3	9.64	85.4	10.3	756
Barrow140-2	25/10/2018	<0.01	0.07	4.9	10.37	90.8	10.2	734
Barrow140-3	25/10/2018	<0.01	0.05	4.7	9.86	86.5	10	733
Barrow140-4	25/10/2018	<0.01	0.07	4.7	10.55	94.3	10.7	719
Barrow140-1	26/11/2018	<0.01	0.02	7.6	11.07	91.7	7	885
Barrow140-2	26/11/2018	<0.01	0.03	7.7	11.89	97.6	6.7	878
Barrow140-3	26/11/2018	0.07	<0.02	7.4	11.96	98	6.8	877
Barrow140-4	26/11/2018	<0.01	0.02	7.7	11.96	98.9	7.1	867
Barrow140-1	14/12/2018	0.01	0.04	8.2	10.53	88.3	7.6	800
Barrow140-2	14/12/2018	0.01	0.04	8.2	11.19	93.2	7.4	798
Barrow140-3	14/12/2018	0.02	0.04	8.3	11.31	94	7.2	798
Barrow140-4	14/12/2018	0.01	0.05	8.2	11.44	94.6	7	784

Table 9. Receptor information for Barrow_140.

Factor	Comment/Description
Risk Category	<i>At Risk</i>
Biological Status	
Monitoring Station(s) with Q-values	Tankardstown Bridge
2016-2018 Q-value data	Poor
2009-2015 Q-value data	Moderate
Trends in Q-value since 2009	Decline
Hydrochemistry Data	
Monitoring Station(s) with data	Tankardstown Br
Existing	Ammonia, ortho-phosphate, TON, BOD
New	
Trends in PO4, NH3 and NO3	
In App (until 2015)	NH3: Downwards
	PO4: Upwards
	TON: Downwards
All available data	
Other water quality data	BOD: Spikes in Feb 2016 (5.1 mg/l) and June 2017 (3 mg/l)
2013-2015 Baseline Concentration (mg/l)	NH3: 0.035 mg/l
	PO4: 0.033 mg/l
	TON: 3.066 mg/l
Distance to threshold	NH3: Near
	PO4: Near
	TON: Far
Supporting Conditions	
Chemistry Conditions	Pass
Oxygenation Conditions	Pass (Dissolved oxygen (% sat) failed but other determinant for oxygenation conditions was high)
Acidification Conditions	Pass
Hydromorphology	
RHAT Score	N/A
Evidence of arterial drainage	None
Ecological Status (2017)	

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Trends 2010-2017	Decline
Protected Areas	River Barrow and Nore SAC, Barrow River Nutrient Sensitive Area
WFD Objective	Good
EPA biologist notes (if any)	
Significant issue/impact for receptor	Nitrate and phosphate



	1971	1976	1980	1982	1986	1989	1994	1997	2000	2003	2006	2011	2014	2018
Result	1	2.5	4	4	4	4	4	3.5	4	4	4	4	3.5	3
Classification	Bad	Poor	Good	Good	Good	Good	Good	Moderate	Good	Good	Good	Good	Moderate	Poor
Q-Value	1	2-3	4	4	4	4	4	3-4	4	4	4	4	3-4	3

Figure 6. Q-values at Tankardstown Bridge on Barrow_140.

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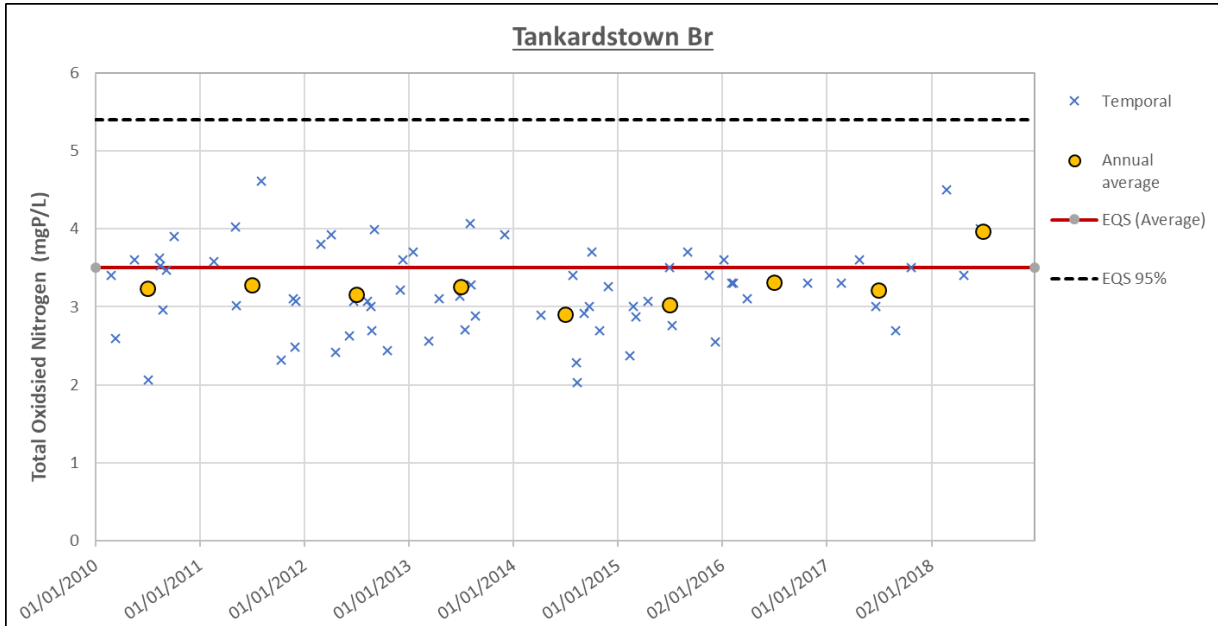


Figure 7. Mean annual TON concentrations at Tankardstown Bridge on Barrow_140.

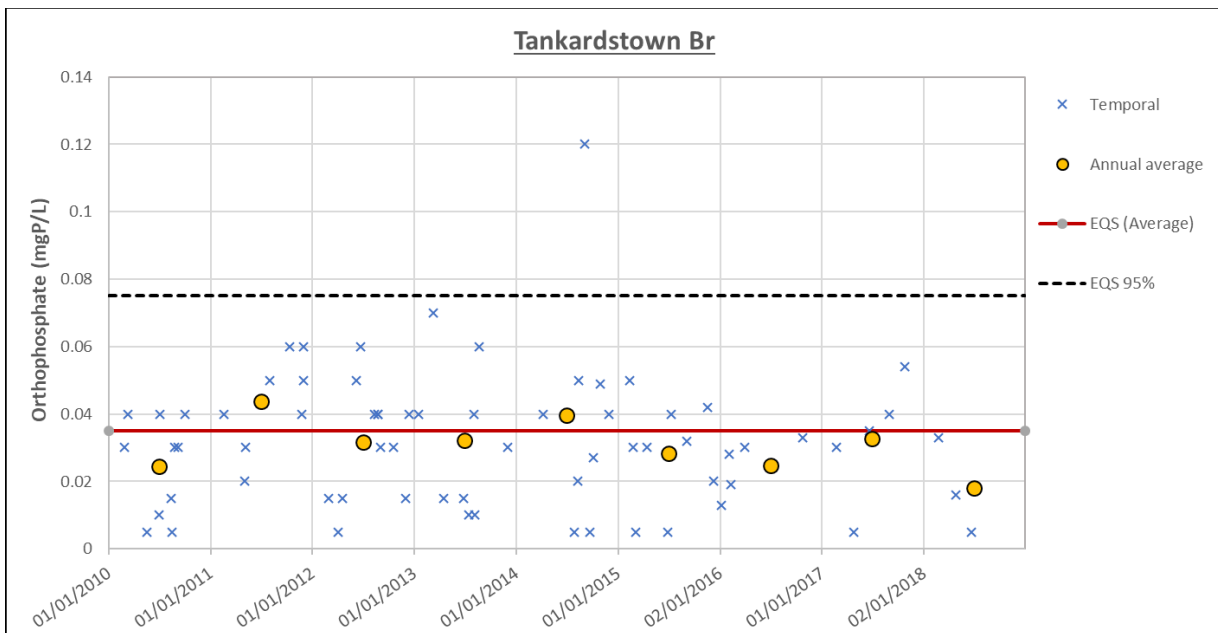


Figure 8. Mean annual ortho-phosphate concentrations at Tankardstown Bridge on Barrow_140.

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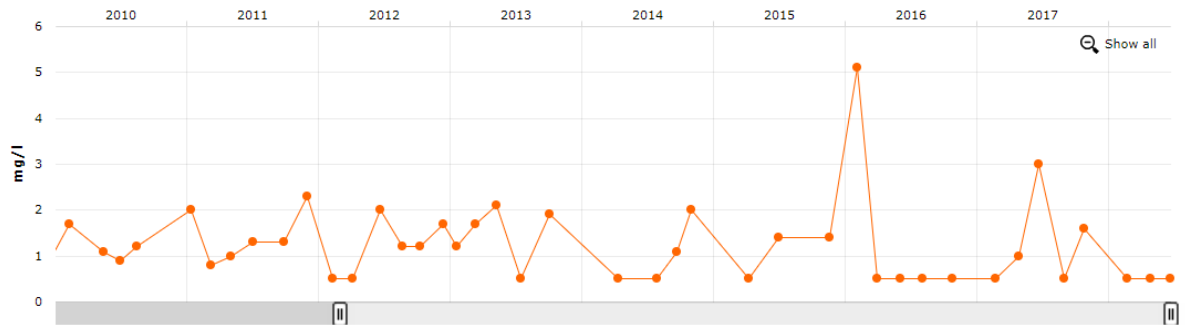


Figure 9. Mean BOD concentrations at Tankardstown Br on Barrow_140.

3 Significant Pressures

Table 10. Significant Pressures identified for the Athy Stream PAA by the Initial Characterisation process carried out by the EPA.

Waterbody	Pressure Category	Sub-category	Significant Pressure
Athy Stream_010	Agriculture	Arable	Altered habitat due to morphological changes
Athy Stream_020	Agriculture	Arable	Altered habitat due to morphological changes
Athy Stream_030	Agriculture	Arable	Altered habitat due to morphological changes
Barrow_140	Agriculture	Arable	Nutrient pollution
	Urban Waste Water	Athy (PE >10,000)	Nutrient pollution
	Hydromorphology	Channelisation	Altered habitat due to morphological and hydrological changes

3.1 Athy Stream_010

- The significant issue in the Athy Stream_010 is sediment. The EPA biologists have noted heavy sedimentation at the monitoring point in 2014 and 2017.
- The significant pressure in Athy Stream_010 is agriculture.
- There is a large proportion of arable farming in this catchment which is a potential source of sediment.
- The data collected by Kildare County Council indicate that nitrate and ammonia are also potentially significant issues at the monitoring point.

3.2 Athy Stream_020

- Nitrate is the significant issue in the Athy Stream_020. This is supported by the data collected by Kildare County Council which found concentrations which increased from 2.6mg/l in August 2018 to 9.6 mg/l in December 2018 at the monitoring point.
- The significant pressure in Athy Stream_020 is agriculture.
- From the surface water nitrate PIP map it can be seen that the upper reaches of the waterbody have the most potential for nitrate loss (Fig. 10).

3.3 Athy Stream_030

- The Athy Stream_030 is a Review waterbody and as such no EPA monitoring data are available and no status has been assigned. Therefore, it is not known whether the waterbody is significantly impacted or not.
- If initial Local Catchment Assessments indicate that the waterbody is significantly impacted then the likely significant issues are nitrate and ammonia.
- If the Athy Stream_030 is significantly impacted then the likely significant pressures are agriculture and peat extraction.

3.4 Barrow_140

- Nitrate and possibly phosphate are the significant issues in the Barrow_140.
- There are three potential significant pressures in the Barrow_140: agriculture, urban waste water and hydromorphology. However, recent upgrades to ferric dosing in the Athy UWWTP may have improved the treatment sufficiently that it is no longer a significant pressure on the waterbody.
- Phosphate, although below the EQS is likely a significant issue in this waterbody with a 2013-2015 baseline concentration of 0.033mg/l. Due to the difficulty of implementing measures for nitrate, further lowering phosphate concentrations may lead to improvements in water quality at the monitoring point.
- Nitrate PIP maps suggest that a large area of the catchment has the potential to contribute nitrate particularly on the left bank of the waterbody (Fig. 10).



Figure 10. Surface water nitrate PIP map.

4 Pathway Information and Analysis

4.1 Overview of Pathways in the PAA

- Two main compartments and two subcompartments have been identified for the Athy Stream PAA.
- Compartment 1 consists of a regionally productive bedrock aquifer with a high transmissivity. There are two subcompartments; one of peat and one of sand and gravel aquifer.
- Compartment 2 consists of a poorly productive aquifer with low transmissivity bedrock. There are three subcompartments; one of peat, one of sand and gravel aquifer and one of poorly draining soils.
- The areas of sand and gravel aquifer pose the greatest risk of nitrate loss while the poorly draining soils pose the greatest risk of phosphate loss.

4.2 Athy Stream_010

- Significant issue: Sediment
- Significant pressure: Agriculture
- Relevant pathways: Poorly draining soils
- High risk areas for loss of sediment are the areas of PIP rank 1 adjacent to the waterbody (Fig. 11).

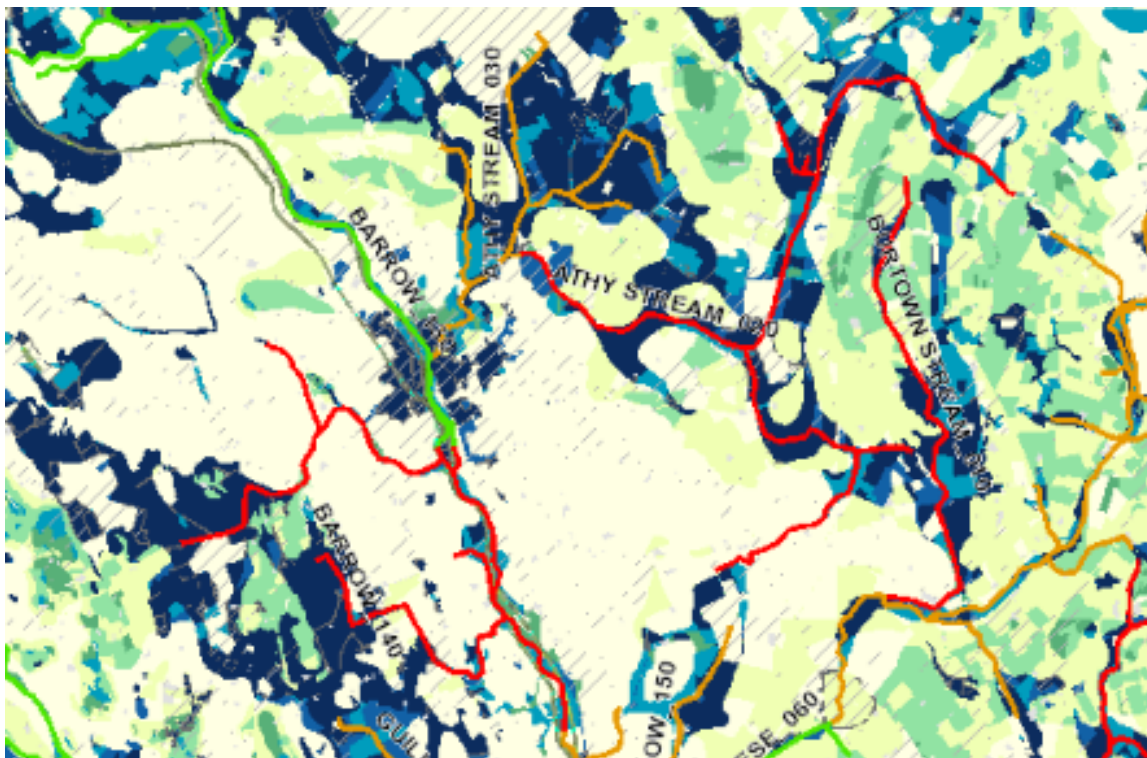


Figure 11. Surface water phosphate PIP map.

4.3 Athy Stream_020

- Significant issue: Nitrate
- Significant pressure: Agriculture
- Relevant pathways: Areas of sand and gravel aquifer and well-drained areas in the upper catchment
- The main areas to focus on include areas of high PIP rank for surface water nitrate loss in the upper catchment (Fig. 10).

4.4 Athy Stream_030

- Significant issue: Nitrate and ammonia
- Significant pressure: Agriculture and peat extraction
- Relevant pathways: Areas of high PIP for nitrate (Fig. 10). Bord na Mona bog in upper reaches of waterbody for ammonia loss (see areas of peat in Fig. 15).

4.5 Barrow_140

- Significant issue: Nitrate and phosphate
- Significant pressure: Agriculture, UWWTP and hydromorphology
- Relevant pathways: Areas of sand and gravel aquifer in the upper catchment (Fig. 14). Areas of high PIP rank for phosphate (Fig. 11)
- Potential sources include direct discharges from the UWWTP at Athy (Fig. 12) and areas of high PIP for surface water phosphate loss on the two tributaries (Fig. 11).

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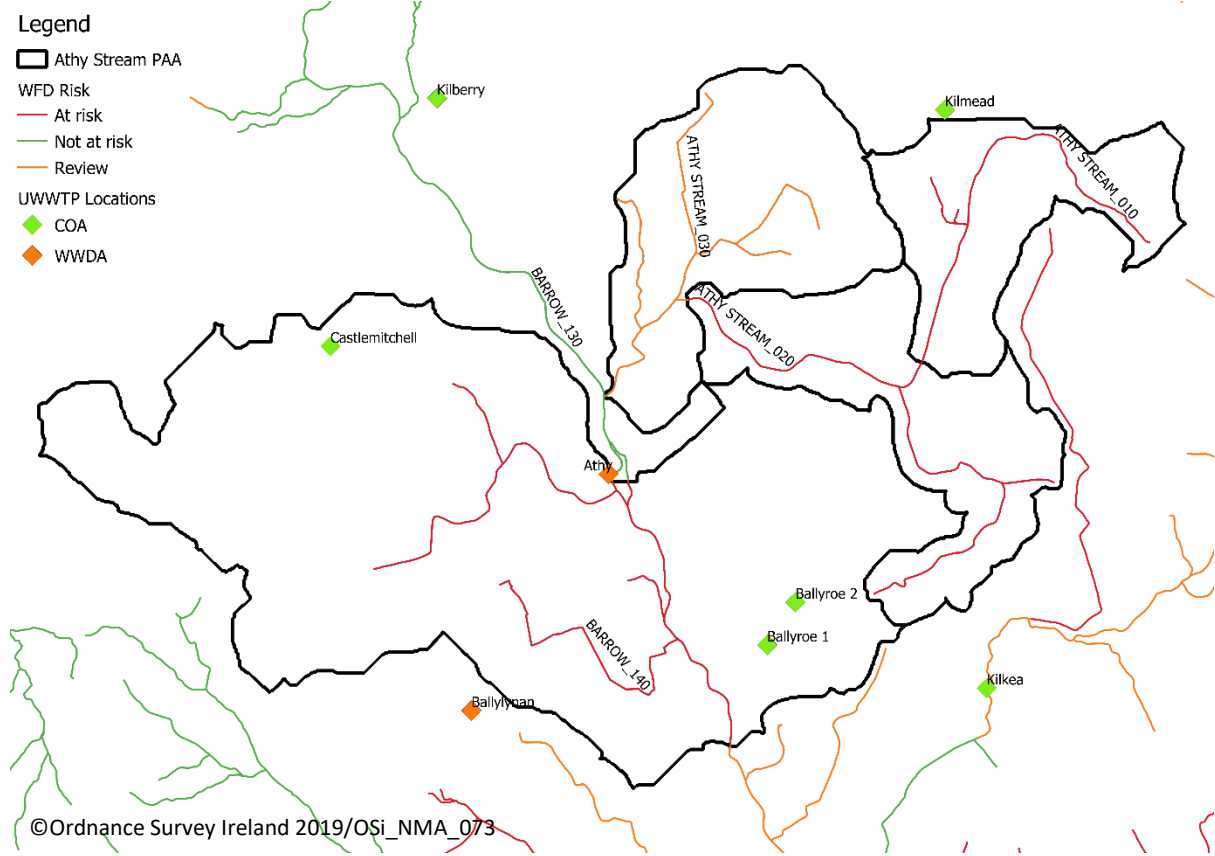


Figure 12. Locations of UWWTPs in Athy Stream AFA.

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Legend

- Aquifer type
- Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
 - Poor Aquifer - Bedrock which is Generally Unproductive
 - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
 - Regionally Important Aquifer - Karstified (diffuse)

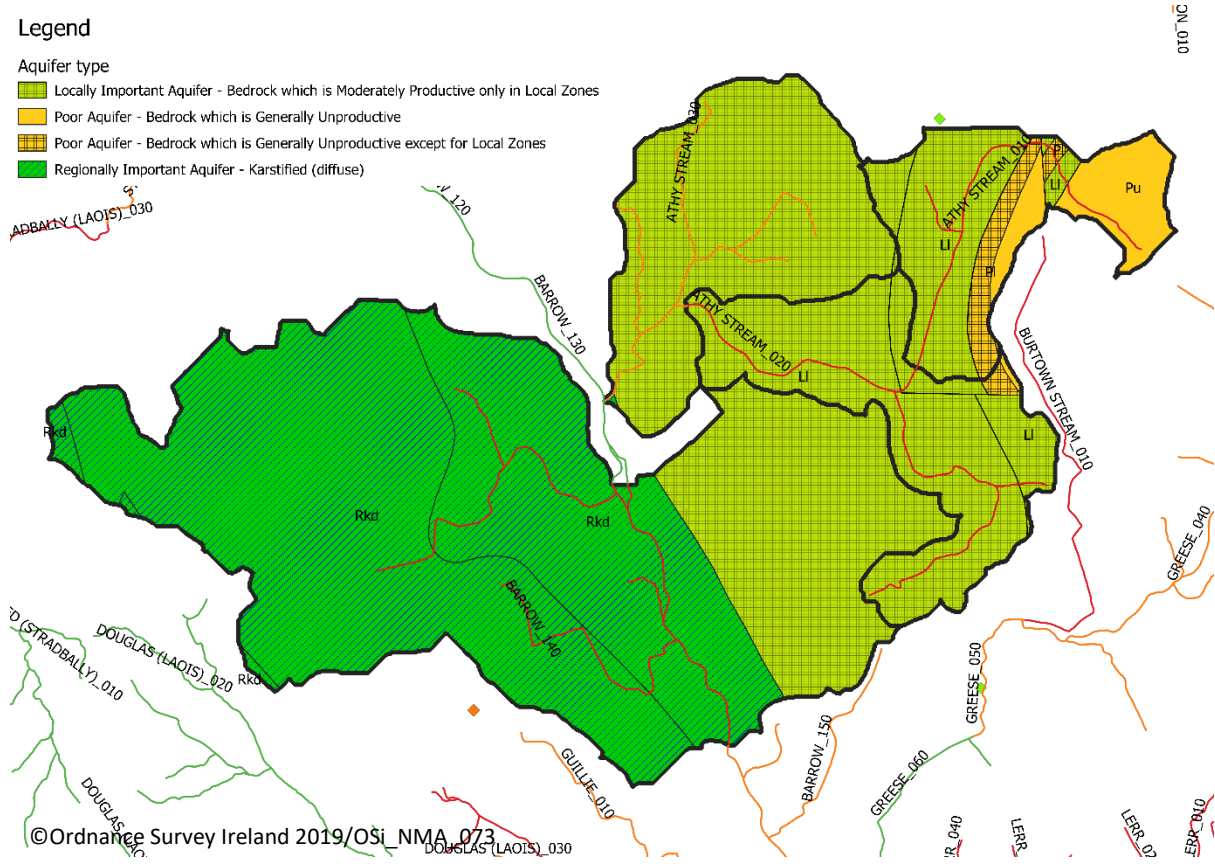


Figure 13. Aquifer types in the Athy Stream AFA.

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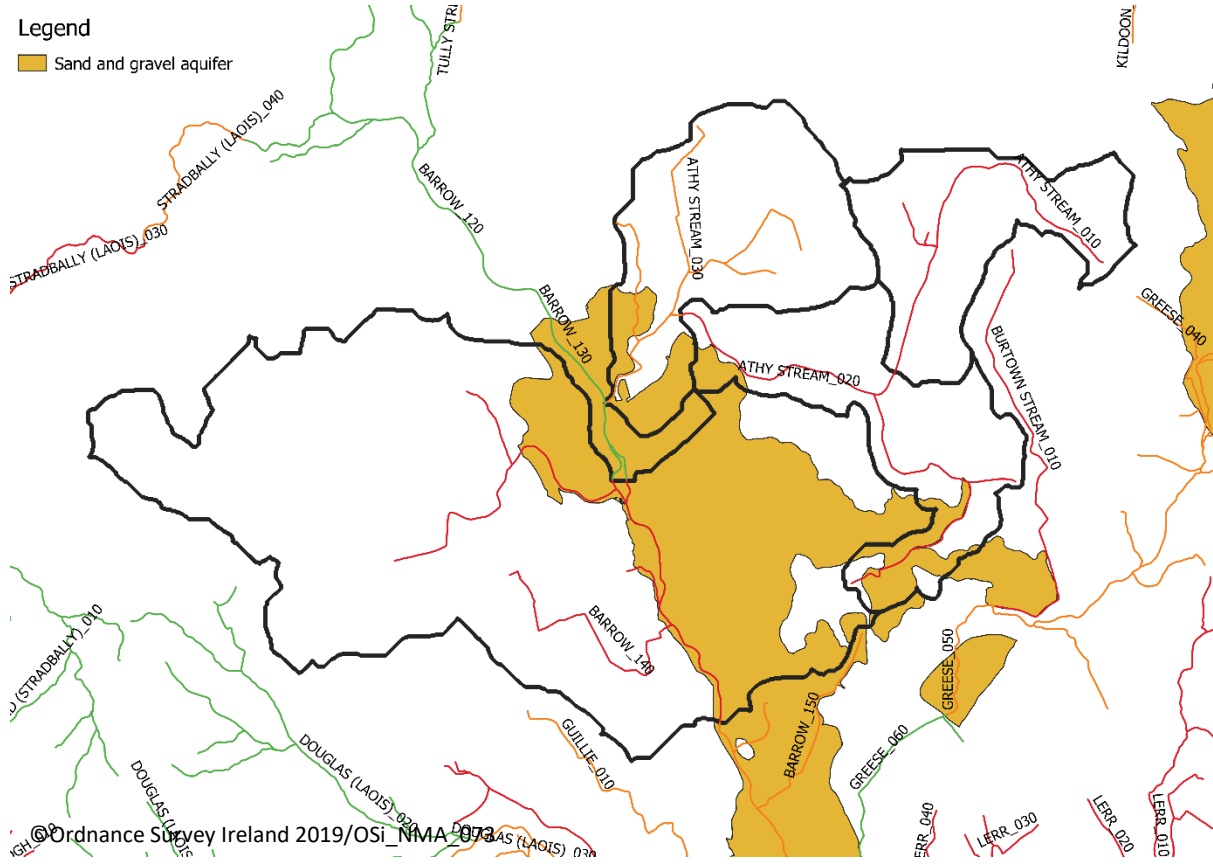


Figure 14. Sand and gravel aquifer in the Athy Stream AFA.

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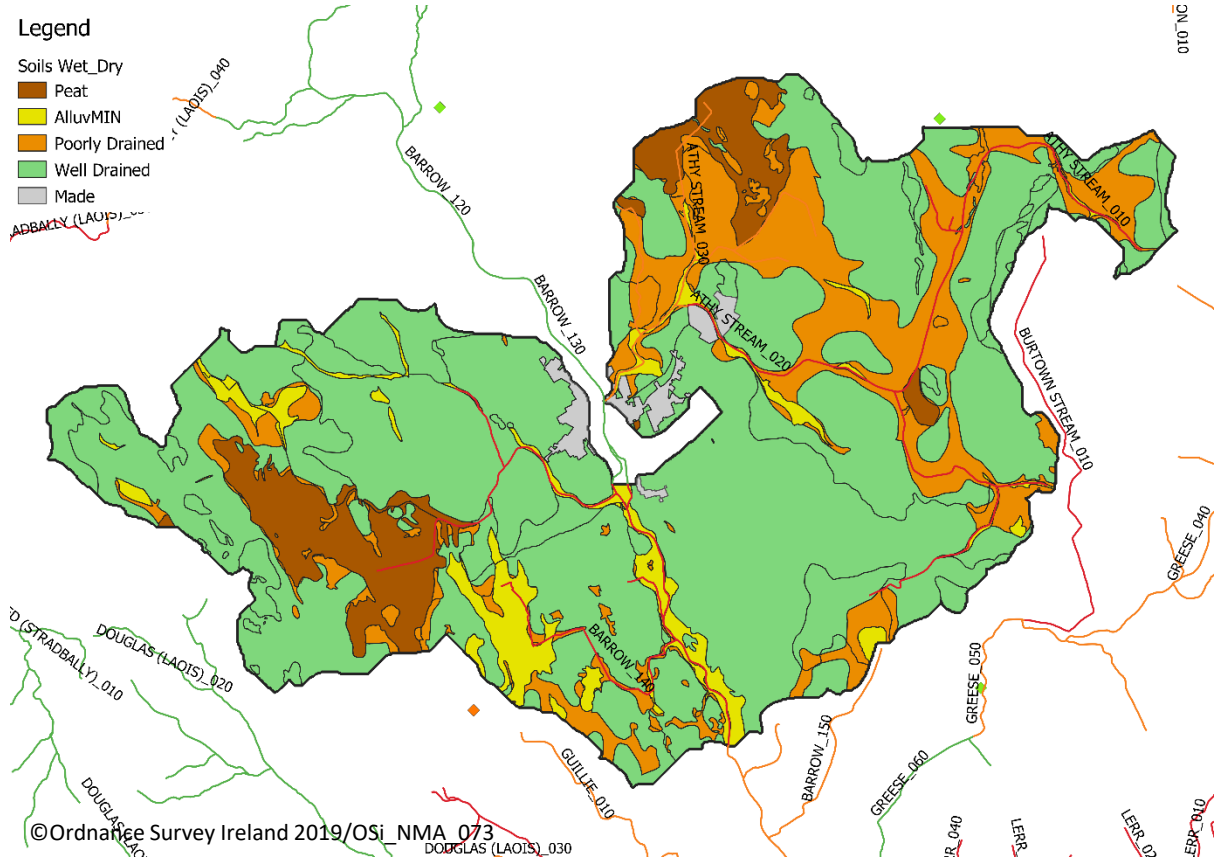


Figure 15. Soils wet & dry in the Athy Stream AFA.

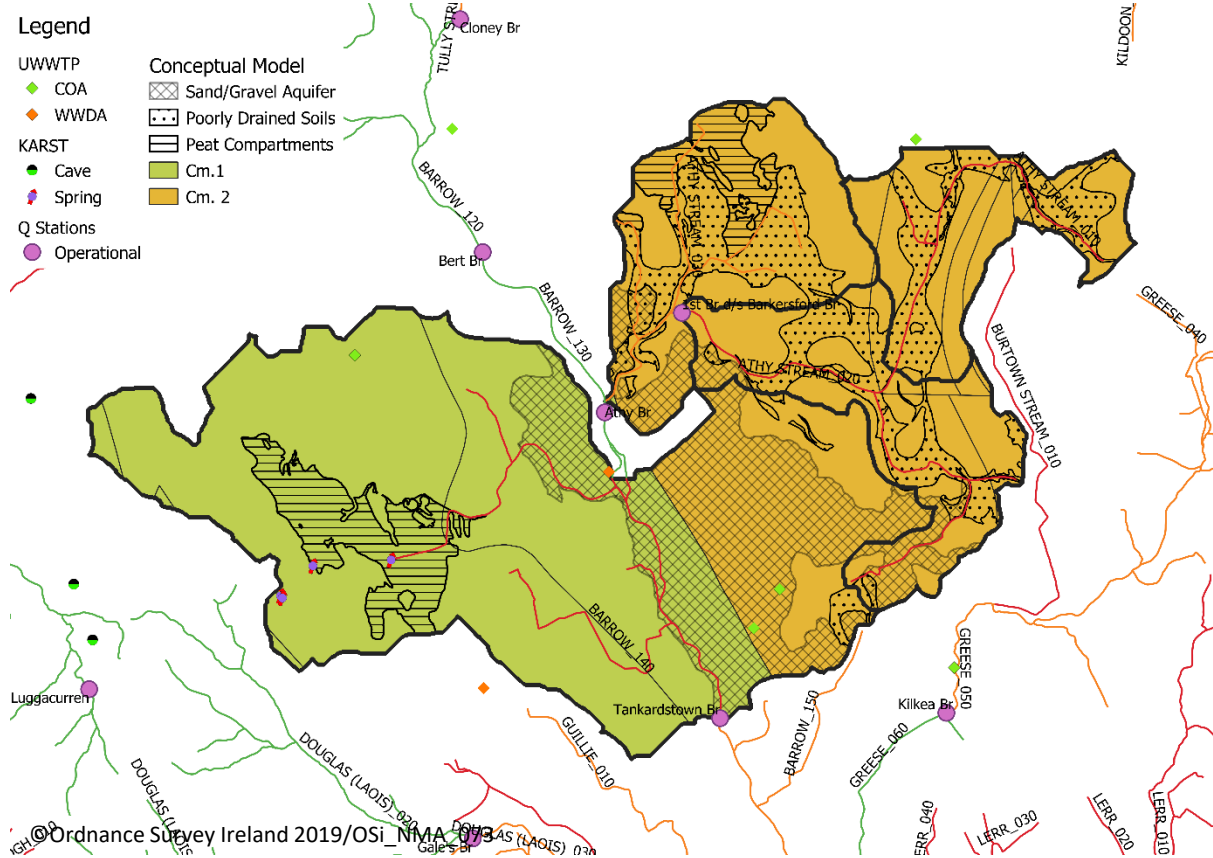


Figure 16. Conceptual model compartments for Athy Stream AFA.

4.6 Pathways Conceptual Model

- For Athy Stream_010 the main pathway for sediment loss is in the poorly draining areas immediately adjacent to the waterbody.
- Nitrate pollution in the Athy Stream_020 is likely from diffuse sources in the upper reaches of the catchment where there are areas of high nitrate PIP on the area of sand and gravel aquifer.
- If there are any significant issues on Athy Stream_030 they are likely nitrate and ammonia. Nitrate is likely coming from Athy Stream_020 and from the upper reaches of the Athy Stream_030. Ammonia is likely coming from the area of peat in the upper catchment.
- Phosphate pollution in the Barrow_140 is likely to be coming either from the UWWTP at Athy or from the areas of high phosphate PIP in the upper reaches of the two tributaries.
- Nitrate on the Barrow_140 is likely coming from areas of high nitrate PIP, particularly on the sand and gravel aquifer and on the uppermost tributary.

Table 11. Main pathways identified in each compartment.

	Compartment 1		Compartment 2		
Direct ¹	Athy UWWTP				
Aquifer	Rkd		Ll, Pu		
Rock Units	Dinantian pure bedded limestones		Dinantian lower impure limestones, Dinantian (early) sandstones, shales and limestones, Silurian metasediments and volcanics, Devonian old red sandstones		
	Sub-Compartment 1A	Sub-Compartment 1B	Sub-Compartment 2A	Sub-Compartment 2B	Sub-Compartment 2C
Soil type	Peat	Well drained	Peat	Well drained	Poorly drained
Subsoil		Sand and gravel aquifer		Sand and gravel aquifer	
Groundwater Vulnerability	Low	High	Low	High	Low
PO ₄ PIP	Rank 1-2	Rank 6-7	Rank 1-2	Rank 6-7	Rank 1-3
NO ₄ PIP	Rank 6-7	Rank 1-2	Rank 6-7	Rank 1-2	Rank 6-7
Main Flow Paths	Overland	Via the sand and gravel aquifer or via the bedrock aquifer	Overland	Via the sand and gravel aquifer	Overland

¹ Point discharges to the water body

5 Interim Story of the Athy Stream PAA

5.1 Athy Stream_010

- Athy Stream_010 is currently at moderate status with a 2018 Q-value of 3-4 at the Bridge near Glenbaun monitoring station. It improved from poor status in 2014 to moderate status in 2017 and has remained at moderate in 2018. The EPA biologist noted heavy sedimentation at the time of the ecological survey in both 2014 and 2017 and sediment is considered to be the significant issue for this waterbody.
- The predominant pathway for sediment is via overland flow and as such losses are likely to be greatest on the poorly draining soils which are adjacent to much of the waterbody (Fig. 14). Particular attention should be given to areas of high phosphate PIP (Fig. 11).
- The other potential issue is nitrate as sampling data from Kildare County Council shows that there are high nitrate concentrations at the monitoring point (AS010-07, Table 3). There are only a few small areas of high nitrate PIP in the catchment which should be focussed on. Additionally, the upper reaches of the catchment should be investigated for potential point sources of nitrate.

5.2 Athy Stream_020

- Athy Steam_020 is currently at moderate status with a 2018 Q-value of 3-4 at 1st Bridge downstream of Barkersford Bridge. It has been moderate status since 2009.
- The significant issue in the waterbody is nitrate. Nitrate concentrations at the 1st Bridge downstream of Barkersford Bridge on Athy Stream_020 have consistently been between 5 and 7 mg/l N since 2008. These concentrations are likely to impact on ecological status. Additionally, data collected by Kildare County Council showed that concentrations at the monitoring point increased from 2.8 mg/l in August 2018 to 9.6 mg/l in December 2018.
- The most important pathways for nitrate in this catchment will be on the areas of sand and gravel aquifer and on areas of well drained soils where transfers to surface water will take place predominantly via the upper fractured zone and via the sand and gravel aquifer itself as the waterbody is underlain by a poorly productive aquifer. Nitrate concentrations were consistently highest in the upper reaches of the waterbody in Kildare County Council sampling (Table 4) and as such these are the areas which should be focussed on for initial stream walks.

5.3 Athy Stream_030

- The status of Athy Stream_030 is currently unknown as it has not been monitored since 1993.
- Therefore, it is unknown whether there are any significant issues in this waterbody.
- However, data from Kildare County Council suggest that nitrate and ammonia are the likely significant issues.
- There is an area of peat which is being extracted by Bord na Mona which is a likely source of ammonia and should be investigated if the waterbody is found to be significantly impacted.

- High nitrate concentrations appear to be as a result of high concentrations on the two uppermost branches of the Athy Stream_030 as well as inputs coming from the Athy Stream_020.

5.4 Barrow_140

- Barrow_140 is currently at poor status with a Q-value of 3 in 2018 at Tankardstown Bridge having declined from moderate status in 2014.
- The significant issue is nitrate and possibly phosphate. Phosphate concentrations are close to the EQS with a 2014 baseline concentration of 0.033 mg/l and an upward trend.
- The main areas with pathways for phosphate loss are in the upper reaches of the two tributaries where there are areas of high phosphate PIP (Fig. 11). The UWWTP at Athy town is another potential source but the Annual Environmental Report for the plant shows that phosphate concentrations are higher upstream than downstream and so it is unlikely to be a significant pressure but should still be investigated.
- Nitrate concentrations have been in the 3-4 mg/l range at the monitoring point since 2007. Although these concentrations have the potential to impact on ecology, they are not particularly high and mitigating nitrate inputs from diffuse sources will be difficult due to the predominantly well drained soils and productive aquifer underlying much of the catchment. Therefore, focussing on phosphate inputs may be more likely to result in improvements in water quality at the monitoring point.
- The area of peat in the catchment does not appear to be a significant pressure as ammonia has not been identified as a significant issue.
- There are three Certificates of Authorisation (COA) in the catchment. Ballyroe 1 and Ballyroe 2 COAs are both located on the sand and gravel aquifer and Castlemitchell COA is located on well drained soils over a productive aquifer. As such all three have potential to be contributing nitrates via sub-surface pathways and should be investigated.
- Data from Kildare County Council shows that nitrate concentrations are quite high on the uppermost tributary of the Barrow_140. This tributary should be investigated although it is unclear whether this might have a significant impact on the monitoring point considering its distance from the monitoring point and the relative load contribution this tributary is likely to be providing to the large Barrow_140.

5.5 Overview

- There are a range of issues throughout the Athy Stream AFA with sediment, nitrate, ammonia and phosphate all being considered significant.
- The presence of a sand and gravel aquifer, well and poorly draining soils, peat, and productive and unproductive bedrock aquifers means that the pathways in the PAA are complex and a good conceptual understanding is key to achieving environmental objectives.
- The predominant land use in the PAA is tillage, which has potential to contribute excess sediment to waterbodies.
- Due to mixtures of well drained soils, sand and gravel aquifers and productive bedrock aquifers there is potential for nitrate loss throughout much of the PAA. Due to the large

vulnerable area and the difficulties associated with mitigating for nitrate loss, water quality improvements may be more easily brought about by tackling phosphate and sediment which have much smaller areas with potential for loss.

- Perhaps targeting large groups of farmers in high nitrate PIP areas with group education campaigns may be a more efficient use of resources rather than specific measures aimed at reducing nitrate loss in these areas given their size.

6 Work Plan

The Bridge near Glenbaun monitoring point on Athy Stream_010 should be visited during normal flow conditions to assess the extent of sedimentation. Upper reaches of Athy Stream_010 should be visited and rapid assessment done above and below AS_010_03 to determine if there is an impact following the high N concentrations found here by Kildare County Council. If there is an impact the farmyard immediately upstream of this site or the forestry which also drains immediately upstream should be investigated as potential sources.

As sediment from arable land has been identified as the potential significant issue in the Athy Stream_010 surveys should focus on areas of PIP rank 1 for phosphate. There are poorly draining areas along most of the waterbody which could provide potential pathways for sediment transfer.

Nitrate concentrations increase from 2.5mg/l at Athy_010_05 to 6.5mg/l at Athy_010_07. SSIS should be carried out at Athy_010_06 to identify if nitrates are entering along this small tributary which would drain an area of high nitrate PIP. Water samples for nitrate may be needed on this tributary. The section between Athy_010_05 and Athy_010_06 should also be walked to identify any direct discharges.

On Athy Stream_020 a nitrate concentration of 11 mg/l N was recorded by Kildare County Council at Athy_020_02. Areas of surface water nitrate PIP in the upper reaches of Athy Stream_020 should be focussed on. As this is in compartment two on the poor aquifer, nitrate loss is likely to be via the sand and gravel aquifer and the upper fractured zone in this area. This may be an area for ASSAP to investigate nitrate mitigation options. It may be difficult to narrow down this area for ASSAP but the river should be walked along the stretch of high nitrate PIP in the upper reaches to try to identify CSAs or any direct discharges using rapid assessments/SSIS and probes.

Three SSIS and three water samples at different times of year are required on Athy Stream_030 in order to determine risk status. Access should be possible in Athy town near the catchment outlet and the confluence with Barrow_130. If at risk additional SSIS surveys should be carried out above and below the confluence with Athy Stream_020 to determine if problems are coming from Athy Stream_020 or from further up the Athy Stream_030. If upper reaches of Athy Stream_030 are identified as *At Risk* the surveys on upper reaches should be aimed at areas of PIP rank 1 for phosphate (which are extensive) as sediment may be the potential issue due to the large amount of tillage in the area. The other tributary in Athy Stream_030 should be visited and it should be determined whether the cut peat is all draining into Athy Stream_030 as aerial photography suggests that this may be the case. SSIS and water samples for ammonia (or conductivity field probes) should be taken to assess the impact of the peat.

Rapid assessment up and downstream of the WWTP on Barrow_140 to determine if the plant is having an impact. To investigate the effects of agriculture, work should focus on the two tributaries where there are areas of PIP rank 1 for P in the upper reaches to investigate pressures from P (which is close to the threshold).

Since sediment is an issue surveys may be required during times of rainfall and higher flows to identify sources. Turbidity measurements should be taken while walking the watercourse.

Actions

1. Three SSIS and three water samples at different times of year required on Athy Stream_030 near catchment outlet to determine risk status.
2. Visit Bridge near Glenbaun on Athy Stream_010 to assess the level of siltation and take SSIS.
3. Stream walk from Bridge near Glenbaun to Athy_010_05 looking for sources of sediment and nitrate. Attention should be paid to levels of deposited sediment while walking upstream and areas of tillage close to the waterbody or open ditches which may contribute sediment should be noted.
4. Rapid assessment should be carried out at Athy_010_05.
5. Rapid assessment should be carried out above and below Kildare County Council site AS_010_03 to determine if ecology is impacted here due to high nitrate levels. Conductivity should be taken along this tributary to identify where nitrate might be coming in. The farmyard or forestry are potential sources with the farmyard more likely to be the source.
6. The upper reaches of Athy Stream_020 which are on sand and gravel aquifer should be walked looking for signs of nitrate loss (conductivity) focussing on areas of high surface water nitrate PIP. It would be useful for ASSAP advisor to accompany us on this section of the walk.
7. If Athy Stream_030 is *At Risk* then the site of the cut peat should be visited. Need to determine who owns it (Bord na Mona?) and ascertain how much of the peat area drains into the Athy Stream_030. Conductivity measurements should be taken on the two uppermost tributaries and SSIS carried out on both to determine possible effects from the cut peat.
8. Rapid assessment should be carried out up and downstream of the Athy UWWTP to determine if it is having an impact on the Barrow_140. If yes, refer back to Irish Water.
9. If the UWWTP is not having an effect then rapid assessments should be carried out at the confluence of the two tributaries to determine if ecology is affected.
10. If ecological quality is affected (i.e. *At Risk*) and particularly if excessive algal growth is seen on the tributaries then areas of high P PIP should be investigated.
11. Investigate the three COAs in the Barrow_140 catchment for evidence of nitrate loss.

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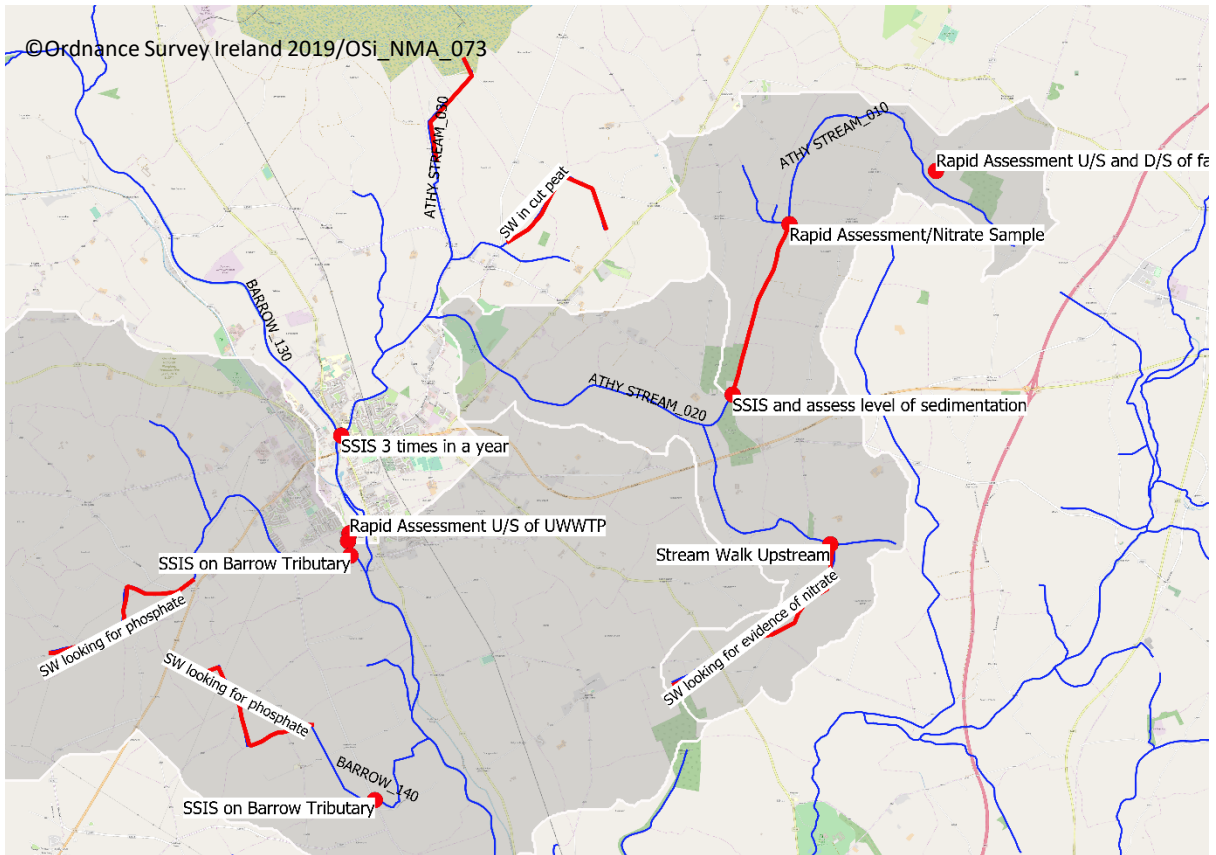


Figure 17. Work plan for the Athy Stream PAA.

7 Possible Mitigation Options

- Improvements in buffer strips in poorly drained areas may be an option to deal with sediment inputs, particularly along the poorly drained areas of Athy Stream_010.
- However, the moderate nitrate status in at least some of the waterbodies pose a more difficult problem and will require work with ASSAP in order to reduce application of nitrate to land. One possible area this may be required is on the areas of sand and gravel aquifer in the upper reaches of Athy Stream_020.
- Perhaps targeting large groups of farmers in high nitrate PIP areas with group education campaigns may be a more efficient use of resources than specific measures in these areas given their size.
- Liaison with Bord na Mona may be required on Athy Stream_030 in order to lower ammonia concentrations.