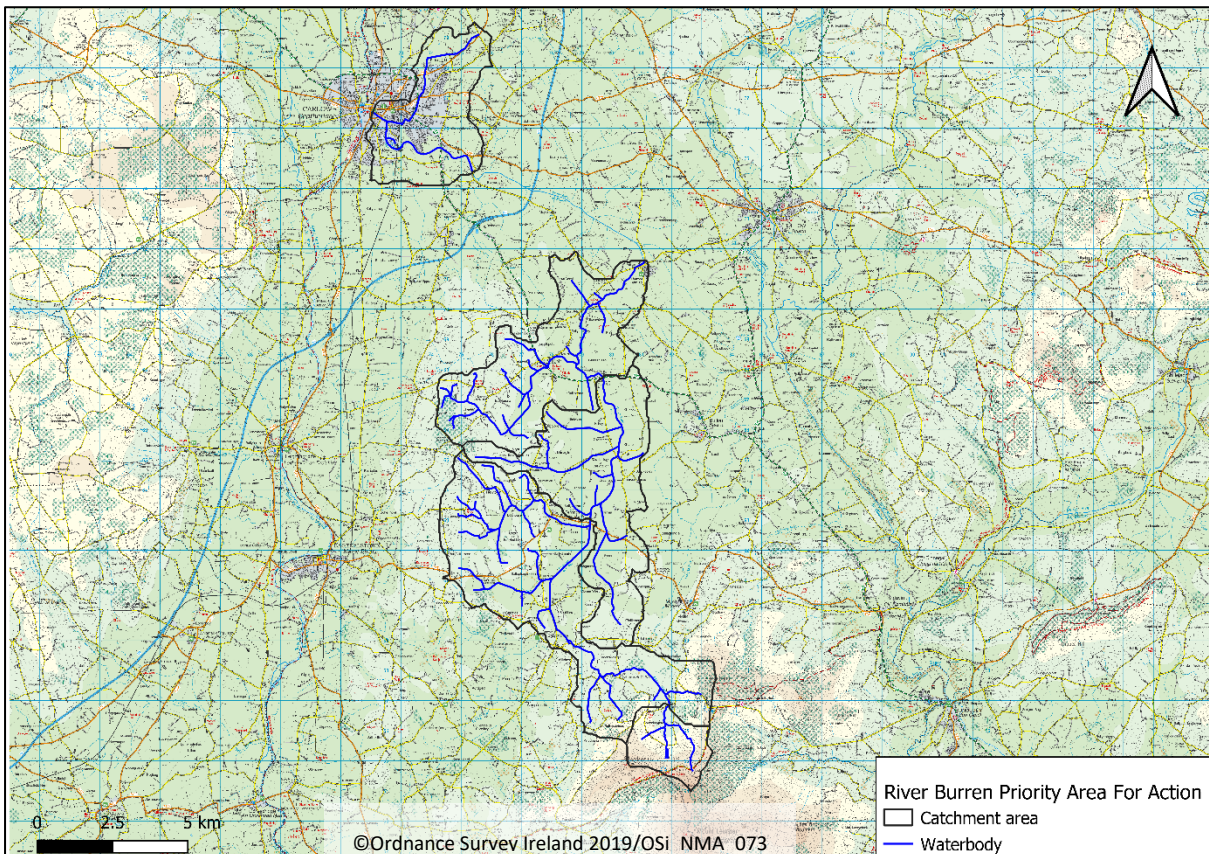


Desk Study

Burren Priority Area for Action (AFA0034)



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V.F02. South East Region.

Burren PAA

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Acknowledgements

The authors would like to acknowledge the contribution of Carlow County Council staff and thank them for their support of the Local Authority Waters Programme.

Burren PAA

1 Background

The Burren Priority Area for Action (PAA) is located in County Carlow to the east and south of Carlow town. The headwaters are in Mount Leinster in the Blackstairs Mountains which form the south eastern boundary of the county. The Burren PAA consists of five waterbodies: Burren_010, Burren_020, Burren_030, Burren_040 and Burren_060. These water bodies are illustrated in **Figure 1** and summarised in **Table 1**.

Regional workshops 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 and Wicklow), and other agencies (Bord Iascaigh Mhara, DHPCLG, 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 Burren PAA was chosen for the following reasons:

- Flows into Carlow town - important for local amenity.
- Sub-catchment project.
- Building on improvement works completed by Inland Fisheries Ireland.
- One potential 'quick win'.
- One *At Risk* High Ecological Status objective water body.
- One deteriorated water body.

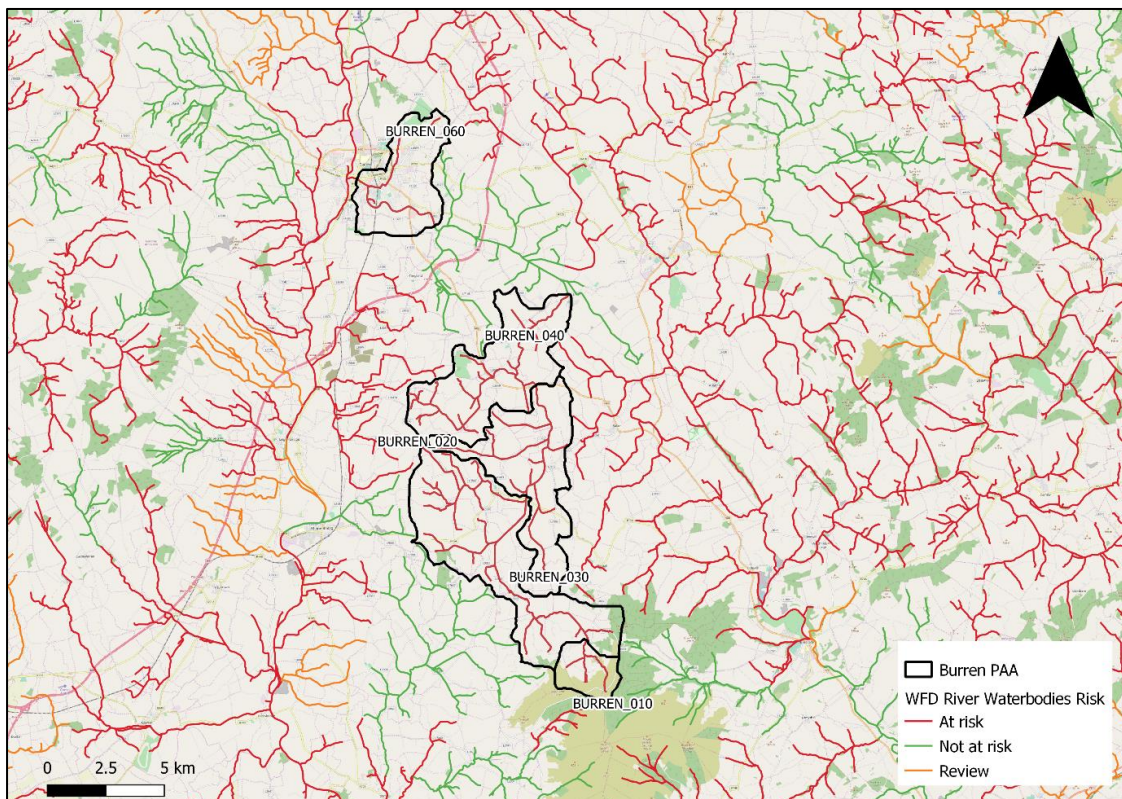


Figure 1. Waterbodies within Burren PAA (outlined in black).

Burren PAA

Table 1. Summary table of water bodies within the Burren PAA.

WB Code	WB Name	WFD Risk	Status Obj.	Status				Pressure Category	Pressure Subcat.	Sig. Pressure
				'09	'12	'15	'17			
IE_SE_14B050020	Burren_010	<i>At Risk</i>	High	G	H	G	G	Hydromorp.	Channelisation Dams, Barriers	Yes
IE_SE_14B050110	Burren_020	<i>At Risk</i>	Good	M	M	M	M	Hydromorp. Agriculture	Channelisation Agriculture	Yes Yes
IE_SE_14B050200	Burren_030	<i>At Risk</i>	Good	M	M	M	M	Agriculture	Agriculture	Yes
IE_SE_14B050310	Burren_040	<i>At Risk</i>	Good	M	G	M	M	Hydromorp. Agriculture	Channelisation Pasture	Yes Yes
IE_SE_14B050500	Burren_060	<i>At Risk</i>	Good	M	M	P		Hydromorp. Urb. Runoff	Channelisation Diffuse Runoff	Yes Yes

The initial characterisation sub-catchment assessments undertaken by the Environmental Protection Agency (EPA) recommended that the following further actions be taken:

Burren_010:

IA8 (EPA): Hydromorphological status driving overall ecological status (Good). Development of EPA morphological assessment will assess/address this. This is a High Ecological Status Objective site.

Burren_020:

IA7 (LAWPRO): Focus on point and diffuse sources of nutrients from agriculture. Visual assessment on impacts from channel maintenance. Details: walk along RWB. Focus on areas high PIP. Note point (drainage ditches, discharge pipes) and diffuse (lack of buffer strips) sources of nutrients. Collect field parameters (DO, temperature, pH, conductivity) to help identify areas of pollution. Use field parameters to guide selection of water quality and SSRS sample locations.

IA1 (LAWPRO): Carlow CoCo to provide the EPA with dates and details of dredging that was reportedly undertaken on the RWB in 2013/2014. Carlow CoCo have confirmed dredging has taken place all the way up to Fennagh in 2014.

IA1 (EPA): When developed, EPA hydromorphologist to carry out a morphological condition assessment, as Carlow CoCo have confirmed dredging has taken place all the way up to Fennagh in 2014.

IFI to provide information on Moderate Fish Status and if there is any more up to date information after 2013. Possible that the 2013 fish kill impact status? See <http://www.fisheriesireland.ie/Press-releases/farmer-pleads-guilty-to-pollution-which-resulted-in-fish-kill-in-the-burren-river-co-carlow.html>. If not water quality or morphological conditions, is it a barrier issue? IFI currently seeking planning permission to install a rock ramp on a weir in the Burren river (present fish pass structure

Burren PAA

not functioning). If installed, would this improve status? (EQ: rock ramp info from AMBER project launch on 28/11/2016).

Burren_030:

IA7 (LAWPRO): Focus on point and diffuse sources of nutrients from agriculture. Details: walk along RWB. Focus on areas high PIP. Note point (drainage ditches, discharge pipes) and diffuse (lack of buffer strips) sources of nutrients. Collect field parameters (DO, temperature, pH, conductivity) to help identify areas of pollution. Use field parameters to guide selection of water quality and SSRS sample locations.

IA1 (EPA): When developed, EPA hydromorphologist to carry out a morphological condition assessment.

Burren_040:

IA7 (LAWPRO): Focus on point and diffuse sources of nutrients from agriculture. Details: walk along RWB. Focus on areas high PIP. Note point (drainage ditches, discharge pipes) and diffuse (lack of buffer strips) sources of nutrients. Collect field parameters (DO, temperature, pH, conductivity) to help identify areas of pollution. Use field parameters to guide selection of water quality and SSRS sample locations. Visual assessment on impacts from dredging.

IA1 (LAWPRO): Carlow CoCo to provide the EPA with dates and details of dredging that was reportedly undertaken on the RWB in 2013/2014. When developed, EPA hydromorphologist to carry out a morphological condition assessment, as Carlow CoCo have confirmed dredging Channel maintenance in 2013/2014. Insufficient buffer strips.

IA1 (EPA): When developed, EPA hydromorphologist to carry out a morphological condition assessment, as Carlow CoCo have confirmed dredging Channel maintenance in 2013/2014. Insufficient buffer strips.

Burren_060:

IA1 (LAWPRO): Carlow to provide details of dredging that was undertaken in 2013/2014 in order to confirm this was the significant pressure. Carlow CoCo have confirmed dredging Channel maintenance in 2013.

IA1 (EPA): When developed, EPA hydromorphologist to carry out a morphological condition assessment, as Carlow CoCo have confirmed dredging in 2013.

IA6 (LAWPRO): Diffuse Urban pressure to be investigated.

2 Receptor Information and Assessment

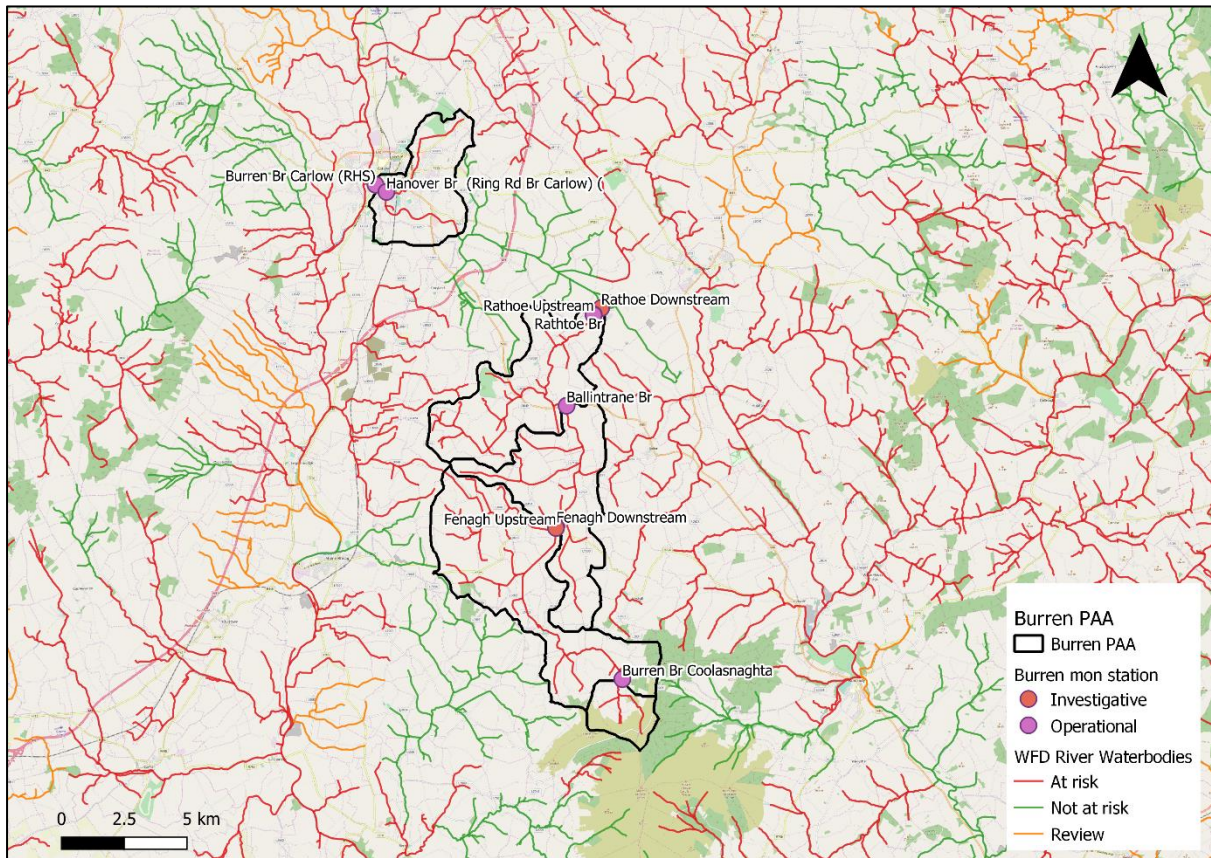


Figure 2. Monitoring stations located within the Burren PAA.

2.1 Burren_010

- The Burren_010 is the headwater of the River Burren which rises in the Blackstairs Mountains and flows into the River Barrow at Carlow Town. **Table 2** summarises the receptor status, data and trends of the quality elements measured for the RWB. The Burren_010 has one operational monitoring station located at Burren Bridge Coolasnaghta (RS14B050020), as illustrated in **Figure 2**.
- High status objective, currently *At Risk*.
- 2017 Q value High.
- Significant issues: Hydromorphology.

Burren PAA

Table 2 Receptor information for the Burren_010

Factor	Figure/ Table	Comment/Description
Risk Category	Fig 2	<i>At Risk</i>
Biological Status Monitoring Station(s) with Q-Values 2009-2015 Status Trends in Q value since 2009 2016-2018 Q value data		Burren Bridge Coolasnaghta Good Increasing/Stable, Q4 in 2009, Q4-5 since. Q4-5 in 2017
Hydrochemistry Data Monitoring Station(s) with data Existing New		Burren Bridge Coolasnaghta Ammonia - Total (as N), Ortho-Phosphate (as P), Total Oxidised Nitrogen (as N), BOD: 2007-2015, Specific Pollutants (Cr, Cu, Zn), Priority Substances (Pb, Ni), priority Hazardous Substances (Cd) BOD: 2015-2018
Summary & Trends in PO₄, NH₃ and NO₃ In App All available data Other water quality data Baseline Concentration (mg/l) Other relevant values Distance to threshold		PO ₄ : Downwards NH ₃ : Downwards TON: Downwards PO ₄ : 0.005 NH ₃ : 0.009 TON: 0.875 PO ₄ : Far NH ₃ : Far TON: Far
Supporting Conditions Chemical Conditions Oxygenation Conditions Acidification Conditions		n/a
Hydromorphology RHAT Score Evidence of arterial drainage		Hydromorphological status driving overall ecological status (good)
Ecological Status (2010-2015)		Good

Burren PAA

Trends 2010-2015		2010-2015 Good due to hydromorphology pressures, invertebrates High. 2010-2012 High 2007 - 2009 Good
Protected Areas		Blackstairs Mountains SAC, Catchment with previous records of Margaritifera, but current status unknown
WFD Objective		High
EPA biologist notes (if any)		High ecological quality was again recorded at the uppermost station in the Burren. The macroinvertebrate fauna indicated moderate ecological conditions along remaining section of the Burren River surveyed in 2017.
Significant issue		Hydromorphology

Burren PAA

2.2 Burren_020

- The Burren_020 continues on from the Burren_010 at Coolasnaghta Bridge down to Ullard Bridge near Fennagh. **Table 3** summarises the receptor status, data and trends of the quality elements measured for the RWB. The Burren_020 has one operational monitoring station located at Ullard Bridge (RS14B050110). There are two investigative monitoring stations, Fenagh Upstream (RS14B050090) & Fenagh Downstream (RS14B050110), at the outfall of the discharge coming from Fenagh urban wastewater treatment plant (uwwtp). The monitoring stations are illustrated in **Figure 2**.
- Good status objective, currently *At Risk*
- Significant pressures: Hydromorphology & Agriculture
- Significant Issues: Hydromorphology

Table 3 Receptor information for the Burren_020

Factor	Figure/ Table	Comment/Description		
Risk Category	Fig 2	<i>At Risk</i>		
Biological Status		Ullard Bridge		
Monitoring Station(s) with Q-Values		Moderate		
2009-2015 Status		Stable, Q3-4		
Trends in Q value since 2009		Q3-4 in 2017		
2016-2018 Q value data				
Hydrochemistry Data				
Monitoring Station(s) with data		Ullard bridge	Fenagh Upstream	Fenagh Downstream
Existing		Ammonia - Total (as N), Ortho-Phosphate (as P), Total Oxidised Nitrogen (as N), BOD: 2007-2017, Specific Pollutants (Cr, Cu, Zn), Priority Substances (Pb, Ni, Isoproturon, Pentachlorophenol), priority Hazardous Substances (Cd, +)	Ammonia - Total (as N), Ortho-Phosphate (as P), BOD: 2015-2018, COD: 2011-2018, SS 2011-2018, Total N: 2011-2018, Total P: 2016-2018	Ammonia - Total (as N), Ortho-Phosphate (as P), BOD: 2015-2018, COD: 2011-2018, SS 2011-2018, Total N: 2011-2018, Total P: 2016-2018
New		BOD: 2015-2018		
Summary & Trends in PO₄, NH₃ and NO₃				

Burren PAA

In App	Fig y	PO ₄ : Downwards NH ₃ : Downwards TON: Upwards	PO ₄ : None NH ₃ : None	PO ₄ : None NH ₃ : Upwards
All available data				
Other water quality data		BOD	BOD, COD, SS, TN, TP	BOD, COD, SS, TN, TP
Baseline Concentration (mg/l) (2014)	Table x	PO ₄ : 0.025 NH ₃ : 0.037 TON: 2.967	PO ₄ : 0.038 NH ₃ : 0.068	PO ₄ : 0.034 NH ₃ : 0.083
Other relevant values		BOD: Spikes: 2.3, Aug 17	BOD: Spikes: 2, Aug 2018 TN: Spikes: 4.8, Feb 2018 TP: Spikes: 0.06, July, Aug 2018	BOD: Spikes: 2, Aug 2018 TN: Spikes: 5.4, Feb 2018 TP: Spikes: 0.06, July, Aug 2018
Distance to threshold		PO ₄ : Far NH ₃ : Near TON: Far	PO ₄ : Near NH ₃ : Near	PO ₄ : Near NH ₃ : Near
Supporting Conditions				
Chemical Conditions		Pass		
Oxygenation Conditions		Pass		
Acidification Conditions		Pass		
Hydromorphology				
RHAT Score				
Evidence of arterial drainage				
Ecological Status (2010-2015)		Moderate		
Trends 2010-2015		2010-2015 Moderate. Based on invertebrates, fish status . 2010-2012 Moderate. 2007-2009 Moderate but Nitrate trend increasing .		
Protected Areas		Drinking Water. Catchment with previous records of Margaritifera, current status unknown.		
WFD Objective		Good		
EPA biologist notes (if any)		High ecological quality was again recorded at the uppermost station in the Burren. The macroinvertebrate fauna indicated moderate ecological conditions along remaining section of the Burren River surveyed in 2017.		
Significant issue		Hydromorphology		

Burren PAA

Ortho-phosphate

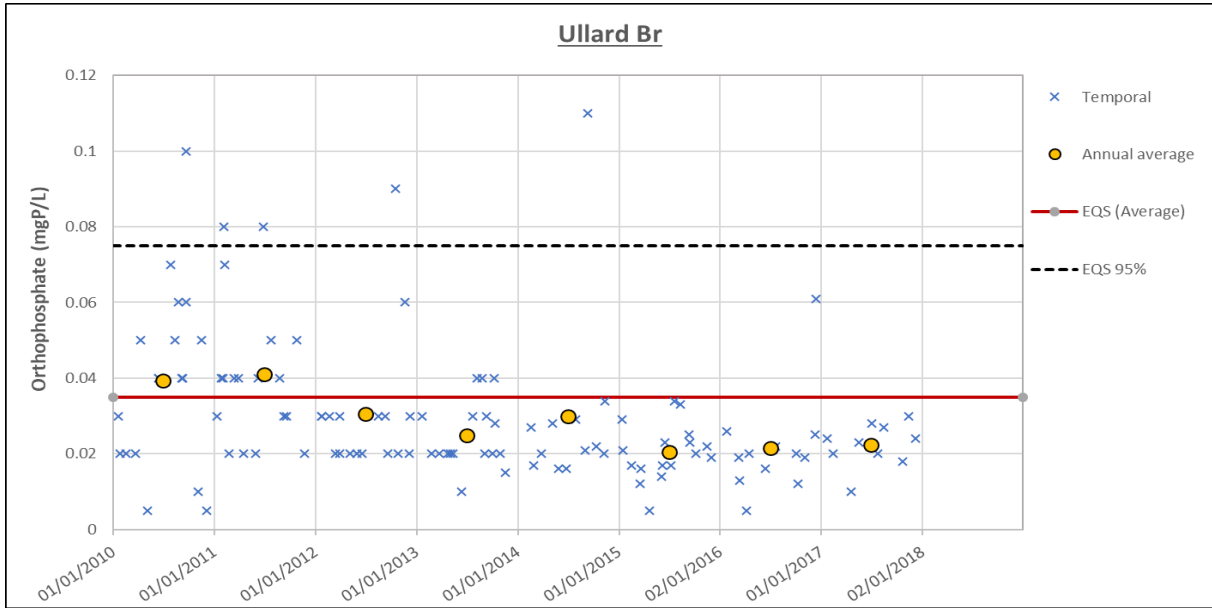


Figure 3. Ortho-phosphate recorded at Ullard Bridge monitoring station.

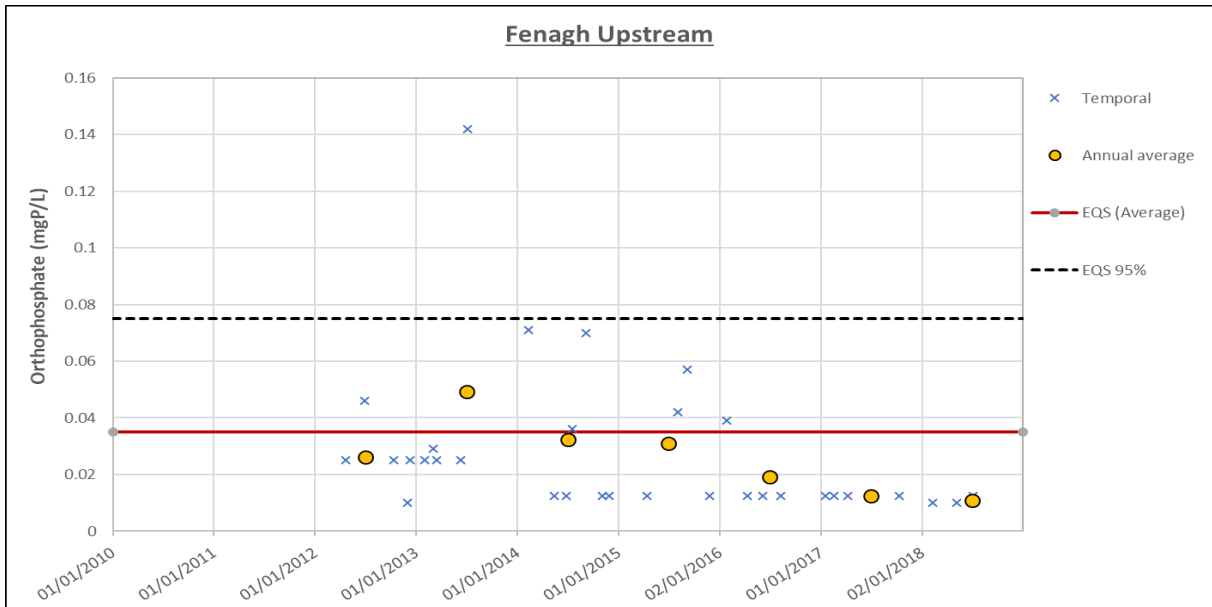


Figure 4. Ortho-phosphate recorded at Fenagh Upstream monitoring station.

Burren PAA

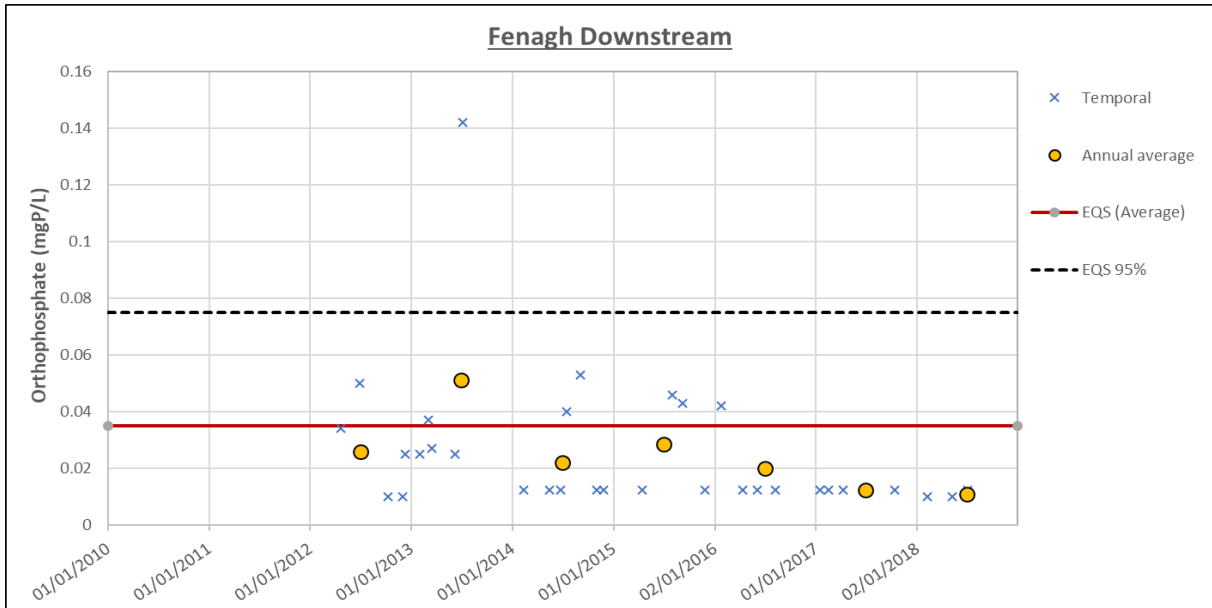


Figure 5. Ortho-phosphate recorded at Fenagh Downstream monitoring station.

Ammonia

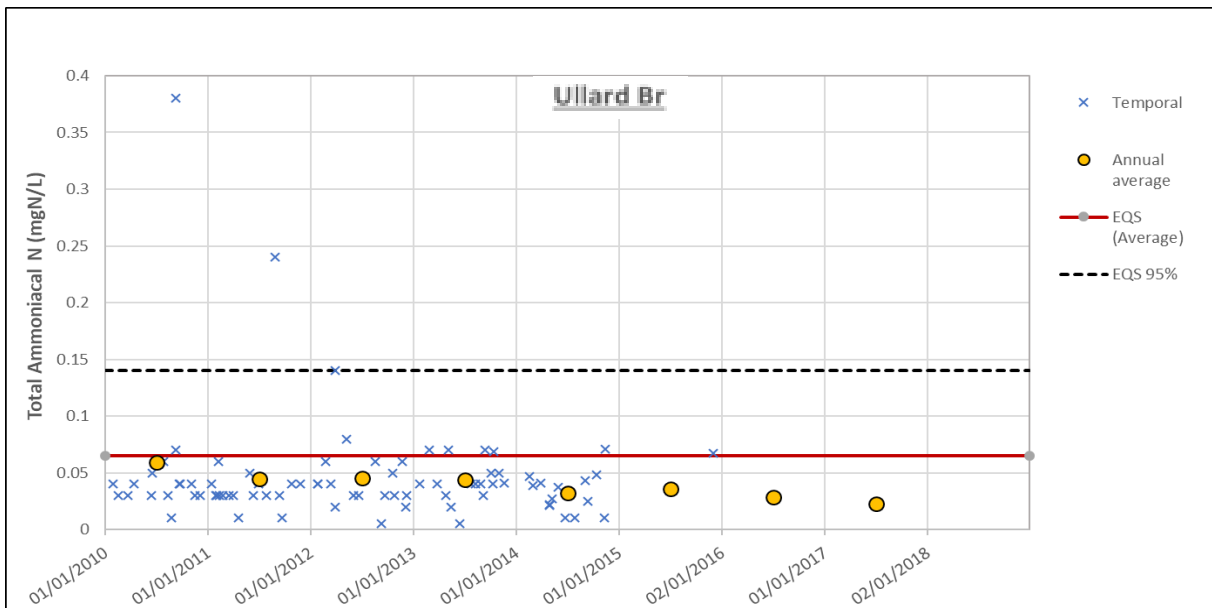


Figure 6. Ammonia recorded at Ullard Bridge monitoring station.

Burren PAA

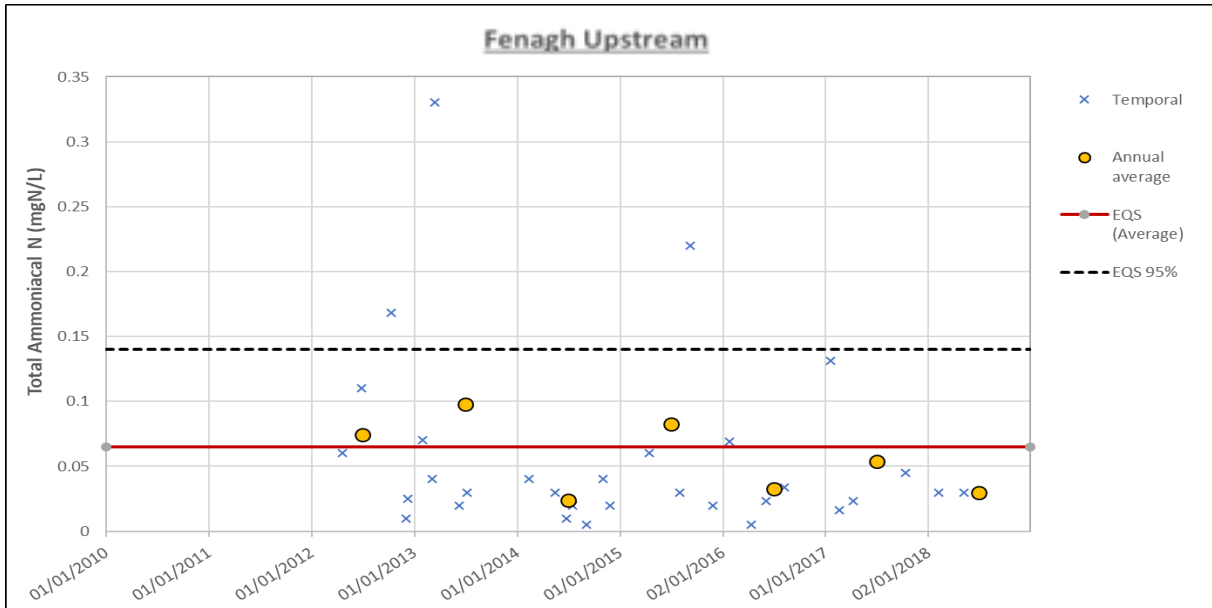


Figure 7. Ammonia recorded at Fenagh Upstream monitoring station.

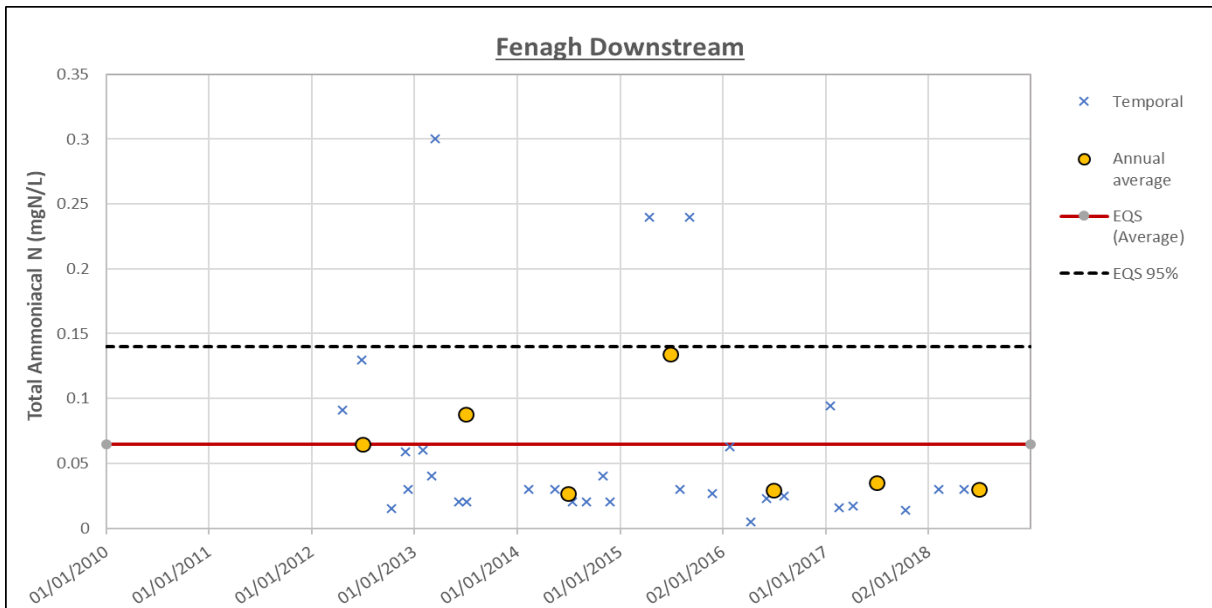


Figure 8. Ammonia recorded at Fenagh Downstream monitoring station.

Burren PAA

Total Oxidised Nitrogen

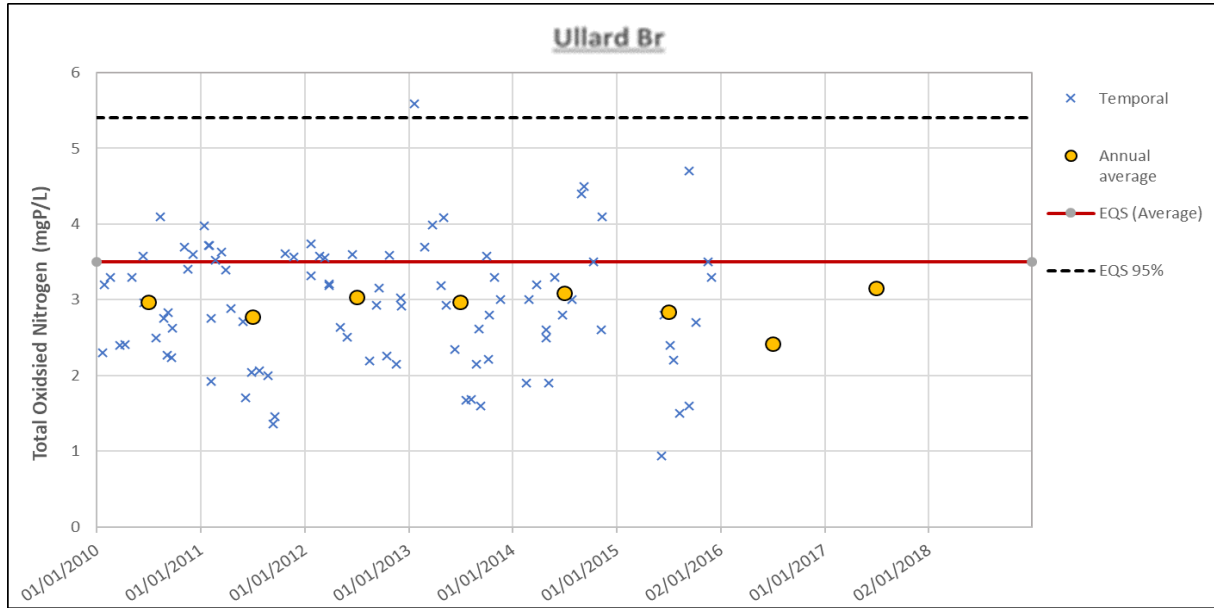


Figure 9. Total Oxidised Nitrogen recorded at Ullard Bridge monitoring station.

Burren PAA

2.3 Burren_030

- The Burren_030 continues from the Burren_020 near Ullard Bridge and to Ballintrane Bridge. **Table 4** summarises the receptor status, data and trends of the quality elements measured for the RWB. The Burren_030 has one operational monitoring station located at Ballintrane Bridge (RS14B050200). The monitoring station is illustrated in **Figure 2**.
- The sub-catchment is dominated by agriculture.
- Good status objective, currently *At Risk*
- Significant pressures: Agriculture
- Significant issues: Nitrates

Table 4 Receptor information for the Burren_030

Factor	Figure/ Table	Comment/Description
Risk Category	Fig 2	<i>At Risk</i>
Biological Status Monitoring Station(s) with Q-Values 2009-2015 Status Trends in Q value since 2009 2016-2018 Q value data		Ballintrane Bridge Moderate Stable, Q3-4 Q3-4 in 2017
Hydrochemistry Data Monitoring Station(s) with data Existing New		Ballintrane bridge Ammonia - Total (as N), Ortho-Phosphate (as P), Total Oxidised Nitrogen (as N), BOD: 2007-2018, BOD: 2015-2018
Summary & Trends in PO₄, NH₃ and NO₃ In App All available data Other water quality data Baseline Concentration (mg/l) 2014 Other relevant values Distance to threshold		PO ₄ : Downwards NH ₃ : Downwards TON: Downwards BOD PO ₄ : 0.033 NH ₃ : 0.029 TON: 3.339 PO ₄ : Near NH ₃ : Far TON: Far

Burren PAA

Supporting Conditions		
Chemical Conditions		Pass
Oxygenation Conditions		Pass
Acidification Conditions		Pass
Hydromorphology		
RHAT Score		
Evidence of arterial drainage		
Ecological Status (2010-2015)		Moderate
Trends 2010-2015		2010-2015 Moderate. Based on invertebrates 2010-2012 Moderate . 2007-2009 Moderate but Nitrate trend increasing.
Protected Areas		Catchment with previous records of Margaritifera, current status unknown.
WFD Objective		Good
EPA biologist notes (if any)		High ecological quality was again recorded at the uppermost station in the Burren. The macroinvertebrate fauna indicated moderate ecological conditions along remaining section of the Burren River surveyed in 2017.
Significant issue		NO ₃

Ballinrane Bridge Monitoring Station

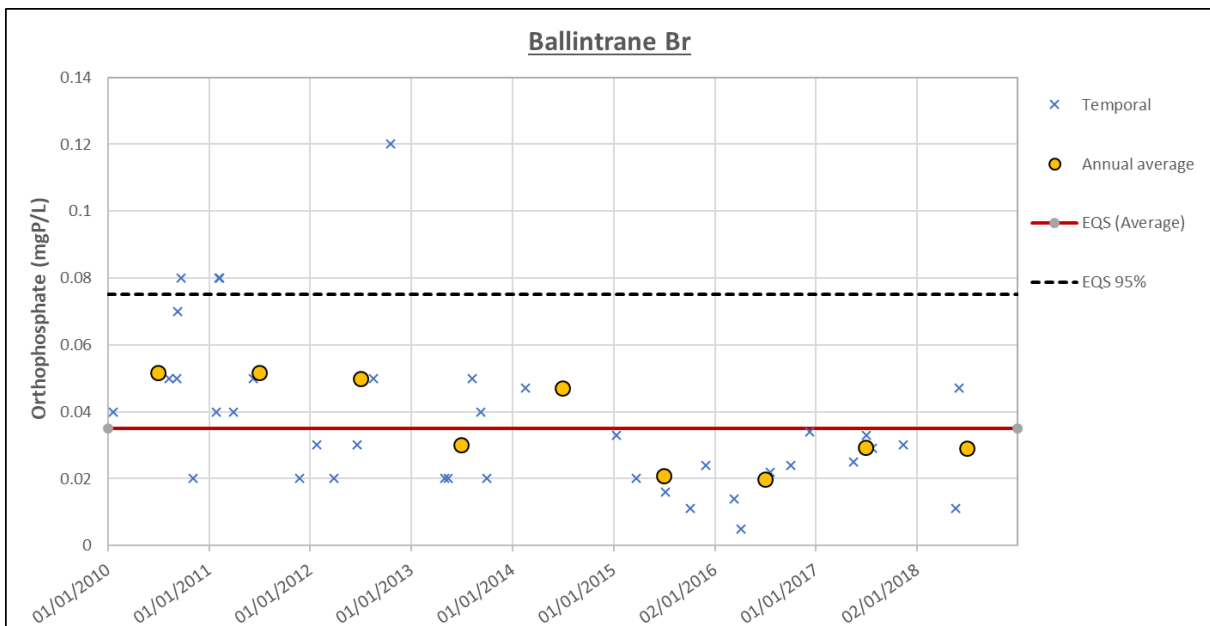


Figure 10. Ortho-phosphate recorded at Ballinrane Bridge monitoring station.

Burren PAA

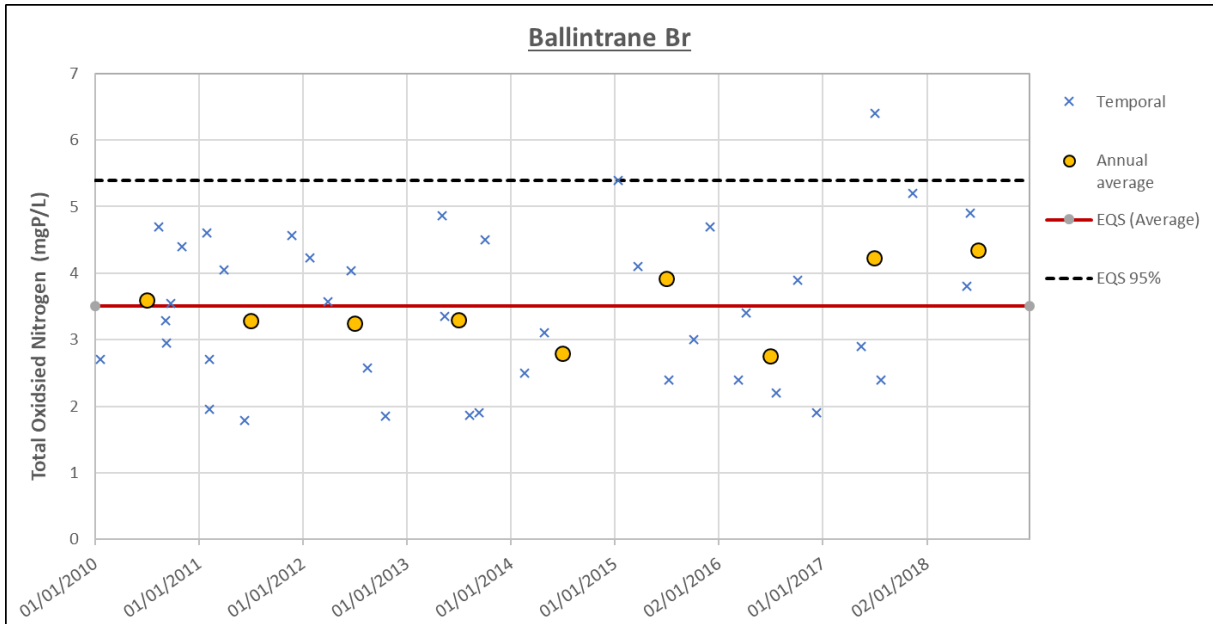


Figure 11. Total Oxidised Nitrogen values recorded at Ballintrane Bridge monitoring station.

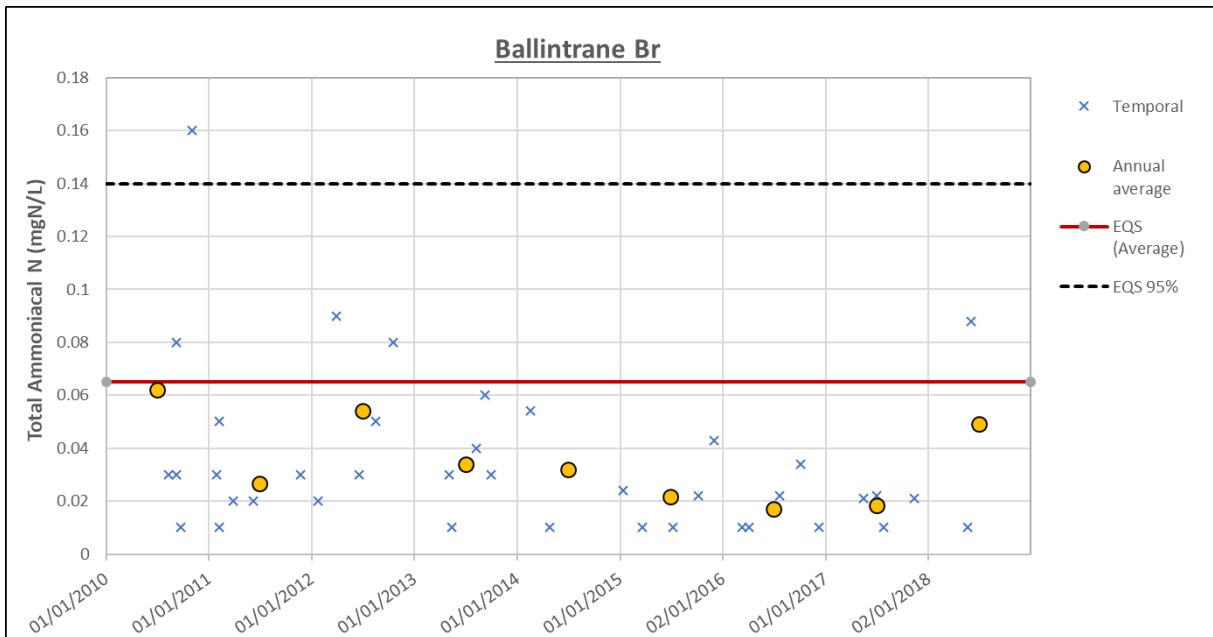


Figure 12. Ammonia recorded at Ballintrane Bridge monitoring station.

Burren PAA

2.4 Burren_040

- The Burren_040 continues from the Burren_030 at Ballintrane Bridge and to just past Rathoe Bridge. **Table 5** summarises the receptor status, data and trends of the quality elements measured for the RWB. The Burren_040 has one operational monitoring station located at Rathoe Bridge (RS14B050300). The monitoring station is illustrated in **Figure 2**. There are two investigative monitoring stations downstream of Rathoe Bridge, Rathoe Upstream (RS14B050301) & Rathoe Downstream (RS14B050310), to monitor an urban wastewater treatment plant at Rathoe.
- The sub-catchment is dominated by agriculture farms – a lot of tillage, with some recently cleared forestry in the headwaters of some tributaries and the town of Rathoe at the bottom of the sub-catchment.
- Good status objective, currently *At Risk*
- Significant pressures: Agriculture, Hydromorphology.
- Significant issues: Nitrate & Phosphate

Table 5 Receptor information for the Burren_040

Factor	Figure/ Table	Comment/Description		
Risk Category	Fig 1	<i>At Risk</i>		
Biological Status		Rathoe Bridge		
Monitoring Station(s) with Q-Values		Moderate		
2009-2015 Status		Q3-4 since 2009, Q4 in 2001.		
Trends in Q value since 2009		Q3-4 in 2017		
2016-2018 Q value data				
Hydrochemistry Data				
Monitoring Station(s) with data		Rathoe Bridge	Rathoe Upstream	Rathoe Downstream
Existing		Ammonia - Total (as N), Ortho-Phosphate (as P), Total Oxidised Nitrogen (as N), BOD: 2007-2017	Ammonia - Total (as N), Ortho-Phosphate (as P), BOD: 2015-2018, COD: 2016-2018, SS 2016-2018, Total N: 2011-2018, Total P: 2016-2018	Ammonia - Total (as N), Ortho-Phosphate (as P), BOD: 2015-2018, COD: 2016-2018, SS 2016-2018, Total N: 2011-2018, Total P: 2016-2018
New		BOD: 2015-2018		
Summary & Trends in PO₄, NH₃ and NO₃				

Burren PAA

In App	Fig y	PO ₄ : Downwards NH ₃ : Downwards TON: Upwards	PO ₄ : Downwards NH ₃ : Upwards	PO ₄ : Downwards NH ₃ : Upwards
All available data				
Other water quality data		BOD	BOD, COD, SS, TN, TP	BOD, COD, SS, TN, TP
Baseline Concentration (mg/l) 2014	Table x	PO ₄ : 0.030 NH ₃ : 0.021 TON: 4.099	PO ₄ : 0.031 NH ₃ : 0.062	PO ₄ : 0.029 NH ₃ : 0.092
Other relevant values		BOD: Spikes, 3.2, Sep 15; 2.1, Sep 16; 2.7, Mar 18.	BOD: Spikes, 3, Jul 2015, 1 since. COD: 279, Nov, 17 TN: Spikes. 9.19, Jan 15; 7.38, Mar 17; 8.81, Jan 18 TP: Spikes 0.673, Oct 16	BOD: Spikes, 3, Jul 15; 8. Jul 18 TN: Spikes. 9.4, Jan 15; 6.04. Feb 17; 8.75, Jan 18 TP: Spikes 0.95, Oct 16
Distance to threshold		PO ₄ : Far NH ₃ : Near TON: Far	PO ₄ : Far NH ₃ : Near	PO ₄ : Far NH ₃ : Far
Supporting Conditions				
Chemical Conditions		Pass		
Oxygenation Conditions		Pass		
Acidification Conditions		Pass		
Hydromorphology				
RHAT Score				
Evidence of arterial drainage				
Ecological Status (2010-2015)		Moderate		
Trends 2010-2015		2010-2015 Moderate. Based on invertebrates 2010-2012 Good. 2007-2009 Moderate but Nitrate trend is increasing .		
Protected Areas		Catchment with previous records of Margaritifera, current status unknown.		
WFD Objective		Good		
EPA biologist notes (if any)		High ecological quality was again recorded at the uppermost station in the Burren. The macroinvertebrate fauna indicated moderate ecological conditions along remaining section of the Burren River surveyed in 2017.		
Significant issue		Nitrate & Phosphate		

Burren PAA

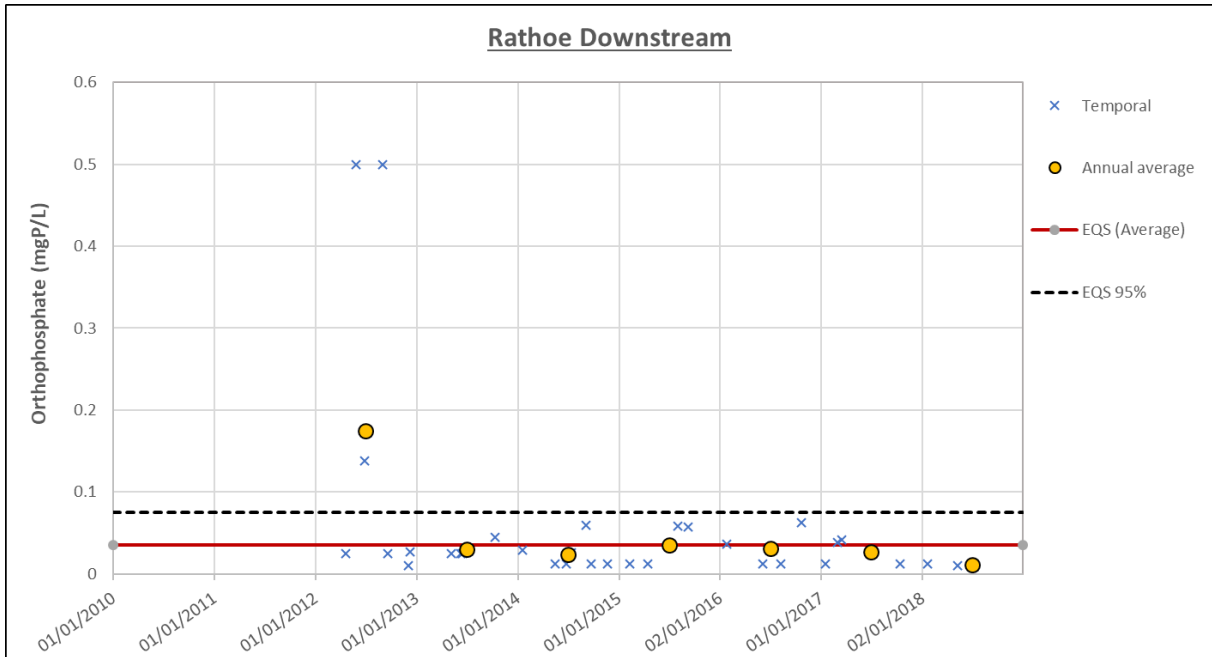


Figure 15. Ortho-phosphate recorded at Rathoe Downstream monitoring station.

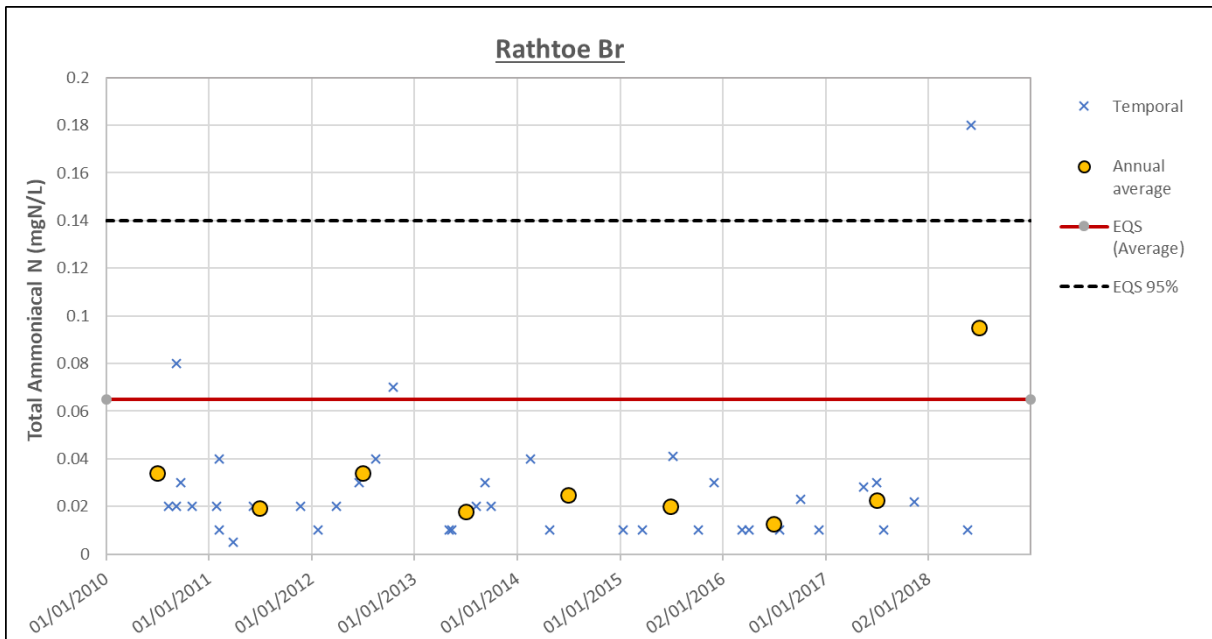


Figure 16. Ammonia recorded at Rathoe Bridge monitoring station.

Burren PAA

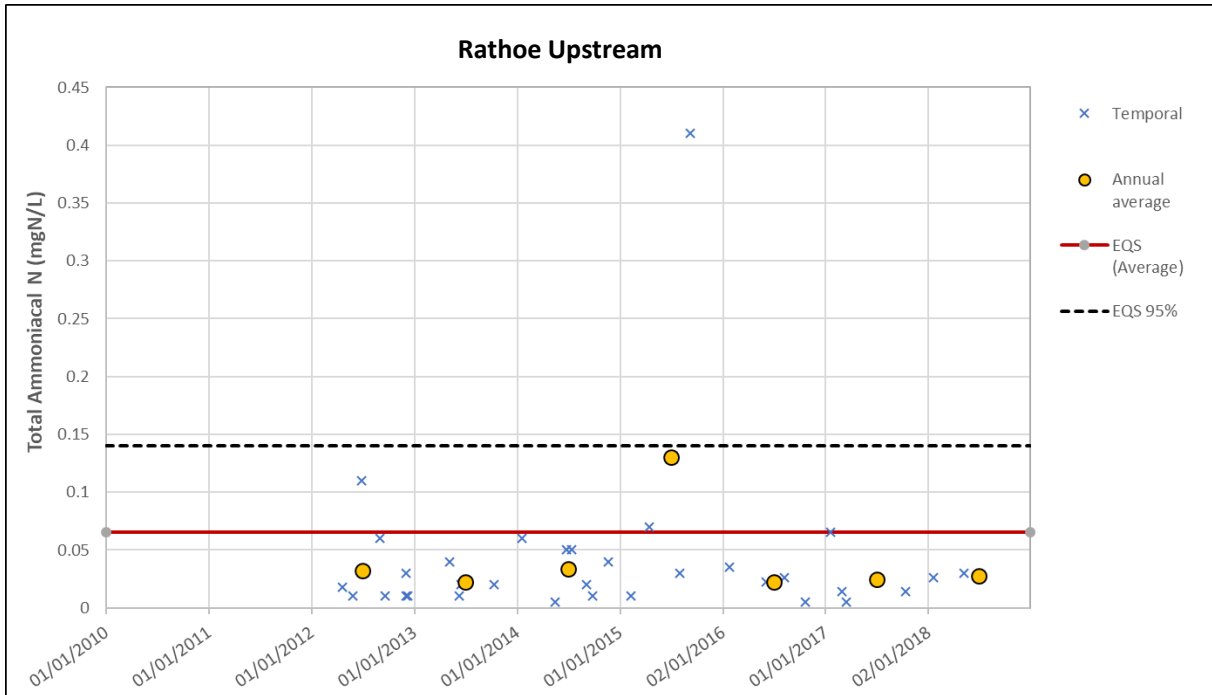


Figure 17. Ammonia recorded at Rathoe Upstream monitoring station.

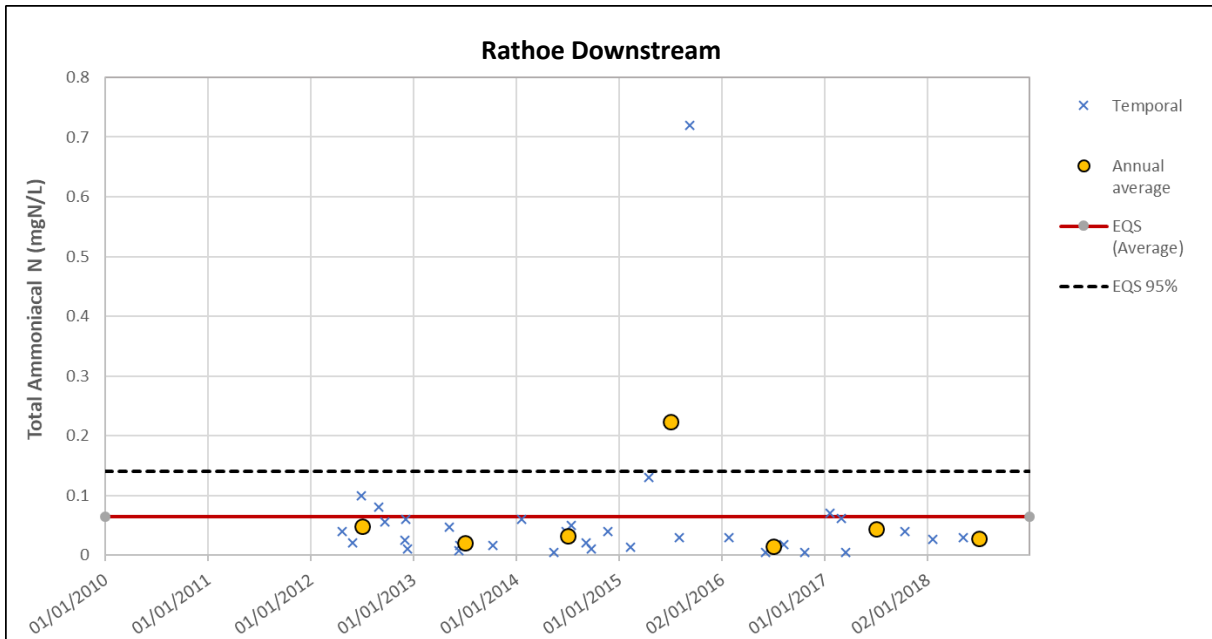


Figure 18. Ammonia recorded at Rathoe Downstream monitoring station.

Burren PAA

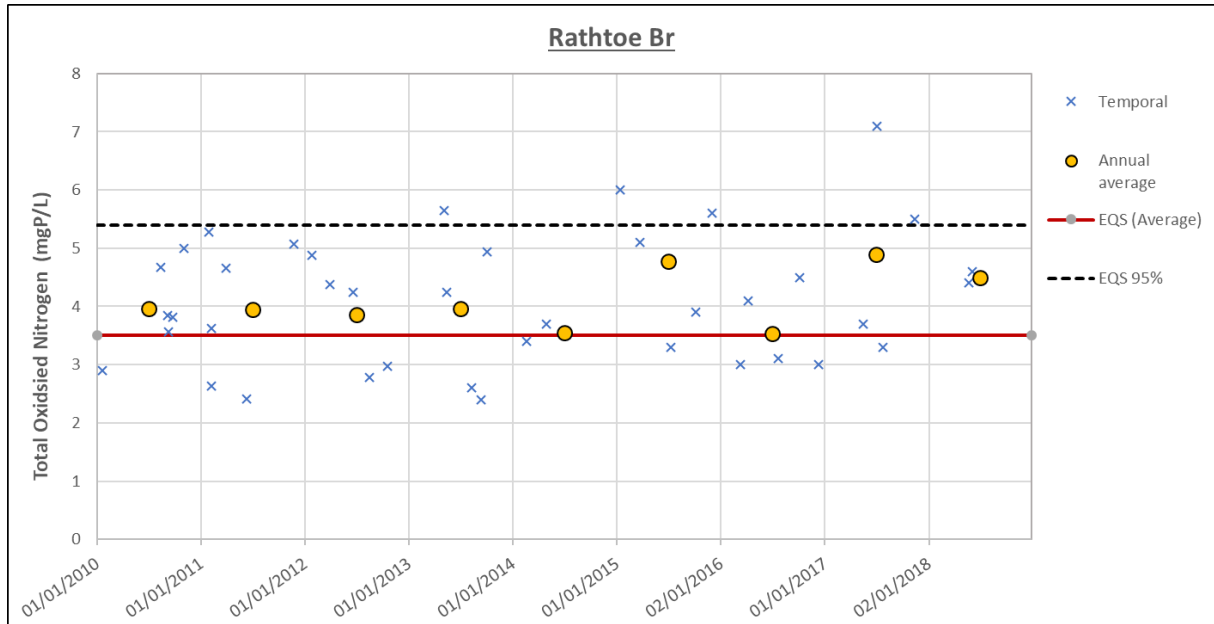


Figure 19. Total Oxidised Nitrogen recorded at Rathoe Bridge monitoring station.

Burren PAA

2.5 Burren_060

- The Burren_060 continues from the Burren_050 which is not part of the Burren Priority Area for Action. **Table 6** summarises the receptor status, data and trends of the quality elements measured for the RWB. The Burren_060 has one operational monitoring station located at Burren Bridge (RS14B050500). The monitoring station is illustrated in **Figure 1**.
- The sub-catchment is dominated by urban development.
- Good status objective, currently *At Risk*
- Significant pressures: Hydromorphology, Urban Run-Off. There are 2 storm water overflows from the local wastewater treatment plant discharging to the Burren_060.
- Significant issues: Nitrates.

Table 6 Receptor information for the Burren_060

Factor	Figure/ Table	Comment/Description
Risk Category	Fig 1	<i>At Risk</i>
Biological Status Monitoring Station(s) with Q-Values 2009-2015 Status Trends in Q value since 2009 2016-2018 Q value data		Hanover Bridge, Carlow Poor Decline, Q3.5 to Q3 n/a
Hydrochemistry Data Monitoring Station(s) with data Existing New		Burren Bridge Ammonia - Total (as N), Ortho-Phosphate (as P), Total Oxidised Nitrogen (as N), BOD: 2007-2018, BOD: 2015-2018
Summary & Trends in PO₄, NH₃ and NO₃ In App All available data Other water quality data Baseline Concentration (mg/l) Other relevant values Distance to threshold	Fig y Table x	PO ₄ : Downwards NH ₃ : Downwards TON: Upwards BOD PO ₄ : 0.028 NH ₃ : 0.026 TON: 6.405 BOD: 2, Jul 17. PO ₄ : Far NH ₃ : Far TON: Far

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Supporting Conditions		
Chemical Conditions		Pass
Oxygenation Conditions		Pass
Acidification Conditions		Pass
Hydromorphology		
RHAT Score		
Evidence of arterial drainage		
Ecological Status (2010-2015)		Poor
Trends 2010-2015		2010-2015 Poor. Based on invertes. 2010-2012 Moderate. 2007-2009 Moderate.
Protected Areas		Catchment with previous records of Margaritifera, current status unknown.
WFD Objective		Good
EPA biologist notes (if any)		High ecological quality was again recorded at the uppermost station in the Burren. The macroinvertebrate fauna indicated moderate ecological conditions along remaining section of the Burren River surveyed in 2017.
Significant issue		Nitrates

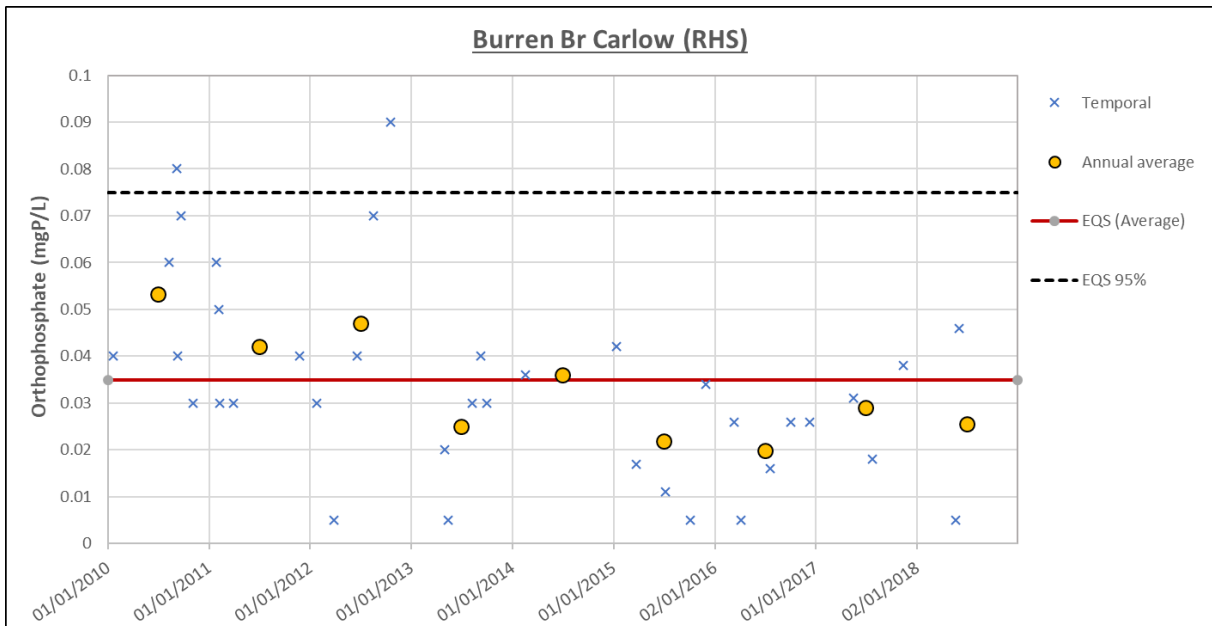


Figure 20. Ortho-phosphate values recorded at Burren Bridge monitoring station.

Burren PAA

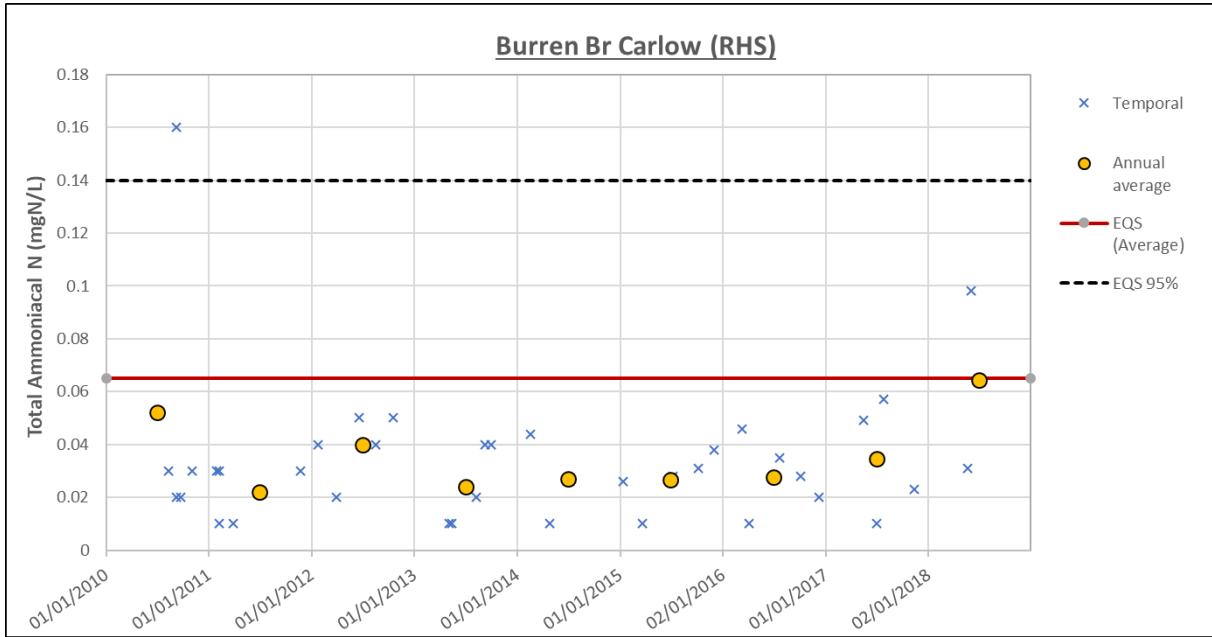


Figure 21. Ammonia values recorded at Burren Bridge monitoring station.

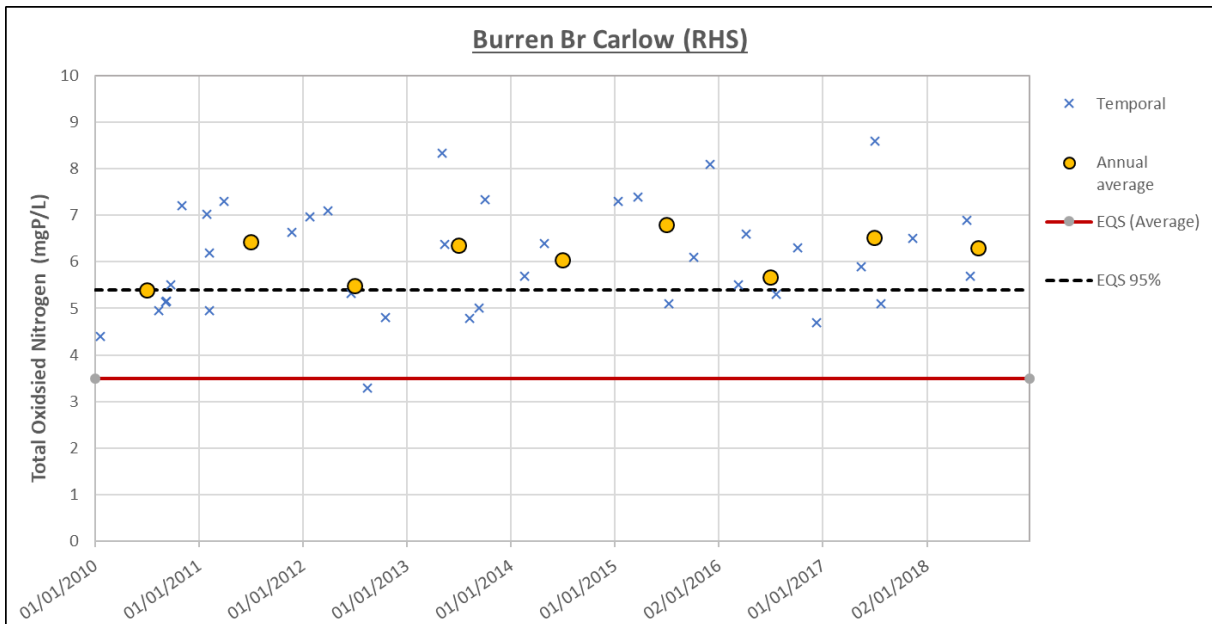


Figure 22. Total Oxidised Nitrogen values recorded at Burren Bridge monitoring station.

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3 Significant Pressures

Table 7 Significant Pressures identified for the Burren PAA by the Initial Characterisation process

Waterbody	Pressure Category	Sub-category	Significant Pressure
Burren_010	Hydromorphology	Channelisation	Yes
	Hydromorphology	Dams, barriers, locks, weirs	Yes
Burren_020	Hydromorphology	Channelisation	Yes
	Agriculture	Agriculture	Yes
Burren_030	Agriculture	Agriculture	Yes
Burren_040	Hydromorphology	Channelisation	Yes
	Agriculture	Tillage	Yes
Burren_060	Hydromorphology	Channelisation	Yes
	Urban Run-Off	Diffuse Sources Run-Off	Yes

3.1 Burren_010

- The EPA identified Hydromorphology as the significant pressure in this water body, physical modifications to the river channel are bringing status down to good, the biological status is High here.

3.2 Burren_020

- Hydromorphology, specifically channelisation, was identified by the EPA as a significant pressure.
- The Burren Drainage district includes Burren_020, see **Figure 23**.
- Agriculture identified by the EPA as a significant pressure.
- Fish status is reported as moderate status. IFI reported lower than expected indicator species in a 2015 survey report possibly due to barriers and channel drainage works.
- Chemical results not demonstrating high levels of nutrients.
- There is a number of areas of forestry in the upper reaches of this catchment.
- Fenagh wastewater treatment plant is located in Burren_020, and in the initial characterisation it was not identified as a significant pressure.
- The UWWTP discharges below Ullard Bridge; it is uncertain if the discharge is u/s or d/s of Ullard Bridge monitoring station. There is a stormwater overflow which discharges at Fenagh to a tributary of the waterbody.

Burren PAA

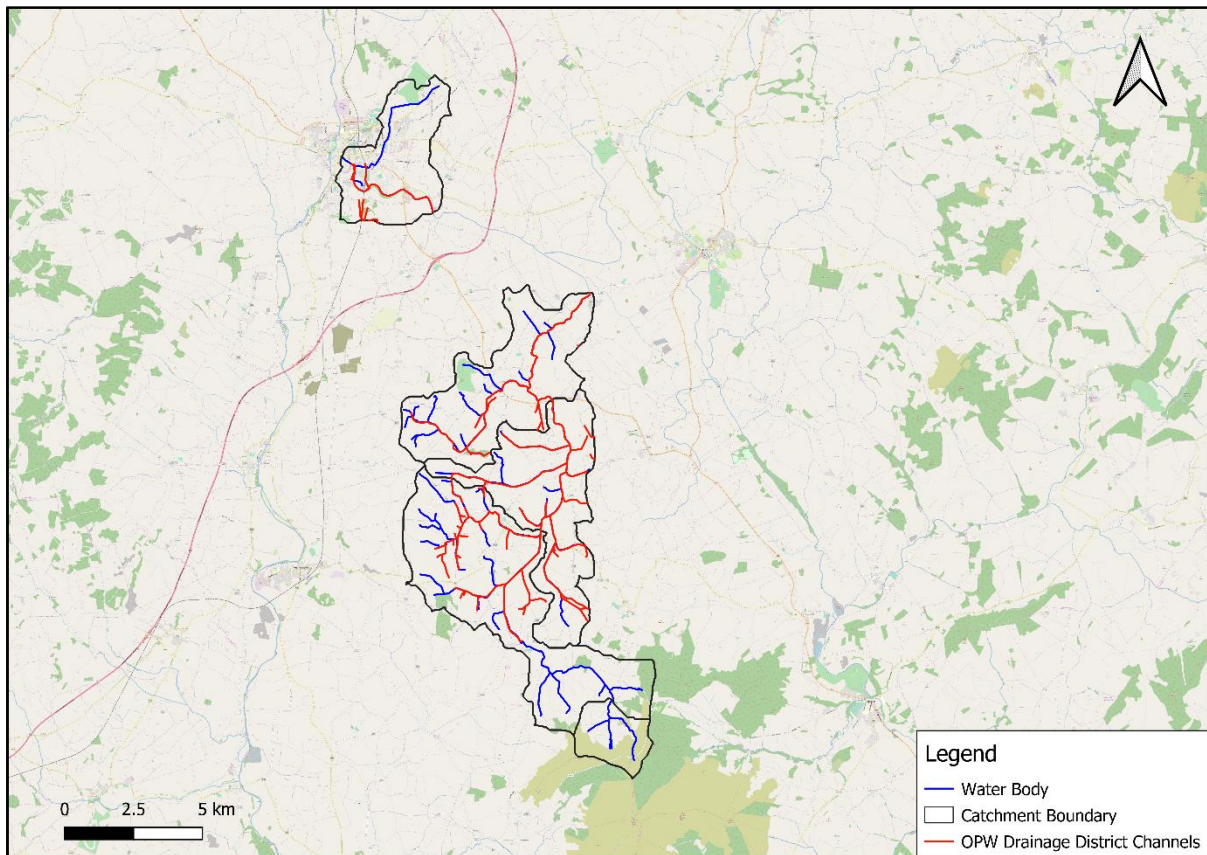


Figure 23. Burren PAA Drainage District Channels.

3.3 Burren_030

- Agriculture identified by the EPA as a significant pressure.
- Chemical analysis demonstrates Nitrate levels are high with numerous exceedances of the Indicative Quality Threshold (3.5mgN/l), however Surface Water Receptor Pollution Impact Potential (PIP) maps generally show areas of medium & low susceptibility with small pockets of high susceptibility.
- Nitrate susceptibility maps support the findings of the PIP maps.
- Maps indicate that the water body is unnaturally straight, hydromorphology channelisation possibly a pressure.
- The Burren Drainage District includes Burren_030, see **Figure 23**.

Burren PAA

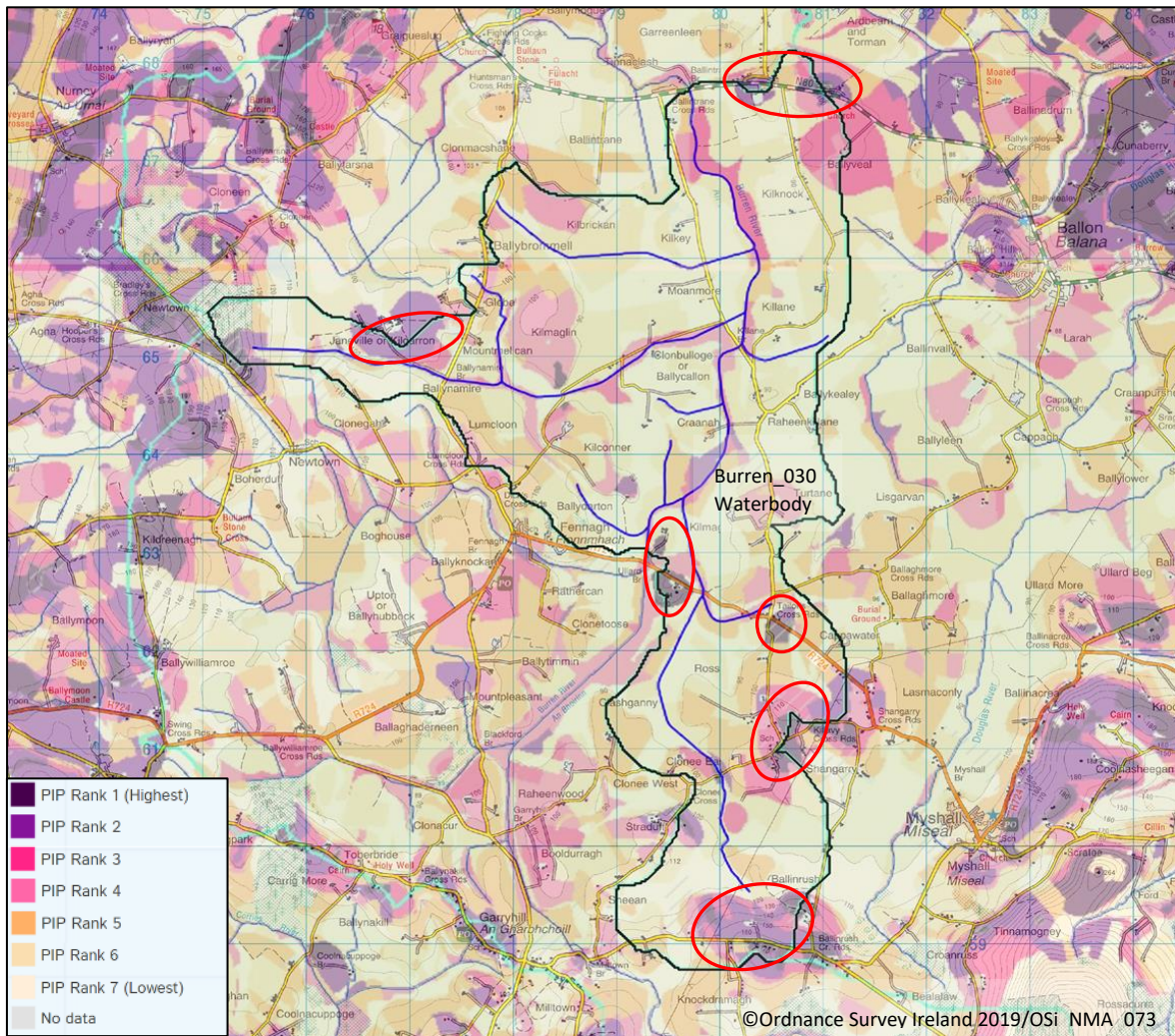


Figure 24. Pollution Impact Potential map for Nitrates. Burren_030

3.4 Burren_040

- Hydromorphology, specifically channelisation, identified by the EPA as a significant pressure.
- The Burren Drainage District includes Burren_040, see **Figure 23**.
- Agriculture, specifically tillage, identified by the EPA as a significant pressure.
- Recently cleared forestry in the headwaters of some tributaries.
- There is a composting plant located on one of the tributaries.
- The urban wastewater treatment plant for Rathoe is located in Burren_040; it has not been identified as a significant pressure.
- Chemical analysis demonstrates Nitrate levels high with regular exceedances of the Indicative Quality Threshold. Surface Water Receptor Pollution Impact Potential (PIP) maps showing areas of high and medium Nitrate susceptibility to the North and North East of the catchment.

Burren PAA

- Chemical analysis demonstrates elevated Phosphate levels with EQS exceedances. Surface Water Receptor PIP maps for Phosphate showing areas of high susceptibility along the water body corridor, with more extensive areas in the south of the catchment.

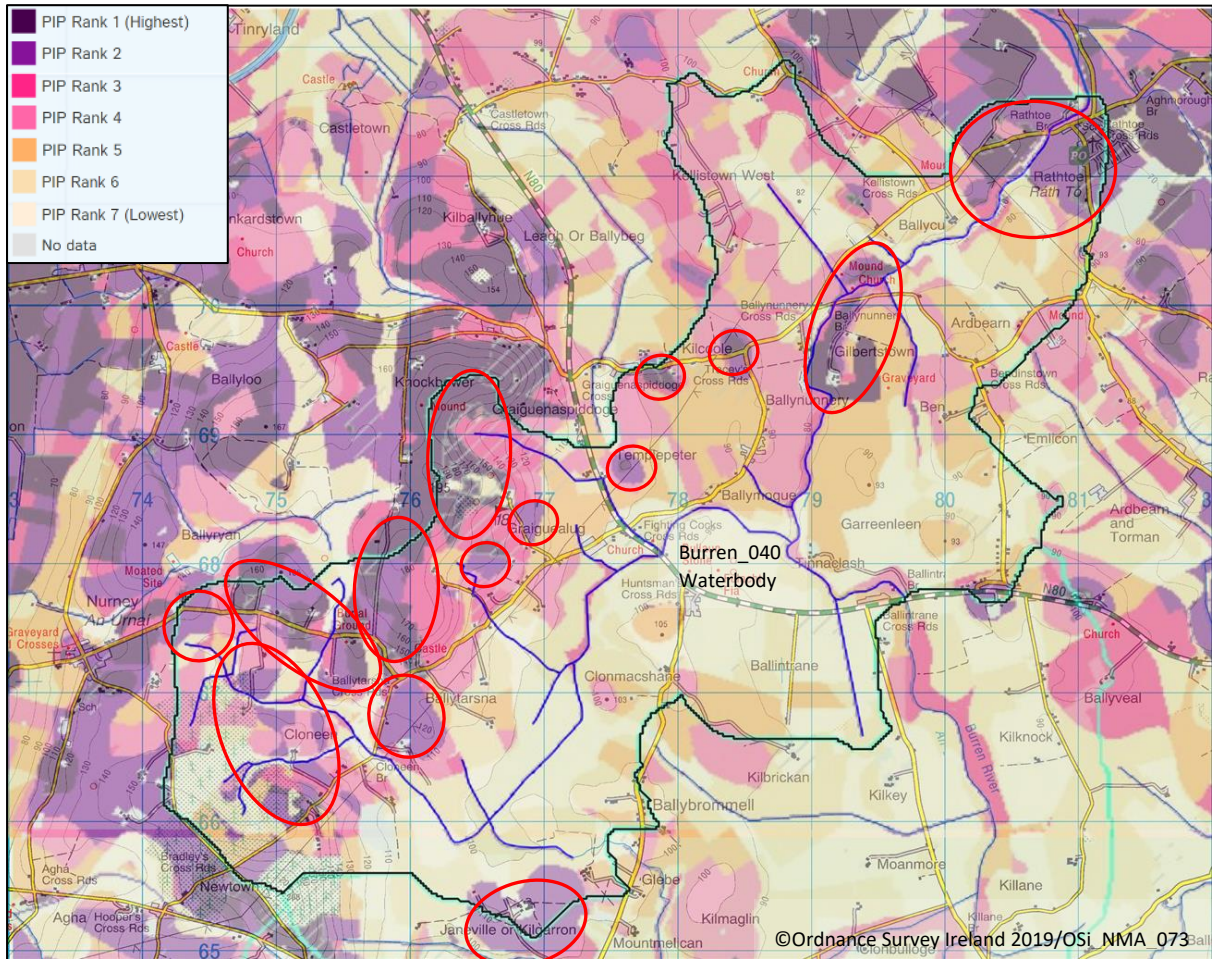


Figure 25. Pollution Impact Potential map for Nitrates. Burren_040

Burren PAA

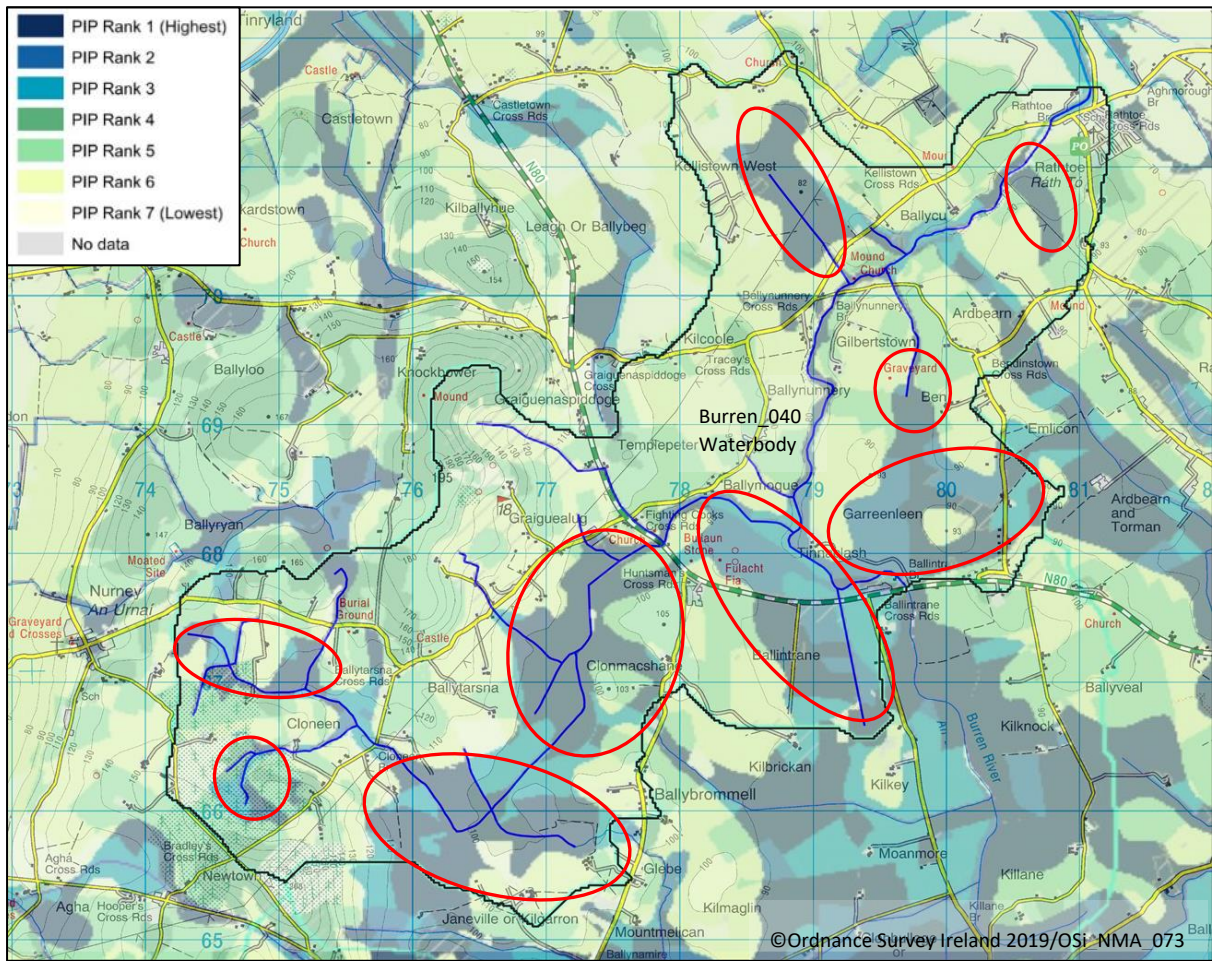


Figure 26. Pollution Impact Potential map for Phosphates. Burren_040.

3.5 Burren_060

- Hydromorphology, specifically channelisation, identified by the EPA as a significant pressure.
- The Burren Drainage District includes Burren_060, see **Figure 23**.
- Urban Run-off from diffuse sources identified by the EPA as a significant pressure. There are 2 storm water overflows discharging to the Burren_060.
- Chemical analysis demonstrates Nitrate levels are high, all results are above the Indicative Quality Threshold. Surface Water Receptor Pollution Impact Potential (PIP) maps show extensive areas of high Nitrate susceptibility outside the urban environment.

Burren PAA

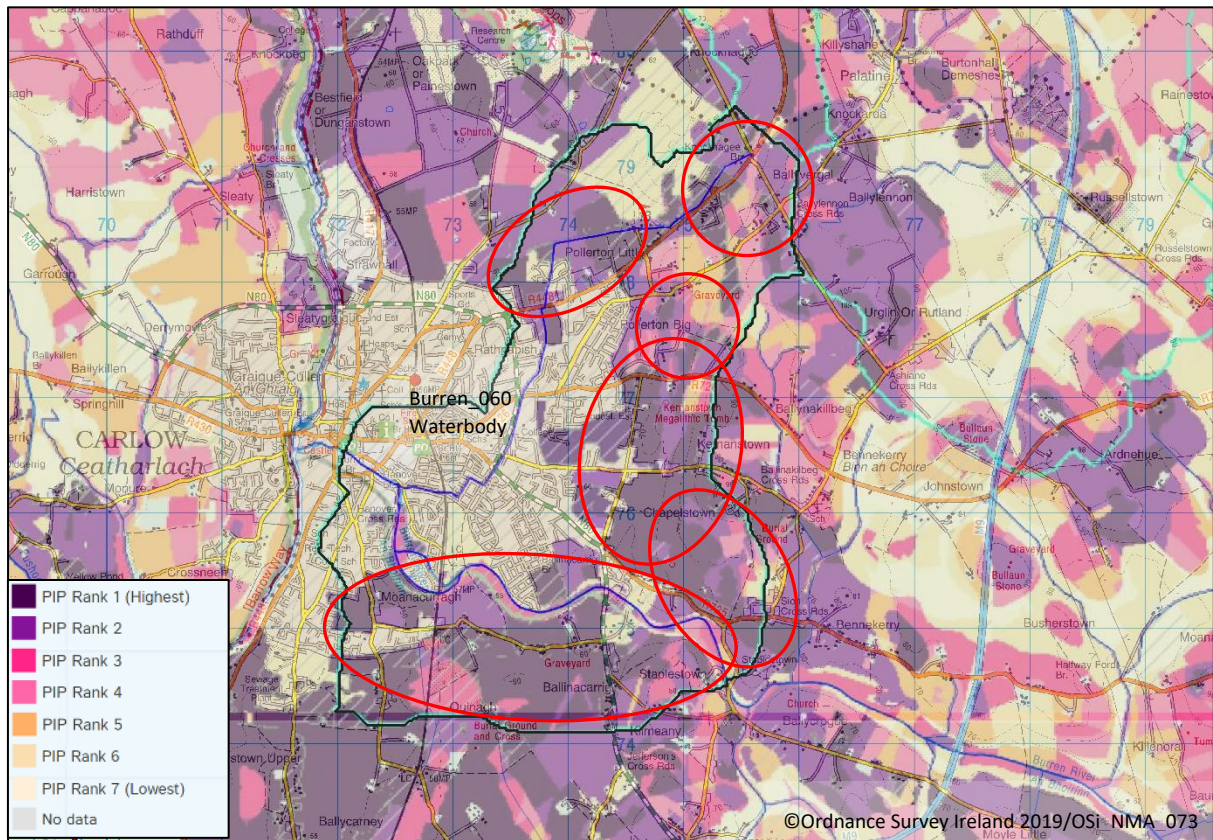


Figure 27. Pollution Impact Potential map for Nitrates. Burren_060.

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4 Pathway Information and Analysis

Two main compartments and three sub-compartments have been identified for the significant issues in the Burren PAA and are described in **Table 8**. The broad regional pathway framework is provided by the aquifer map (**Figure 28**) and the soil type map (**Figure 29**).

- **Compartment 1** is made up of a locally important aquifer which is moderately productive only in local zones (LI) and a poor aquifer which is generally unproductive except for local zones (PI). The Compartment is primarily underlain by granites and other igneous intrusive rocks which are generally unproductive with the main flow-paths in a thin upper fractured zone and occasional fault zones however in east Carlow several meters of weathered granite may be present, giving a free draining situation (EPA, 2018). The compartment is subdivided into 2 sub-compartments: 1A well-drained soils and 1B poorly- drained soils. The main flow-paths for Compartment 1 are subsurface flow in Sub-Compartment 1A and overground flow in Sub-Compartment 1B.
- **Compartment 2** is made up of a regionally important aquifer which is karstified. Flow is diffuse in fractures, bedding planes and small conduits. The Compartment is underlain primarily by Dinantian Dolomitised Limestone along with some Dinantian Pure Bedded Limestones. There is also a Sand and Gravel aquifer to the East of the compartment. There is only one sub-compartment which is characterised by well drained soils. The main flow-path is subsurface flow.

Burren PAA

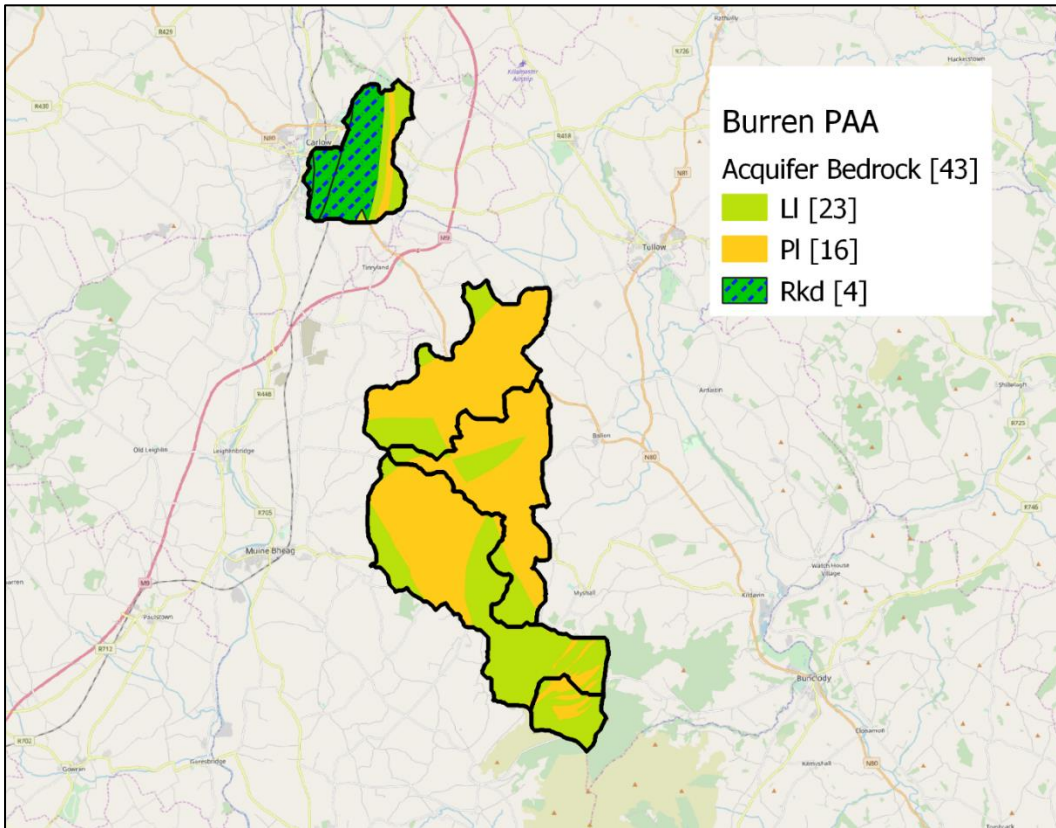


Figure 28. Aquifer Map.

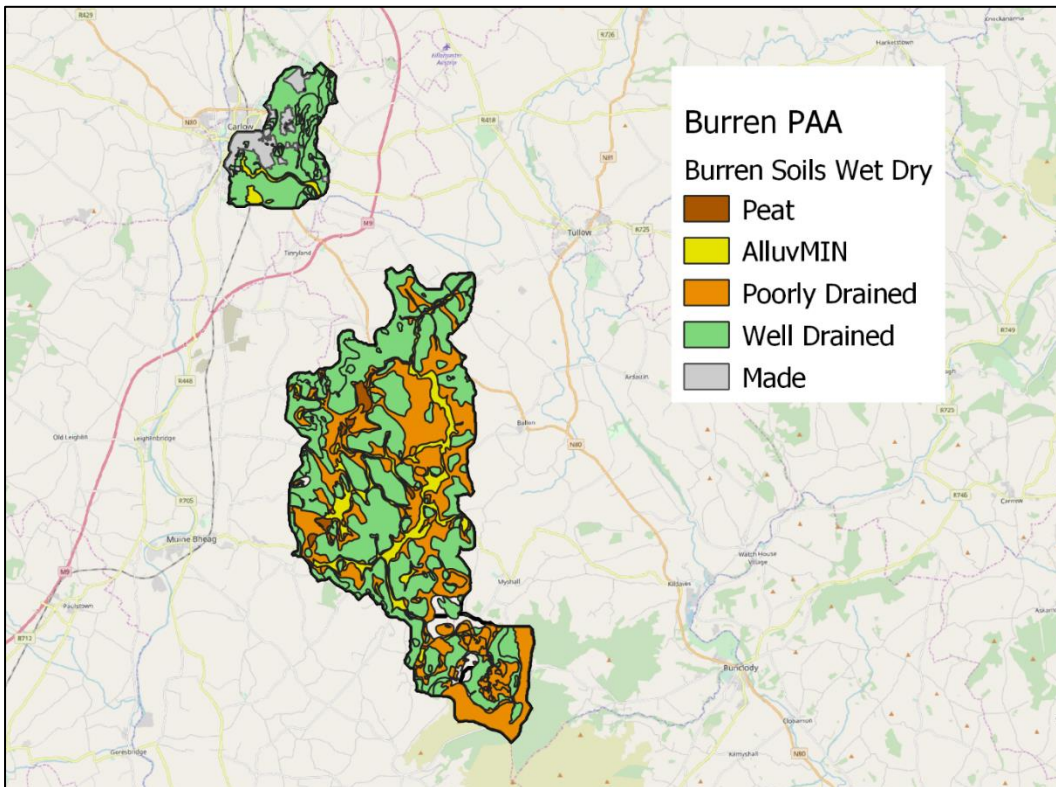


Figure 29. Soils Map.

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Table 8. Main pathways identified in each compartment.

	Compartment 1		Compartment 2
Direct ¹			
Aquifer	LI & PI		Rkd primarily (sand and gravel aquifer)
Rock Units	Granites & other Igneous Intrusive rocks, Ordovician Metasediments		Diniantian Dolomitised Limestones
	Sub-Compartment 1A	Sub-Compartment 1B	Sub-Compartment 2A
Soil type	Well Drained	Poor Drained	Well Drained
Subsoil	Rock & Granite Till	Rock, Granite Tills, Alluvium, Cut away	Limestone Gravels & Tills, & Rock
Groundwater Vulnerability	X, E, H, M, I	X, E, H, M, L	X, E,H
PO ₄ PIP	4, 5,6,7	1,2,3	4,5,6,7, & 1(urban)
NO ₄ PIP	1,2,3,4, 5	5, 6,7	1,2,3,4 & 6(urban)
Main Flow Paths	Subsurface	Overground	Subsurface
Location of Monitoring Point	None	Approx. half way	

¹ Point discharges to the water body

5 Interim Story of the Burren PAA

5.1 Burren_010

- Burren_010 is a high status objective water body. It currently at Good ecological status. In 2017 a Q-value 4-5 was recorded at Burren Bridge Coolasnaghta. However, the ecological status is reduced to Good because of hydromorphological pressure. High status was last recorded in Burren_010 in 2012.
- The significant issue is hydromorphology, possibly due to the infrastructure associated with the water abstraction.
- No further details on hydromorphology issue is available at this stage.

5.2 Burren_020

- Burren_020 is currently at Moderate ecological status.
- The latest Q-value 3-4 Moderate was recorded in 2017 at Ullard Bridge.
- Fish Status is also Moderate. Currently querying issues with IFI.
- Burren_020 lies in Compartment 1 and contains a mix of well drained and poorly drained soils as defined by Sub-Compartment's 1A & 1B.
- The significant pressures identified in the Burren_020 are Agriculture and Hydromorphology.
- Nitrate concentrations are elevated in Burren_020 i.e. 2.96 mg/l N, however they do not exceed the action threshold for nitrate i.e. >3.5mg/l N.
- A fish farm operated under a Section 4 License at Milltown Bridge but ceased operations 3 to 4 years ago.
- The pressure from forestry needs to be examined further.

5.3 Burren_030

- Burren_030 is currently at Moderate ecological status.
- The latest Q-value 3-4 Moderate was recorded in 2017 at Ballintrane Bridge.
- The significant pressure identified in the initial characterisation in the Burren_030 is Agriculture. It is considered that hydromorphology, which has not been identified as a pressure may also be a significant pressure due to drainage maintenance works.
- The significant issue impacting water quality in the Burren_030 is Nitrate.
- Burren_030 lies in Compartment 1 and contains a mix of well drained and poorly drained soils as defined by Sub-Compartment's 1A & 1B.
- Higher NO₃ PIP areas occur within the free drained soils, but it should be noted that pockets of high susceptibility are small with the PIP map generally showing areas of medium & low susceptibility. The Alluvial deposits which follow the course of the water body also demonstrate medium & high NO₃ PIP.
- Though generally poorly draining the alluvial deposits are located on the river's lowest points where the groundwater table is close to the surface. The increased connectivity in these areas leads to a higher risk of NO₃ leaching to groundwater.
- This catchment is primarily underlain by granites and other igneous intrusive rocks which are generally poor aquifers. East Carlow however is known to have up to several meters of a

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weathered zone in places which gives free draining conditions (EPA, 2018), and which may explain why we are seeing Nitrate as an issue when NO₃ PIP is not that high.

- PIP maps use farming data from a number of years ago and may not accurately reflect recent changes in practice or intensification.
- Nitrate susceptibility maps support the findings from the PIP maps.
- The source of NO₃ is likely to be in higher NO₃ PIP areas which occur in small pockets and in narrow strips along the water body corridor. However, all areas with free draining soils should be targeted to account for the possibility that the poor aquifer may have increased transmissivity and to account for a possible intensification in farming activities in recent years.

5.4 Burren_040

- Burren_040 is currently at Moderate ecological status.
- The latest Q-value 3 Moderate was recorded in 2017 at Rathoe Bridge.
- The Significant pressures identified in the initial characterisation in the Burren_040 are Agriculture (tillage) and Hydromorphology (Channelisation- Drainage maintenance works possibly a pressure need to confirm).
- The significant issues impacting water quality in the Burren_040 are Nitrate and Phosphate.
- The presence of peat lands and forestry needs to be examined further.
- The UWWTP Rathoe is located in Burren_040, it has not been identified as a significant pressure.
- Burren_040 lies in Compartment 1 and contains a mix of Well Drained and Poorly Drained Soils as defined by Sub-Compartment's 1A & 1B.
- Higher NO₃ PIP areas occur within the free drained soils. It should be noted that the highest risk areas occur in the North and North East of the catchment even though large areas of the catchment are free draining . The Alluvial deposits which occur along the main channel also demonstrate medium & high NO₃ PIP.
- Though generally poorly draining the alluvial deposits are located on the river's lowest points where the groundwater table is close to the surface. The increased connectivity in these areas leads to a higher risk of NO₃ leaching to groundwater.
- This catchment is primarily underlain by granites and other igneous intrusive rocks which are generally poor aquifers. East Carlow however is known to have up to several meters of a weathered zone in places which gives free draining conditions (EPA,2018).
- PIP maps use farming data from a number of years ago and may not accurately reflect recent changes in practice or intensification.
- The source of NO₃ is likely to be in the higher NO₃ PIP areas which occur in the north and north east of the catchment and along the main channel. However, all areas with free draining soils should be targeted to account for the possibility that the poor aquifer may have increased transmissivity and to account for a possible intensification in farming activities in recent years.
- High PO₄ PIP areas occur in poorly drained soils and tend to be along the course of the waterbody and in the south of the catchment.
- The CSA for PO₄ is likely to be in High PO₄ PIP areas.

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5.5 Burren_060

- Burren_060 fell from moderate to poor ecological status in 2017.
- The significant pressures identified in the Burren_060 are Urban Run-Off and Hydromorphology.
- The significant issue impacting water quality in the Burren_060 is Nitrate.
- The inputting surface waterbody Burren_050 is not a part of the PAA. Nitrate levels are high in the Burren_050.
- There are 2 storm water overflows from the local wastewater treatment plant discharging to the Burren_060.
- Agriculture may also be a pressure.
- Burren_060 is characterised by well drained soils.
- High NO₃ PIP areas occur in the well-drained soils outside of the urban area.
- The source of NO₃ outside the urban area is likely to be in high risk NO₃ PIP areas and likely to be coming from outside of the Burren_060 catchment. CSAs in town are likely to be point discharges from storm water overflows and surface water drainage.

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6 Work Plan

6.1 Burren_010

Hydromorphology is the significant pressure in Burren_010, in 2017 Q4-5 was recorded. The EPA are carrying out a hydromorphological assessment of this water body; LAWPRO have not planned any additional local catchment assessments pending the outcome of the hydromorphological assessment.

6.2 Burren_020

Burren_020 is currently at moderate ecological status. The latest moderate Q-value was recorded in 2017 at Ullard Bridge. Fish status is also moderate. The biological status drops from good to moderate across the catchment. Chemical analysis indicates nutrients are not a significant issue here. The significant pressures identified by the EPA are agriculture and hydromorphology. SSIS surveys and field parameters (pH, DO, T, Cond.) should be taken at intervals along the catchment to investigate where the decline in water quality begins and identify critical source areas for any potential issues. SSIS surveying along with field measurements should be taken in the following locations:

- Downstream of the disused fish farm.
- On the two bigger western tributaries .
- At the catchment boundary, Ullard Bridge .
- Downstream of the WWTP discharge point. If impacts are observed further assessments of the WWTP discharge will be carried out.

Following SSIS surveying, river walks will target impacted areas. Chemical testing may also be carried out in impacted areas where necessary to further inform the investigative process. The effect of hydromorphology will be considered as drainage works were carried out by Carlow County Council up until 2014. Further information on the Burren Drainage District will be obtained from Carlow County Council.

6.3 Burren_030

Burren_030 is currently at moderate ecological status. The latest moderate Q-value was recorded in 2017 at Ballintrane Bridge. Chemical analysis at Ballintrane Br. demonstrates elevated NO₃ levels, with numerous exceedances of the NO₃ Indicative Quality Threshold. The significant pressure identified by the EPA is Agriculture. SSIS surveys and field parameters should be taken at intervals along the catchment to investigate any changes in water quality and to identify any critical source areas. An SSIS survey and field parameters should be taken at the following locations:

- On each of the inputting tributaries, one eastern and two western.
- at the catchment boundary at Ballintrane Br.

Following SSIS surveying river walks can be targeted in impacted areas. The source of NO₃ can be in all free draining areas including but not limited to the high risk NO₃ PIP areas which occur in small pockets. The low lying flood plains along the water body corridor will also be investigated. Chemical testing will be carried out in impacted areas where necessary to determine the level of the issues. The effect of hydromorphology will be considered as drainage works were carried out by Carlow

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County Council up until 2014. Further information on the Burren Drainage District will be obtained from Carlow County Council.

6.4 Burren_040

Burren_040 is currently at Moderate ecological status. The latest Moderate Q-value was recorded in 2017 at Rathoe Bridge. Chemical analysis demonstrates elevated PO₄ levels with EQS exceedances and high NO₃ levels with regular exceedances of the Indicative Quality Threshold. The EPA's initial characterisation identified the significant pressures as Agriculture and Hydromorphology. SSIS surveys and field parameters should be taken at intervals along the catchment to investigate any changes in water quality and to identify any critical source areas. An SSIS survey and field parameters should be taken at the following locations:

- On the small western tributary to check for any impact due to the presence of a composting plant.
- On the large western tributary.
- At the catchment boundary at Rathoe Br.
- Downstream of the WWTP discharge point. If impacts are observed further assessments of the WWTP discharge will be carried out.
- Activities such as the golf course, grassed cutaway peatlands and forestry should also be investigated.

Following SSIS surveying, river walks can be targeted in impacted areas. The source of NO₃ can be in all free draining areas including but not limited to the high risk NO₃ PIP areas which occur in the north and north east of the catchment. The low lying flood plains along the water body corridor will also be investigated. The CSA for PO₄ is likely to be in poorly drained high risk PO₄ PIP areas where the pathway will be overland flow. Chemical testing will be carried out in impacted areas where necessary to determine the level of the issues. The effect of hydromorphology will be considered as drainage works were carried out by Carlow County Council up until 2014. Further information on the Burren Drainage District will be obtained from Carlow County Council.

6.5 Burren_060

Burren_060 is currently at Poor ecological status. The latest Poor Q-value was recorded in 2017 at Hanover Bridge. Chemical analysis demonstrates high NO₃ levels with routine exceedances of the Indicative Quality Threshold. The EPA have identified the significant pressures as Urban Run-Off and Hydromorphology. SSIS surveys and field parameters should be taken at intervals along the catchment to investigate any changes in water quality and to identify any critical source areas. SSIS surveys and field parameters should be taken at the following locations:

- The 2 storm water overflows.
- On the northern tributary to check for any impact due to the presence of a golf course.
- At the WFD monitoring point at Hanover bridge.

Following SSIS surveying river walks can be targeted in impacted areas. Point discharges to the river will be noted and assessed. The source of NO₃ outside the urban area is likely to be in high risk NO₃ PIP areas and likely to be coming from outside of the Burren_060 catchment. The pathway for NO₃

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will be subsurface through free draining soils. CSAs in the urban area are likely to be point discharges from storm water overflows and surface water drainage. Chemical testing will be carried out in impacted areas where necessary to determine the level of the issues. The effect of hydromorphology will be considered as drainage works were carried out by Carlow County Council up until 2014. Further information on the Burren Drainage District will be obtained from Carlow County Council.

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7 Possible Mitigation Options

The significant issues identified in the Burren PAA are Hydromorphology, elevated Nitrates and elevated Phosphates.

The EPA are currently developing a tool for assessing hydromorphological pressures. When developed an EPA hydromorphologist will carry out a morphological condition assessment which will inform possible mitigation measures.

Nitrate and Phosphate issues will be addressed using a number of control measures targeting source control, mobilisation control and pathway interception.

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8 References

EPA, 2018. Table 5-1, Local Catchment Assessments: Pressures and Catchment Walks (Volume 2), Guidance on Further Characterisation for Local Catchment Assessments, Version 1. Catchment Science and Management Unit, Environmental Protection Agency.

The desk study was completed in May 2020.