

# Upper Caragh

## Priority Area for Action Desk Study

### AFA 0179

#### South-West Region



Photograph of WFD operational monitoring point at 'Foot Bridge downstream Owenroe River Confluence', taken on 17<sup>th</sup> of July 2019

**Disclaimer:**

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. The Local Authority Waters Programme (LAWPRO) nor the author(s) accept any responsibility whatsoever for loss or damage occasioned, or claimed to have been occasioned, in part or in full as a consequence of any person acting or refraining from acting, as a result of a matter contained in this publication.

Copyright ©LAWPRO, February 2020

This report cannot be reproduced without the prior written consent of LAWPRO.

## Table of Contents

Acknowledgements.....	3
Summary .....	4
1 Background .....	6
1.1 Location of Upper Caragh Priority Area for Action and Reasons for Selection .....	6
1.2 Waterbody information .....	10
2 Receptor Assessment.....	12
2.1 Overview table .....	13
2.2 Q values.....	17
2.3 Hydrochemistry.....	20
2.4 Summary of Issues .....	22
3 Significant pressures .....	23
3.1 Initial EPA characterisation .....	23
3.2 Conclusions on the Significant Pressures.....	24
4 Pathways Information (diffuse pollution) .....	24
4.1 Conceptual Model Development.....	24
5 Interim conclusions on the PAA.....	26
6 Workplan.....	28
6.1 EPA further characterisation actions .....	28
6.2 Additional Information Requirements.....	28
6.3 Local Catchment Assessment.....	28
7 Review of possible mitigation options.....	33
8 Communications .....	33
9 Appendices.....	34

List of Figures

Figure 1-1: Upper Caragh Waterbodies ..... 7  
 Figure 1-2: Upper Caragh Priority Area for Action WFD Risk Map ..... 8  
 Figure 1-3: Upper Caragh Priority Area for Action Ecological status (2016)..... 9  
 Figure 2-1: WFD monitoring stations..... 12  
 Figure 2-2: Q value, at Caragh - Br SW of Cloghfune ..... 17  
 Figure 2-3: Q value, at Foot-bridge d/s Owenroe R confl ..... 17  
 Figure 2-4: Q value, at site 1.1 km u/s Caragh R confl ..... 18  
 Figure 2-5: Annual average Total Oxidised Nitrogen levels (as N), at 1.1 km u/s Caragh R confl ..... 20  
 Figure 2-6: Annual average ammonia levels (as N), at 1.1 km u/s Caragh R confl ..... 20  
 Figure 2-7: Annual average ortho-Phosphate levels (as P), at 1.1 km u/s Caragh R confl..... 21  
 Figure 2-8: BOD results at 1.1 km u/s Caragh R confl ..... 21  
 Figure 6-1: Sample locations for Caragh\_010 ..... 30  
 Figure 6-2: Sample locations for Caragh\_020 ..... 31  
 Figure 6-3: Sample locations for Owenroe (Caragh\_010)..... 32  
 Figure 9-1: Pollution impact potential: surface water receptor phosphate PIP Map ..... 34  
 Figure 9-2: Soils Wet/Dry ..... 35  
 Figure 9-3: Aquifer Vulnerability..... 36  
 Figure 9-4: Subsoil Permeability ..... 37  
 Figure 9-5: Aquifer Type ..... 38  
 Figure 9-6: Ground Waterbodies ..... 39  
 Figure 9-7: Soil Type..... 40  
 Figure 9-8: Bedrock Aquifer ..... 41  
 Figure 9-9: Land Use ..... 42

List of Tables

Table 1-1: Background information on the Upper Caragh Priority Area for Action ..... 6  
 Table 1-2: Summary table of individual waterbodies within the Upper Caragh Priority Area for Action  
 ..... 10  
 Table 1-3: Monitoring point locations ..... 10  
 Table 2-1: Receptor information for Caragh\_010 and Caragh\_020 ..... 13  
 Table 2-2: Receptor information for Owenroe (Caragh)\_010, Cloon KY and Reagh Mullaghanattin... 15  
 Table 2-3: Table of Q values..... 19  
 Table 3-1: Initial EPA characterisation ..... 23  
 Table 4-1: Conceptual model ..... 25  
 Table 6-1: EPA further characterisation actions ..... 28

## Acknowledgements

The authors would like to acknowledge the contribution of Kerry County Council staff to this report and thank them for their support of the Local Authority Waters Programme. The Council has carried out a significant amount of work in the Upper Caragh catchment in recent years.

## Summary

The Upper Caragh Priority Area for Action (PAA) consists of three river waterbodies: Caragh\_010, Caragh\_020 and the Owenroe (Caragh)\_010. The PAA lies within the Caragh\_SC\_010 subcatchment within catchment area Laune-Maine-Dingle Bay. The PAA waterbodies are also part of the Caragh Freshwater Pearl Mussel catchment, listed in Schedule 1 of SI 296, 2009 (The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009). The Freshwater Pearl Mussel European Innovation Partnership (EIP) project, a voluntary result-based agri-environmental programme for farmers, was launched in the area in 2018 and will run for six years.

The three Upper Caragh PAA waterbodies are high ecological status objective sites, currently failing to meet this objective and thus are characterised as *At Risk*.

- Caragh\_010 is 33.65 km in length. Currently this is at Poor ecological status with the biology (invertebrates) driving status.
- Caragh\_020 is 25.81 km in length. Currently this is at Good ecological status with the biology (invertebrates) driving status.
- The Owenroe (Caragh)\_010 is 73.59 km in length. This is at Good ecological status with the biology (invertebrates) driving ecological status.

No chemistry data are available for Caragh\_010 and Caragh\_020. Land use, soils and phosphate PIP maps indicate that the significant issue could be phosphate, ammonia and/or sediment. The significant issues need to be determined/confirmed so that suitable mitigation measures can be identified which will deliver status improvement.

Supporting chemistry data are available for Owenroe (Caragh)\_010. Results are below the relevant EQS's for orthophosphate, ammonia and nitrate.

The PAA overlies a LI aquifer. Soils are generally shallow, peaty and bedrock is at or near the surface in many areas with a few small areas of well-draining soil. The geology is Devonian Old Red Sandstone, overlain mainly by blanket peat or sandstone till. Drainage density is high and there are two lakes in the catchment - Reagh Mullaghanattin (*Not At Risk*) and Cloon KY (*Review*).

Hydromorphology and agriculture were identified as the significant pressures in the initial characterisation of all three waterbodies.

In terms of the significant issue/s, PIP maps indicate areas along the main river channel with high risk of surface phosphate (and sediment) pathways. Corine land use and soil maps indicate pasture on peat in all three waterbodies, with the risk of ammonia loss to surface waters. Areas of land reclamation carry the risk of sediment loss to surface waters. Pathways may be both point sources (e.g. farmyards) and diffuse (e.g. slurry spreading, overland flow and land drains).

### Recommended Actions:

- Undertake SSIS at CARAGH - Br SW of Cloghfune on the Caragh\_010. Also take nutrient samples at this monitoring point.
- Undertake SSIS assessments in Caragh\_010 from tributaries upstream of CARAGH - Br SW of Cloghfune.

- Undertake SSIS at Foot-bridge d/s Owenroe R confl on the Caragh\_020. Also take nutrient samples at this monitoring point.
- Undertake SSIS assessments in Caragh\_020 from tributaries upstream of Foot-bridge d/s Owenroe R confl.
- Undertake SSIS 1.1 km u/s Caragh R confl at this monitoring point on the Owenroe (Caragh\_010).
- Undertake SSIS assessments in Owenroe (Caragh\_010) from tributaries upstream of Foot-bridge d/s Owenroe R confl to the lake (currently unassigned). Cloon KY is a *review* lake. Also carry out SSIS assessments in two tributary streams which flow into the lake.

Information from this first local catchment assessment will inform the extent of additional assessment and stream walks needed.

# 1 Background

## 1.1 Location of Upper Caragh Priority Area for Action and Reasons for Selection

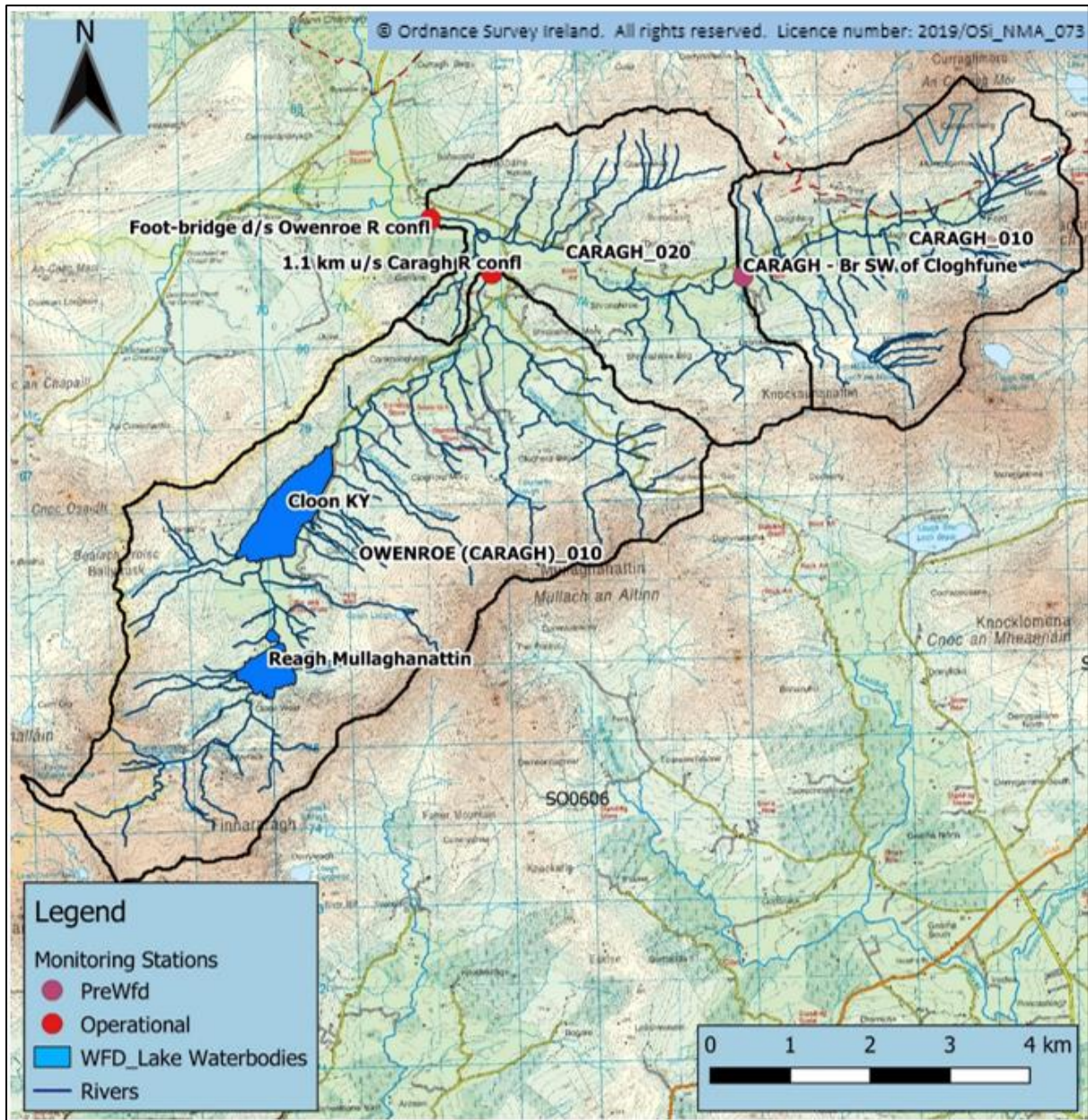
Table 1-1: Background information on the Upper Caragh Priority Area for Action

Priority Area for Action	Catchment Number	Catchment Name	Sub catchment	Region	Local Authority
Upper Caragh	22	Laune-Maine-Dingle Bay	22_13 Caragh_SC_010	Southwest	Kerry

Priority Area for Action	No of <i>At Risk</i> WBs	No of <i>Review</i> WBs	No of dRBMP Prioritised WBs	No of WBs for Status Improvement:		
				2021	2027	Beyond 2027
Upper Caragh	3	0	3	1	2	0

Reasons for selection	
	<ul style="list-style-type: none"> <li>Failing to meet protected area objectives for Priority 8 Freshwater Pearl Mussels.</li> <li>Opportunity to work with KerryLIFE.</li> <li>Important fishery - Arctic char are unusual genetically here.</li> <li>High scenic value.</li> <li>Headwaters to river Caragh.</li> <li>Three <i>At Risk</i> High Ecological Status objective water bodies.</li> </ul>

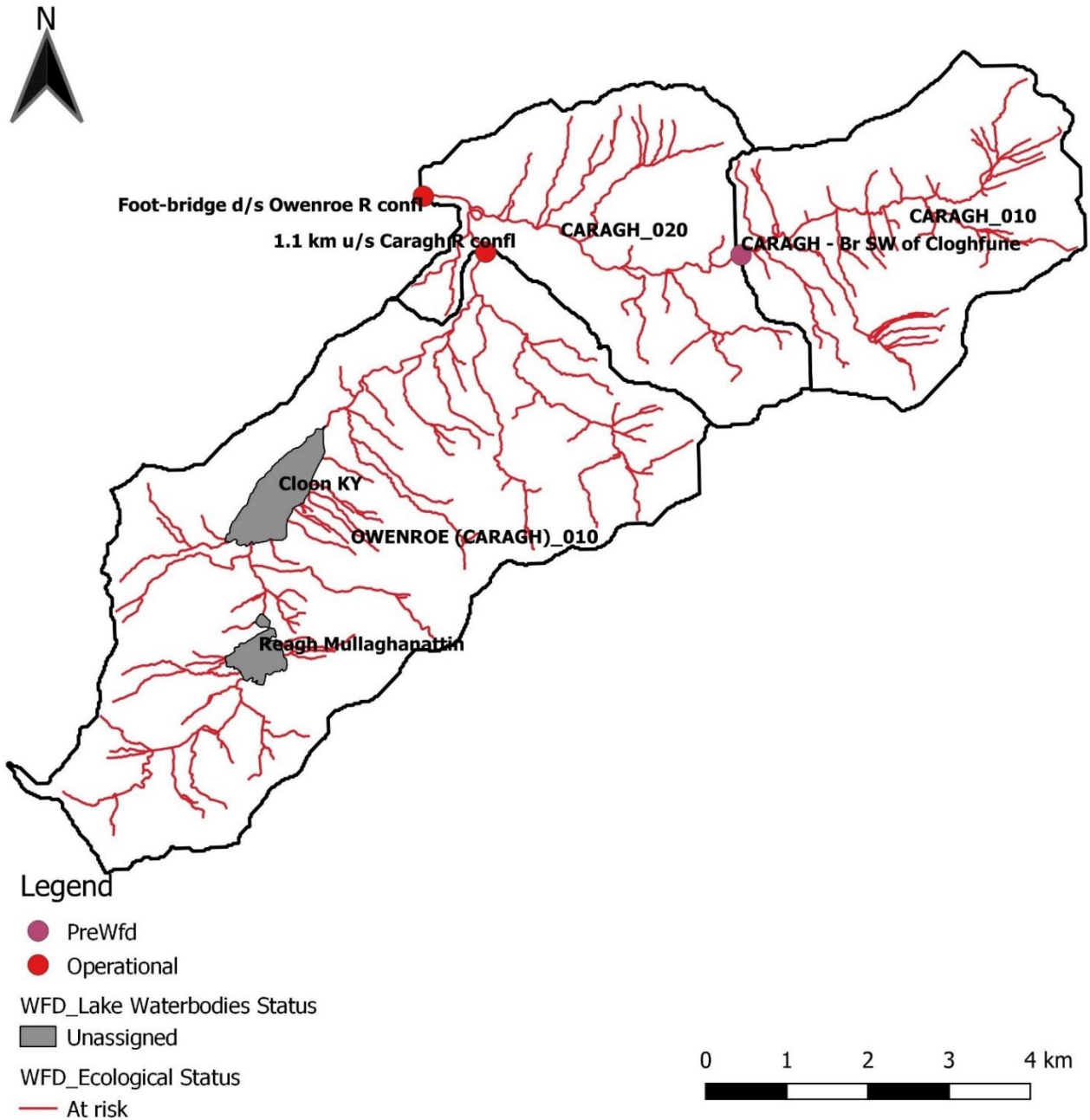
A map of the Upper Caragh waterbodies is presented in figure 1.1 below:



Source: EPA

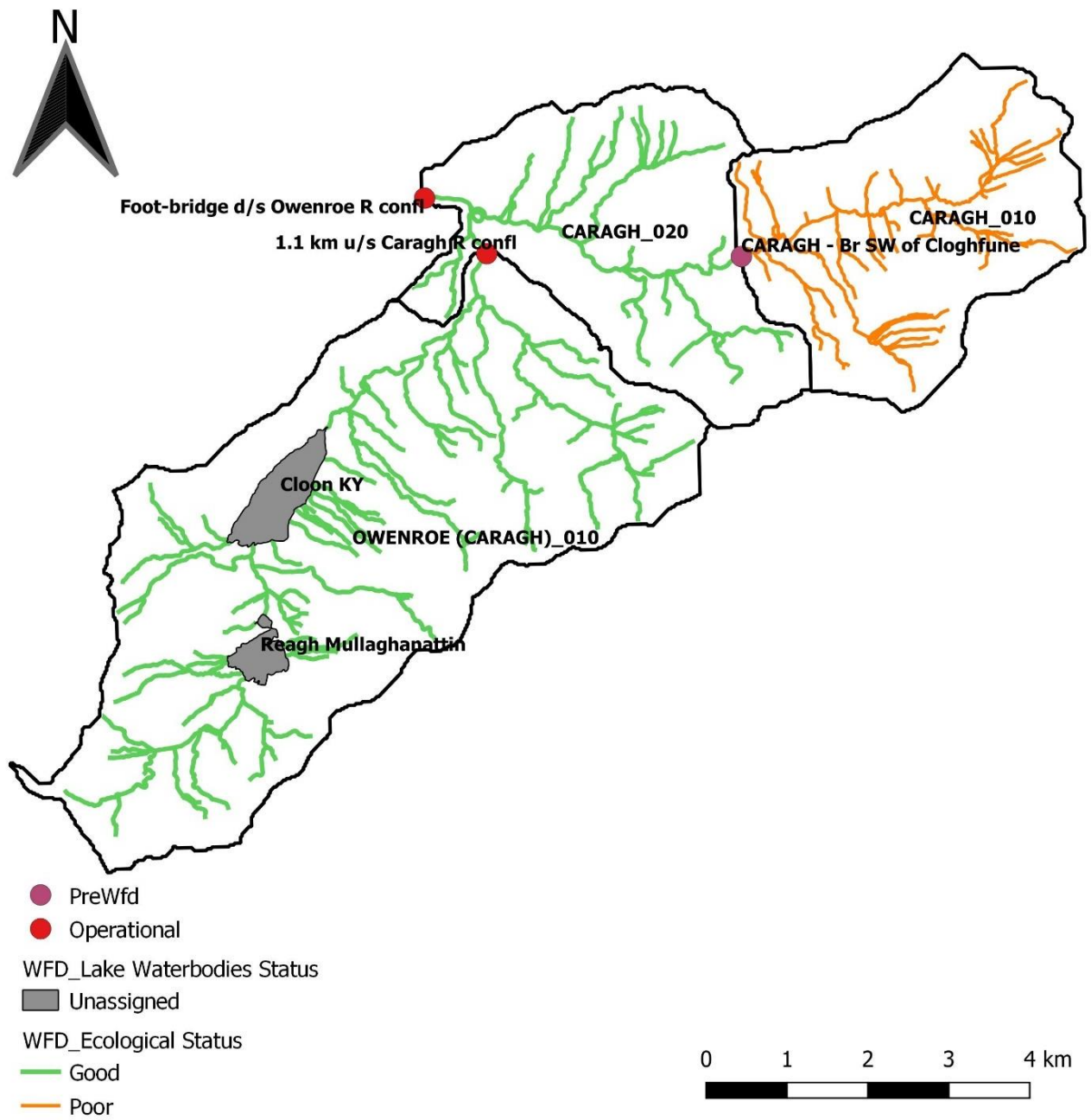
Figure 1-1: Upper Caragh Waterbodies

The Upper Caragh River waterbody risk and status maps are shown on figures 1.2 and 1.3 respectively, with monitoring point locations.



Source: EPA 2018

Figure 1-2: Upper Caragh Priority Area for Action WFD Risk Map



Source: EPA 2018

Figure 1-3: Upper Caragh Priority Area for Action Ecological status (2016)

## 1.2 Waterbody information

Table 1.2 outlines summary status and pressure information on each waterbody. Details of monitoring points on each waterbody are provided in table 1.3 and shown on the map in figure 1.1.

Table 1-2: Summary table of individual waterbodies within the Upper Caragh Priority Area for Action

Water body Code	Water body Name	Water body Type Name	Date to meet Environmental Objective	Risk	Status Objective	Ecological Status			Pressures		
						07-09	10-12	10-15	Category	Sub Category	Significant
IE_SW_22C020200	Caragh_010	River	2027	At risk	High	Good	Poor	Poor	Hydromorphology	Land Drainage	Yes
									Agriculture	Agriculture	Yes
IE_SW_22C020400	Caragh_020	River	2027	At risk	High	Good	Good	Good	Hydromorphology	Land Drainage	Yes
									Agriculture	Agriculture	Yes
IE_SW_22O040200	Owenroe (Caragh)_010	River	2021	At risk	High	Good	Good	Good	Agriculture	Agriculture	Yes
									Hydromorphology	Land Drainage	Yes
IE_SW_22_206	Cloon KY	Lake	-	Review	Unassigned	Unassigned	Unassigned	Unassigned			
IE_SW_22_192	Reagh Mullaghanattin	Lake	-	Not At Risk	Unassigned	Unassigned	Unassigned	Unassigned			

Source: EPA 2018

Table 1-3: Monitoring point locations

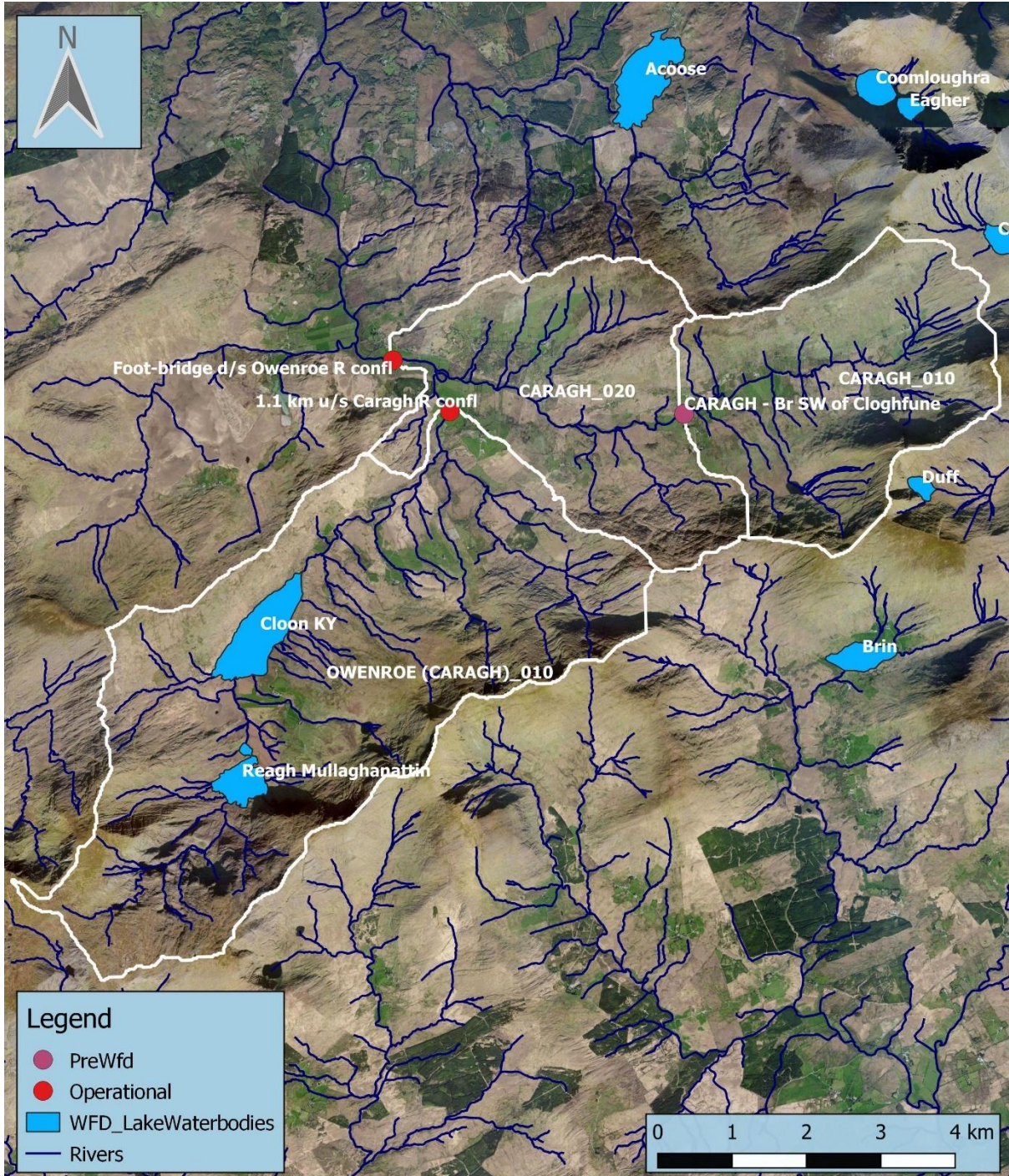
Upper Caragh Priority Area for Action Desk Study Report

Waterbody	Monitoring Point Code	Name	Type	Comments
Caragh_010	RS22C020200	CARAGH - Br SW of Cloghfune	PreWfd	Includes Q data only
Caragh_020	RS22C020400	Foot-bridge d/s Owenroe R confl	Operational	Includes Q data only
Owenroe (Caragh)_010	RS22O040200	1.1 km u/s Caragh R confl	Operational	Includes Q data chemistry data
Cloon KY	Not monitored	-	-	-
Reagh Mullaghanattin	Not monitored	-	-	-

Source: EPA 2018

## 2 Receptor Assessment

Monitoring stations are shown on the map below:



Source: EPA

Figure 2-1: WFD monitoring stations

## 2.1 Overview table

Table 2-1: Receptor information for Caragh\_010 and Caragh\_020

	Figures Tables	Caragh_010	Caragh_020
<b>Risk Category</b>	Y	<i>At risk</i>	<i>At risk</i>
<b>Monitoring station</b>	Y	RS22C020200	RS22C020400
<b>Biological Status (Inverts)</b> 2010-2015 2018 Q data Trends in Q values	Y	Poor (3)	Good (4)
		Q3 (Poor)	Q4 (Good)
		Good status in 2011. No data	Good status since 2007. No data
<b>Biological Status (fish)</b>			
<b>Hydrochemistry Data</b>			
<b>Ortho-P (mg/l P)</b> Baseline Indicative quality Trends - significant? Distance to threshold	Y	No data	No data
		No data	No data
		No data	No data
		No data	No data
<b>NH4-N (mg/l N)</b> Baseline Indicative quality Trends - significant? Distance to threshold	Y	No data	No data
		No data	No data
		No data	No data
		No data	No data
<b>TON (mg/l N)</b> Baseline Indicative quality Trends - significant? Distance to threshold		No data	No data
		No data	No data
		No data	No data
		No data	No data
<b>Supporting Conditions</b> Chemical conditions Oxygenation Conditions Acidification Conditions		No data	No data
<b>Hydromorphology</b>			
<b>RHAT score</b>		No data	No data
<b>Evidence of Arterial drainage</b>		No	No
<b>Ecological Status (2010–2015)</b>		Poor	Good

	Figures Tables	Caragh_010	Caragh_020
<b>Trends (2010-2015)</b>		Yes drop. Good status in 2011.	Good status since 2007.
<b>Protected Areas</b>		None	None
<b>WFD Objective</b>		High	High
<b>EPA biologist notes (if any)</b>		Some areas of high rank PIP for P to SW along channel; substrate/siltation is moderate. Check with KerryLIFE for further chemistry data. Investigative assessment.	Some areas of high rank PIP for P to SW at d/s extent; substrate/siltation is slight. Check with KerryLIFE for further chemistry data. Investigative assessment.
<b>Significant issue/impact for receptor</b>		-See section 2.4	-See section 2.4

Source: EPA 2018

Table 2-2: Receptor information for Owenroe (Caragh)\_010, Cloon KY and Reagh Mullaghanattin

	Figures Tables	Owenroe (Caragh)_010	Cloon KY	Reagh Mullaghanattin
<b>Risk Category</b>	Y	<i>At risk</i>	<i>Review</i>	<i>Not At risk</i>
<b>Monitoring station</b>	Y	RS220040200	No monitoring station	No monitoring station
<b>Biological Status (Inverts)</b> 2010-2015 2018 Q data Trends in Q values	Y	Good (4)	Unassigned	Unassigned
		Q4 (Good)	Unmonitored	Unmonitored
		Good status since 2007.		
<b>Biological Status (fish)</b>		No data	No data	No data
<b>Hydrochemistry Data</b>				
<b>Ortho-P (mg/l P)</b> Baseline Indicative quality Trends - significant? Distance to threshold	Y	0.003ppm 2015 (Baseline 0.003)	No data	No data
		High	No data	No data
		Yes, downward trend	No data	No data
		Far	No data	No data
<b>NH4-N (mg/l N)</b> Baseline Indicative quality Trends - significant? Distance to threshold	Y	0.022ppm 2015 (Baseline 0.014)	No data	No data
		High	No data	No data
		No, upward trend	No data	No data
		Far	No data	No data
<b>TON (mg/l N)</b> Baseline Indicative quality Trends - significant? Distance to threshold		0.123 ppm 2015 (Baseline 0.204)	No data	No data
		Good	No data	No data
		No, upward trend	No data	No data
		Far	No data	No data
<b>Supporting Conditions</b> Chemical conditions? Oxygenation Conditions Acidification Conditions		Pass	No data	No data
		Pass		
		Pass		
<b>Hydromorphology</b>				
<b>RHAT score</b>		No data	No data	No data
<b>Evidence of Arterial drainage</b>		No	No	No
<b>Ecological Status (2010–2015)</b>		Good	Unassigned	Unassigned

	Figures Tables	Owenroe (Caragh)_010	Cloon KY	Reagh Mullaghanattin
<b>Trends (2010-2015)</b>		Good status since 2007.	-	-
<b>Protected Areas</b>		None	None	None
<b>WFD Objective</b>		High	Good	Good
<b>EPA biologist notes (if any)</b>		2013 biology- good. Chemistry suggests upwards trend, but all are far from threshold and 2013-2014 chemistry data is all good. Low PIP (N and P). Substrate/siltation is slight. Check with KerryLIFE for further chemistry data. Investigative assessment.	Check with KerryLIFE for further chemistry data. Investigative assessment.	Check with KerryLIFE for further chemistry data. Investigative assessment.
<b>Significant issue/impact for receptor</b>		-see section 2.4	-	-

Source: EPA 2018

## 2.2 Q values

### Caragh\_010 (*At Risk*)

There is one monitoring station on Caragh\_010: the Caragh - Br SW of Cloghfune, RS22C020200, labelled as a pre-WFD monitoring station in the WFD App. Q results for the monitoring point have been consistently poor (Q3) since 2013 (see below figure 2.2).

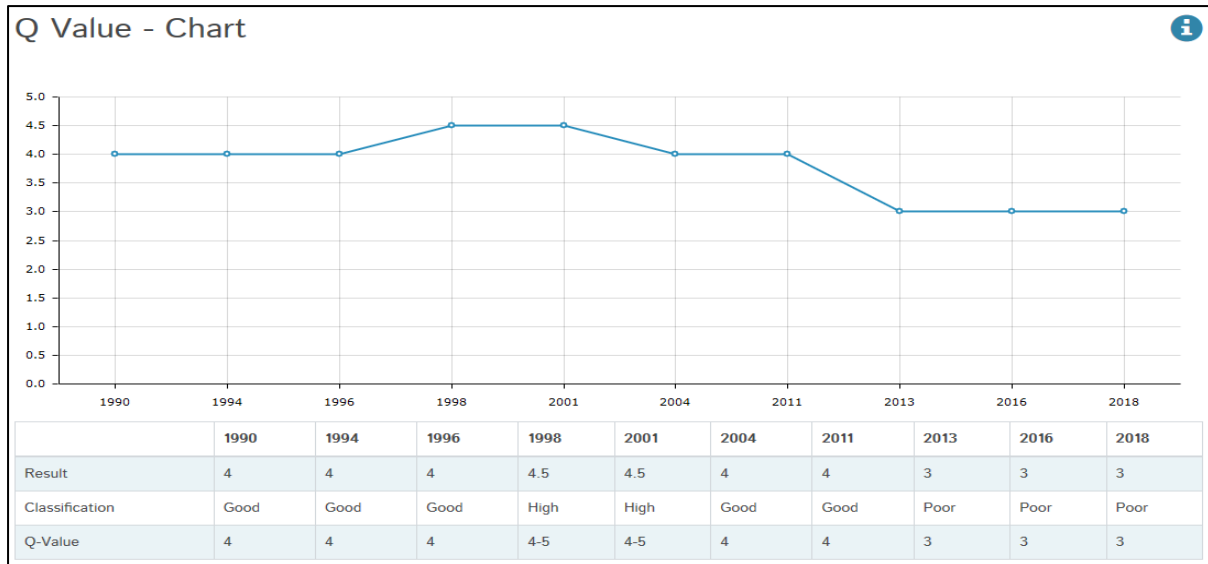


Figure 2-2: Q value, at Caragh - Br SW of Cloghfune

### Caragh\_020 (*At Risk*)

There is one operational station on Caragh\_020, Foot-bridge d/s Owenroe R confl, RS22C020400. Q results for the monitoring point have been consistently good (Q4) since 2007 (see figure 2.3).

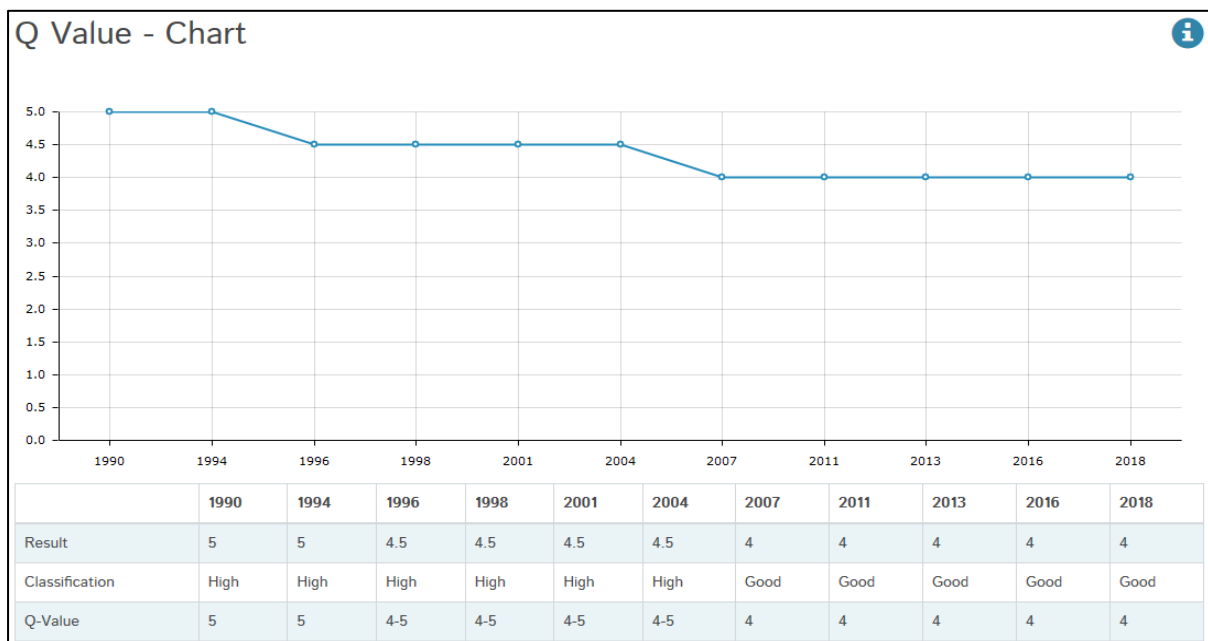


Figure 2-3: Q value, at Foot-bridge d/s Owenroe R confl

Owenroe (Caragh)\_010 (*At Risk*)

There is one operational station on Owenroe (Caragh)\_010, site name 1.1 km u/s Caragh R confl, RS22O040200. Q results for the monitoring point have been consistently good (Q4) since 2007 (see below figure 2.4).

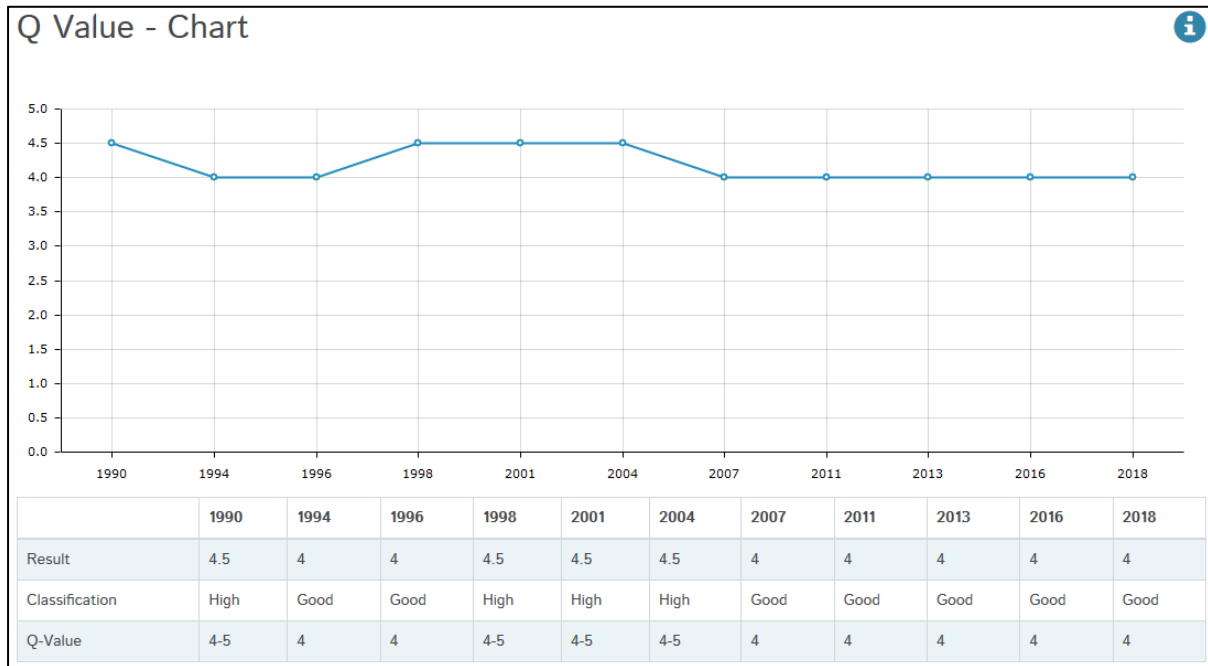


Figure 2-4: Q value, at site 1.1 km u/s Caragh R confl

Reagh Mullaghanattin (*Not At Risk*)

There is no monitoring station for this lake (currently unassigned).

Cloon KY (*Review*)

There is no monitoring station for this lake (currently unassigned).

Table 2-3: Table of Q values

Water body Name	Monitoring Point	1990	1994	1996	1998	2001	2004	2007	2011	2013	2016	2018
Caragh_010	CARAGH - Br SW of Cloghfune	Good	Good	Good	High	High	Good	-	Good	Poor	Poor	Poor
Caragh_020	Foot-bridge d/s Owenroe R confl	High	High	High	High	High	High	Good	Good	Good	Good	Good
Owenroe (Caragh)_010	1.1 km u/s Caragh R confl	High	Good	Good	High	High	High	Good	Good	Good	Good	Good
Reagh Mullaghanattin	-	-	-	-	-	-	-	-	-	-	-	-
Cloon KY	-	-	-	-	-	-	-	-	-	-	-	-

Source: EPA 2018

### 2.3 Hydrochemistry

Annual average TON, ammonia and phosphate levels are shown below in figures 2-5 to 2-7 respectively. TON levels are very low, as expected. Ammonia and phosphate levels are graphed with the relevant High Status EQS (annual average) from the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009).

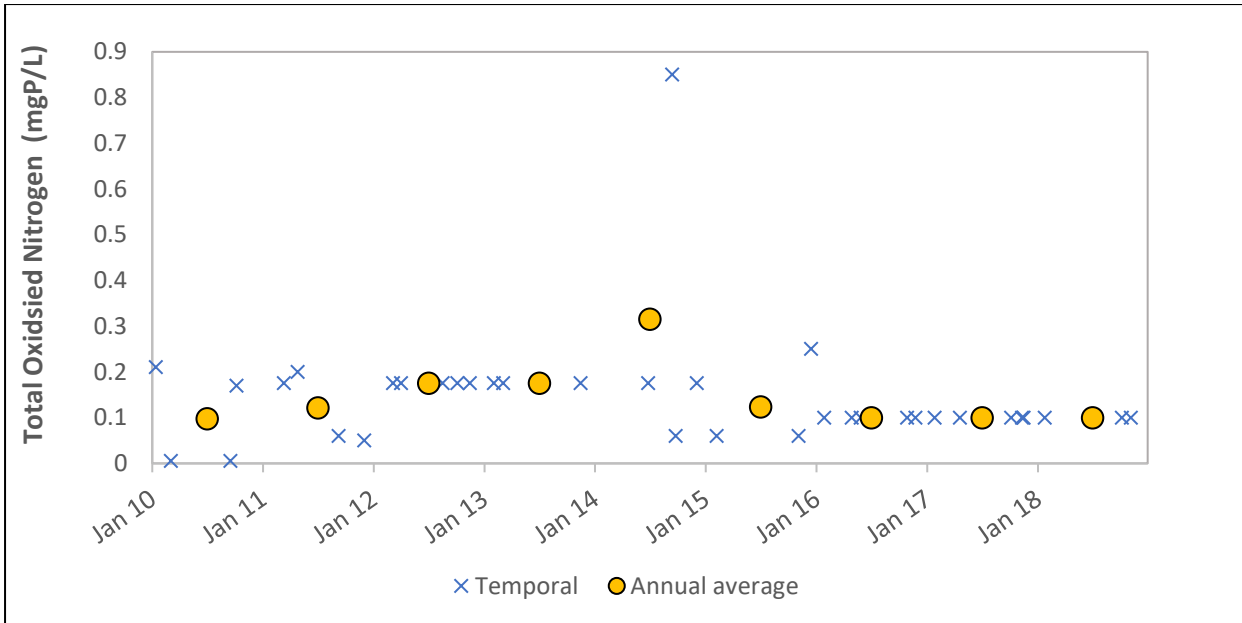


Figure 2-5: Annual average Total Oxidised Nitrogen levels (as N), at 1.1 km u/s Caragh R confl

Annual average ammonia concentrations are below the EQS and are stable. The result for 2018 was 0.018mg/l (see figure 2.6).

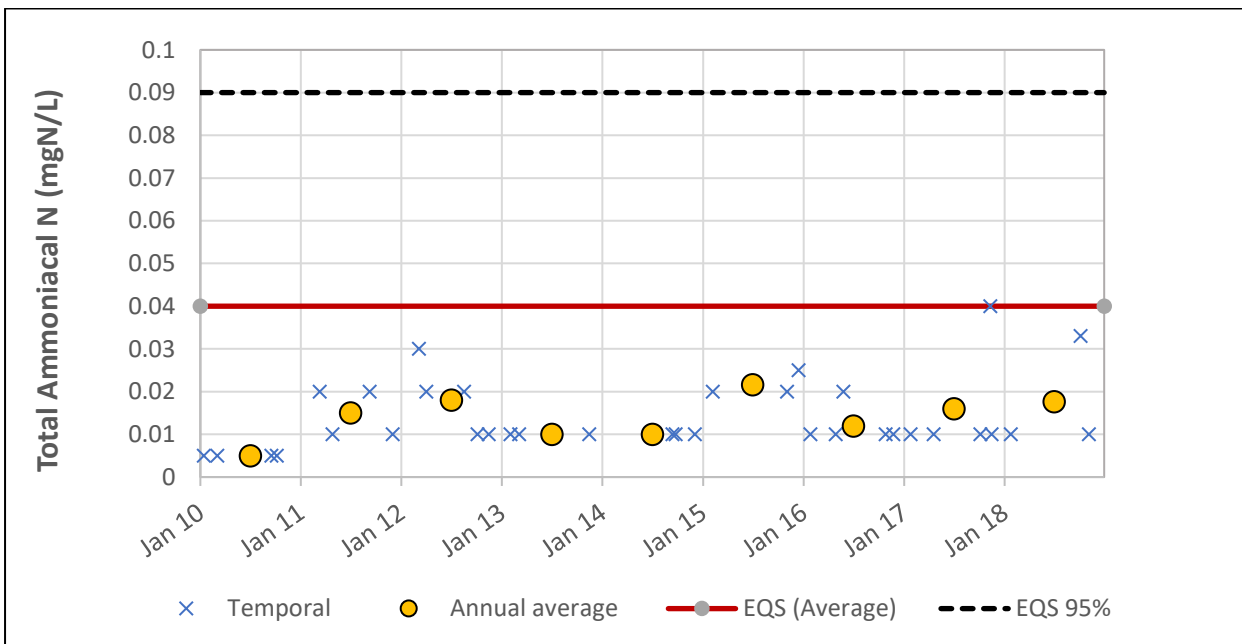


Figure 2-6: Annual average ammonia levels (as N), at 1.1 km u/s Caragh R confl

Annual average orthophosphate levels are below the EQS and stable. The result for 2018 was 0.005mg/l (see figure 2.7).

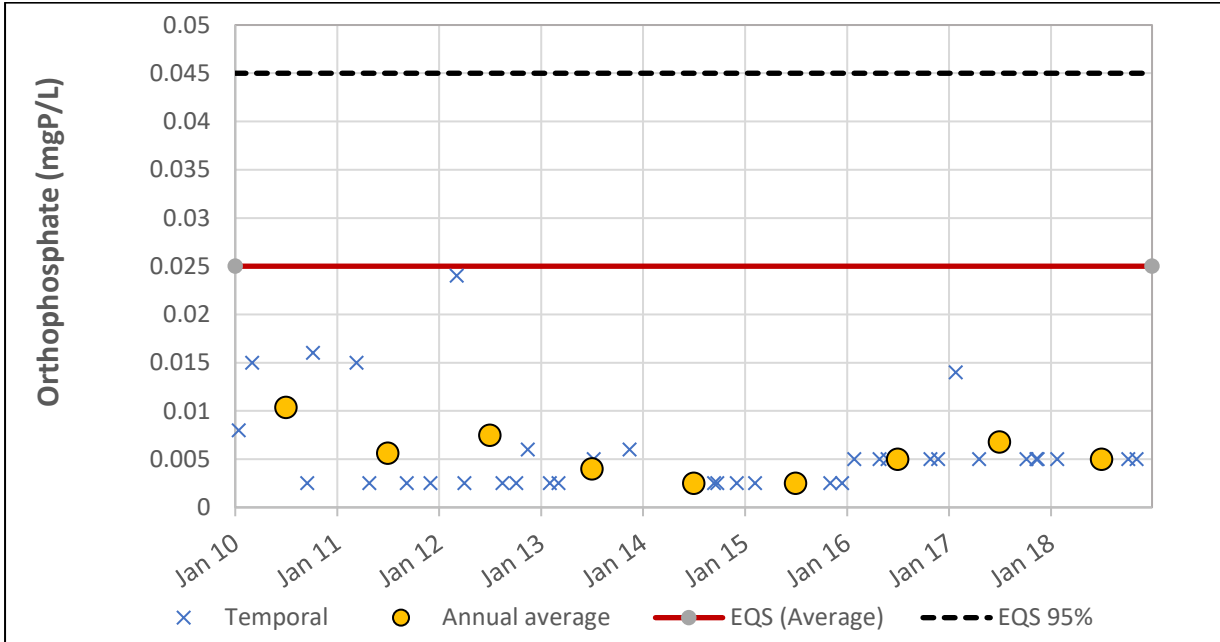


Figure 2-7: Annual average ortho-Phosphate levels (as P), at 1.1 km u/s Caragh R conflu

BOD results are graphed below in figure 2.8. As can be seen from the graph, BOD results have been generally satisfactory. Only one individual result exceeded the High Status EQS of 1.3ppm (annual average).

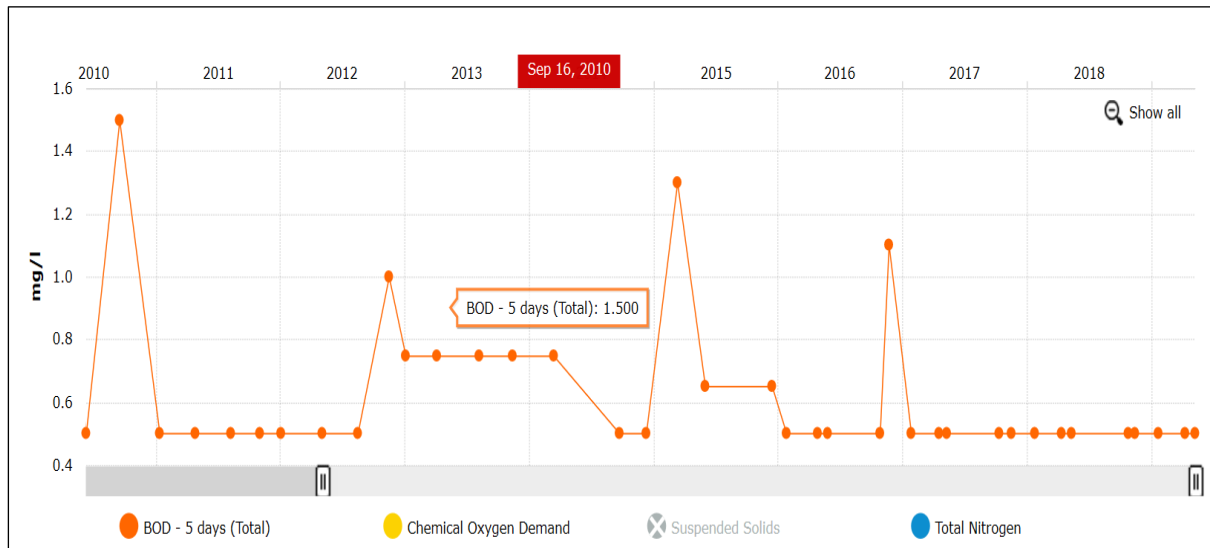


Figure 2-8: BOD results at 1.1 km u/s Caragh R conflu

## 2.4 Summary of Issues

### Caragh\_010 (*AT Risk*)

Biological monitoring results for the WFD monitoring station have been consistently poor (Q3) since 2013. No chemistry data are available for this waterbody. There are areas of pasture on peat in the catchment, carrying the risk of ammonia, phosphate and sediment loss to surface waters. The surface phosphate PIP map indicates very high/high areas for risk of diffuse sources of phosphate along the main river channel. Land drains and surface pathways could also be contributing. The significant issues in the catchment may be ammonia, phosphate and/or sediment.

### Caragh\_020 (*AT Risk*)

Biological monitoring results for the monitoring point on Caragh\_020 have been consistently good (Q4) since 2013. As for Caragh\_010, land use and soil maps indicate pasture on peat, carrying the risk of ammonia, sediment and phosphate loss to surface waters. PIP maps show areas of high rank for surface phosphate (see figure 9.1) particularly to the west, towards the waterbody outlet. However there are no chemistry data available for Caragh\_020. The significant issues in this waterbody may be ammonia, phosphate and/or sediment.

### Owenroe (Caragh)\_010 (*AT Risk*)

Biological monitoring results for the WFD monitoring point have been consistently Good (Q4) since 2007. There are chemistry data available for this waterbody and results indicate that nutrients don't seem to be the issue here; phosphate and ammonia results are below the relevant EQS's. This is supported by the PIP maps for surface phosphate, which indicate mainly low ranked areas throughout the catchment. Sediment may be the significant issue in this waterbody, from land drainage and pasture on peat. There is also a small area of forestry on peat (to the south), which should be investigated.

### 3 Significant pressures

#### 3.1 Initial EPA characterisation

Table 3-1: Initial EPA characterisation

Waterbody Name	Id	Category	Sub Category	Name	Significant	Pressure & Impact details
<b>Caragh_010</b>	WBP0005506	Hydromorphology	Land Drainage	n/a	Yes	Altered habitat due to Hydrological changes Altered habitat due to Morphological changes
	WBP0005507	Agriculture	Agriculture	n/a	Yes	Nutrient Pollution Altered habitat due to Morphological changes
<b>Caragh_020</b>	WBP0005508	Hydromorphology	Land Drainage	n/a	Yes	Altered habitat due to Hydrological changes Altered habitat due to Morphological changes
	WBP0005509	Agriculture	Agriculture	n/a	Yes	Nutrient Pollution Altered habitat due to Morphological changes
<b>Owenroe (Caragh_010)</b>	WBP0005518	Agriculture	Agriculture	n/a	Yes	Nutrient Pollution Altered habitat due to Morphological changes
	WBP0005519	Hydromorphology	Land Drainage	n/a	Yes	Nutrient Pollution Altered habitat due to Hydrological changes, Altered habitat due to Morphological changes

*Source: EPA 2018*

## 3.2 Conclusions on the Significant Pressures and Significant Issues

The WFD App lists Hydromorphology and Agriculture as the significant pressures on all three waterbodies.

No chemistry data are available for Caragh\_010 and Caragh\_020. Phosphate PIP maps indicate areas along the main river channel with high risk of surface phosphate (and sediment) pathways. Land drains and surface pathways could also be contributing. Corine land use and soil maps indicate pasture on peat in all three waterbodies, with the risk of ammonia, phosphate and sediment loss to surface waters. Areas of land reclamation carry the risk of sediment loss to surface waters. There are chemistry data available for Owenroe (Caragh\_010) and results indicate that nutrients don't seem to be the issue here; phosphate and ammonia results are well below the relevant EQS's. This is supported by the PIP maps for surface phosphate, which indicate mainly low ranked areas throughout the catchment. Sediment may be the significant issue in this waterbody, from land drainage and pasture on peat. Land use, soils and phosphate PIP maps support the EPA conclusions that the significant pressures could be from hydromorphology and agriculture. However, there is also a small area of forestry on peat (to the south) on Owenroe (Caragh\_010), which should be investigated.

Field assessment will be needed to assess potential significant pressure/s on the ground.

## 4 Pathways Information (diffuse pollution)

### 4.1 Conceptual Model Development

The conceptual model is based largely on a combination of aquifer type, bedrock type, soil type, PIP maps (and susceptibility maps). Available information indicates that significant issues are orthophosphate, ammonia and/or sediment. Land use and management must be investigated (agriculture, land drainage and also possibly forestry activities). Flow paths for pollutant transfer are likely to be via diffuse overland flow and land drains with possible contribution from small point sources (eg farmyards and DWWTSs).

Most of the area is covered by poorly draining soils as well as peaty soils (AminSRPT, AminPDPT, BktPt, AminPD). The main flow paths are overland flow of phosphate and sediment (including land drains). The surface phosphate PIP map (see figure 9.1) has areas of very high/high PIP Rank which are along channels under agricultural use and these areas should be the focus for stream walks in assessing phosphate loadings. Ammonia, orthophosphate and/or sediment from agriculture (and possibly forestry) should also be considered as the Corine land usage map (see figure 9.9) indicates pasture on peaty soils, with small areas of forestry on peat also. Orthophosphate and ammonia may be the significant issues here. This needs to be investigated by nutrient sampling. Note that there are a few areas of well-draining soil and this corresponds with the Surface NO3 PIP map. The phosphate contribution via this pathway is likely to be insignificant.

Table 4-1: Conceptual model

Factor	Map Y/N	Description and relevance
<b>Topography</b> Map Aerial imagery		Uplands, high slopes
<b>Soil type</b>	Y	AminSRPT (Shallow Podzols soils with peaty topsoil), AminPDPT (Poorly drained soils with peaty topsoil), BktPt (Blanket Peats), AlluvMIN (Mineral alluvium), AminDW (deep well drained soils), AminPD, (deep poorly drained soils), AminSW (shallow well drained soils)
<b>Subsoil type</b>		RckNcA (Bedrock at surface-Non calcareous), TDSs (Sandstone Till Devonian), BktPt (Blanket peat), GDSs (Devonian Sandstone sands and gravels), A (Alluvium undifferentiated)
<b>Subsoil permeability</b>	Y	Mostly low subsoil less than 3 metres; some moderate; localised areas of low and high
<b>Soil drainage</b>	Y	Mostly poor (blanket peat and poorly drained soil), localised areas of well drained
<b>Gwb</b>	Y	Cahersiveen GWB
<b>Gwb flowpath</b>		Diffuse recharge occurs across the GWB through the subsoils and rock outcrops. Due to the generally low permeability of the aquifers within this GWB and the high slopes, a high proportion of effective rainfall will runoff, or discharge rapidly to surface water courses via interflow and shallow flow. Baseflow to rivers and streams is likely to be relatively low. Flow occurs along fractures, joints and major faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures.
<b>Bedrock unit</b>	Y	Devonian Old Red Sandstones
<b>Aquifer type</b>	Y	Mainly LI (Locally important aquifer, moderately productive only in local zones), Small area of PI (Poor aquifer, generally unproductive except for local zones)
<b>Groundwater vulnerability</b>	Y	Mostly rock near surface(X) and extreme (E) on mountain slopes, some area of high (H) to moderate (M) on the valley, localised areas low by the river.
<b>PO4 susceptibility (surface)</b>		Mainly moderate. Some areas of high along channels in agricultural use. Localised areas of very low on well drained soils
<b>NO3 susceptibility (sub surface)</b>		Very low
<b>NO3 susceptibility (surface)</b>		Mostly low/very low, although high in areas along alluvial river channels. Localised areas of moderate on the well-drained soils (see wet/dry soils map).
<b>Po4 PIP (Surface water)</b>	Y	Mainly moderate (rank 4). Some areas of very high/high (Rank 1 and 2) along channels in agricultural use (see corine map). Localised areas of very low/ low (rank 6 and 7) on well drained drained soils (see wet/dry soils map).
<b>NO3 PIP (ground water)</b>		Very low (rank 7)
<b>NO3 PIP (Surface water)</b>		Mostly very low (rank 7), low (rank 5) in areas along alluvial river channels. Localised areas of low (rank 6) on the well-drained soils (see wet/dry soils map).
<b>Likely main pathway(s)</b>		Near surface drainage and overland flow
<b>Likely CSA(s)</b>		Along channel (especially areas in agricultural use)

From Desk Studies for Areas for Action, EPA Recommendations. Version 3, January 2019

## 5 Interim conclusions on the PAA

### Caragh\_010

- Caragh\_010 is a high ecological status objective site, currently at Poor status and *At Risk*.
- Status is driven by invertebrates; biological status for the monitoring point has been consistently Q3 (poor) since 2013.
- The WFD App gives the significant pressures for Caragh\_010 as hydromorphology and agriculture.
- There are areas of pasture on peat in the catchment, carrying the risk of ammonia, phosphate and sediment loss to surface waters.
- The surface phosphate PIP map indicates very high/high areas for risk of diffuse sources of phosphate along the main river channel. Land drains and surface pathways could also be contributing.
- As there are no water chemistry data available, it is difficult to know which pollutant is impacting the invertebrates here.
- EPA biologist observed substrate/siltation is moderate.
- Land use, soil type and phosphate PIP maps indicates that the possible significant issues may be orthophosphate, ammonia and/or sediment and these areas will be the focus for the local catchment assessments.

### Caragh\_020

- Caragh\_020 is a high ecological status objective site, currently at Good status and *At Risk*.
- Status is driven by invertebrates; biological status for the monitoring point has been consistently Q4 (good) since 2013.
- The WFD App characterises the significant pressures for Caragh\_020 as hydromorphology and agriculture.
- Land use and soil maps indicate pasture on peat, carrying the risk of ammonia, sediment and phosphate loss to surface waters.
- PIP maps show areas of high rank for surface phosphate particularly to the west, towards the waterbody outlet. Land drains and surface pathways could also be contributing.
- As there are no water chemistry data available, it is difficult to know which pollutant is impacting the invertebrates here.
- EPA biologist observed substrate/siltation is slight.
- Land use, soil type and phosphate PIP maps indicates that the possible significant issues may be orthophosphate, ammonia and/or sediment and these areas will be the focus for the local catchment assessments.

### Owenroe (Caragh\_010)

- Owenroe (Caragh\_010) is a high ecological status objective site, currently at Good status and *At Risk*.
- Status is driven by invertebrates; biological status for the monitoring point has been consistently Q4 (good) since 2007.

- The WFD App characterises the significant pressures for Owenroe (Caragh\_010) as hydromorphology and agriculture.
- Chemistry data indicate that nutrients don't seem to be the issue here; phosphate and ammonia results are below the relevant EQS's. This is supported by the PIP maps for surface phosphate, which indicate mainly low ranked areas throughout the waterbody.
- Sediment may be the significant issue in this waterbody, from land drainage and pasture on peat. There is also a small area of forestry on peat (to the south), which should be investigated.
- Land use, soil type and phosphate PIP maps indicate that the possible significant issues may be orthophosphate, ammonia and/or sediment and these areas will be the focus for the local catchment assessments.

## 6 Workplan

### 6.1 EPA further characterisation actions

Table 6-1: EPA further characterisation actions

WB Name	Id	Action	Responsible Organisation	Further Characterisation Action details
Caragh_010	FC002632	IA8 High status RWB pressures	Kerry County Council	Full local catchment assessment to focus on farming and hydromorphological pressures.
Caragh_020	FC002633	IA8 High status RWB pressures	Kerry County Council	Full local catchment assessment to focus on farming and hydromorphological pressures.
Owenroe (Caragh_010)	FC002640	IA8 High status RWB pressures	Kerry County Council	IA8 to focus on agriculture and hydromorphological pressures such as land drainage and bank erosion.

The estimated resource for this local catchment assessment is 90 days.

### 6.2 Additional Information Requirements

- LAWPRO scientist to contact Kerry County Council for information on potential significant pressures including agricultural, forestry and hydromorphological pressures.
- Talk to representatives of Kerry LIFE project for information on their Investigative assessment and chemistry data.
- More detailed information from EPA biologists would be useful.

### 6.3 Local Catchment Assessment

Field investigations to be undertaken at the following locations as outlined below and as shown on figures 6.1, 6.2 and 6.3. The focus is on elevated orthophosphate, ammonia and/or sediment loadings in Caragh\_010, Caragh\_020 and the Owenroe (Caragh)\_010. Identification of tributary streams contributing possible orthophosphate, ammonia and/or sediment loadings will help to focus the work of ASSAP in this PAA. Start in the headwaters (Caragh\_010). Water quality here may be impacting receiving water body (Caragh\_020) downstream.

#### Caragh\_010

- Start at monitoring point for the waterbody, CARAGH - Br SW of Cloghfune on the Caragh\_010. Carry out an SSIS assessment and take nutrient samples at the monitoring point.
- Above this monitoring point, there is an area of high/very high risk rank for surface phosphate. Follow up with SSIS assessments at points 2-14 to assess individual inflow tributaries. Agriculture and a small section of forestry (only on point 5) occur along the tributary streams. Take note of any point sources of sediment here.

### Caragh\_020

- Start at monitoring point for the waterbody, Foot-bridge d/s Owenroe R confl on the Caragh\_020.
- Carry out an SSIS assessment and take nutrient samples at the monitoring point. Above this monitoring point is an area ranked high/very high risk for phosphate to surface waters. Follow up with SSIS assessments at points 2-9 to assess individual inflow tributaries. Agriculture and a small section of forestry on point 2 occur along the tributary streams. Take note of any point sources of sediment here.

### Owenroe (Caragh\_010)

- Start at WFD monitoring point for the waterbody, 1.1 km u/s Caragh R confl on the Owenroe (Caragh\_010). Undertake SSIS assessment and chemistry at this monitoring point.
- Above this monitoring point, there is small section of pasture directly along the main river channel with high risk rank for surface phosphate. Follow up with SSIS assessments at points 2 and 3 to assess individual inflow tributaries. If the condition of point 2 is less than good, undertake SSIS assessment at points 4 and 5. Agriculture and forestry occur along the tributary streams here. Carry out SSIS assessments along the tributary streams on points 6 and 7 (only if SSIS scores at points 4 and 5 indicate impact, to narrow the focus).
- If the condition of point 3 is less than good, follow up with SSIS assessments at points 10-16 to assess individual inflow tributaries.
- Carry out SSIS assessments along the tributary streams on points 17 and 18 (flowing into the lake). This is a high/very ranked area for surface phosphate risk.

The initial information gathered by the local catchment assessment team will inform further, more targeted assessments, where required. When significant issue(s) are identified, appropriate mitigation measures will be discussed and referred to the relevant agency.

Note to samplers: This is a freshwater pearl mussel (FPM) catchment and there may be FPM present. Use bathyscope before kick sampling and comply with internal procedures.

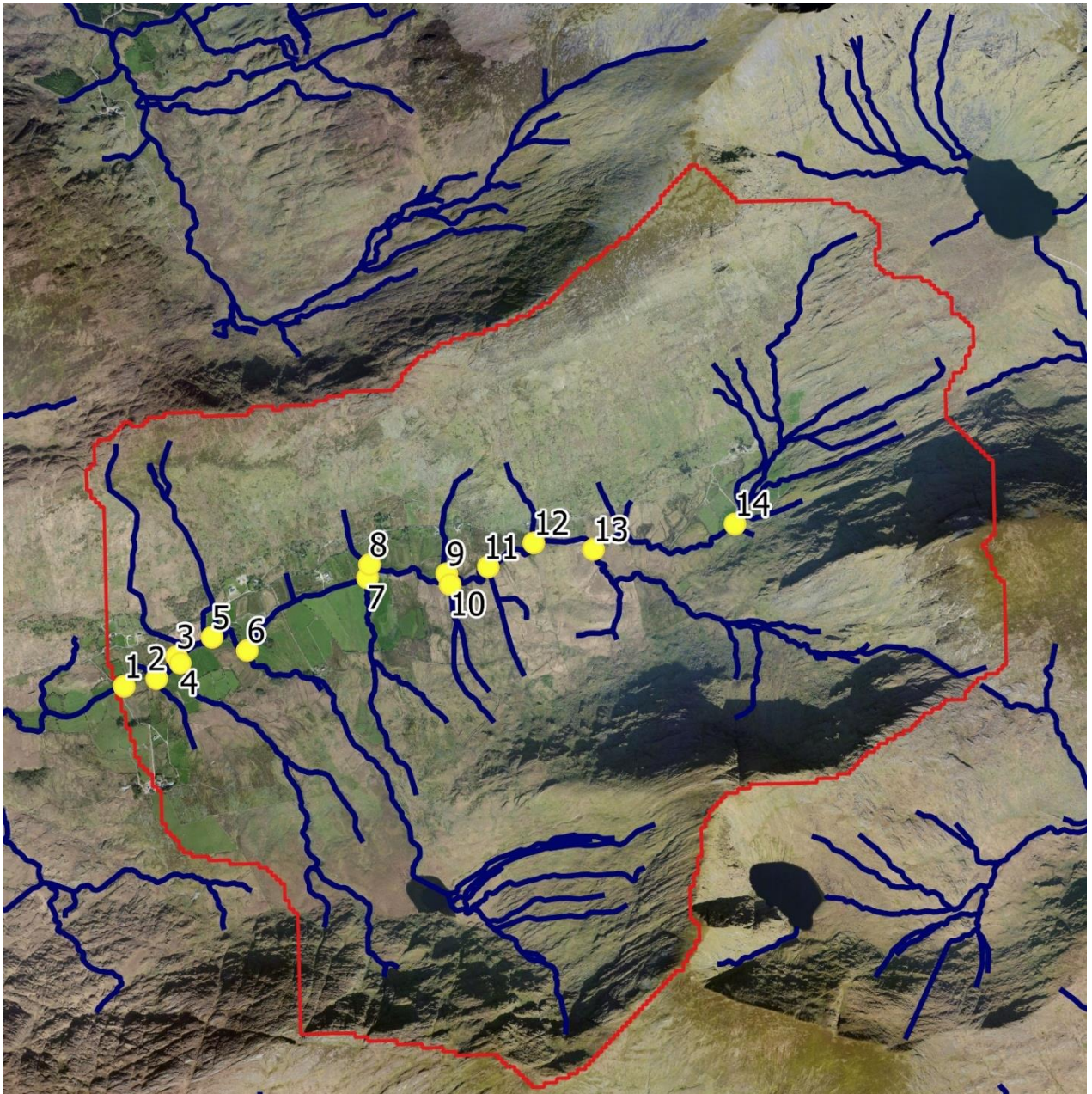


Figure 6-1: Sample locations for Caragh\_010

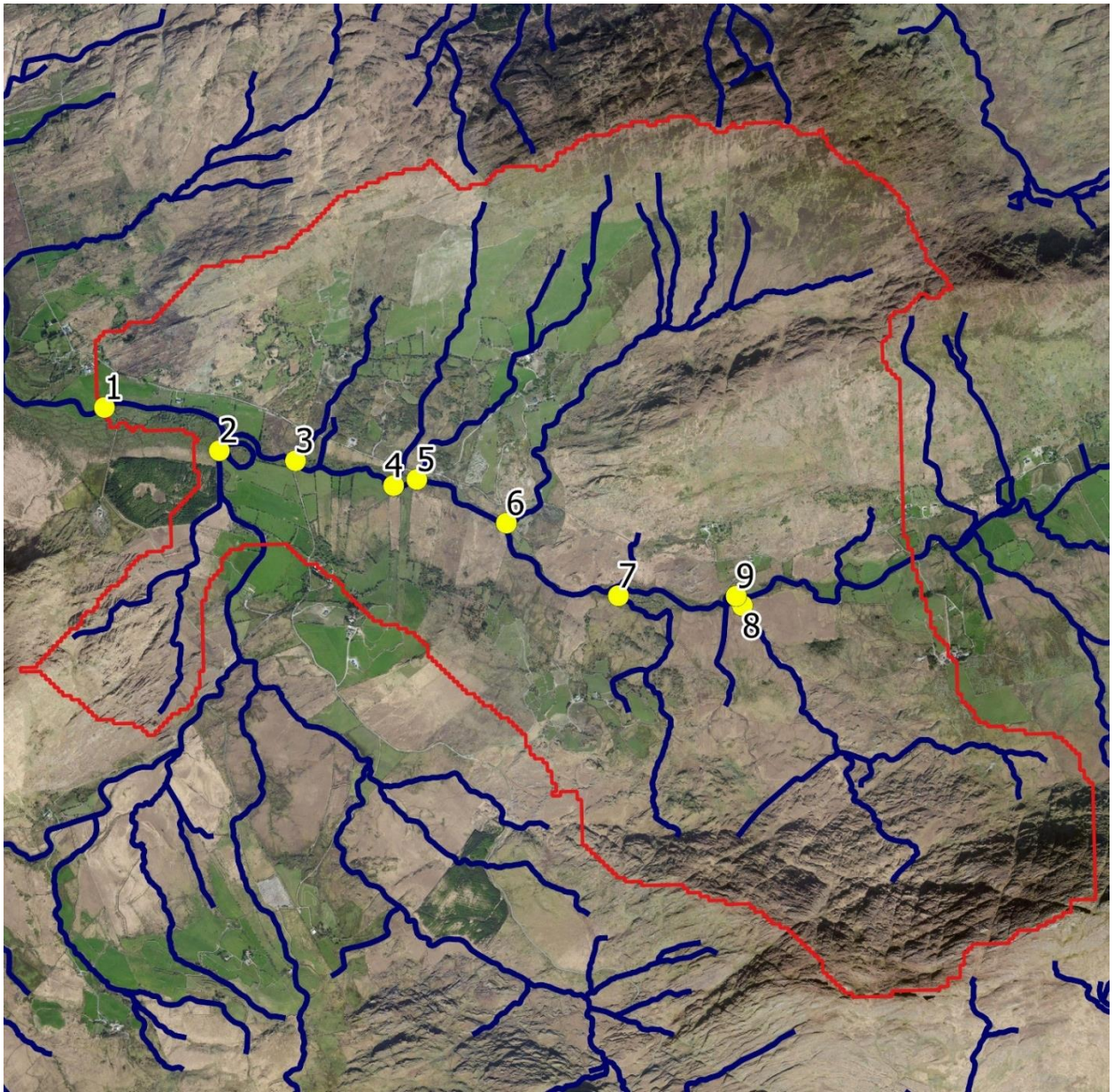


Figure 6-2: Sample locations for Caragh\_020

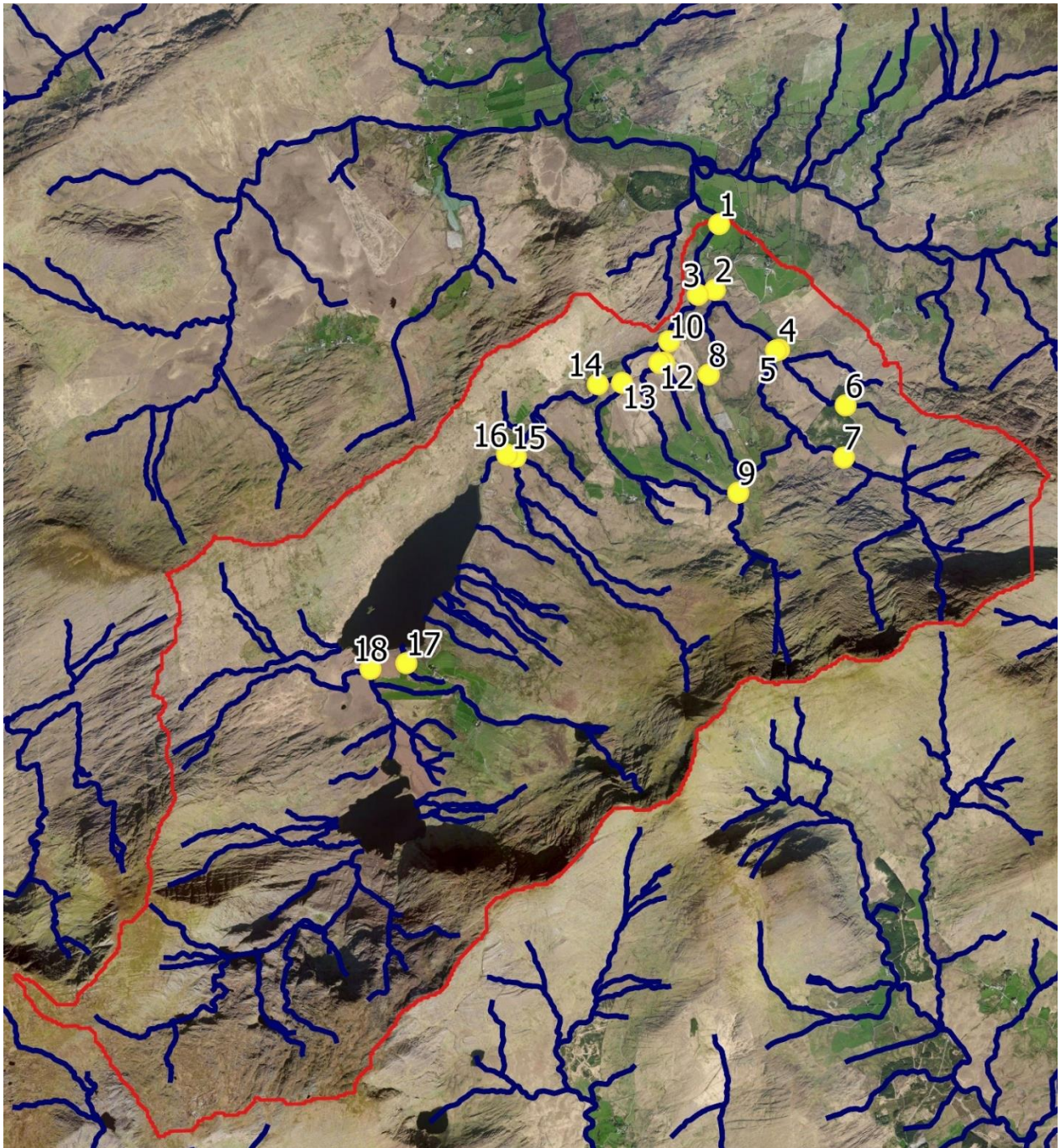


Figure 6-3: Sample locations for Owenroe (Caragh\_010)

## 7 Review of possible mitigation options

The initial characterisation information and desk study findings identified agriculture and hydromorphology as the significant pressures in this PAA and nutrients (phosphate and possibly ammonia) as the significant issues. The local catchment assessment process will confirm the significant pressures and issues and help to inform the nature of the mitigation measures required. Where agriculture is the significant pressure and phosphate and/or sediment are identified as the significant issue, measures should be focussed on areas of poorly draining soils to minimise loss to surface waters. Identify critical source areas and break pollutant pathways.

## 8 Communications

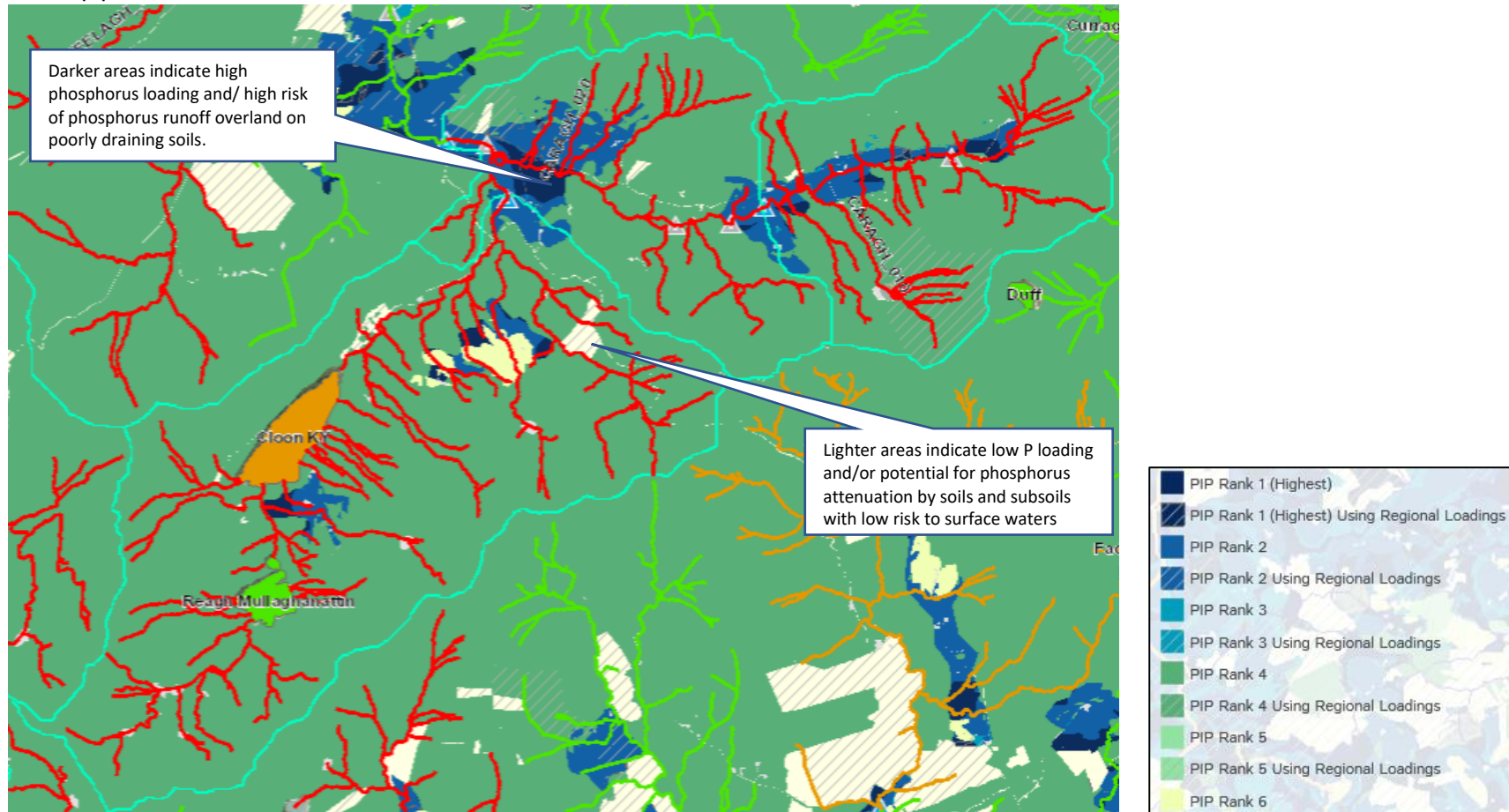
- Public meetings will be required for this PAA.
- According to the initial characterisation, significant pressures include agricultural and hydromorphology. As agriculture is a significant pressure for this catchment, farm engagement will be needed here.

### Key messages for this PAA

- Initial assessments have identified agriculture and hydromorphology as the significant pressures in this PAA.
- The significant issues may be phosphate, ammonia and/or sediment.
- Staff from the Local Authority Waters programme will work in the catchment to identify the issues impacting on water quality and to confirm whether agriculture and hydromorphology (or other pressures) are causing the water quality problems.
- The LAWPRO team will work with the relevant stakeholders to address any issues identified.
- If agriculture is confirmed as a significant pressure in the catchment, the ASSAP advisor will work with local landowners to identify suitable mitigation measures.

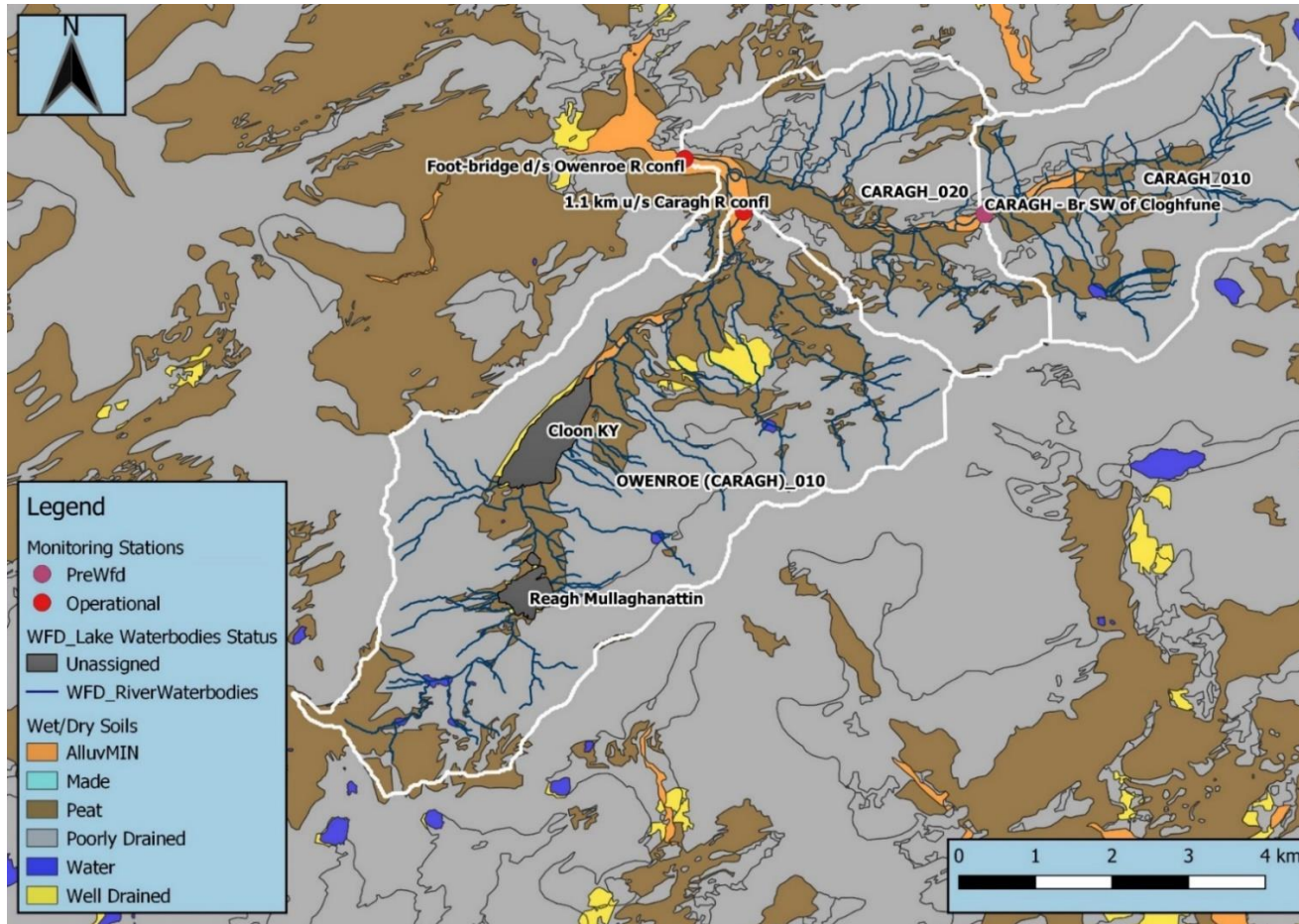
Date of completion of the desk study: 3 February 2020

## 9 Appendices



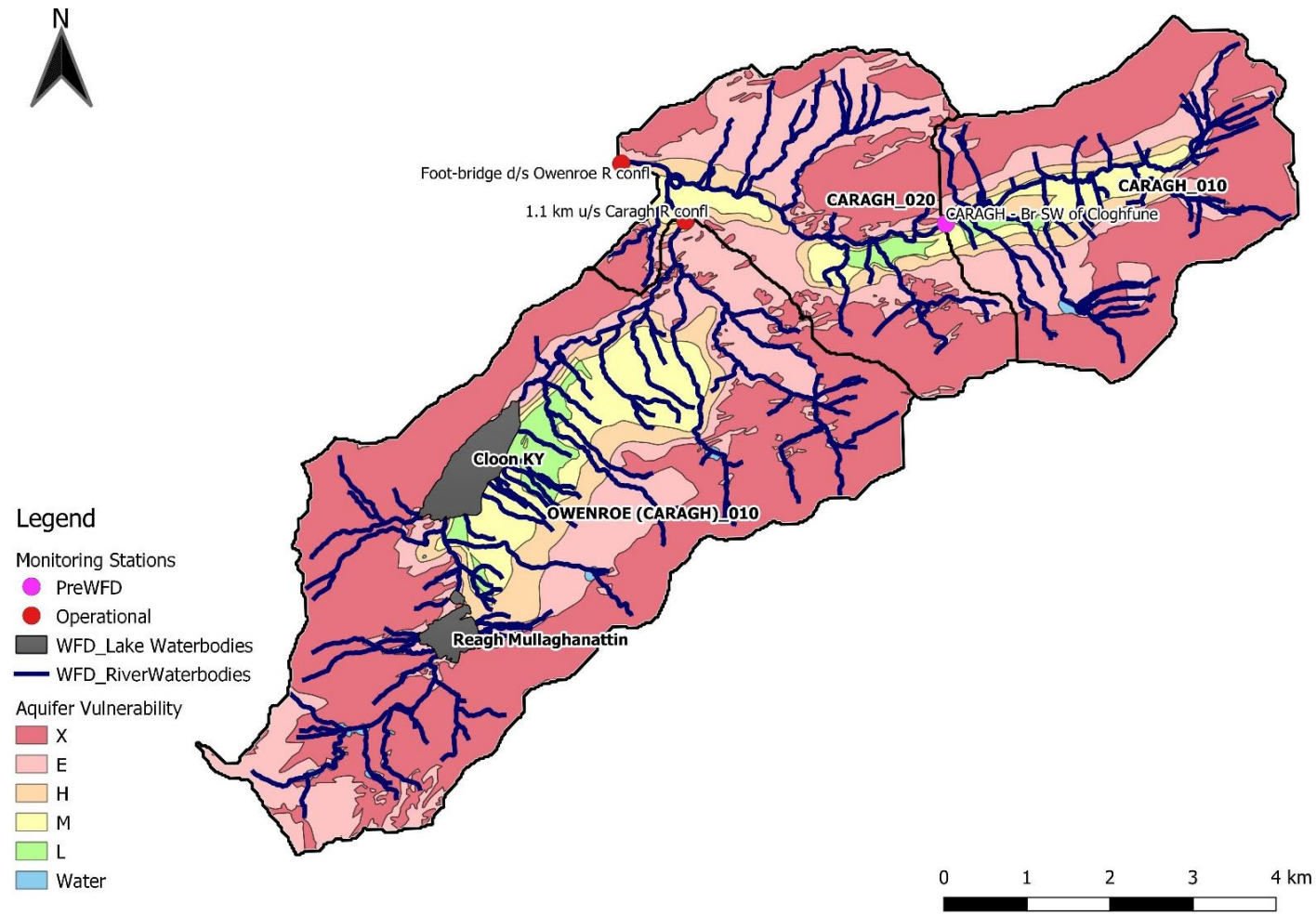
Source: EPA 2016

Figure 9-1: Pollution impact potential: surface water receptor phosphate PIP Map



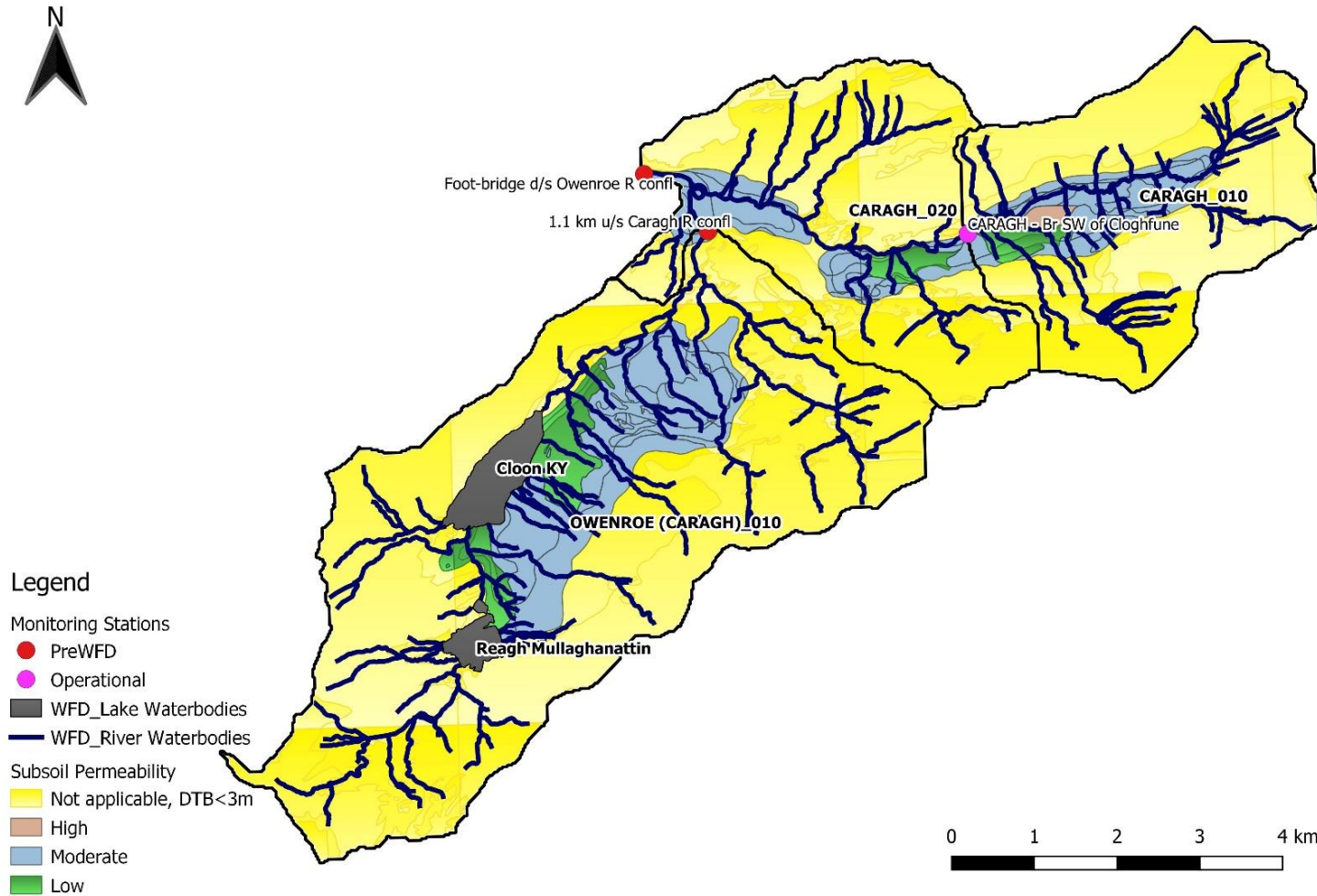
Source: Teagasc-EPA

Figure 9-2: Soils Wet/Dry



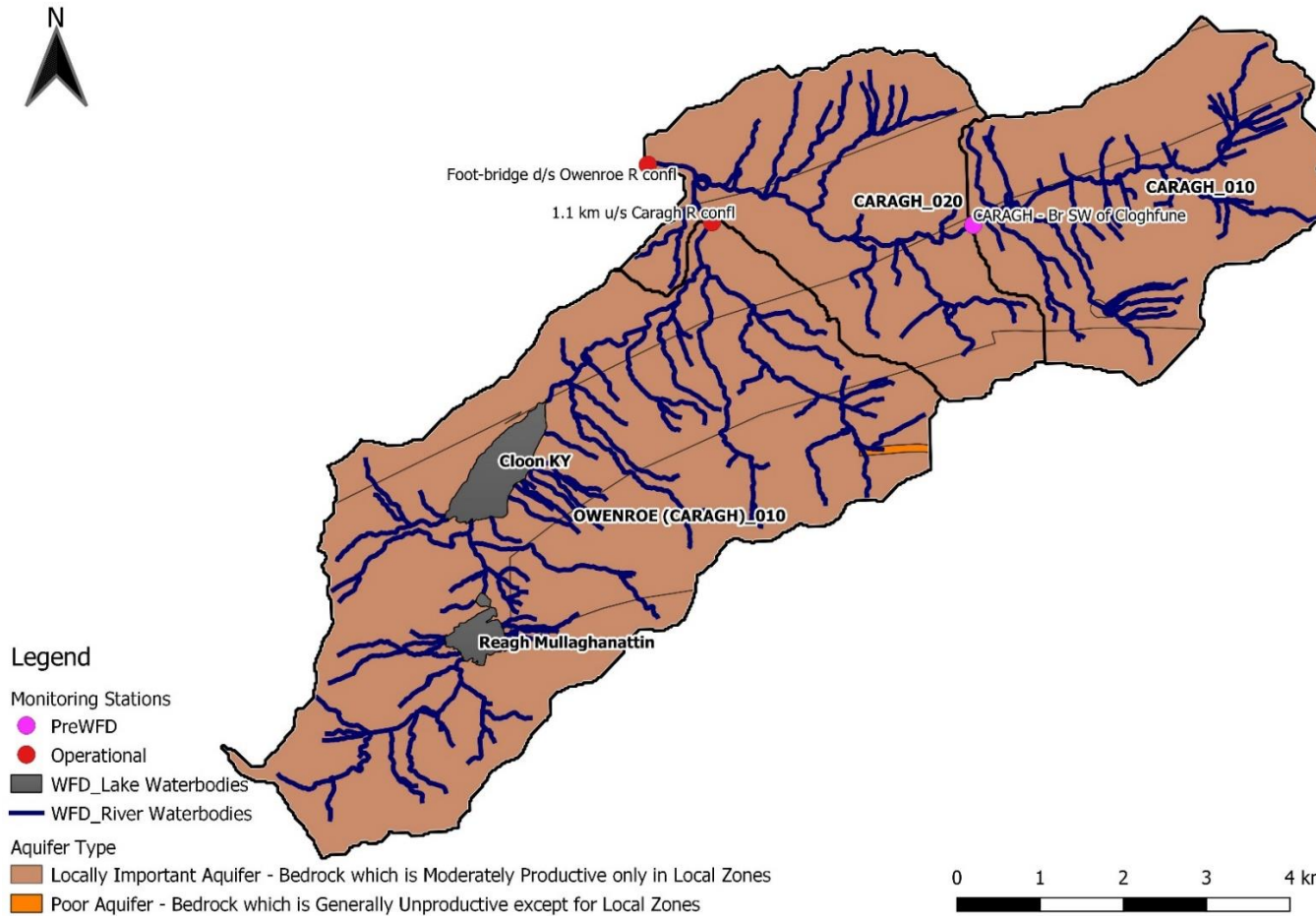
Source: GSI (2015)

Figure 9-3: Aquifer Vulnerability



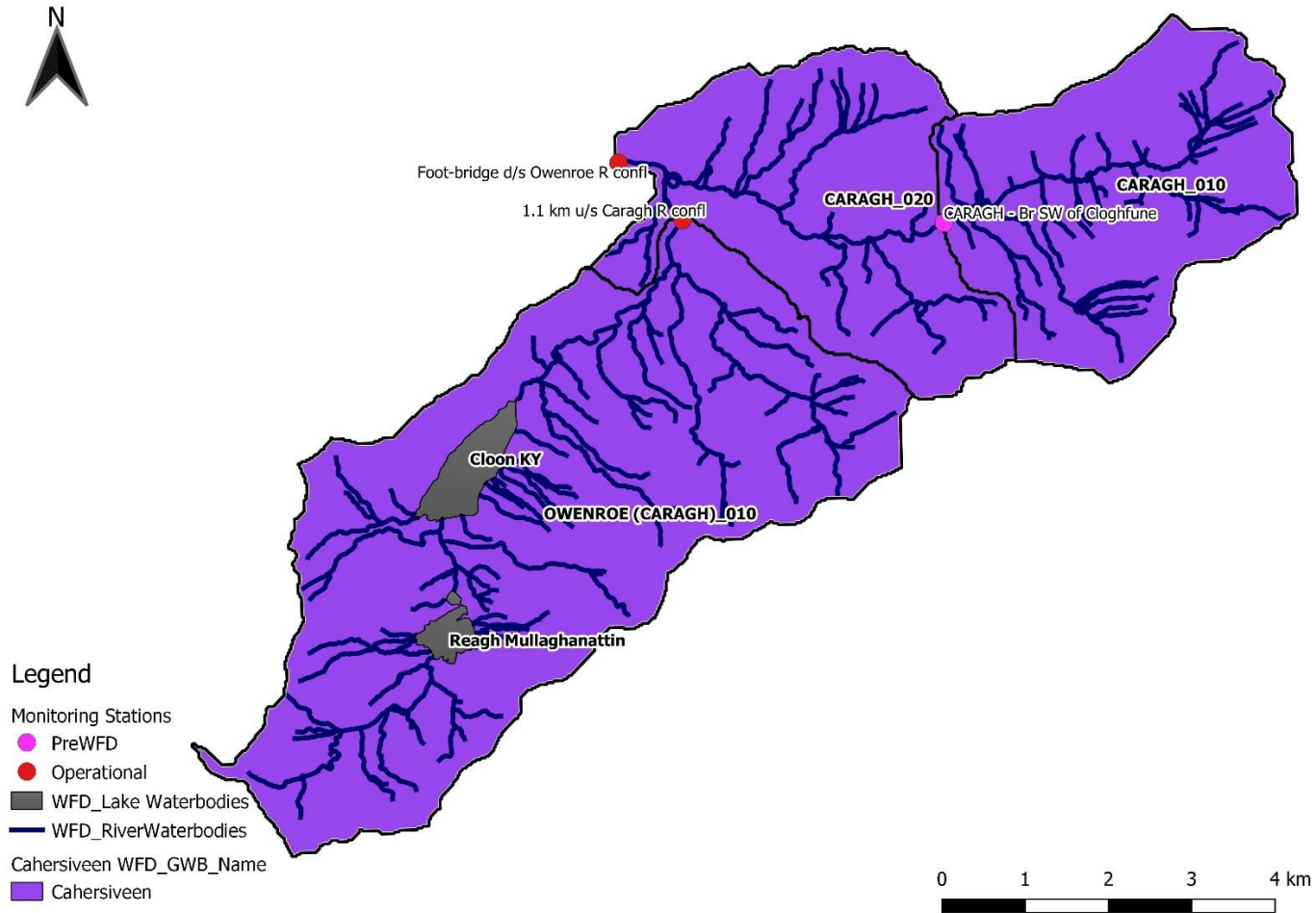
Source: GSI (2015)

Figure 9-4: Subsoil Permeability



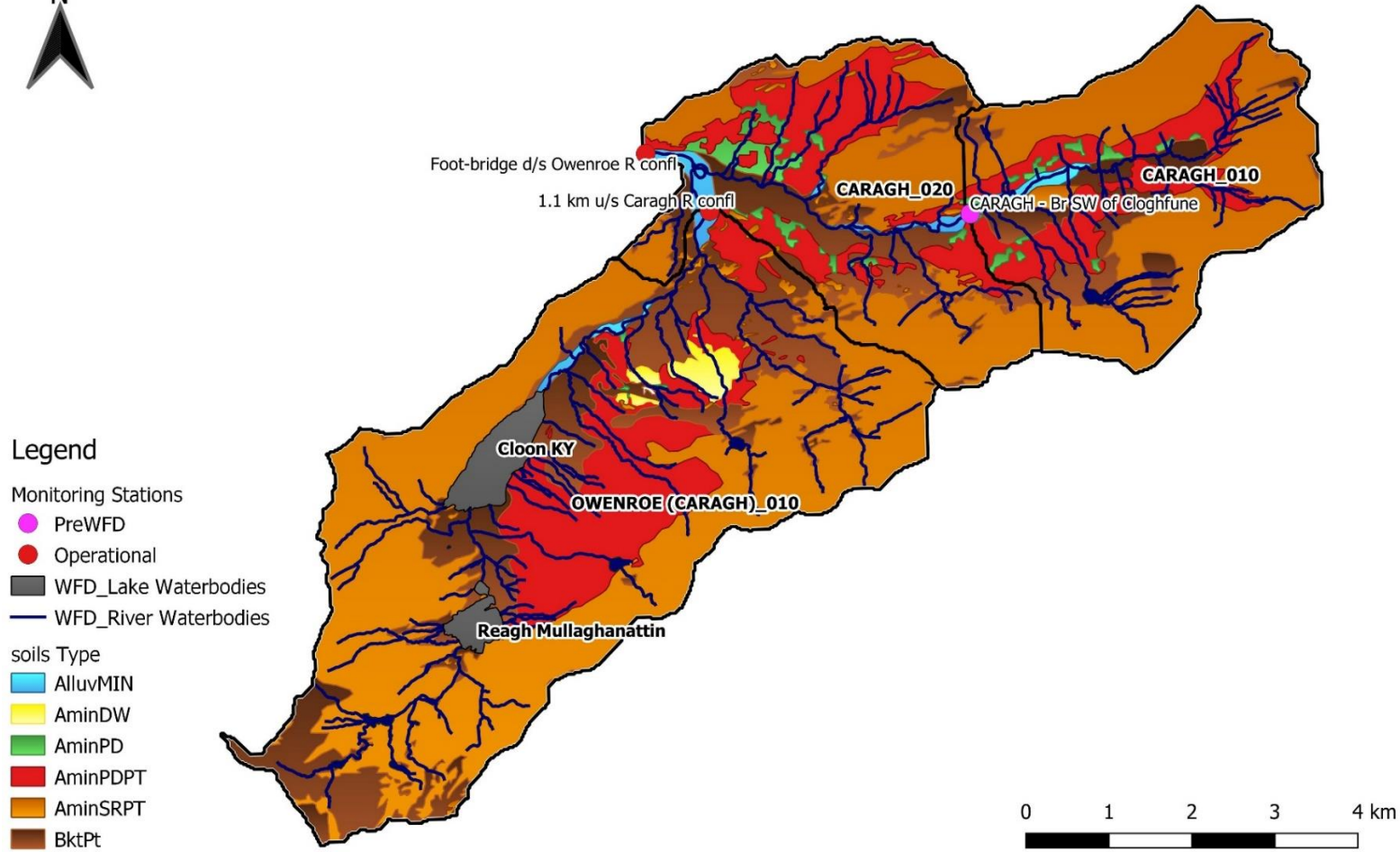
Source: GSI (2015)

Figure 9-5: Aquifer Type



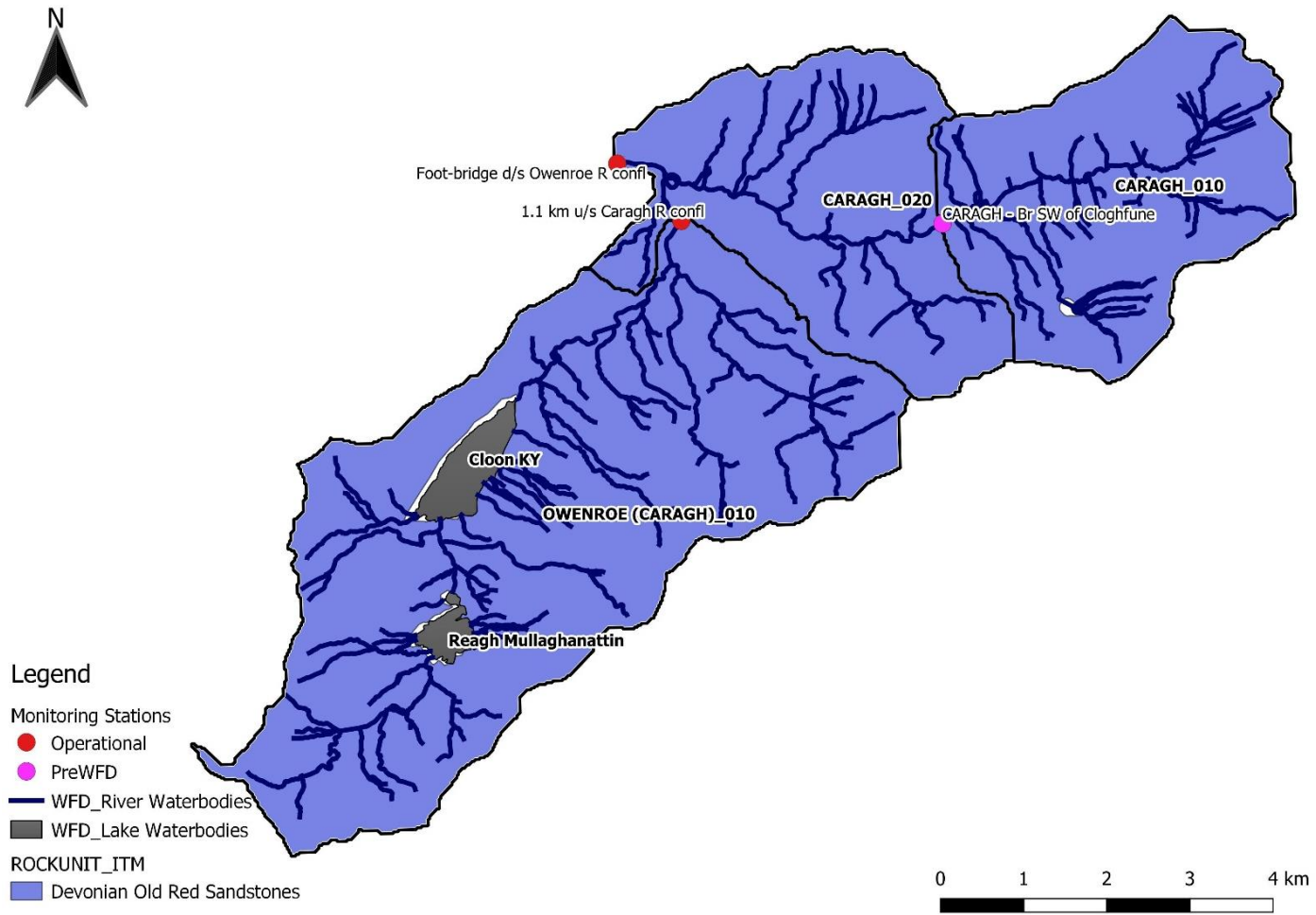
Source: EPA (2016)

Figure 9-6: Groundwater Bodies



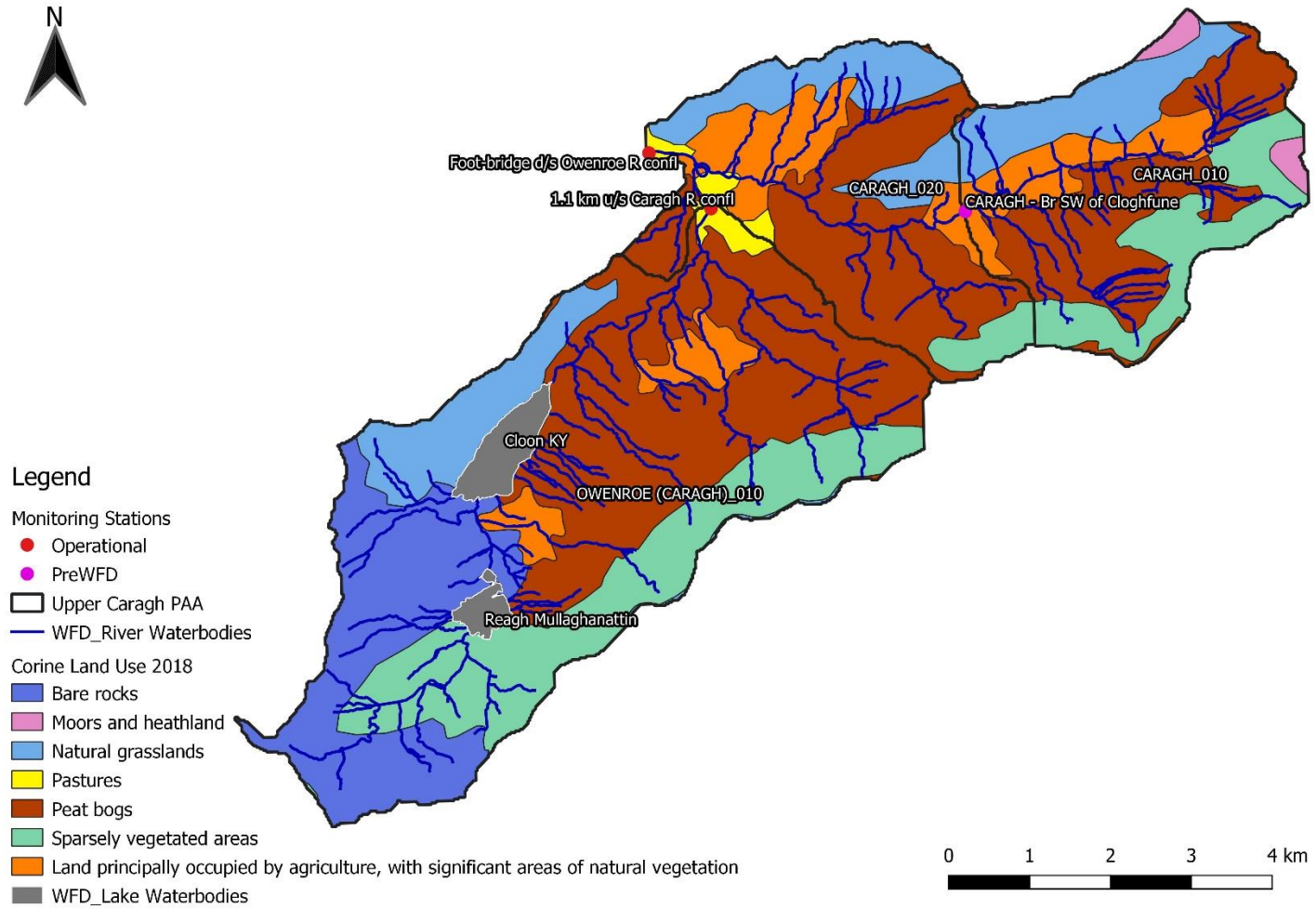
Source: EPA

Figure 9-7: Soil Type



Source: GSI (2008)

Figure 9-8: Bedrock Aquifer



Source: EPA 2018

Figure 9-9: Land Use