



Kilmainham (Dee) Priority Area for Action

Desk Study Report

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Acknowledgements

The authors would like to acknowledge the contribution of Meath 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 Kilmainham (Dee) catchment in recent years.

1 Non-technical Summary

The waterbody Kilmainham (Dee)_020 is at risk as the 2010-2015 ecological status is moderate, due to moderate biological status and the failing pH status. The waterbody is underlined predominately by a poor aquifer (PI), which is unproductive except for local zones. The dominant bedrock type is Silurian Metasediments & Volcanics. The main flow pathways are occurring in the upper fractured zones and deep groundwater flow is limited. There are two dominant soil types present in this waterbody area, fine, loamy drift with siliceous stones which is good draining and fine loamy over sandstone bedrock which is well draining. There are small pockets of peat as well. Most groundwater movement is occurring within the upperpart of the aquifer and within the first three metres. There are areas of extreme vulnerability to ground water and areas of rock outcrop. And these areas occur in the same locations on well drained soils.

The significant issues are nutrients and organic pollution from agriculture and altered habitat due to hydrological and morphological changes due to channelisation. Chemistry data for this waterbody shows that it's within the range for good water quality. Previous work carried out by Meath County Council show that the tributary joining the Kilmainham_020 is having a negative impact on water quality.

The significant pressure is agriculture. Diffuse and small point source pollution from agriculture will be the focus of the field assessment, particularly within locations to the west of the main channel where on the Surface Water Phosphate PIP map indicates the highest risk category. Small Stream Impact Score will be initially undertaken in Kilmainham (Dee) to narrow down the stretches of the river being impacted, and stream walks will be carried out where appropriate. Mitigation options for Phosphate diffuse agricultural pressures should focus on pathway interception measures to target Phosphate flowing overland and along drains and ditches.

2 Introduction

2.1 Background to the Priority Area for Action (PAA)

The Midlands and Eastern catchment assessment workshops were held in Ballycoolin, Dublin from the 9th to 12th May 2017. They were attended by representatives of local authority staff (operational staff on all days and both operational and senior staff on final day of the workshop), Local Authority Waters and Communities Office (LAWCO) (now part of the Local Authority Waters Programme LAWPRO), Irish Water, Inland Fisheries Ireland, Forest Service, Coillte, National Parks and Wildlife Service, Teagasc, Department of Housing Planning and Local Government, Geological Survey Ireland, National Federation of Group Water Schemes, Department of Agriculture, Food and Marine, Bord na Mona, Waterways Ireland and Environmental Protection Agency. The workshop was facilitated jointly by LAWCO and EPA.

Based on the draft River Basin Management Plan priorities, a set of agreed principles and the local priorities of the workshop attendees, 29 areas were recommended for action, of which the Kilmainham (Dee) PAA was one.

The Kilmainham (Dee) PAA was selected as a priority area for action in the 2nd cycle. The EPA report includes the following reasons:

- Restore deteriorated waterbody

The catchment consists of the area drained by the Newry, Fane, Glyde and Dee rivers. It's a cross border catchment with 10 subcatchments within it. The waterbody Kilmainham (Dee)_20 river was selected as a PAA as its status had deteriorated from good to moderate in 2010-2015 and is classified "At Risk". The Kilmainham (Dee)_20 is in North Meath. This status is being driven by its moderate biological status and failing pH status. The failing raised pH is based on 1 result in 3 years where it slightly exceeded the threshold. The monitoring station is located at the very end of waterbody (Figure 1). The Kilmainham (Dee)_20 is 10.56km in length and runs in predominantly a South- East direction. Its inputting water is the headwater Kilmainham (Dee)_10 river, which has a good status. Its receiving water is the river Dee_30, which has a poor status. The main land use in the Kilmainham Dee_020 is agricultural, with forestry and urban land use being also present. Based on Corine data, agriculture is the dominant land use. There are several farmyards and dwelling houses located along the river. The village of Kilmainham Wood is in the south east part of the waterbody. The EPA identified agriculture (nutrient & organic pollution) and hydromorphology (Channelisation) as the significant pressures in this PAA.

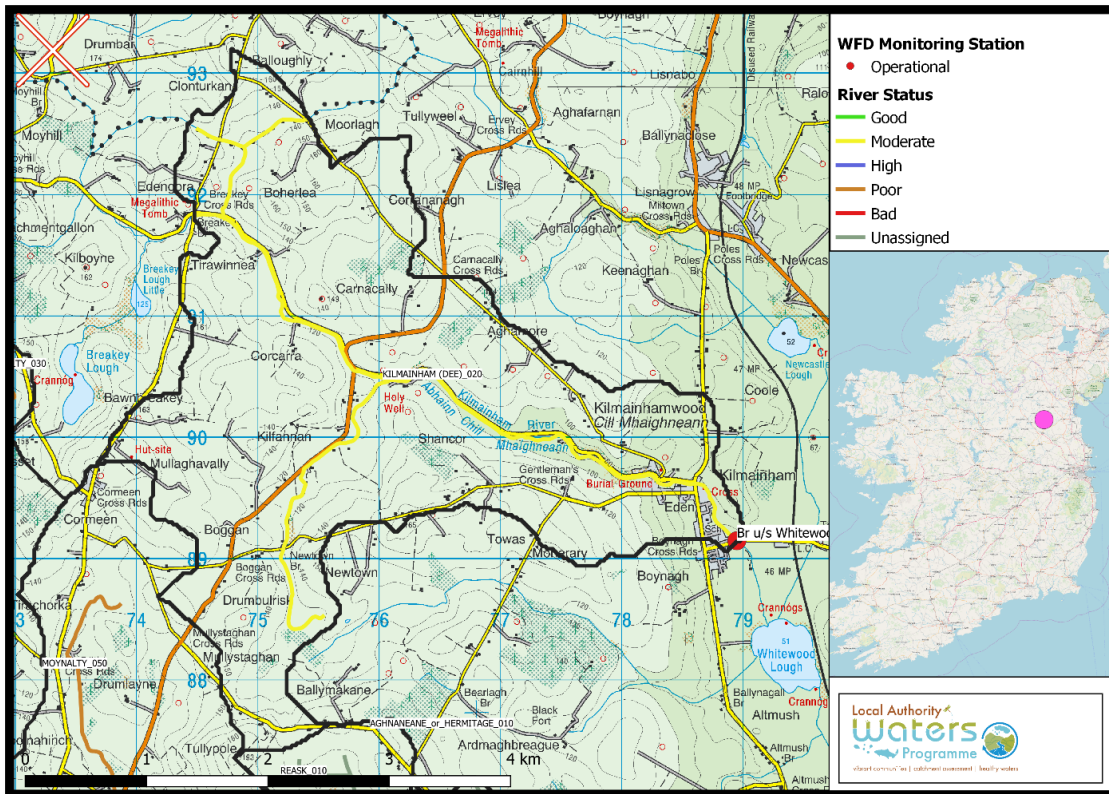


Figure 1: Location of the EPA monitoring stations in the waterbody Kilmainham (Dee)_20

2.2 Information Sources Consulted

Several information sources were consulted during the preparation of the desk study for the Kilmainham (Dee) PAA including:

- Meath County Council
- WFD App (EPA Environmental Data Exchange Network)

2.3 PAA Summary Information

A summary of risk, ecological status, known pressures and associated significance for the Kilmainham (Dee) PAA are presented in Table 1. The Kilmainham (Dee)_010, which is not in the PAA flows in the Kilmainham (Dee)_020. In 2015, the Kilmainham (Dee)_010 has good status and was classified as *Not at Risk*. In 2015, its Q-Value was good (4) but it dropped to moderate (3-4) in 2018. The Kilmainham (Dee)_020 was classified as *At Risk* and has moderate status. The Q-Value dropped from good (4) in 2009 and has remained at moderate (3-4) since. The water quality from the Kilmainham (Dee)_010 has a direct impact on the water quality in the Kilmainham (Dee)_020 and the Q-Values reflect this.

WB Code	WB name	WB Type	Risk	High status obj.	2009	2012	2015	2018	No of pressures	Pressure Category	Pressure Subcategory	Pressure Name	LCA Action	Responsible Agency
IE_NB_06K040055	KILMAINHAM (DEE)_010	River	Not at risk	No	G	M	G	M	1	n/a	n/a	n/a	n/a	n/a
IE_NB_06K040100	KILMAINHAM (DEE)_020	River	At risk	No	G	M	M	M	2	Agriculture	Agriculture	n/a	IA7	LAWPRO
										Hydromorphology	Channelisation			

Table 1. Summary of waterbodies in the Kilmainham (Dee) river

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

Waterbody Kilmainham (Dee)_020:

- *IA7 Multiple sources in multiple areas*
- *investigative assessment to locate where the likely significant issues are coming from.*
- *Note that acidification conditions failed based on one result over a three-year period (pH 9.01 - threshold 9.0)*

3 Receptor information & assessment

3.1 Context and Setting

The Kilmainham (Dee) was selected as a PAA as it previously had high ecological status (2007-2009) but has it dropped to moderate (2010-2012). The EPA monitoring station for the Kilmainham (Dee)_010 is located at Breaky Bridge at the start of the PAA and the EPA monitoring station for the Kilmainham (Dee)_020 is located at White lodge Bridge at the end of the PAA (Figure 2).

3.2 WFD Information

The waterbody status is moderate but previously had a good ecological status in 2007-2009. It also has a failing pH status with a pH of 9.01. (Threshold is 9.0) but this has only occurred once in 3 years. The Water Framework Directive (WFD) objective is to return it to good status by 2021. Since 1971 the Q value has been recorded every three years (Table 2). The Q value score has ranged from 4-5 up until 2012 when it dropped to 3.5 where it has remained. The Q value was assessed again in 2018 and it has remained at moderate (3-4) Q-Value (Figure 3). The average for ortho-phosphate in 2016 for Kilmainham (Dee)_020 was 0.057 mg/L, 2017 was 0.041 mg/l 2018 was 0.34 mg/l (Figure 4).

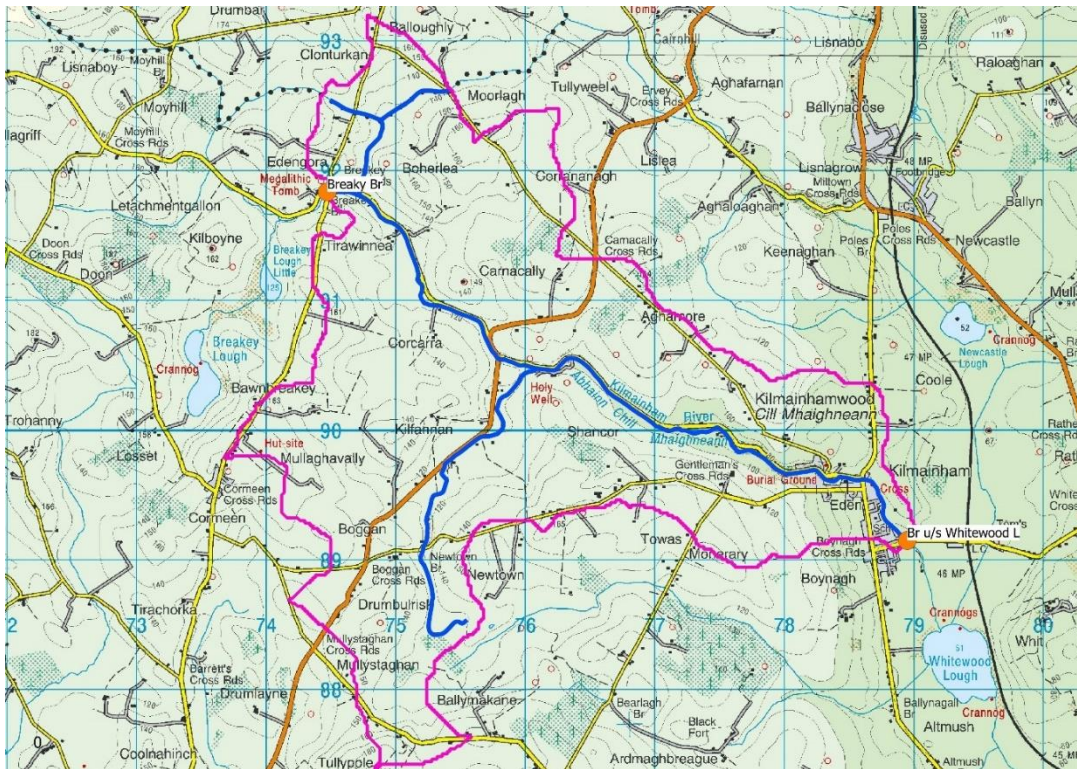


Figure 2: Locations of the EPA monitoring stations in the Kilmainham (Dee).

Waterbody		Kilmainham (Dee)_020
Risk Category		At risk
Monitoring station		Br u/s Whitewood L
Monitoring station type		Operational
Biological Status		
Q values	2009	4
	2010	
	2011	
	2012	3-4
	2013	
	2014	
	2015	3-4
	2016	
	2017	
	2018	3-4
Water chemistry		
Monitoring station		Br u/s Whitewood L
PO4+	2010	0.030

	2011	0.038
	2012	0.027
	2013	0.026
	2014	0.041
	2015	0.031
	2016	0.057
	2017	0.041
	2018	0.034
Baseline PO4		0.036
NH4+	2010	0.018
	2011	0.022
	2012	0.020
	2013	0.016
	2014	0.033
	2015	0.084
	2016	0.023
	2017	0.026
	2018	0.052
Baseline NH4		0.032
NO3-	2010	1.338
	2011	1.235
	2012	1.195
	2013	1.228
	2014	1.970
	2015	1.533
	2016	0.836
	2017	0.948
	2018	1.98
Baseline NO3		1.36
HYMO	Arterial drainage scheme	
Conceptual model required (Y/N)	y	
Ecological Status	Moderate	
Significant issue: monitoring point	Phosphate	
Significant issue: Waterbody	Phosphate	

Table 2: Summary of significant issues in Kilmainham (Dee)_020

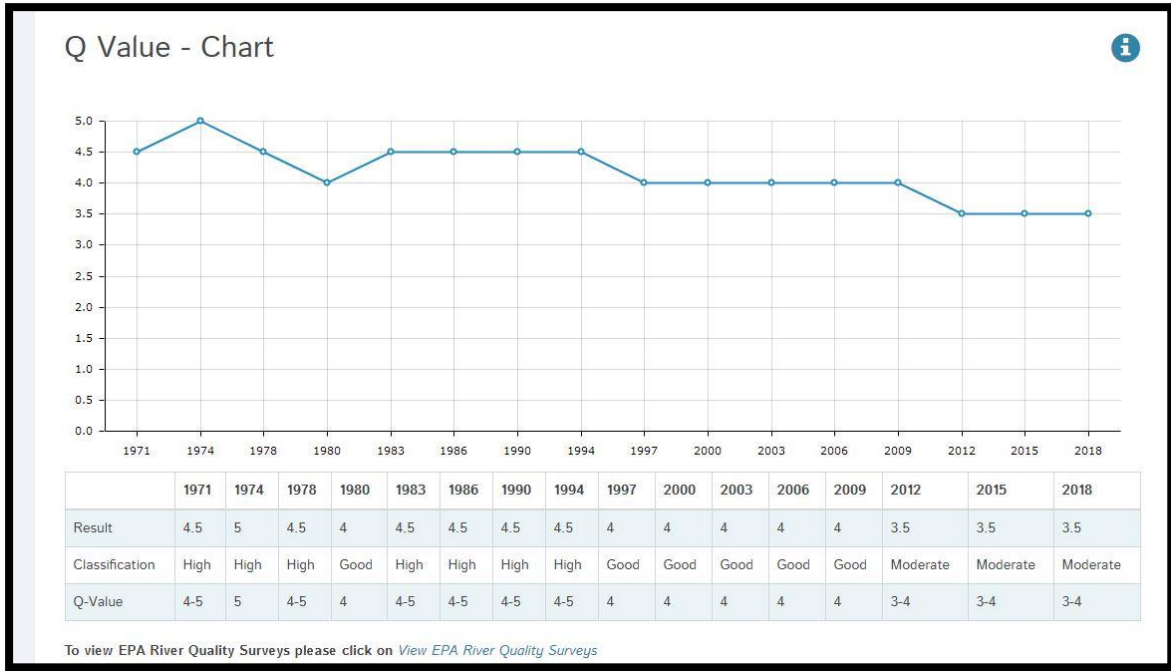
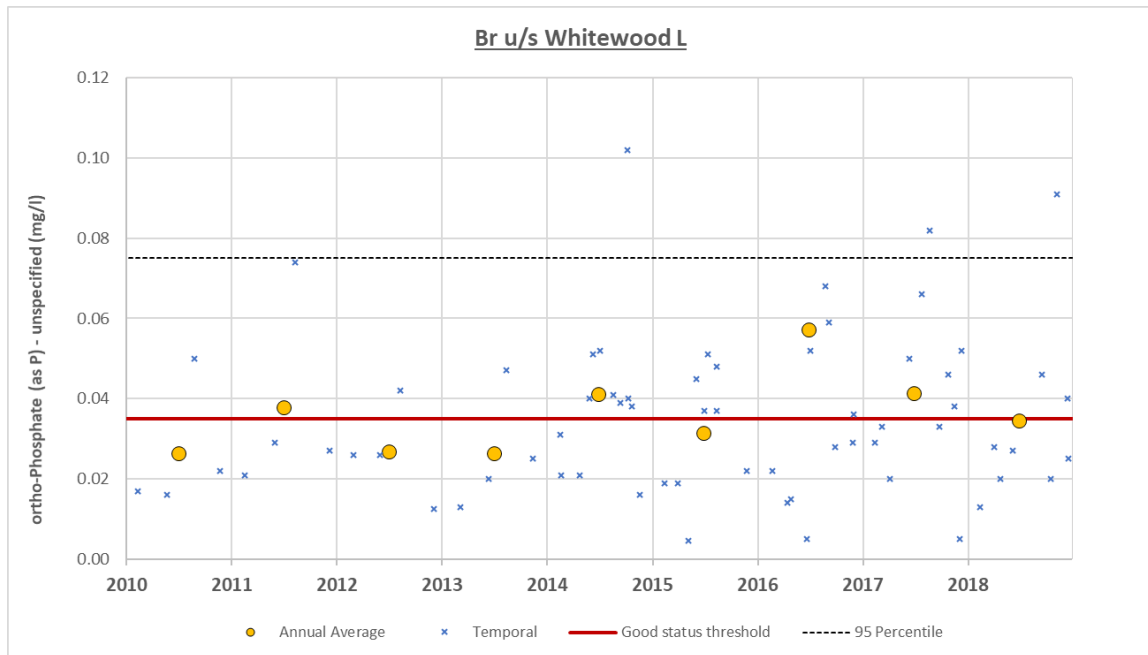


Figure 3: Q values for Kilmainham (Dee)_20



(Outlier 0.30mgN/L on 22/11/2016 not displayed on graph)

Figure 4 : ortho-Phosphate (as P) mg/L

3.3 Supplementary Information

Meath County Council provided a copy of two assessments that they carried out in the past two years. The first was the Specific Electrical Conductivity (SEC) readings) taken on the 10/02/2017. They sampled 13 points and the results range from 231 $\mu\text{S}/\text{cm}$ to 422 $\mu\text{S}/\text{cm}$ on a tributary leading to Newtown. The second report was SSRS scores (figure 6) that were carried out on the 18/04/2018 at 6

locations. The scores ranged from 4-11.2, 5 of the 6 locations were classified as “Probably not at Risk” (>7.25) and one being classified as “Stream at Risk”. The location that is classified as “at Risk” is the same location as the high conductivity reading. In 2018, based on these results Meath County Council carried out several farm inspections on this tributary. Several different sources of pollution were identified through the farm inspections e.g. point source, run off from dung and waste silage heap, and seepage from housing.

Meath County Council observed that there also seemed to be soil run off resulting in sediment loss into the waterbody as well. This could be having an impact on the ecology of the river and needs to be ground truthed. The ecology may also be impacted due to the hydromorphological changes, which may have created the sediment issues. As the Kilmainham (Dee)_020 is part of the Glyde/Dee Arterial Drainage Scheme channelization has been identified as a significant pressure. This may have resulted in the loss of natural habitats on certain indicator invertebrates.

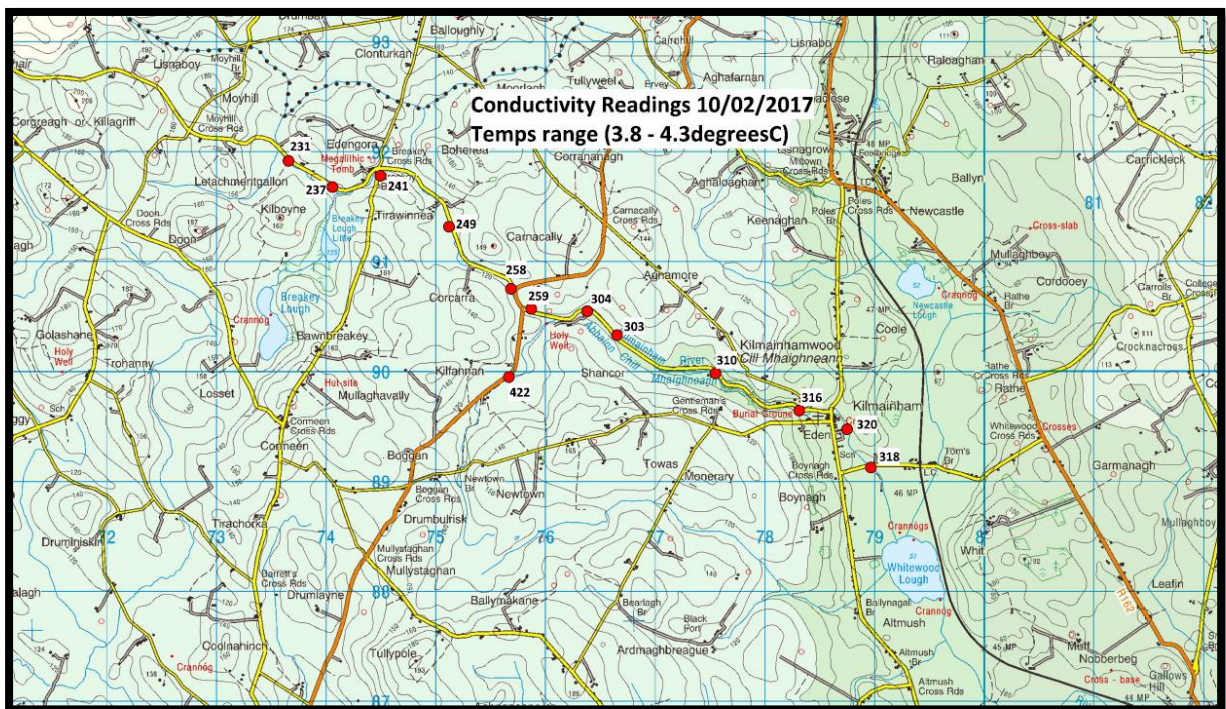


Figure 5: Conductivity results from Meath County Council.

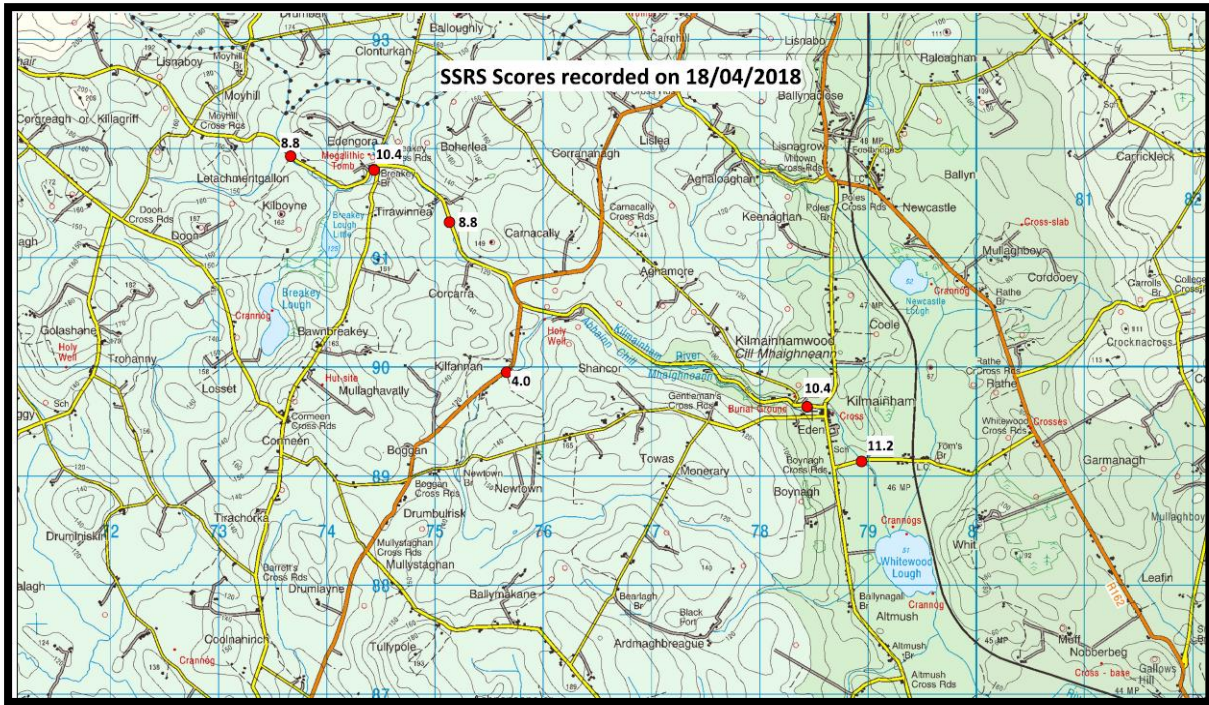


Figure 6: SSRS Scores from Meath County Council.

3.4 Conclusion on Significant issues

The Q-Value assessment was carried out in the summer of 2018 and it remained at moderate (3-4). The chemistry shows that phosphate levels are classified as indicative quality of good. However, as phosphate might be bound up in the macrophytes and bridge hops will visually confirm if this is occurring. Meath County Council observed soil runoff in the stream while carrying out their assessments. Sediment could be another impact on the water ecology, and it will be assessed to see if it is a potential significant impact. As the Kilmainham (Dee)_020 is part of an arterial drainage scheme channelisation information was requested from the EPA and the OPW. This will help to determine if channelisation is a significant issue and if it needs to be followed up.

4 Significant pressure information

4.1 Initial EPA Characterisation

The EPA identified agriculture and hydromorphology (Table 3) as the significant pressures in the Kilmainham (Dee) PAA.

Table 4.1: Initial EPA characterisation

Water body Name	Id	Category	Sub Category	Name	Significant?	Pressure & Impact details
Kilmainham (Dee)_020	IE_NB_06K040100	Agriculture	Agriculture	n/a	Yes	nutrient and organic pollution
		Hydromorphology	Channelisation	n/a	Yes	Altered habitat due to hydromorphological changes

Table 3: EPA characterisation of Kilmainham (Dee)_020

4.2 4.1 Agriculture

Agriculture is the main land use in the PAA apart from Kilmainhamwood village at the base of the PAA. Based on Corine data, the agricultural land use is entirely permanent pasture. The farms are predominantly drystock with a few dairy farms in the PAA.

4.3 Hydromorphology

The OPW carry out arterial drainage schemes in catchments as required under the Arterial Drainage Act, 1945. The Kilmainham (Dee)_20 is part of the Glyde-Dee arterial drainage scheme (figure 7). A hydromorphological assessment will be carried out to see if the drainage scheme is having any impact on the water quality.

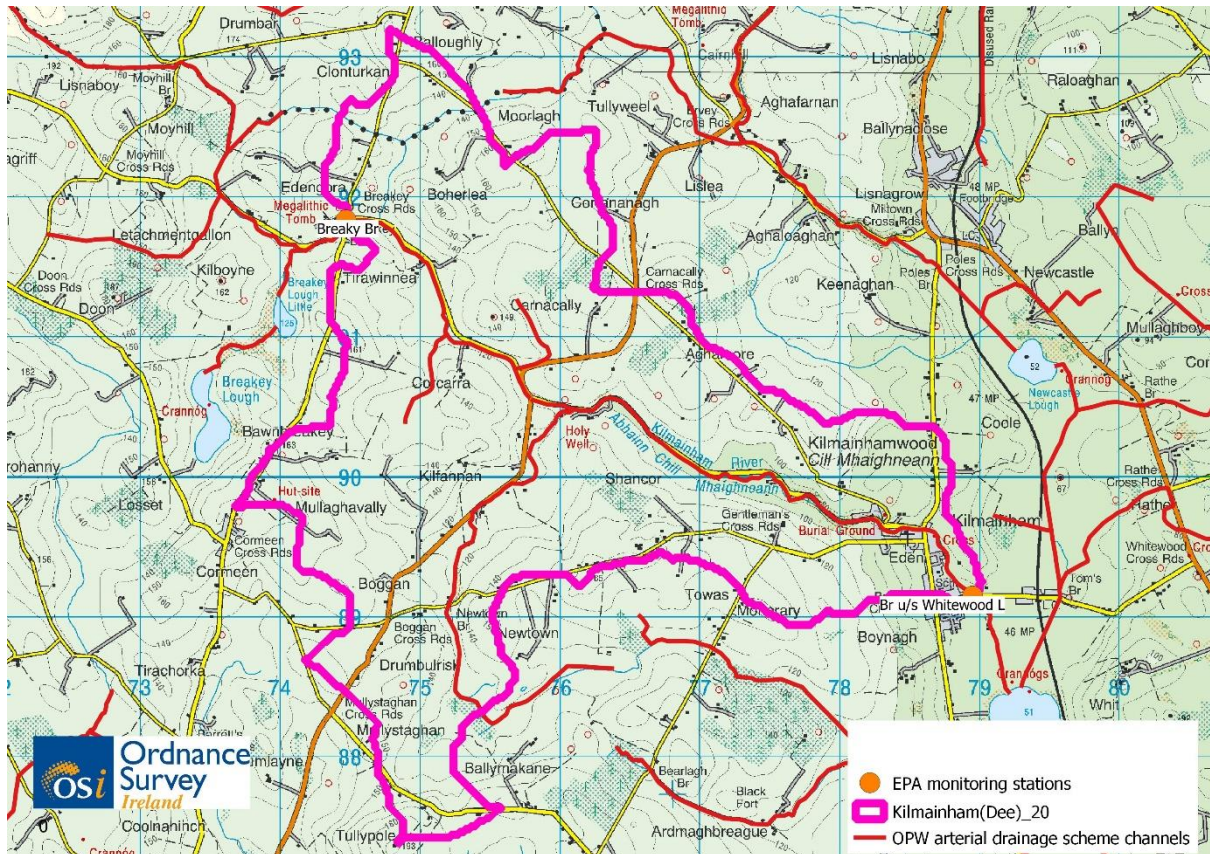


Figure 7: OPW arterial drainage channels in Kilmainham (Dee) PAA.

4.4 Conclusion on Significant Pressures

The EPA water chemistry for the Kilmainham (Dee)_020 shows the phosphate is the only nutrient that has exceeded the annual EQS standard more than once between 2010-2018. The SSRS carried out by Meath County Council show that nutrients are impacting on the river. The Pollution Impact Potential (PIP) for phosphate map (figure 8) can be used to locate likely Critical Source Areas (CSA). The PIP map will be used to narrow down the focus of the fieldwork to areas where overland flow of phosphate can occur. During the Local Catchment Assessment (LCA) an assessment will be made to establish if hydromorphology is a significant pressure.

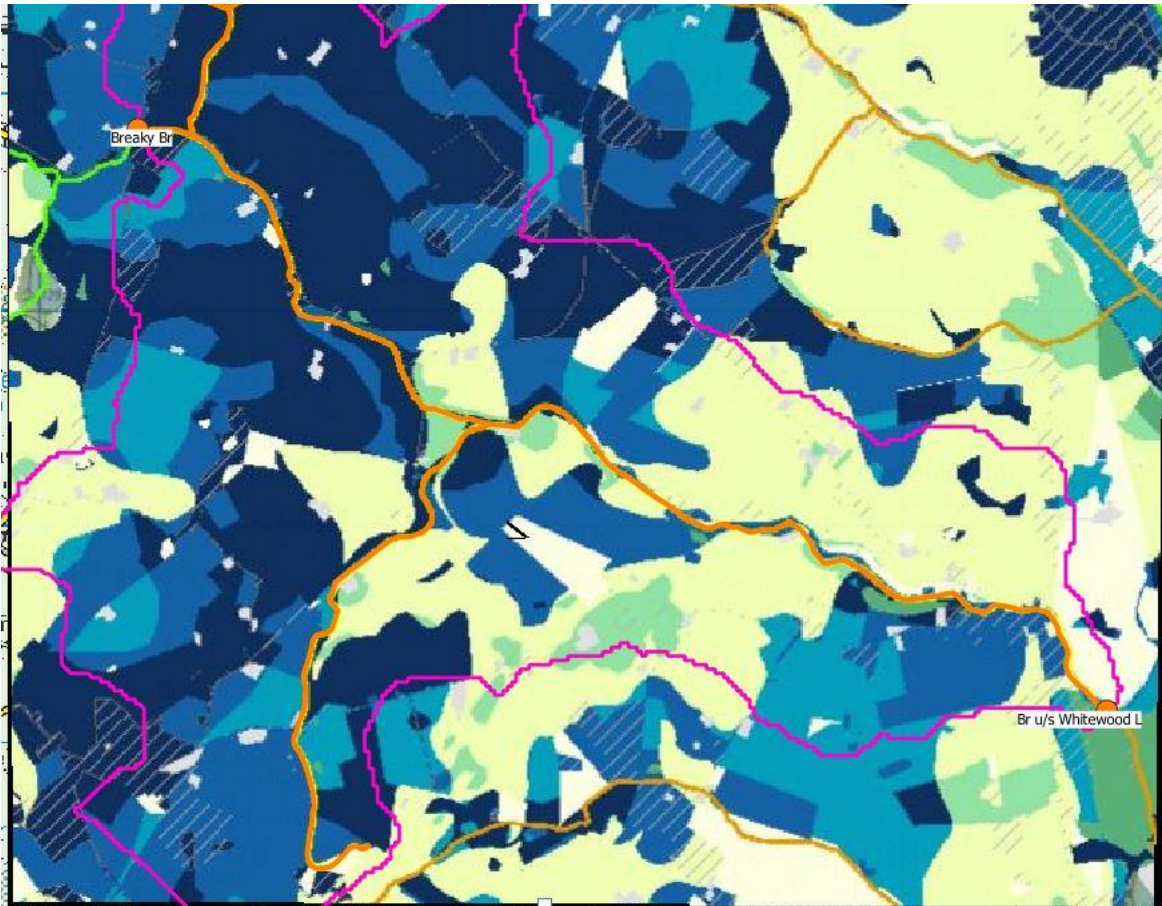


Figure 8: PIP map showing the areas of high phosphate (blue) in the Kilmainham (Dee) PAA.

5 Pathway information & analysis

A conceptual model (table 4 & figure 9) was built to understand and visualise the pathways of contaminants from the land to the river. It follows the source-pathway-receptor approach and looks at the relationships between contaminants and environmental layers. The conceptual model predicts the flow and attenuation of potential pollutants along the pathways which allows for a more focused fieldwork assessment. The EPA monitoring station shows that phosphate is the significant issue in the Kilmainham Dee_020. Based on the conceptual model, Compartment 1 will be the focus of the field work. This is an area where overland flow of water will occur and where nitrogen will be attenuated but phosphate could be washed into the river. Compartment 1 correlates with the areas showing high risk areas for phosphate in the PIP map (figure 9).

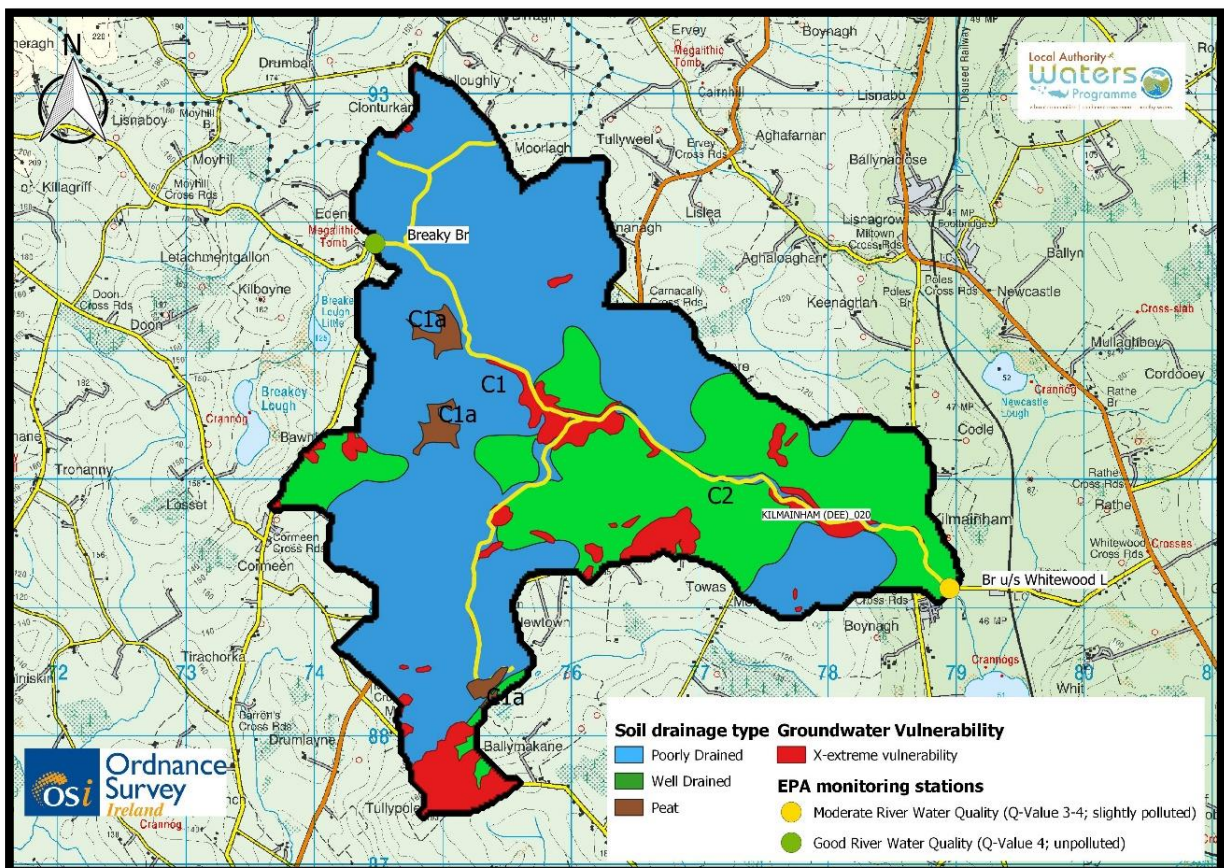


Figure 9: Conceptual Model for Kilmainham (Dee)_20

		Compartment 1	Compartment 2
Pathway Information	Source	diffuse	
	Aquifer (map in appendix)	Poor Aquifer (PI) which is unproductive except for local zones.	Poor Aquifer (PI) which is unproductive except for local zones. Locally Important (LI) aquifers & Locally Moderately Important aquifers (Lm).
	Topography		
	Soil (map in appendix)	Poorly drained	Well Drained
	Subsoil	Sandstone and shale till	Sandstone and shale till, Sandstone and shale sands and gravels
	Subsoil K	Low	
	Rock Unit	Silurian Metasediments and Volcanics	Silurian Metasediments & Volcanics, Dinantian Impure Limestones, Naumurian Undifferentiated.
	Groundwater Vulnerability (map in appendix)	Low with E	High with X
	PO₄ Susceptibility	high	Low
	NO₃ Susceptibility	low	Moderate
	NH₃ Susceptibility	High in areas of peat	Low
	PO₄ PIP	high	Low
	NO₃ PIP	low	Low
	Flowpaths	Poorly drained soils on poorly productive Aquifer	Well drained soils on poorly productive aquifer
	Location of Monitoring Point	Monitoring station located at the bottom of Compartment 2	
	Significant Pressures	Agriculture and hydromorphology	

Table 4: Summary of conceptual model compartments for Kilmainham (Dee)_020

6 Interim story of the Priority Area for Action based on the Desk study

The Kilmainham (Dee)_020 is classified as *At Risk* and has a moderate status. The Water Framework Directive target for the Kilmainham (Dee) PAA, is to return it to good status by 2021. Both the biological and ecological status are moderate, and the failing pH status. The failing raised pH is based on 1 result in 3 years where it slightly exceeded the threshold. The EPA have identified nutrient and organic pollution from agriculture and altered habitats due to hydromorphological changes as the significant pressures in the PAA. Based on the conceptual model and the chemistry data, phosphate is the significant issue in the Kilmainham Dee_020. If phosphate is the significant issue in this waterbody, it potentially is having an impact on the biology through increasing the growth of macrophytes that in turn have a negative impact on the “good status indicator” invertebrates. The source of phosphate is through agricultural practices e.g. land spreading of slurry, FYM, chemical fertilizer, animal grazing in the area. The PIP map (figure 8) shows that the areas that are vulnerable to phosphate and are located along the tributary Newtown Kilmainham waterbody and the north section of the Kilmainham (Dee)_20. The field work carried out by Meath County Council confirms that there is a pressure impacting on the tributary. The pathway for phosphate in this waterbody is diffuse through overland flow in the poorly drained soils. areas These areas are identified as compartment 1 (figure 9).

Sediment has been observed by Meath County Council in this waterbody and this potentially is impacting on the biology and contributing to its failing status. Hydromorphology potentially is having an impact as well and will be assessed as part of the LCA.

7 Workplan

The EPA identified the further characterisation action as IA7 (Stream walks in rural area for >1km). The EPA carried out a Q value survey on this waterbody in 2018 and the results remain at moderate status.

A public meeting will be held followed by a farmers meeting has been arranged by the Agricultural Sustainability Support and Advisory Programme (ASSAP) advisor.

A field visit to carry out a SSIS in each of the compartments should be able to identify where the impacts on ecology are occurring. stream walks will be continued up the tributary that Meath County Council identified with their assessments. The stream walks should focus on the tributary flowing into Kilmainham Dee_020.

The following should be tested for during the stream walks to narrow the focus of investigation:

- Biological indicators
- Temperature
- Dissolved Oxygen
- pH (due to the pH exceeding the threshold of 9.0 once in three years)
- Electrical Conductivity
- Sediment observations

If mitigation measures are required, (e.g. using low emission slurry spreading, riparian zone, buffer strips, catch crops) they will be discussed with the ASSAP advisors prior to the farm visits. The ASSAP advisors should also carry out visits to the farms along the tributary that Meath County Council have previously visited to work with the farmers to address any reoccurring signification pollution issues.

Channelization was also identified as a significant pressure in this area. Following on from discussion with Meath County Council further information from the EPA is required as to how channelization was identified as a significant pressure. Information from OPW regarding the arterial drainage scheme work schedule for the Kilmainham (Dee)_020 will be requested.

AFA 0099 Kilmainham (Dee)

8 Review of mitigation options

Potential actions which will be confirmed following a field assessment of the PAA.

- Fencing off watercourse from livestock
- Incorporation of organic manures – trailing shoe, injection
- Limiting poaching by farm animals, particularly close to watercourses
- Siting of manure heaps/bailed silage away from streams and vulnerable groundwater
- Good farmyard facilities and management: GAP measures
- Increasing slurry storage, where beneficial, to improve timing of slurry applications
- Buffer zones in appropriate locations
- Managing farm roadways:
 - Divert runoff.
 - Locate away from high risk areas.
 - Avoiding steep slopes/follow contours if possible.
 - Camber roadway to shed water.

9 Communications

9.1 Community information meeting

Community information meeting held on the 12/02/2019 in the Steam Threshing Museum, Moynalty in County Meath. Number of attendees excluding LAWPRO and ASSAP representatives: 20

9.2 Supplementary communications

A School event in Kilmainhamwood national school with the Community Water officer was held on the 12th of March 2019.

Date of completion of Desk Study: 17/04/2019

AFA 0099 Kilmainham (Dee)

10 Appendices

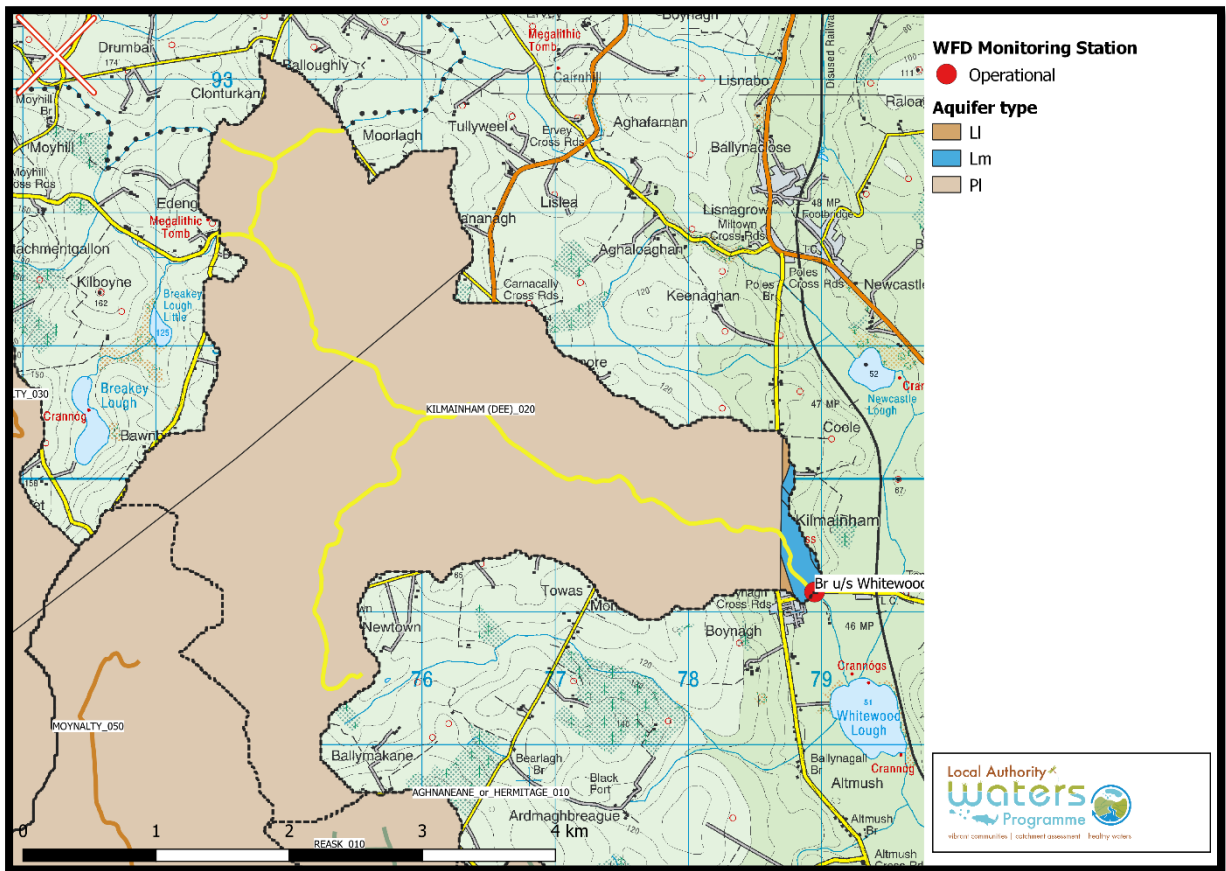


Figure 10: Aquifer type in Kilmainham Dee_020 PAA

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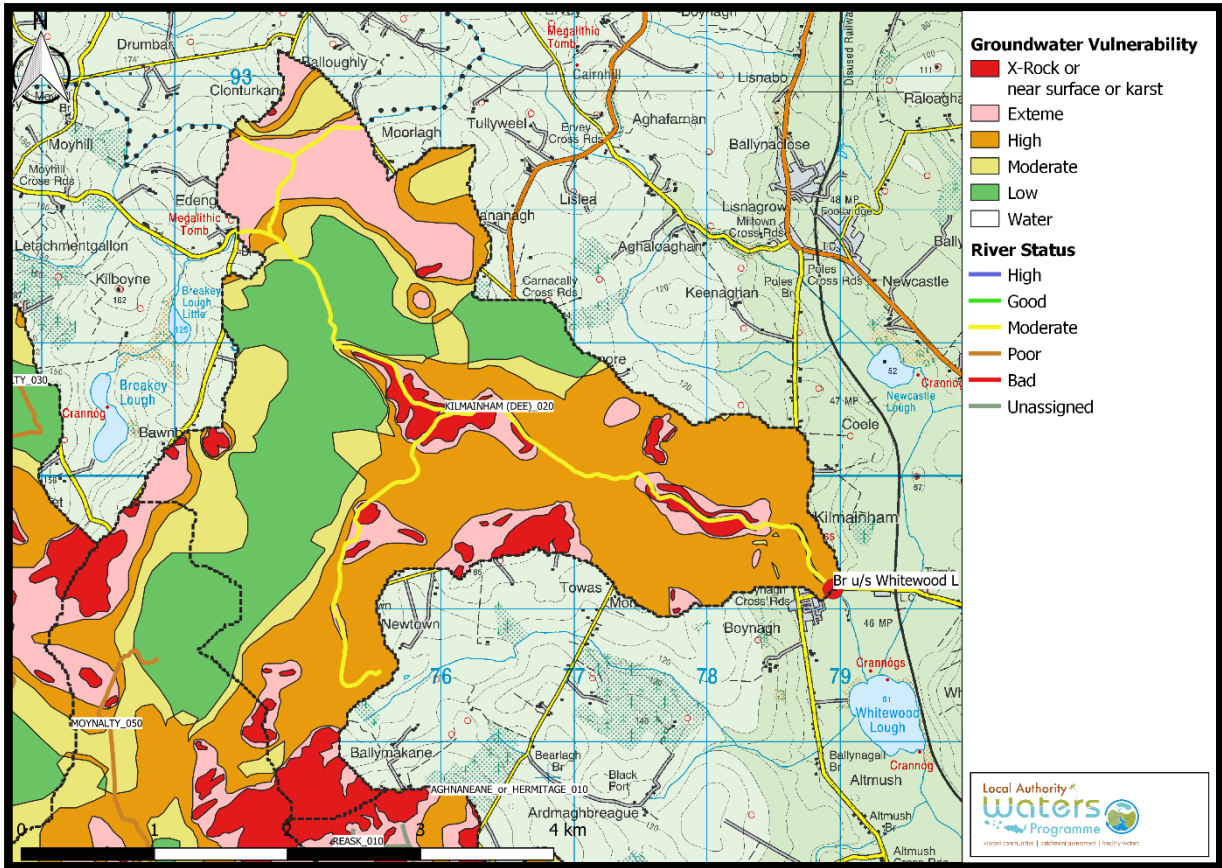


Figure 11: Groundwater Vulnerability in Kilmainham Dee_020 PAA

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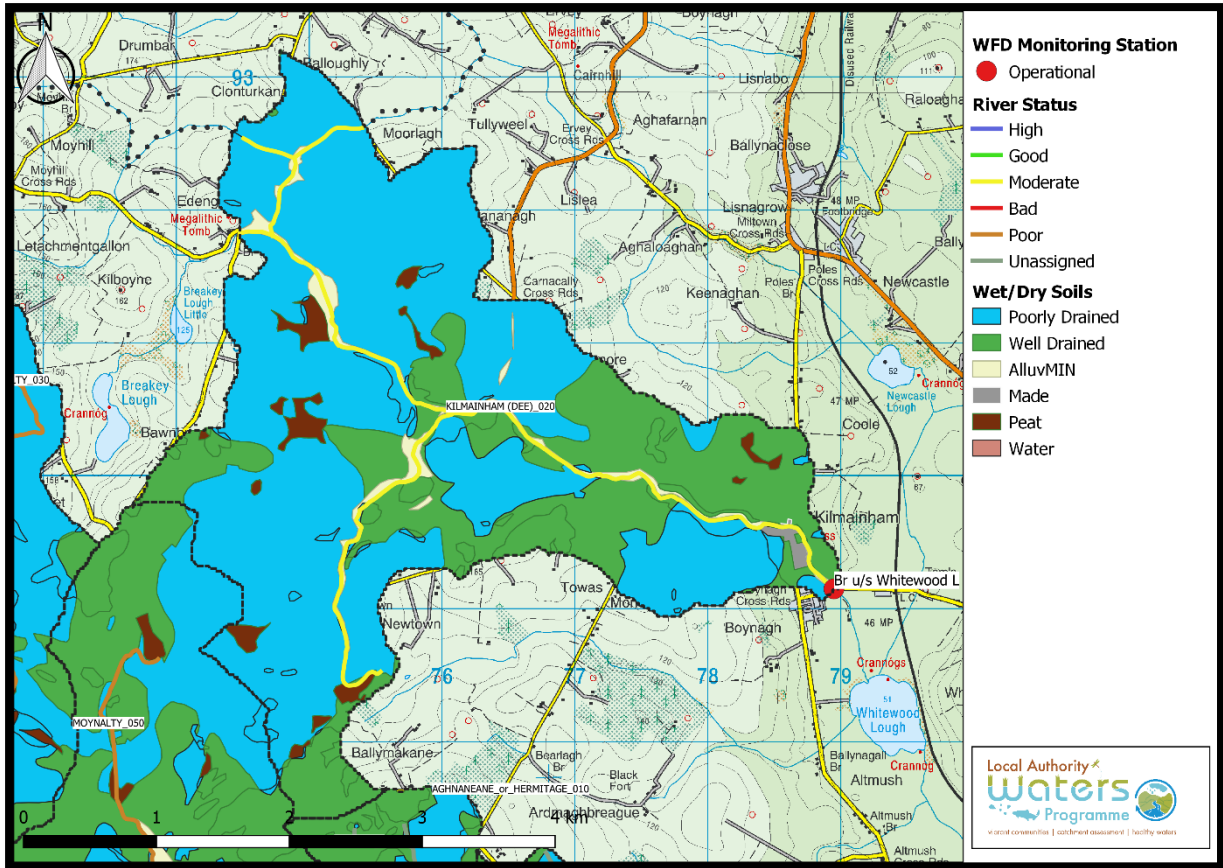
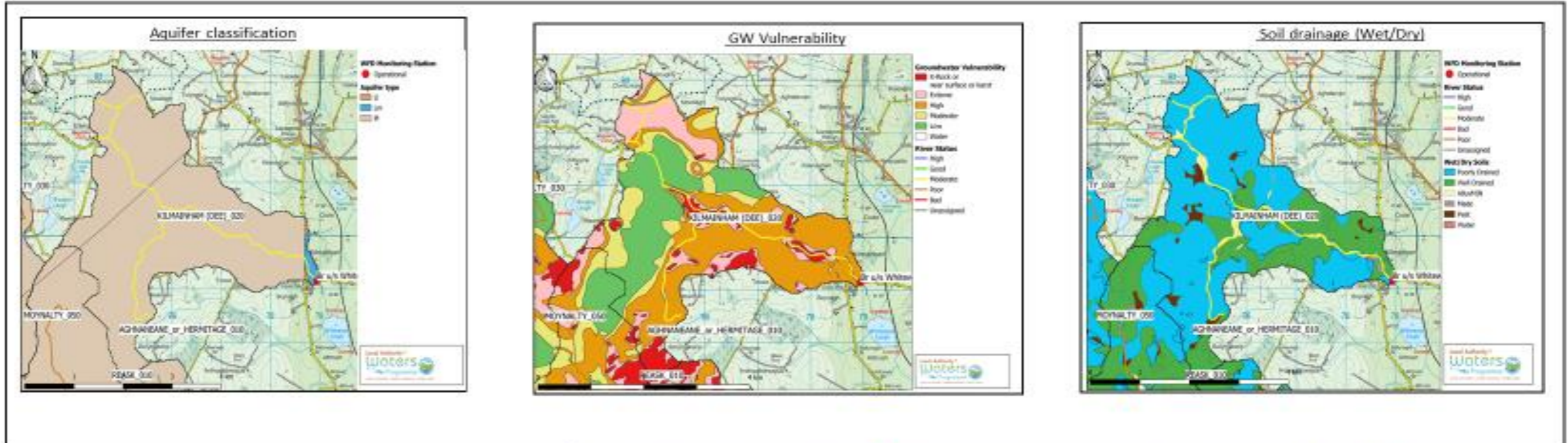


Figure 12: Soil drainage in Kilmainham Dee_020 PAA

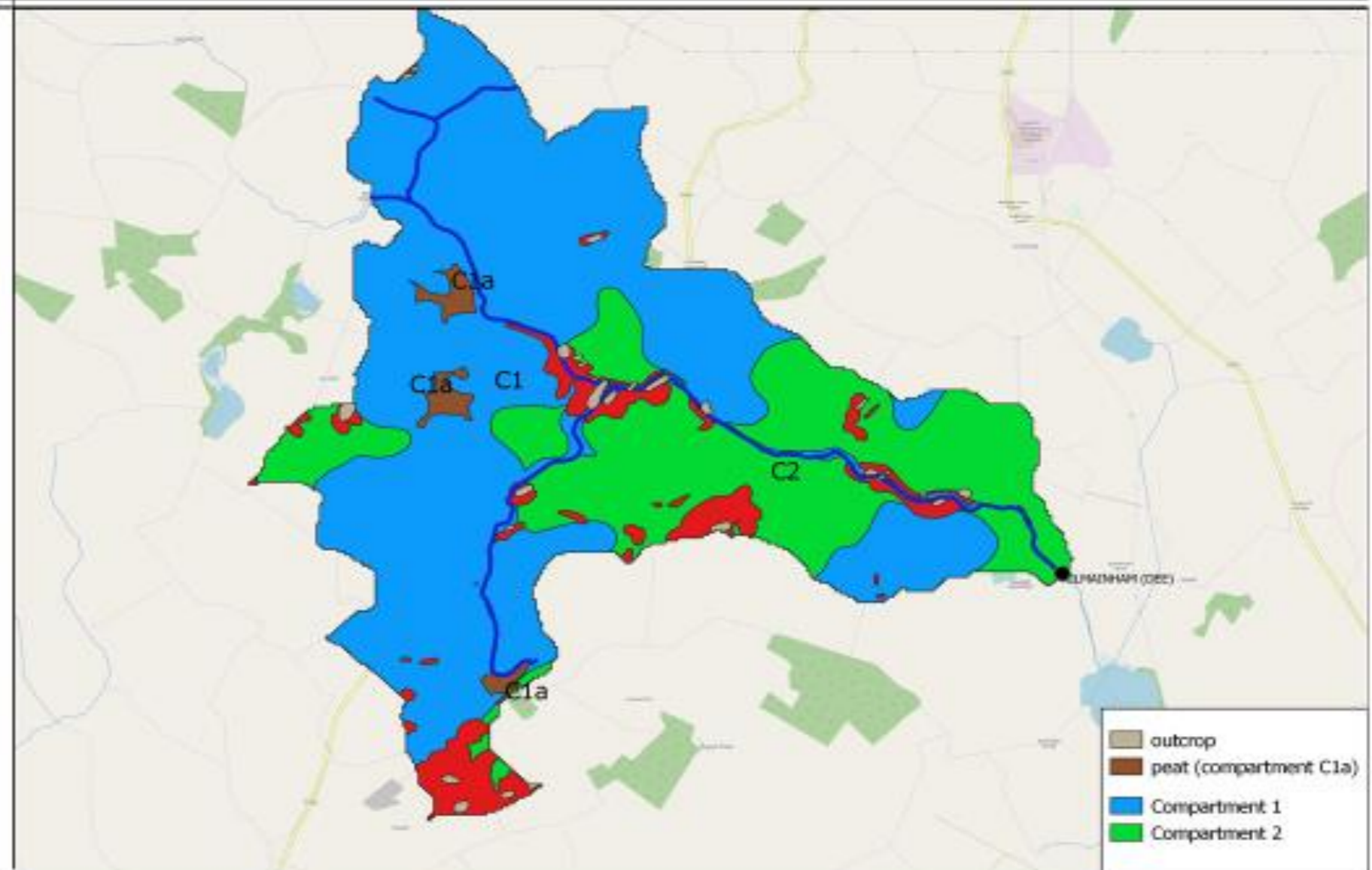


Compartment 1

Land use: Mostly pasture with some tillage. Potential for high loading for N&P.
 Bedrock: Silurian Metasediments & Volcanics
 Aquifer: Poor (PI), Fault line present.
 Soil Drainage: C1: Poorly drained. Potential for N attenuation.
 Pathway: Overland flow of PO4
 C1a: Poorly drained areas of Peat.
 Pathway: Overland flow of NH3 & PO4

Compartment 2

Land use: Mostly pasture with some tillage and a small cluster of houses. Potential for high loading for N&P from agriculture.
 Bedrock: Predominantly Silurian Metasediments & Volcanics, with small areas of Dinantian Upper Impure Limestones & Namurian Undifferentiated.
 Aquifer: Predominantly Poor (PI), small areas of Locally Important (LI) & (Lm)
 Soil Drainage: C2: Well drained
 Pathway: Shallow ground water transport of NO3
 Bedrock Outcrop
 Pathway: Groundwater of NO3 & PO4 (in areas of extreme ground water vulnerability and rock outcrop).



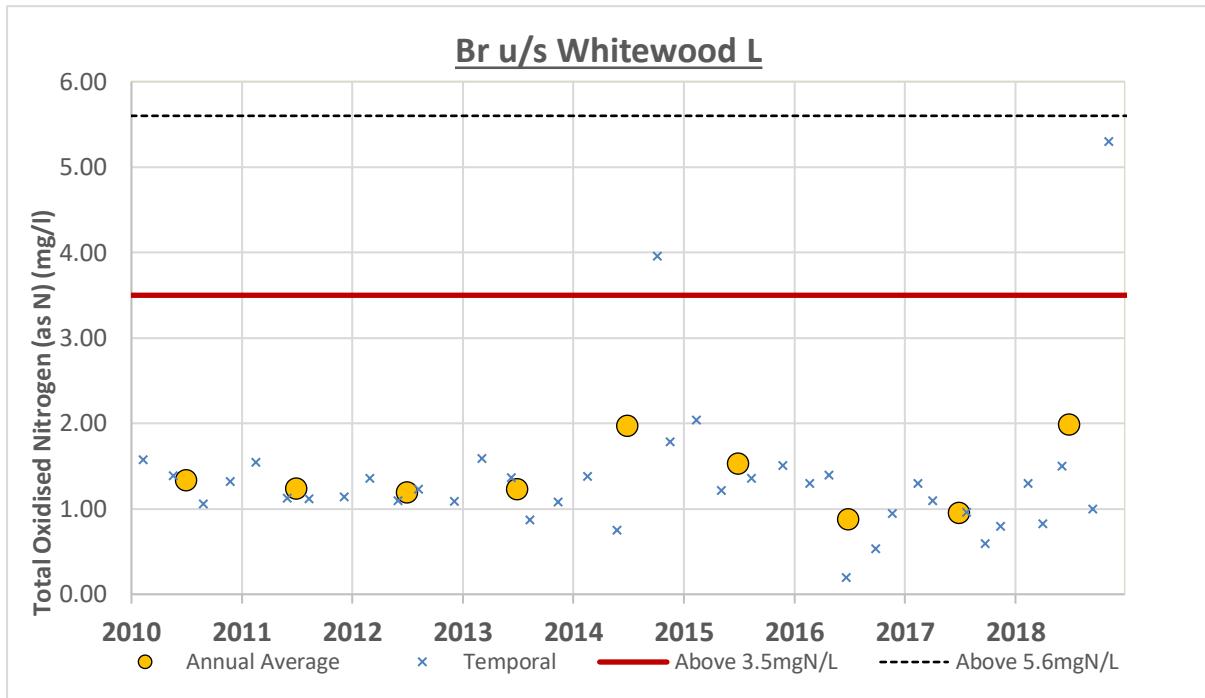


Figure 13: Average TON at the EPA monitoring station in Kilmainham Dee_020

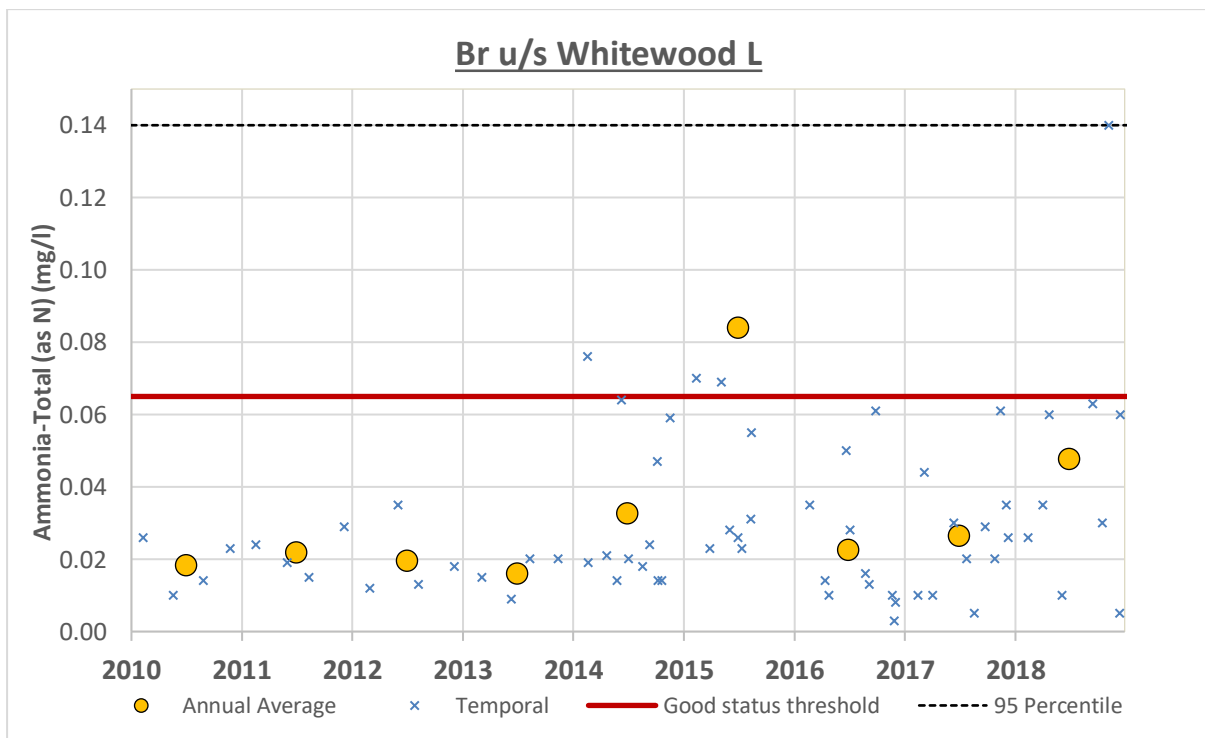


Figure 14: Average Ammonia at the EPA monitoring station in Kilmainham Dee_020

(Outlier 0.43mgN/L on 25/11/2015 not displayed on graph)

