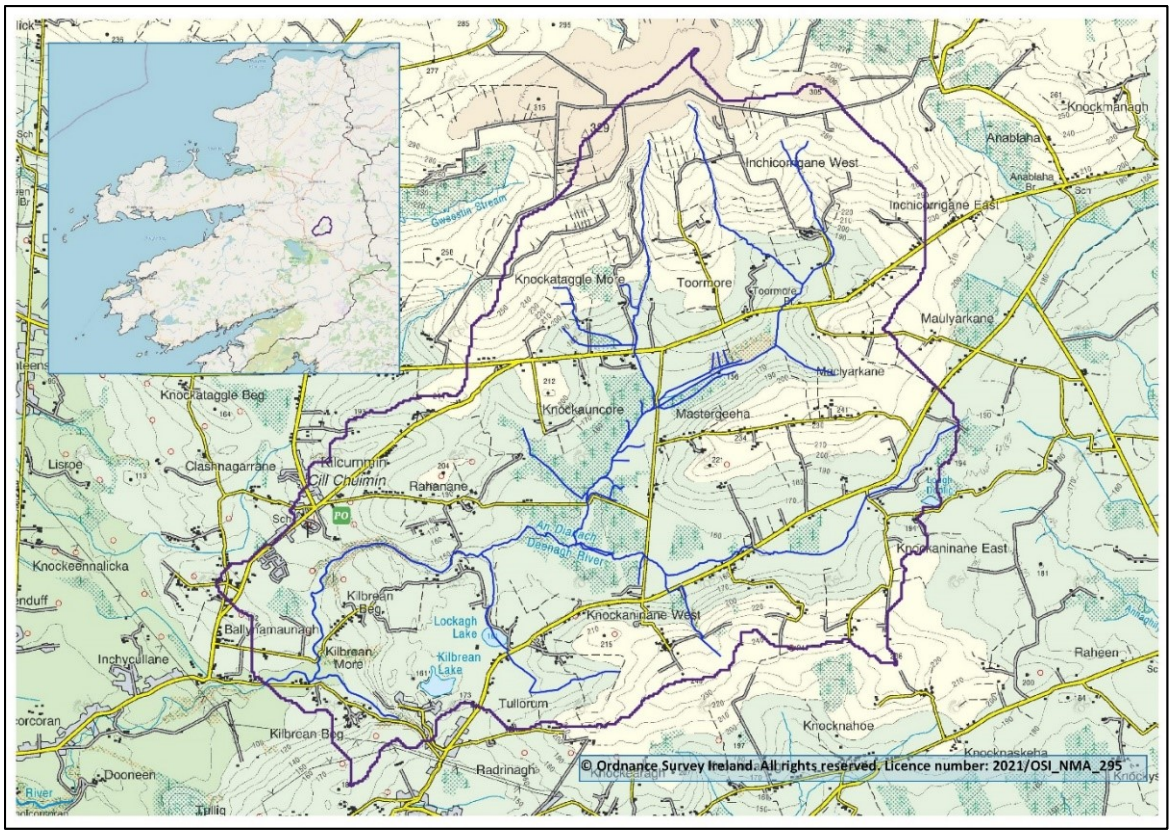
Deenagh PAA

Desk Study

AFA0060

Southwest Region



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Acknowledgements

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Summary

The Deenagh Priority Area for Action in Co. Kerry comprises a single waterbody (Deenagh_010), headwaters of the Deenagh River, located upstream of Deenagh_020, which flows from a northeast to southwest direction, towards Killarney and into Lough Leane. Deenagh_010 covers an area of just over 22km^2 with river length totalling approx. 29km.

Deenagh_010 lies within Catchment Area 22 (Laune-Maine-Dingle Bay), Sub-catchment 22-1 and overlies ground water body IE_SW_G_073 Scartaglin. It is currently at Poor Ecological Status and is *At Risk* of failing to achieve its WFD Objective which is to Restore to Good Status by 2027. This waterbody was selected as a PAA on the basis of it being a single deteriorated waterbody and being the headwaters of a contributing catchment to Lough Leane and thereby building on the extensive work already carried out by the local authority under the Lough Leane Project.

Soil type in the Deenagh_010 is somewhat mixed. There is a significant amount of blanket peat present at the headwaters in the north of the sub-basin, bordering most of the length of the main Deenagh River channel and with smaller areas along its eastern tributary. These areas are typically poorly draining where land use appears to be predominantly taken up with peat harvesting (in the northern part of the waterbody), commercial forestry and agriculture. Bordering the peat areas are poorly draining acid mineral gleys which also cover a large proportion of the eastern part of the sub-basin. All other soils in Deenagh_010 are relatively deep well drained mineral soils of brown earths and podzolics, shallow in some more elevated places where bedrock is at or close to the ground surface.

There are two WFD operational monitoring stations within this waterbody, monitoring macroinvertebrates only. There are no chemistry data for these sites. The furthest downstream station is at the outlet from Deenagh_010 called 'Br. Near Woodpark' (22D010100) which is at Q4 (Good Status) and has remained so consistently since 1998 to the present, with Q4-5 (High Status) recorded here in 2015. The other station is 'Br. NE of Tulloram' (22D010045, approx. 4.6km upstream of 22D010100) and located on the eastern tributary of the Deenagh River which has been consistently Q3 (Poor Status) since 1996 except for 2007 and 2019 which recorded Q3-4 (Moderate Status) for this station.

It is the monitoring point 22D010045 'Br. NE of Tulloram' on the eastern tributary that is driving Poor Status for Deenagh_010 based on its macroinvertebrate communities. The significant issues driving the poor status are not clear at present but likely to be phosphate and sediment which will be clarified through the Local Catchment Assessment (LCA). Diffuse agriculture and agriculture-related small point sources have been identified as possible key pressures causing the issues at the monitoring point.

To note, there is chemistry monitoring undertaken at a third site in Deenagh_010 at 'Br. N of Tulloram' (22D010060) which is approx. 3km upstream from the most downstream biological monitoring site at 22D010100 'Br near Woodpark'. The results for this site show it to be meeting good status EQS for total ammonia and Phosphate values although data show spikes in both parameters at times. Total Phosphorus is also monitored here where frequent high levels are recorded signifying a possible sediment issue. This is relatable to the nature of the catchment with a large predominance of peat upstream of this point particularly in the headwaters and along its main channel. Peat extraction has been cited as a significant pressure in this waterbody. As this site is essentially meeting its WFD objective and for the purposes of addressing issues that are driving Poor Status in this sub-basin, the focus of the LCA will be on the eastern tributary only. However, if the Deenagh_010 PAA is expanded to include Deenagh_020 in the third cycle then this monitoring location at 22D010060 'Br. N of Tulloram' would be assessed further as too its contributing tributaries upstream. The outcome of the

LCA for Deenagh_010 PAA will inform the expanded PAA and any subsequent LCAs. Deenagh_020 is a High Status Objective water body which deteriorated during the 2015 – 2018 monitoring period falling from Q4-5 (High Status) to Q4 (Good Status) in 2016 and has remained at Good status since. While Deenagh_020 is not currently a PAA and deemed *Not at Risk* under the current second cycle River Basin Management Plan it has however been categorised as *At Risk* in the third cycle (2022 – 2027).

1 Background

Table 1-1 Background information on the Deenagh_010 PAA

Priority Area for Action	Catchment Number	Catchment Name	Sub catchment	Region	Local Authority
Deenagh	22	Laune-Maine-Dingle Bay	22-1 Deenagh_SC_010	South West	Kerry CoCo

Priority Area for Action	No. of *At Risk* WBs	No. of *Review* WBs	No. of dRBMP Prioritised WBs	No of WBs for Status Improvement:		
				2021	2027	Beyond 2027
Deenagh_010	1	0	1	0	1	0

Reason for selection	• Of Interest from a planning perspective. • Build on work completed for the Lough Leane project. • Headwaters to Lough Leane. • One deteriorated water body. • One water body (Deenagh_010) is failing to meet its protected area objectives for salmon.

Figure 1-1 Deenagh_010 Priority Area for Action Ecological Status (2018)

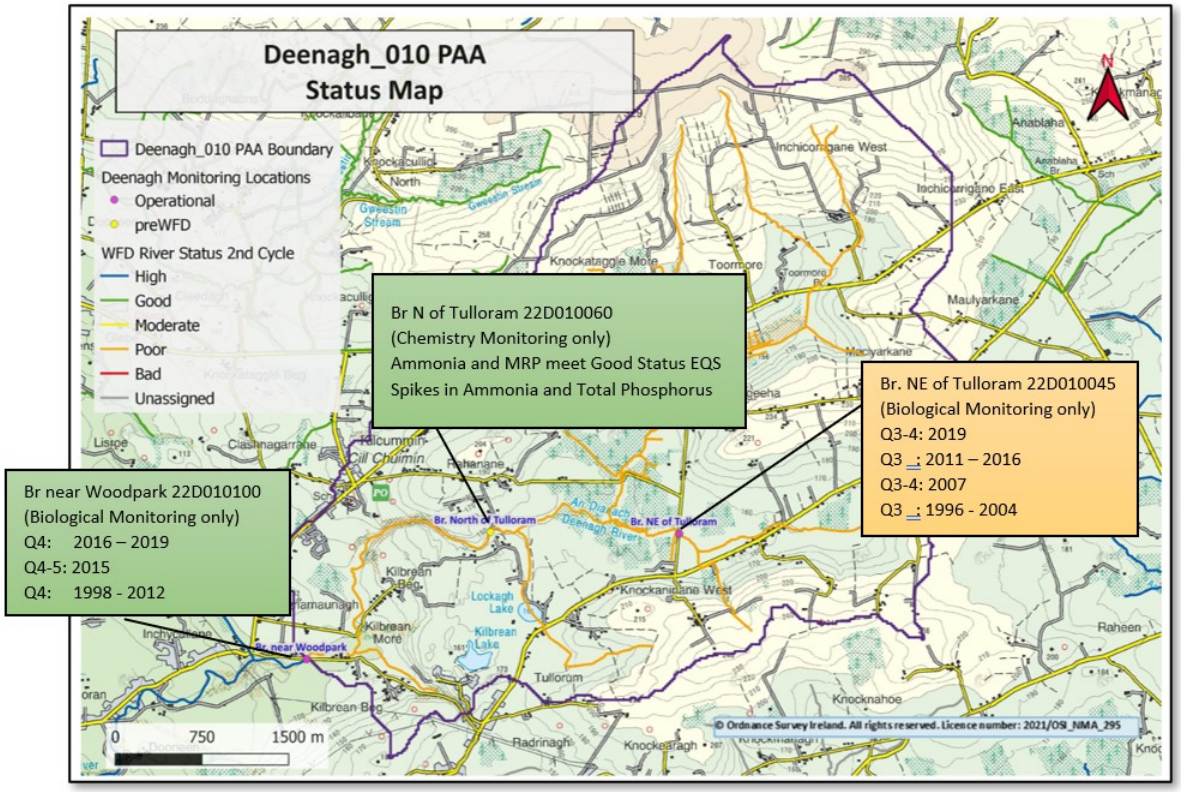


Figure 1-2 Deenagh_010 Priority Area for Action WFD Risk Map

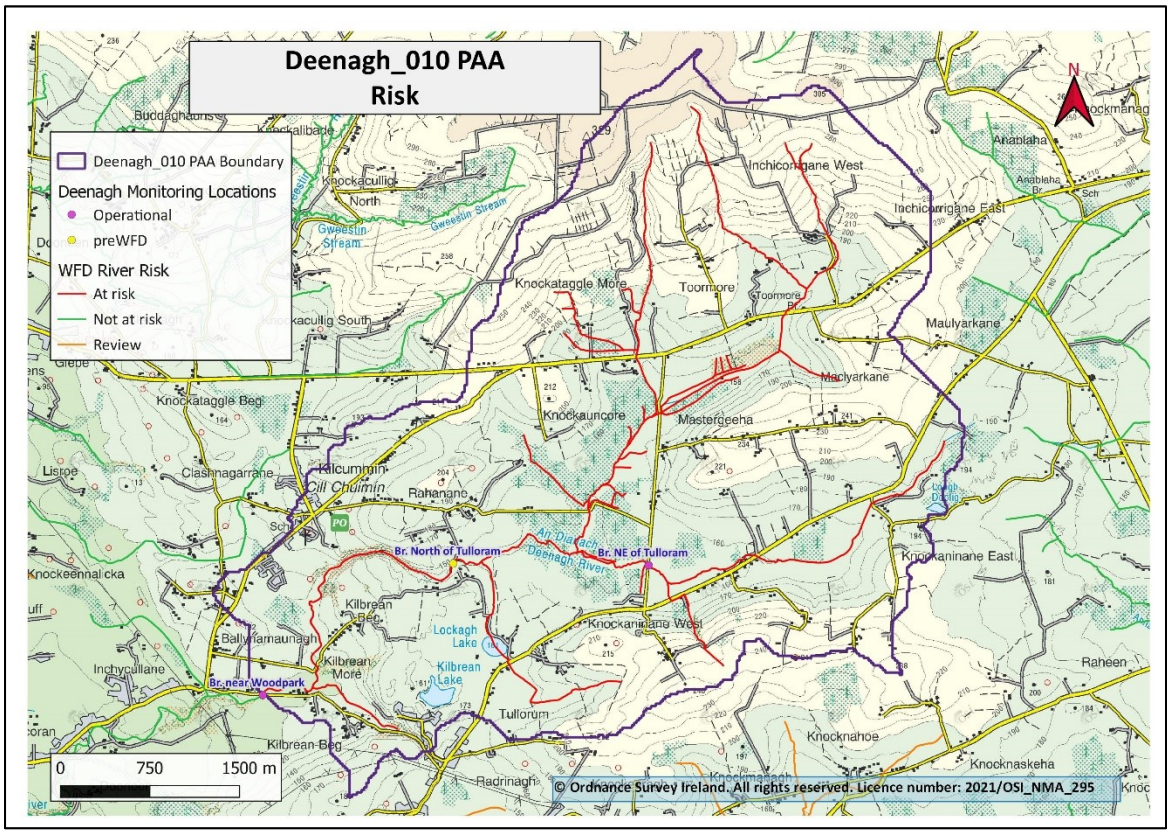


Table 1-2 Summary table of individual waterbodies within the Deenagh_010 PAA

Water body Code	Water body Name	Risk	Obj.	Ecological Status			Pressures		
				2009	2012	2015	Category	Subcategory	Sig? (Y/N)
IE_SW_22D010100	Deenagh_010	At Risk	Restore 2027	Mod	Poor	Poor	Extractive	Peat Harvesting	Y
							Agriculture	Agriculture	N
							Forestry	Forestry	N
							DWWTS	Wastewater Discharge	N

(Source: WFD APP and Storyboards)

Table 1-3 Monitoring Stations within the Deenagh_010 PAA

Site Name	Code	Type	Data	Recent data available
Bridge near Woodpark	22D010100	Operational	Biological only	Yes
Bridge N of Tulloram	22D010060	PreWFD	Chemistry only	Yes
Bridge NE of Tulloram	22D010045	Operational	Biological only	Yes
Bridge West of Lough Doolig	22D010015	PreWFD	Biological only	No (1990)
Bridge d/s Lockagh Lake	22L100200	PreWFD	No data	No
U/s Br. Near Mastergeeha	22D010013	PreWFD	No data	No
Toormore Br	22D010011	PreWFD	No data	No
Br. Near Looneys Garage	22D010008	PreWFD	No data	No

2 Receptor information

2.1 Overview table

Table 2-1 Receptor information for Deenagh_010 PAA

		Figures / Tables	Deenagh_010		
Risk Category			***At Risk***		
Monitoring Stations	**Operational/*preWFD**	*Table 1-3*	**Br. NE Tulloram 22D010045**	***Br. North of Tulloram 22D010060**	**Br. Near Woodpark 22D010100**
Biological Status (Inverts)	**2015**	*Table 2-2*	Poor	*No biological data/chemistry only*	High
	2016		Poor	*No biological data/chemistry only*	Good
	2019		Moderate	*No biological data/chemistry only*	Good
	trends in Q values 2016-2018 Q value data		Improved but tentative - consistently Q3 since 1996 except on two occasions it went to Q3-4 in 2007 and 2019	*No biological data/chemistry only*	Stable, consistently at Q4 since1998 to present, except 2015 when it went to Q4-5
	Fish status (where rel)		No fish assessment details		No fish assessment details
Hydrochemistry Data					
Ortho-P (mg/l P)	**Baseline 2017** **indicative quality** **Trends - significant?** **Dist to threshold**		No chemistry available	0.011mg/l High Downwards/No Far	No chemistry available
NH4-N (mg/l N)	**Baseline 2017** **indicative quality** **Trends - significant?** **Dist to threshold**			0.035mg/l High None/No Near	
TON (mg/l N)	**Baseline 2017** **indicative quality**			1.05mg/l Good	
	Trends - significant?			Downwards/No	

		Figures / Tables	Deenagh_010		
Risk Category			***At Risk***		
Monitoring Stations	**Operational/*preWFD**	*Table 1-3*	**Br. NE Tulloram 22D010045**	***Br. North of Tulloram 22D010060**	**Br. Near Woodpark 22D010100**
	Dist to threshold			Far	
Supporting Conditions	**Chemical conditions?** **Oxygenation Conditions** **Acidification Conditions**		Pass Pass		
Hydromorphology					
RHAT score			No data	No data	No data
Evidence of Arterial drainage			No programme for Arterial Drainage by the OPW for Deenagh_010		
MQI – Hydromorphological Quality			Moderate at this location and approx. 3km upstream (i.e. eastern tributary of the river in Deenagh_010)	Good at and upstream of this monitoring point for approx. 1.07km, then moderate up to headwaters in the north of the sub-basin	Good for approx. 4.1km u/s of this monitoring point
		Figure 2-4	Most of the river length is at 'Moderate condition' for MQI at approx. 10.7km, 'Good' in the lower part of the sub-basin for approx. 4.1km, with some 'High conditions' in the smaller streams in the headwaters approx. 1.08km total		
Ecological Status: (2010–2015) **(2013 – 2018)** **Element Driving Status** **Trend since first cycle**		*Table 1-2*	Poor Poor Macroinvertebrates (at Br. NE of Tulloram 22D010045) Deteriorated since the first cycle which was Moderate Status		
Protected Areas		*Figure B-(xi) Appendix B*	Yes, the Deenagh River channel is within SAC 000365 Killarney National Park, Macguillycuddy Reeks and Caragh River		
WFD Objective			**Restore to Good by 2027**		

	Figures / Tables	Deenagh_010		
Risk Category		***At Risk***		
Monitoring Stations Operational/*preWFD	*Table 1-3*	**Br. NE Tulloram 22D010045**	***Br. North of Tulloram 22D010060**	**Br. Near Woodpark 22D010100**
EPA biologist notes (if any)		(26th June 2019 – EPA Biologist notes) Siltation at monitoring point but improvement in fauna since last round, a lot of simulidae and chironomus. pressures associated with sediment observed. Cladophera identified in 2015, somewhat less in 2019. This site remains unsatisfactory, diffuse source pollution suspected (*Ref: www.epa.ie/QValue/webusers/*)	*No biological data*	(Aug 2016) 1 sensitive Mayfly and 1 sensitive Stonefly found, 'Mild' bank erosion upstream and downstream of the site, 1 % macroalgae, 1 – 2.5% filamentous algae, 9% macrophyte. This site is satisfactory at good ecological quality and stable at Q4 historically. (*Ref: EPA*)
Significant issue/impact for receptor (e.g. PO_4)		Sediment and nutrients are the most likely significant issues. There are no chemistry data at present	Nutrient levels show that this monitoring point meets High or Good EQSs for MRP and Ammonia respectively, except for spikes that are well elevated beyond good status thresholds. Site will require further investigation during the 3rd cycle when the PAA may be expanded to include Deenagh_020.	N/A

2.2 Biological Monitoring

There are two sites within Deenagh_010 where biological monitoring data are available. The most downstream site at the outlet from the sub-basin at 'Br. Near Woodpark' 22D010100 is currently at Q4 and has maintained this quality since 1998, which also includes a brief improvement to Q4-5 in 2015. Figure 2-1 shows historic Q monitoring data where prior to 1998 the station saw fluctuations between high and good quality. There are no chemistry data for this site. Downstream of this station is Deenagh_020 sub-basin and while not a PAA, it is a High Status Objective waterbody, and a Blue Dot River and is currently at Good status and *Not at Risk* (2nd cycle) but risk is reclassified as *At Risk* for the 3rd cycle (2022 – 2027).

The other biological monitoring station is at 'Br. NE of Tulloram' 22D010045 which is located on a branch of the Deenagh River in the east/south-eastern part of the sub-basin. This eastern tributary of the river is in a poorly draining area with predominantly peat and gley soils with some limited areas of well drained soils. The EPA biologist notes from June 2019 for this site indicates heavy siltation with high numbers of pollution tolerant Simulidae and Chironomus. The fauna had improved somewhat and a Q3-4 was given to this site compared to Q3 in 2016. The notes also indicate improvements in macroalgae at the site but identifies some agriculture practices nearby such as land improvements, the storage of baled silage close to the river and the presence of horses which may be accessing the river, all of which would potentially impact on river water quality. It was also noted during the 2019 survey that a cattle access point upstream of the monitoring point (observed during previous surveys) had been removed and the river was also fenced off, both of which would have positive effects. Figure 2-2 below shows historical Q data for this site.

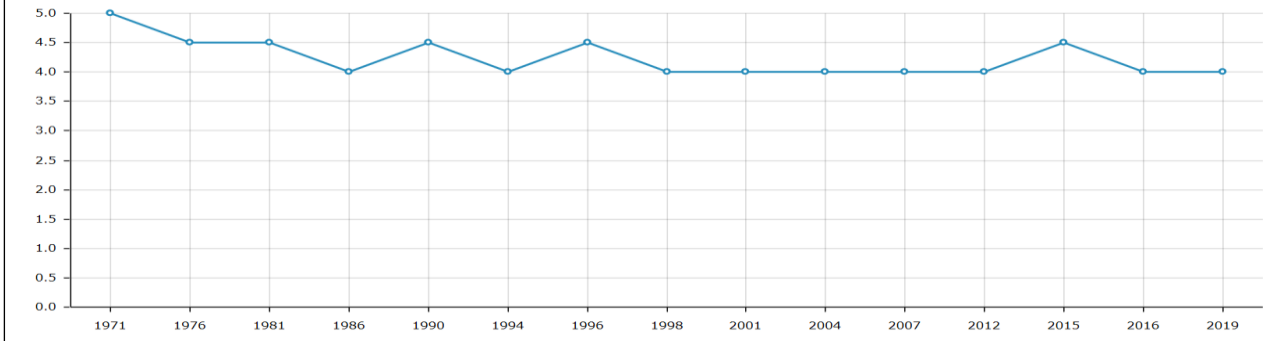
Table 2-2 shows all historic Q data for Deenagh_010. It is clear that the monitoring point 'Br. NE of Tulloram' 22D010045 is the driver of the overall Poor Status of Deenagh_010 and therefore the catchment upstream of this point should be the main focus for the Local Catchment Assessment in determining the critical source areas where the significant contributors of sediment and nutrients are accessing the river.

Figure 2-1 Biological Monitoring for Station Br. Near Woodpark 1971 – 2019

Monitoring Station: RS22D010100

Code	**RS22D010100**	Monitoring Type	**RIVER_STATION**
Station	**Br near Woodpark**	Easting	**98915.30**
Station Type	**Operational**	Northing	**93485.36**

(Source: WFD APP)



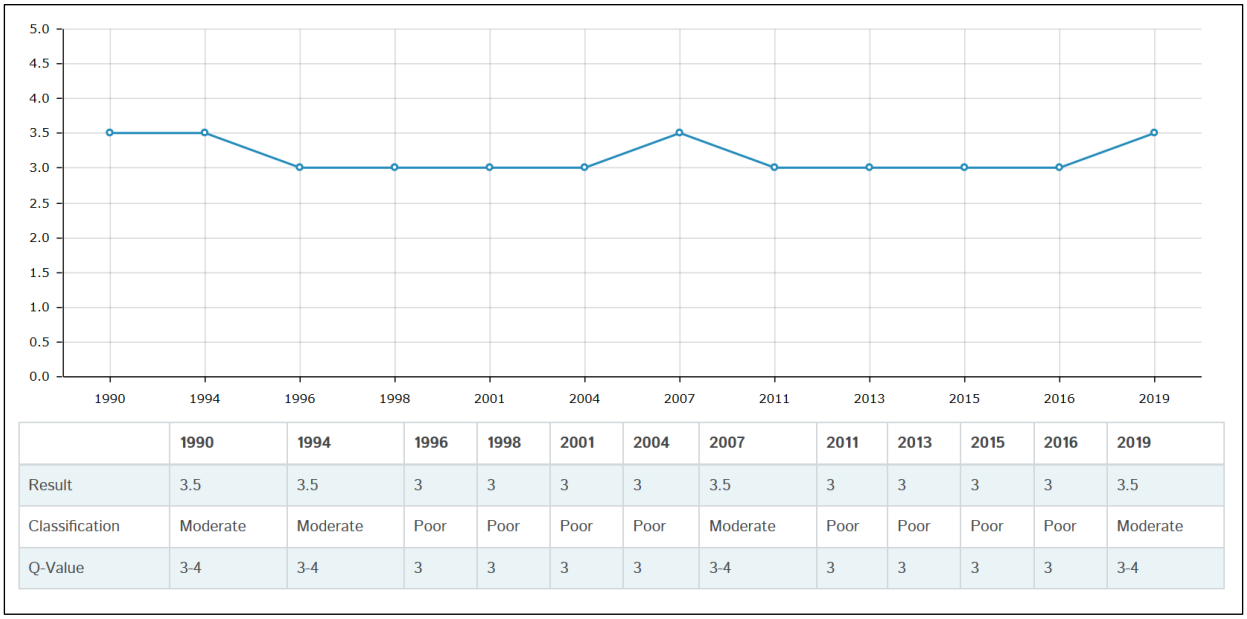
	1971	1976	1981	1986	1990	1994	1996	1998	2001	2004	2007	2012	2015	2016	2019
Result	5	4.5	4.5	4	4.5	4	4.5	4	4	4	4	4	4.5	4	4
Classification	High	High	High	Good	High	Good	High	Good	Good	Good	Good	Good	High	Good	Good
Q-Value	5	4-5	4-5	4	4-5	4	4-5	4	4	4	4	4	4-5	4	4

Figure 2-2 Biological Monitoring for Station Br. NE of Tulloram 1990 - 2019

Monitoring Station: RS22D010045

Code	**RS22D010045**	Monitoring Type	**RIVER_STATION**
Station	**Br NE of Tulloram**	Easting	**102136.00**
Station Type	**Operational**	Northing	**94558.21**

(Source Ref: WFD APP)



	1990	1994	1996	1998	2001	2004	2007	2011	2013	2015	2016	2019
Result	3.5	3.5	3	3	3	3	3.5	3	3	3	3	3.5
Classification	Moderate	Moderate	Poor	Poor	Poor	Poor	Moderate	Poor	Poor	Poor	Poor	Moderate
Q-Value	3-4	3-4	3	3	3	3	3-4	3	3	3	3	3-4

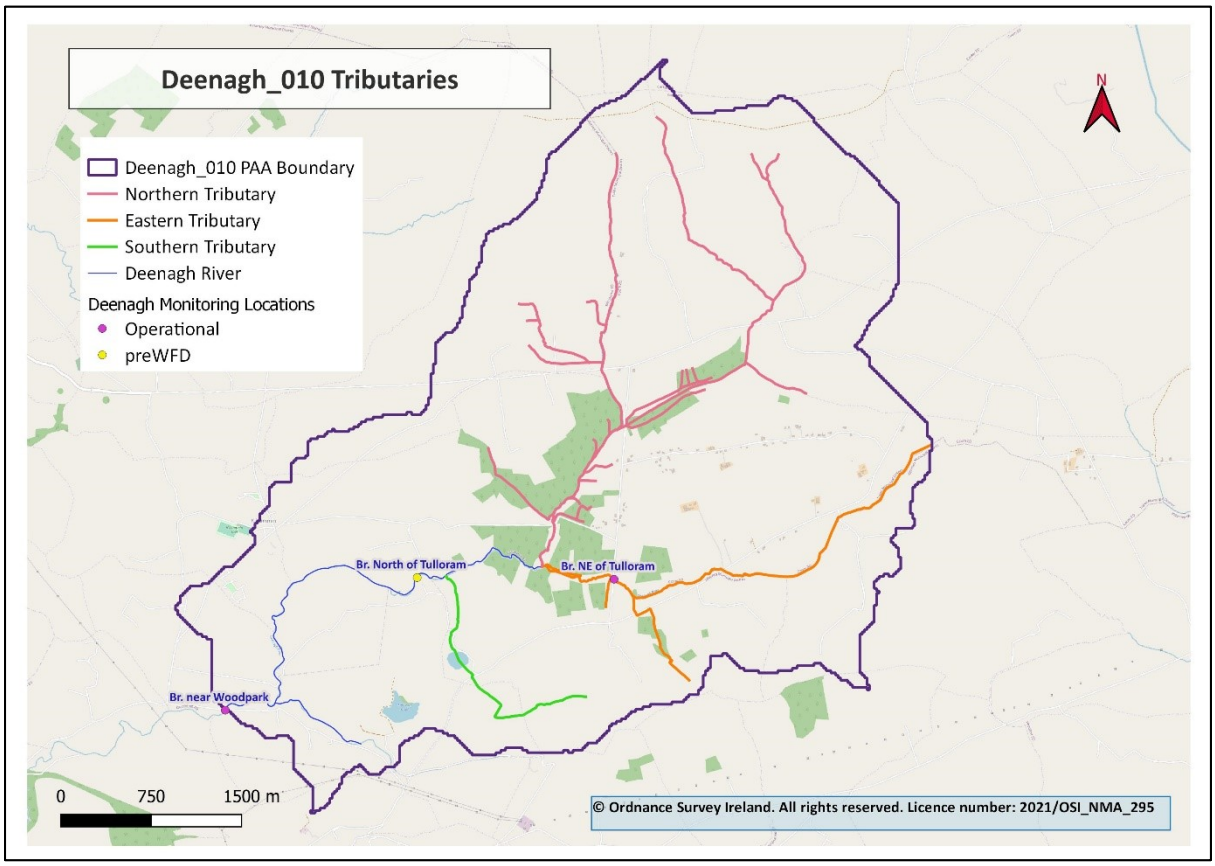
Table 2-2 Summary Q Data for Deenagh_010, Biological Monitoring Stations

Year	Biological Station	Biological Station
	Br. NE Tulloram 22D010045	Br. Near Woodpark 22D010100
1971		5
1976		4-5
1981		4-5
1986		4
1990	3-4	4-5
1994	3-4	4
1996	3	4-5
1998	3	4
2001	3	4
2004	3	4
2007	3-4	4
2011	3	
2012		4
2013	3	
2015	3	4-5
2016	3	4
2019	3-4	4

2.3 Hydrochemistry

There are no hydrochemistry monitoring carried out at either of the two biological monitoring sites 22D010100 Br near Wood park or 22D010045 Br NE of Tulloram. Hydrochemistry data are available only for one site at 22D010060 'Br. N of Tulloram'. This site is located downstream of the northern, eastern and southern tributaries of the Deenagh River (see *Figure 2-3* below) and <3km upstream of biological monitoring station 'Br. near Woodpark' 22D010100 which is at the outlet of the sub-basin and at Q4.

Figure 2-3 Map showing the tributaries of the Deenagh_010



The available chemistry data for this site, Br N of Tulloram, span between 2014 and 2019 where grab sampling occurred on average 10 times per year. A closer look at the data does however show spikes of elevated values at times, in some instances well outside mean good status EQSs (these spikes are included in Table A-(i), Appendix A). Total phosphorus (TP) was also analysed at this monitoring location as Deenagh_010 is a contributing waterbody to Lough Leane (Nutrient Sensitive Lake).

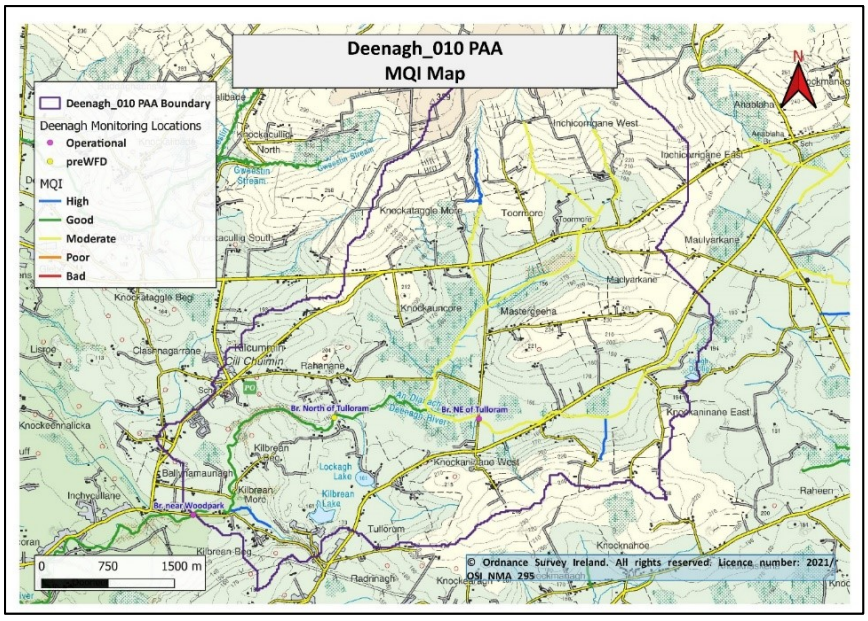
The chemistry is showing that annual averages for ortho-phosphate and total ammonia are within their respective Good Status EQSs and therefore meeting the WFD objective at this site. However, the data shows that total ammonia and total phosphorus are elevated on occasion such to indicate that there may be an issue here at times. Elevated total ammonia levels are likely due in part to the peaty nature of the catchment upstream of this point and a large spike detected in March 2015 indicates possibly a nearby intermittent point source (see *Table A-(ii), Appendix A). Elevated total phosphorus levels would indicate possibly a sediment issue here.

As this chemistry monitoring point is not driving the status of this sub-basin no further assessment is proposed for this site at this time under the current local catchment assessment (LCA). The LCA will be focussed on the catchment area upstream of the monitoring point 22D010045 'Br. NE of Tulloram' on the eastern tributary, that is driving poor status for Deenagh_010. However the chemistry data for the site 22D010060 Br N of Tulloram is presented in Appendix A as it was taken into consideration for this desk study.

2.4 Hydromorphology

There are no significant Hydromorphological pressures reported for this waterbody. The sub-basin is not a High Status Objective River and is not part of an OPW Arterial Drainage scheme or a Local Authority Drainage District Programme. The MQI for the river waterbody shows most of the river in the moderate category with the lower section as good. Only a small stretch of some of the headwater streams are high. (*Ref: WFD APP and MQI dataset LAWPRO*)

Figure 2-4 Morphological Quality Index mapping for Deenagh_010



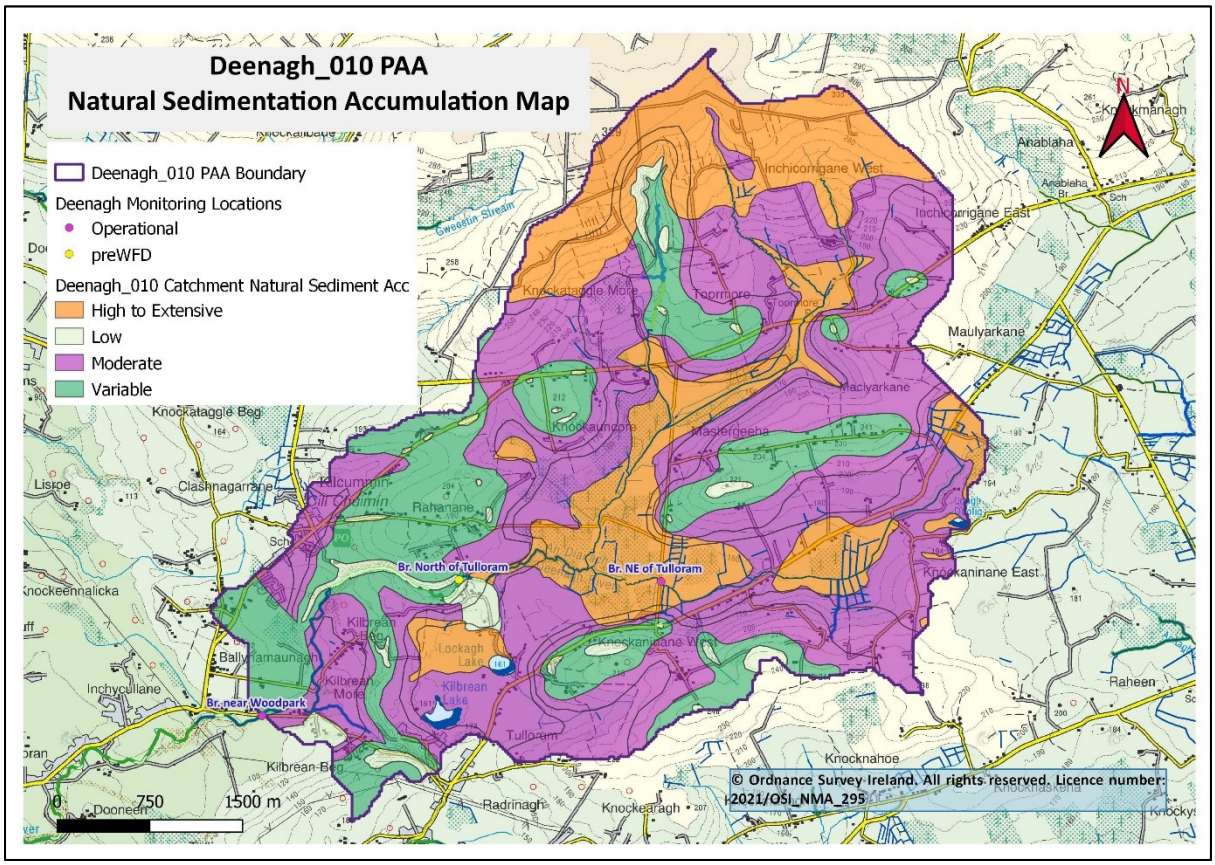
2.5 Sedimentation

Sedimentation mapping shows that there is a high to extensive risk potential for natural sediment accumulation along most of the Deenagh River in its headwaters, along its northern tributary and eastern tributary in particular – see Figure 2-6 below. As discussed above in *Section 2-3 Hydrochemistry*, sedimentation may be an issue at monitoring point 22D010060 'Br. N of Tulloram' because of high Total Phosphorus and elevated Suspended solids levels at times.

Biologist notes for the monitoring station on the eastern tributary 22D010045 'Br. NE of Tulloram' indicate a sediment issue. Land use within the eastern tributary's catchment is primarily agriculture where biologist notes also identified land improvement works and cattle access upstream of the monitoring point. There may also be peat harvesting at the headwaters of the eastern tributary, but it appears to be on a small scale if at all.

There is no sediment issue identified at the furthest downstream biological monitoring station at 22D010100 'Br. Near Woodpark'.

Figure 2-5 Natural Sediment Accumulation based on catchment/substrate/zoning



2.6 Conclusion on Significant Issues

1. Based on all available information and data for Deenagh_010 it appears that the biological monitoring point on the eastern tributary 'Br NE of Tulloram' 22D010045 is driving the overall Poor status for this sub-basin. The significant issue driving poor status at this monitoring location is not yet fully known but sediment and macroalgae have been observed by biologist so sediment and phosphate are likely to be issues here.
2. The driver of poor status at 22D010045 'Br NE of Tulloram' is the poor macroinvertebrate communities. Pressures from diffuse agricultural and domestic wastewater sources have been cited in EPA biologist notes but there is currently no supporting chemistry for this tributary to verify this or determine extent of impact. Drainage characteristics of the catchment draining this tributary is mixed but primarily poorly draining.
3. The outcome of the pending LCA on the eastern tributary upstream of the impacted monitoring point driving status, 22D010045 Br NE of Tulloram, will inform contributions of nutrients and sediment to the chemistry monitoring site downstream which will be more relevant to the extended Deenagh PAA during the third cycle (yet to be confirmed) which will include sub-basin Deenagh_020 (High Status Objective Waterbody).
4. The overall conclusion is that the eastern tributary will be the focus of the LCA and the most likely significant issues are Phosphate and Sediment.

3 Significant pressures

3.1 Initial EPA characterisation

Table 3-1 Initial EPA characterisation (Source: excerpt from WFD APP pressures and impact details)

Water body Name	Id	Category	Sub Category	Name	Significant?	Pressure & Impact details
Deenagh 010	WBP000 4088	Forestry	Forestry	n/a	No	High P PIP Rank 1-3 mainly along forested and peatland areas in the central part of waterbody and the eastern pockets on poorly drained wet soils. SLAM v2.04 indicates a phosphate contribution of 12% from forestry **.**
	WBP000 4089	Agriculture	Agriculture	n/a	No	PIP (SW/P) is predominantly low but high rank 1-3 upstream of the monitoring station RS22D010045 and along the main channel in the upper waterbody. SLAM v2.04 indicates a phosphate contribution of 75% from pasture. PIP not high enough for beyond 2027. Limited areas of high PIP.
	WBP000 4090	Domestic Waste water	Waste water	n/a	No	There are clusters of rural settlement with the SLAM estimating DWWTS 11% phosphate contribution. Free draining soils mainly in the west and south of the waterbody.
	WBP000 6404	Extractive Industry	Peat Harvesting	n/a	Yes	Peat harvesting mainly in the headwaters in northern part of the waterbody

3.2 Significant Pressures from the Desk Study

The EPA WFD APP states that *peat extraction is possibly a significant pressure in Deenagh_010 which requires further investigation by LAWPRO*. Occasional high TP and suspended solids levels found in chemistry data would support this. However, the chemistry monitoring point is downstream of the northern, eastern and southern tributaries (Fig. 2-3 above) and the data are showing overall that nutrient parameters are meeting at least good status EQSs. Therefore, further assessment at this point will not be included in the LCA for the second cycle but would likely be included in the third cycle if the PAA is expanded to include Deenagh_020. Therefore, the focus now is primarily on the part of the catchment that is impacting the monitoring station driving poor status which is 22D010045 'Br. NE of Tulloram'.

From the desk study so far, the pressures that appear to be most prominent in the eastern tributary catchment are Agriculture and DWWTS. There may be some small scale peat extraction in the headwaters of the eastern tributary but it would not be expected that this would be significant with respect to the monitoring point that is driving poor status. The following descriptions of pressures are those identified in the WFD APP (as set out in Table 3-1 above) which took in potential pressures across all of the sub-basin. However, as already stated, as the eastern tributary will be the focus of the LCA, the pressures are regarded with more pertinence to the eastern tributary's catchment.

3.2.1 Agriculture

Of the poorly drained areas within the waterbody, those where agriculture appears a prominent land use and where there is also very high PIP (Phosphate to Surface water) are in the east and south-eastern part of the water body – see Figure 3-1 and Figure 3-2 below. High PIP rank 1-3, covers a large portion of the eastern tributary catchment area approx. 45% and is bordering the river channel. Aerial imagery shows drainage patterns on very poorly draining land which is used for agricultural purposes. Some of these are close to the monitoring point at 22D010045 'Br. NE of Tulloram'. It has also been highlighted in the WFD APP that point source impacts may be an issue close to or at the monitoring point such as cattle poaching, horses and storage of silage bales (as were detailed in biologist notes for this site).

Figure 3-1 PIP map for Deenagh_010 of Potential Risk of Phosphate to SW

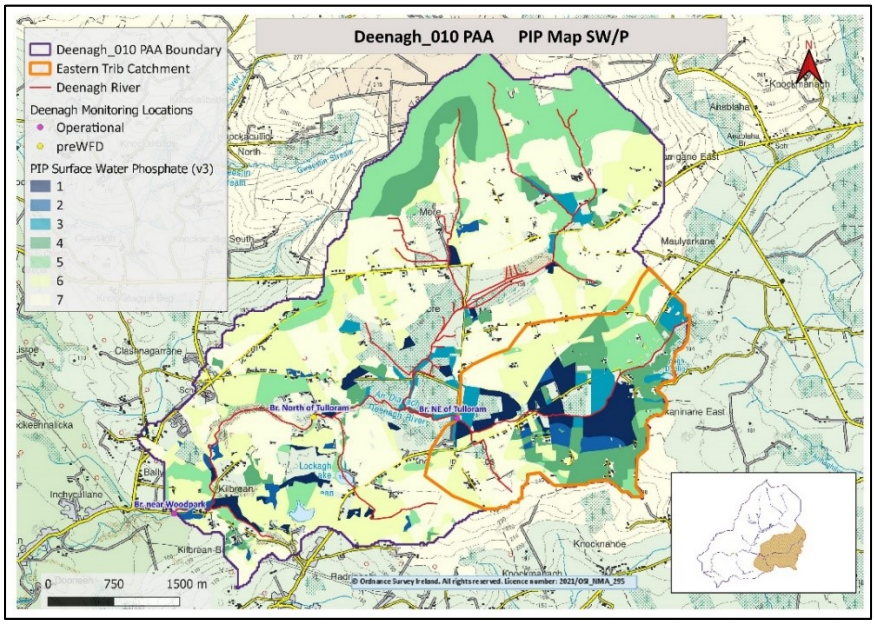
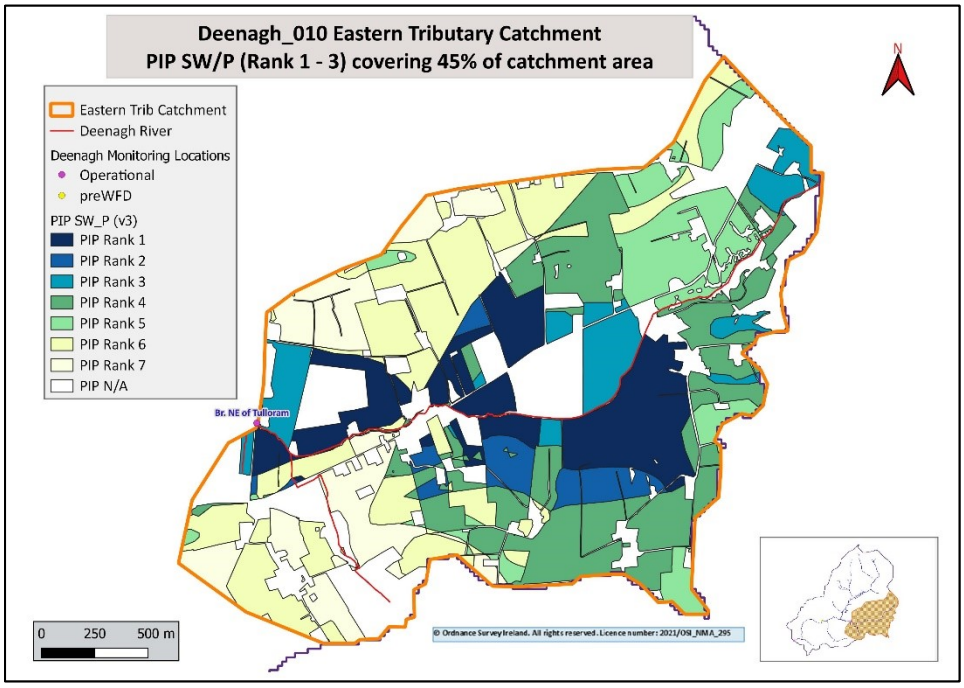


Figure 3-2 PIP map of the Eastern tributary catchment with potential risk of Phosphate to Surface Water



3.2.2 DWWTS

Domestic wastewater treatment systems have been cited as a potential pressure but not significant. It is more likely that potential significant pressures from DWWTS would be from a more direct/close proximal source. The area is relatively small, there is not a high density of DWWTS and is not close to the monitoring point, therefore it is highly unlikely to be a significant pressure causing the poor status at the monitoring point at 22D010045 'Br. NE of Tulloram'

In relation to other areas within Deenagh_010, the WFD APP mentions the unsewered village of Kilcummin as a pressure which was supposed to be connected to the WWTP for Killarney (as indicated in EPA WWDA Licence no. D0037-01) but this is still pending. However due to location within the sub-basin of Deenagh_010 Kilcummin is not impacting on the monitoring point that is driving poor status and therefore is not regarded as a significant pressure for the purpose of this desk study.

3.2.3 Peat Extraction

Peat extraction has been identified as a significant pressure in this sub-basin but is highly unlikely to be the main pressure driving poor status at the monitoring point 22D010045 'Br NE of Tulloram'. Figure 3-3 and Figure 3-4 show large areas in the headwaters of the northern tributary of the Deenagh River with peat cutting and extraction activities. Peat harvesting gives rise to the mobilisation of sediment and nutrients (ammonia and phosphate), creating high colour, turbidity and lowered pH. Any impact of peat harvesting in the northern tributary of the Deenagh River would not affect the monitoring station that is driving poor status in Deenagh_010 at 22D010045 'Br NE of Tulloram'. There is also peat in the headwaters of the eastern tributary but appears to be very small in scale with some planted with forestry. It is therefore very unlikely that peat harvesting is impacting the monitoring station on the eastern tributary with any significance to cause poor status.

Figure 3-3 Corrine map showing Peat areas in the headwaters of the waterbody

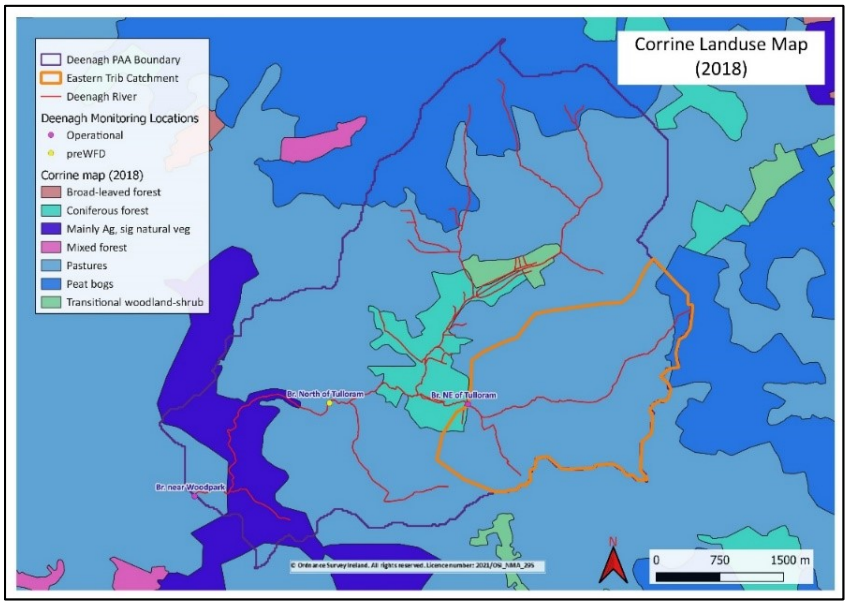
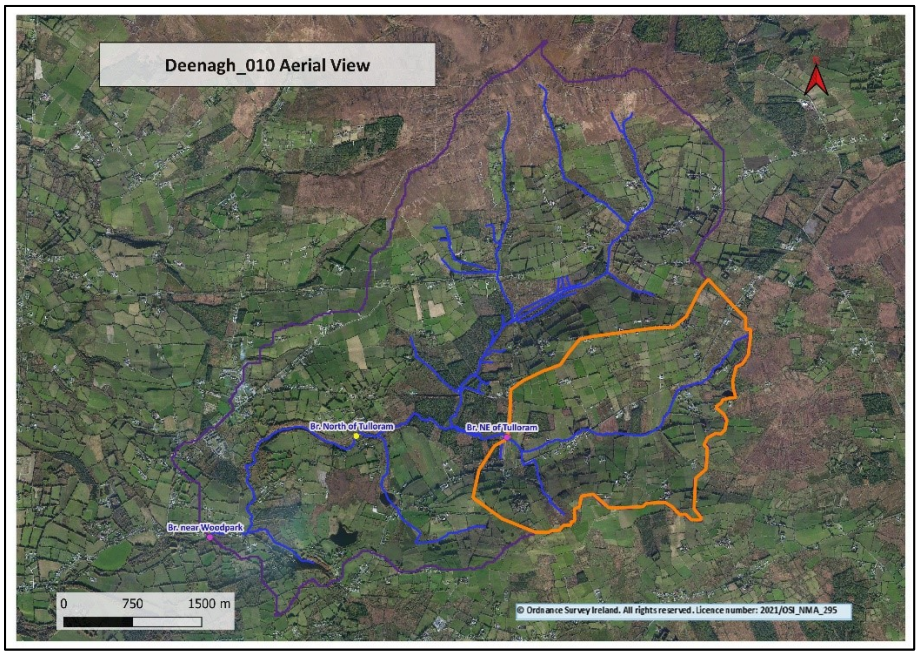


Figure 3-4 Aerial View of Deenagh shows Peat in the north of the sub-basin

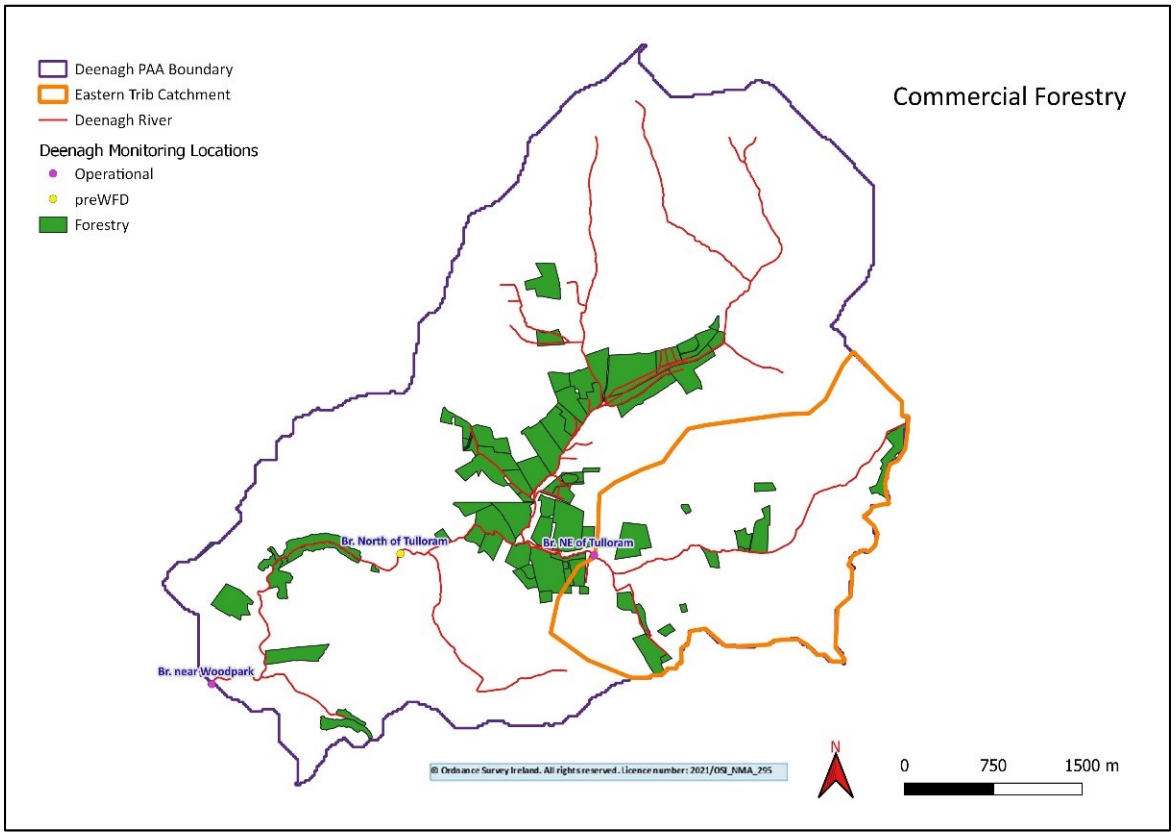


3.2.4 Forestry

The main areas where forestry is located are bordering either side of the main channel on the northern tributary of the Deenagh River in the middle of the sub-basin, situated on peat and gley soils which are typically very poorly draining. There are forestry stands located in the eastern part of the subbasin in the catchment of the eastern tributary again mostly on peat or gley poorly draining soils. Much of the forestry appears to have been planted between 1995 – 2000 (prior to the Code of Best Forest Practice), according to aerial imagery, making the crop about 26 years old. Therefore, impacts to water quality from tree harvesting particularly regarding sediment and nutrients (phosphate and Ammonia) release may be a potential issue for the Deenagh_010 in the next ten years or so, as it is planted on peat and in close proximity to the main channel. This will be flagged further along in this desk study under Section 7 Mitigation as a *Protect* measure as this is not an issue now.

Within the catchment of the eastern tributary there are forestry stands directly adjacent to river and stream channels on poorly draining peat and gley soils -see Figure 3-5. Potential forestry impacts along the eastern tributary will be assessed during the LCA to determine their significance now but also potential impacts in the future, and, where mitigation for *Protect* measures are relevant in this regard, they will be included in the LCA outcome. It is not likely that forestry is a significant pressure on the monitoring point that is driving poor status at 22D010045 'Br. NE of Tulloram'.

Figure 3-5 Forestry



3.3 Conclusion on the Significant Pressures

The most likely Significant Pressure that is impacting the monitoring point 22D010045 Br. NE of Tulloram, which is driving poor status for Deenagh_010, is **Agriculture**:

- There are currently no chemistry data for this monitoring point therefore further assessment is required here to establish the significant issue. As the land use appears to be predominately agriculture with 45% of the land in the catchment of the eastern tributary at high-risk PIP for phosphate to surface waters and in poorly draining soils, this is most likely a critical source area with phosphate and sediment as the significant issue.
- There may also be close proximal direct sources of impact to the monitoring point such as cattle poaching and other farming practices which may be impacting the monitoring point. If these pressures are identified during the LCA process, they will be referred to ASSAP in due course.

- As mentioned above, other pressures discussed are, at this stage, unlikely to be significant in terms of impact to the monitoring point driving poor status. However, where issues are identified during the LCA they will be referred to the relevant body to be addressed, e.g. forestry, DWWTS.

4 Pathways information (diffuse pollution)

The Conceptual Model (CM) for the Eastern Tributary Catchment (a mini catchment within Deenagh_010) is divided into two compartments based on a natural divide by soil drainage characteristics being either poorly drained or well drained soils – see Fig 4-1 below. The aquifer is LI (Locally important with moderate productivity in local zones) across both compartments. Table 4-1 below sets out the detail for the conceptual model to identify dominant pathways. As the significant issue driving status at the monitoring point is yet to be determine, the CM looks at both nutrients and sediment in this regard.

Figure 4-1 Conceptual Model Map showing two compartments of the Eastern Tributary where LCA is focused

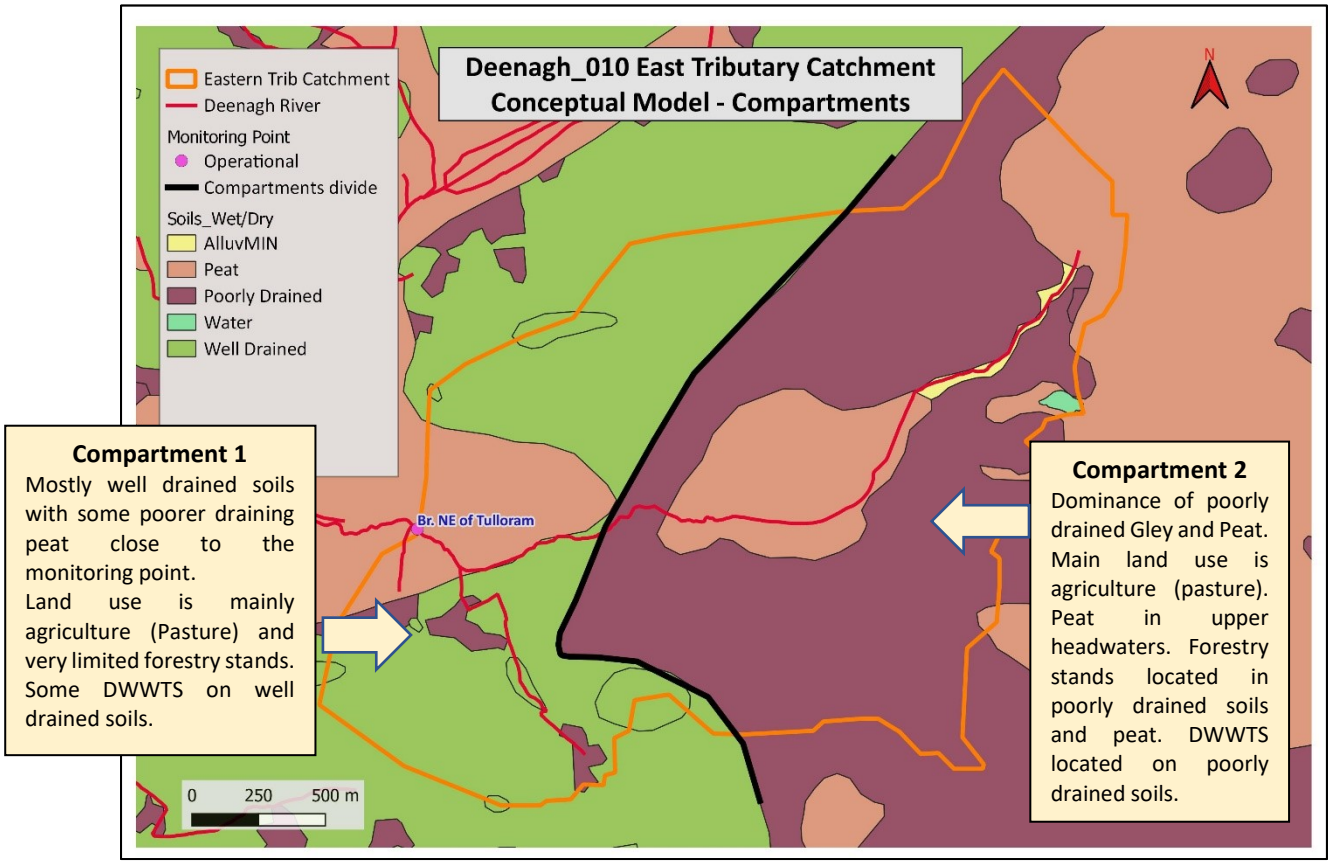


Table 4-1 Conceptual Model for Deenagh_010, Eastern Tributary mini-catchment which is driving Poor Status.

(Associated maps attached in Appendix B: Figures B(i) to B(xi)

Factor	Map Y/N	Description and relevance	
		Compartment 1	**Compartment 2**
Location	Y	Starts at the western side of the catchment area at the monitoring point that is driving poor status, extending east forming a crescent shape	Starts at the central part of the catchment area extending eastwards to the headwaters
Topography	Y	High ground to 234m OD at the northern part of this compartment falling across a moderate slope towards the river at 160m OD. The ground is also high at the southern side of the compartment with similarly steep slopes falling from 240m OD to 160m OD	At northern and southern sides of this compartment the land is elevated to 230/240m OD respectively with moderate slopes falling to the river at 170m OD
Soil type	Y	Acid brown earths and brown podzols, deep and well drained; Peat around the monitoring point and along the northern side of the river channel	Acid mineral deep and poorly drained Gleys; Peat borders both sides of the river channel and at the headwaters
Subsoil type	Y	Clayey Tills – (Namurian Shale and Sandstone Tills); Peat	Clayey Tills – (Namurian Shale and Sandstone Tills, Acid mineral poorly draining) ; Peat; Alluvium soils
Subsoil permeability	Y	Subsoil maps indicates low permeability underlying some of the well-drained soils mainly in the lower slopes from the higher ground. Bedrock at/near ground surface on high ground. Poor permeability in Peat.	Subsoil maps indicates low permeability through all this compartment
Soil drainage	Y	Wet/Dry soils mapping showing good drainage characteristics of well-drained soil in the north and southern part of this compartment. However, low permeability subsoils under areas of well drained soils will affect its overall drainage. A section of poorly draining peat is present around the monitoring point.	Very poor drainage characteristics in this compartment. Wet/Dry soils mapping showing this compartment to be poorly draining throughout. Gleys and peat are dominant, low permeability subsoils across the entire compartment.
Gwb	N	IE-SW-G-073 Scartaglin	
Gwb flowpath	N	In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Permeability is highest in the upper few metres but generally decreases rapidly with depth. Groundwater levels are about 1.5-15 m below ground level and will generally follow the topography. Close to the rivers and streams, water levels will be near ground level. Surface water features are considered to be in hydraulic continuity with the water table. Groundwater flow will be local. Groundwater flow paths are generally short, typically 30-300 m, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Groundwater is generally unconfined. Due to the generally low permeability of the aquifers within this GWB and the high slopes, a high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer. (*Source ref: GSI Groundwater body descriptions*)	
Bedrock unit	Y	Greywacke, siltstone and Shale - Cloone Flagstone Formation; Namurian Undifferentiated – Shale and Sandstone	
Aquifer type	N	Ll Locally important moderately productive in local zone only	

Factor	Map Y/N	Description and relevance	
		Compartment 1	**Compartment 2**
Groundwater vulnerability	Y	Extreme with rock at or near surface to High Vulnerability in the upper slopes of both compartments; Moderate to low vulnerability in the lower slopes and bordering the river channel	
PO4 susceptibility (surface)	Y	High (Rank 2) only where there is Peat; Low (Rank 4) on well drained soils	High/Moderate (Rank 2 and 3) across entire area due to poorly draining soils
NO3 susceptibility (sub surface)	N	Low (Rank 4) at highest elevations; Low (Rank 5) across entire area	Low (Rank 5) across entire area
NO3 susceptibility (surface)	Y	High (Rank 2) on higher slopes of well drained soils; Low (Rank 4) everywhere else on Peat and low permeability subsoils	High (Rank 2) in very limited area of Alluvial soil next to headwaters; Low (Rank 4 and 5) throughout
PO4 PIP (to Surface water)	Y	Very High (Rank 1) on Peat around monitoring point; Low (Rank 6) everywhere else	Very High/High (Rank 1-2) along river channel and central part of this compartment; Moderate (Rank 4) further away from main channel
NO3 PIP (to ground water)	N	Very low (rank 6-7) across majority of the area; Low (rank 5) at highest elevations	Very low (rank 6-7) across entire area
NO3 PIP (to Surface water)	Y	Low across majority of the area (rank 6-7); Very high/high (rank 1-4) on highest elevations and upland slopes	Very Low (Rank 7) across entire area
Likely main pathway(s)	N	In peat at surface/overland flow of phosphate to surface waters and via the drainage network; Sub-surface of NO3 to drainage in well drained soils with low permeability subsoils on elevated slopes	Predominantly at surface/overland flow of phosphate to surface waters and via the drainage network;

Compartment 1

This compartment extends from the monitoring point 22D010045 'Br. NE of Tulloram' and takes a crescent shape eastward up to the boundary of compartment 2 – see Figure 4-1 above. This area contains largely well drained soils except for an area of peat in and around the monitoring point itself and bordering along the northern bank of the river channel. There are some other smaller pockets of poorly draining soils south of the monitoring point. This compartment contains approx. 790m of the main channel of the eastern tributary and also a smaller stream from the south joining the main channel at 225m upstream of the monitoring point.

The peat appears to have signs of drainage throughout (as viewed in aerial images) and used for either agriculture or forestry. Pathways here are predominantly at the surface via overland flow and via drainage routes to the river favouring phosphorus, ammonia, pesticide and sediment movement.

Much of the rest of the land in this compartment is well drained. In the upper elevated areas on higher ground, generally soil is deep and well drained as too its subsoils. In some places, soils are shallow with bedrock at or close to the surface. It is not expected that these areas would include critical sources areas for parameters of concern. On the lower slopes, both north and south of the

eastern tributary's main channel, the well-drained soils are underlain with low permeability subsoils. These areas are mainly used for agriculture. Therefore, sub-surface pathways may occur here allowing for movement laterally above the low permeable subsoil layer and aided by the sloping nature of the ground particularly during times of heavy rainfall. However, the area involved is relatively small and much of the well drained soils here are deep. Whether this is a critical sources area is heavily dependent on agricultural intensity but it looks unlikely. Nitrates and pesticides would favour this type of pathway.

Chemistry to be undertaken in the LCA at the monitoring point will inform re the significant issue and define the critical sources areas (CSA) further. If phosphate and sediment, as expected, are the significant issues, attention will be turned to the poorly draining peat soils as a CSA. In terms of other land uses in this compartment, there is limited forestry with some discrete stands north and south of the main channel. There are some DWWTS on well drained ground in relative close proximity to the river but not close to the monitoring point. There is a low density of domestic systems here.

Compartment 2

This compartment is entirely poorly draining with gleys and peat dominating throughout. The river channel runs through peat in the mid-section of this compartment, with alluvium soils bordering the channel in its upper reaches. At the headwater is blanket peat, some of which is planted with forestry bordering the river channel. This peat is part of a larger area which extends across the upper part of the adjoining catchment of the Owneykeagh River.

The predominant land use in this compartment is agriculture and aerial imagery shows that the poorly draining land including areas of peat look to have been greatly improved for agricultural use. The dominant pathway is overland flow including via the drainage networks (land drainage, field drains) favouring sediment, phosphate, ammonia and pesticide movement. Considering the soil type and drainage characteristics here there is possibility for a pesticides issue if there is a need to keep rushes back. The CSAs in this regard will be based on connectivity of drainage to the main eastern tributary channel and land practices.

This compartment is larger in size than compartment 1 and may be contributing to a larger degree to impact in water quality. DWWTS are not high in numbers and while in relative close proximity to the river, in some cases, it is unlikely that they are driving the poor status at the monitoring point downstream. It is not clear if there is peat extraction in the upper headwaters here but it would appear to be on a small scale if there is and not likely to impact the monitoring point to any significant degree.

5 Interim conclusions on the PAA

Deenagh_010

- This sub-basin is currently at *Poor Status* (2013-2018) and *At Risk* of failing to meet WFD Objectives by 2027. The objective for this sub-basin is to be restored to Good Status by 2027.
- Poor status in Deenagh_010 is driven by biological monitoring at 22D010045 'Br. NE of Tulloram' located on an eastern tributary which is at Q3-4 presently (2019 data) but which has been historically mostly poor at Q3.
- The significant issue at the monitoring point which is driving poor status at 22D010045 'Br NE of Tulloram' has not been established as there is no chemistry data but sediment and phosphate is likely to be issues based on observations by biologists during monitoring here.
- The WFD APP cites peat extraction as the significant pressure in this sub-basin but it is unlikely that is responsible for the issues driving the poor status at the monitoring point 22D010045 'Br NE of Tulloram'. It appears more likely that diffuse and small point source agriculture are the significant pressures here.
- The critical source area is that of the poorly draining wet soils in the middle and upper reaches of the eastern tributary catchment, i.e. compartment two (see Figure 4-1 and Table 4-1), where main pathways are by overland flow and via drainage routes.
- Sediments observed at the monitoring station driving poor status is likely to be from localised small point source agriculture such as animal access but also possibly from land drain clearances upstream.

6 Workplan

6.1 EPA further characterisation actions

Table 6-1 Further Characterisation Actions taken from WFD APP

WB Name	Identifier	Action	Responsible Organisation	Further Characterisation Action details
Deenagh_010	FC002601	IA1 Provision of Information	LAWPRO	Watching brief: monitor to see do improvements continue here in the next cycle
	FC003399	IA3 Determination of Water Quality (unassigned waterbody)	LAWPRO	Need to take water quality samples to determine if peat is the pressure

6.2 Local Catchment Assessment

The focus for Deenagh_010 LCA will be on the Eastern Tributary as this is driving Poor Status for the entire sub-basin.

Biologist notes for this site indicate sediment impact and dominance of pollution tolerant Chironomus and Simulidae. There is no chemistry monitoring carried out at this site. The LCA will determine what the significant issues are and the critical source areas that are contributing and mainly responsible for the poor status at the monitoring point. Below are two maps showing the locations of LCA monitoring points. There are two LCA monitoring sites within Compartment 1 and three within Compartment 2 – see Figure 6-1.

Site 1: At the site of monitoring point 22D010045 'Br NE of Tulloram'. Field measurements to be taken and assess for indicators of nutrient and sediment impact. Take SSIS, RA and chemistry samples here at seasonal low, high and mean flows to determine the significant issue. Look for point source impacts close by this station such as animal access, bank erosion, storing of silage bales, other agriculture related practices in close proximity. Also look for drainage outlets close to the monitoring point particularly from poorly draining peat, taking note of their location, distance from the monitoring point and size.

Site2: Inputting stream from the south in compartment 1 joining the eastern tributary main channel at approx. 225m upstream of the monitoring point 22D010045 'Br. NE of Tulloram'. SSIS, RA, field measurements and chemistry to be taken here at low, high and mean flows. Rule this stream in or out as a CSA.

Site 3: Most downstream point in compartment 2, downstream of poorly draining agricultural land. Can be used to compare to Site 1 to determine loadings of nutrients from this compartment and levels of sedimentation present. SSIS, RA, field measurements and chemistry samples to be taken here at low, high and mean flows. Note drainage inputs to the river here and agricultural practices.

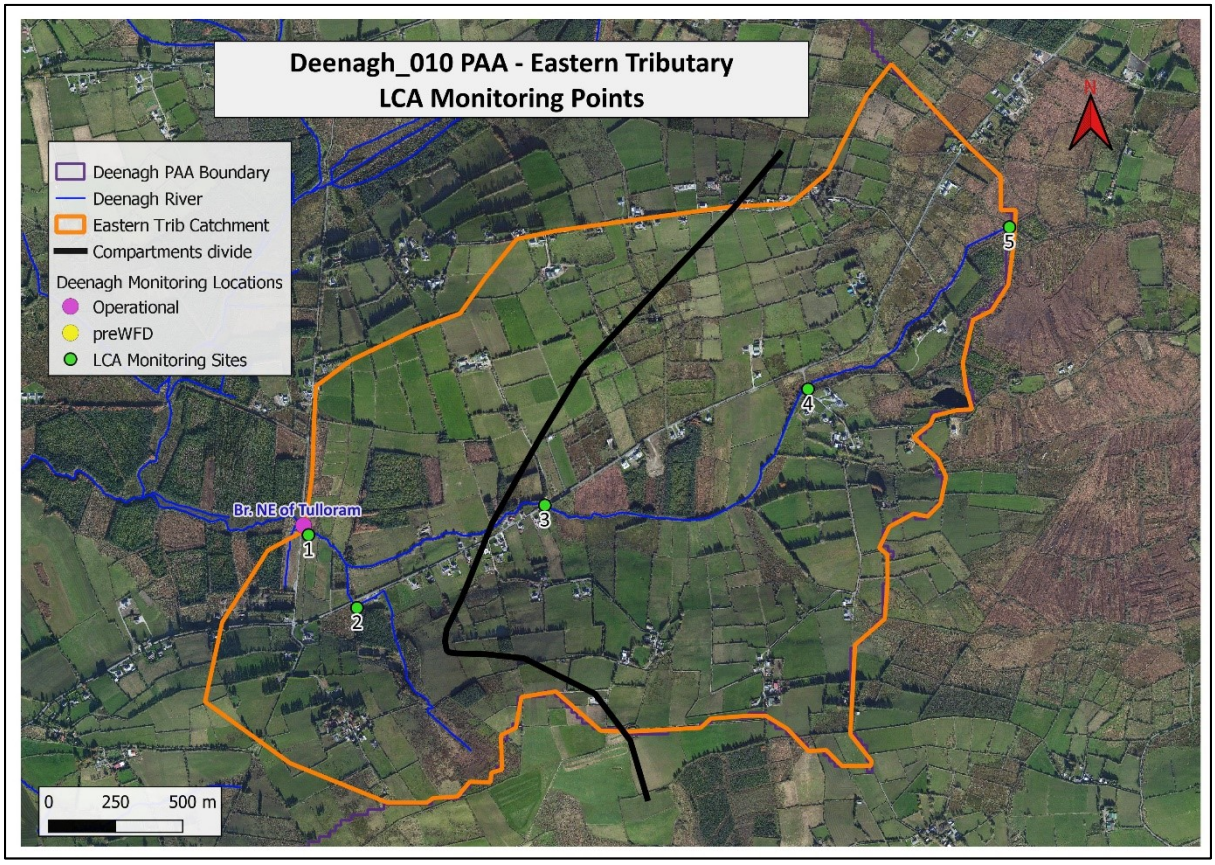
Site 4: In the upper reaches of compartment 2 and will determine if sediment is an issue in the headwaters by comparing this site with Site 2. SSIS, RA, field measurements and chemistry to be taken here at low, high and mean flows. Note drainage inputs to the river here.

Site 5: In the upper headwaters of the eastern tributary. SSIS may not be possible as these waters are very small and possibly not appropriate but could be assessed to determine if there are sources of

sediment through peat drainage, noting drainage density and connectivity, channel straightening and extent of peat extraction (if any).

Depending on the outcome of initial assessments and chemistry, the LCA will identify the critical source areas contributing to the impact at the monitoring point. Where these are located between LCA sites river walks will be conducted and with a primary focus on identifying drainage connectivity and agricultural practices. Figure B-(ix) in Appendix B will be of great value in this regard as PIP maps show potential pathways and points of connectivity to the tributary main channel. Where sediment is an issue, drains which are a sediment source will be identified and any drainage issues with the upper headwaters where there may be peat extraction and forestry will be assessed.

Figure 6-1 LCA Monitoring Points on the Eastern Tributary



7 Review of possible mitigation options

The outcome of the LCA will inform the most appropriate mitigation options at locations where the significant contributing source of the issue is coming from with a view to breaking the pathway and preventing further impact. The interim conclusion of the desk study indicates that diffuse agriculture and possibly some agriculture related proximal point sources may be the key significant pressures driving poor status at the monitoring point 22D010045 'Br. N of Tulloram'. Therefore, mitigation would involve LAWPRO and ASSAP advisors working together to determine most appropriate and effective measures and ASSAP subsequently liaising with relevant landowners and farmers to support the implementation of mitigation measures.

Where peat extraction is an issue, this will be referred to the local authority to liaise with landowners to determine best practices and prevent sediment loss from drainage.

As forestry has been highlighted as a potential issue in the near future when stands directly adjacent to or close to the main channel will be due for harvesting, this can be referred to the Forest Service as a *Protect* measure, particularly in light of the sensitivity of the downstream receptor, i.e. Deenagh_020 Blue Dot River/High Status Objective waterbody.

8 Communications

Due to Covid restrictions an online Public Meeting was held on the 4thMay 2021 at 19.30. Approx. 15 participants attended and included LAWPRO and ASSAP staff, Kerry Co. Co. staff and members of the public.
Information about the public meeting was distributed by the Community Water Officer for Kerry via leaflet, media release, through local community groups and contacts and generally throughout the community of the Deenagh River.

Questions asked in the meeting included:

- whether we knew where the pollution pressures were coming from within the PAA;
- if there was impact from the Deenagh_010 PAA to the rest of the Deenagh River and Lough Leane;
- if we were publishing findings and outcomes and where that information can be accessed by the public.

Desk Study is based on data collated on or before 4th June 2021

Appendix A

Hydrochemistry data for monitoring station 22D010060 Br. N of Tulloram

Table A–(i) Hydrochemistry Summary for *monitoring point Br. N of Tulloram* 22D010060

		Br N of Tulloram (22D010060)			EQS (Surface Water) Regulations 2009 - 2019	
Parameter	Unit	Mean	95%ile	Max values/greater than mean good status EQS threshold (03/04/2014 – 11/12/2019)	**mean EQS High Status**	**mean EQS Good Status**
					95%ile	**95%ile**
Total Ammonia	mg/l N	0.049	0.10	0.07, ***0.98**, 0.19, 0.09, 0.07, 0.07, 0.10 (7/59 = 12% of data)	≤ 0.040	≤ 0.065
					≤0.090	≤0.140
MRP - Ortho-Phosphate (unspecified)	mg/l P	0.014	0.041	0.05, 0.04, 0.04, 0.11 (4/57 = 7% of data)	≤0.025	≤0.035
					≤0.045	≤0.075
Total Phosphorus	mg/l P	0.032	0.075	0.042, 0.028, 0.068, 0.063, 0.114, 0.029, 0.037, 0.039, 0.046, 0.040, 0.035, 0.029, 0.034, 0.040, 0.027, 0.027, 0.031, 0.149, 0.075, 0.030, 0.042, 0.042, 0.044, 0.053, 0.032, 0.044,0.045, 0.05, 0.040, 0.034, 0.032 (31/59 = 52.5% of data)	≤0.010	≤0.025
					n/a	n/a
Total Oxidised Nitrogen	mg/l N	1.12			n/a	n/a
Suspended Solids	mg/l	4.8		[1](>25mg/l) 34, 35 [1]using threshold levels from Codified Freshwater Fish Directive	n/a	n/a

- Total Ammonia

Figure A-(i) below shows occasional elevated Total Ammonia levels over the mean EQS of ≤0.065mg/l N with two spikes above the 95%ile EQS. A large spike occurred on 04/03/15, 0.98mg/l N. The peaty nature of the catchment could explain the occasionally elevated ammonia levels - average pH of the Deenagh is 6.6 units. There are no other similarly very high levels of total ammonia seen in data which might suggest it could have been a one-off event indicative of a nearby point source that was picked up at the time of sampling. Rainfall data for around the time of sampling show a total of 50.5mm of rain over the week prior to sampling. The average weekly rainfall level in Kerry is 45mm. Looking at other parameters for this sampling occasion (see Table A-(ii) below), nitrite is also very high at

0.588mg/l $NO2^-$ (the Codified Freshwater Fish Directive is used as a guide for nitrite here, 95%ile standard is ≤0.05 mg/l NO^{2-}). Dissolved oxygen results shows nothing unusual nor do any of the other parameters. The minor spike of 0.15mg/l N in the 15/09/16 saw a total rainfall during the week prior of 87.4mm, twice the average weekly amount. This again could suggest there is a nearby intermittent point source that dilutes with heavier rainfall.
Compared to the baseline level of 0.035mg/l N (2017) there appears to be no trend regarding ammonia.

Figure A-(i) Total Ammonia mg/l N, data 2014 – 2019

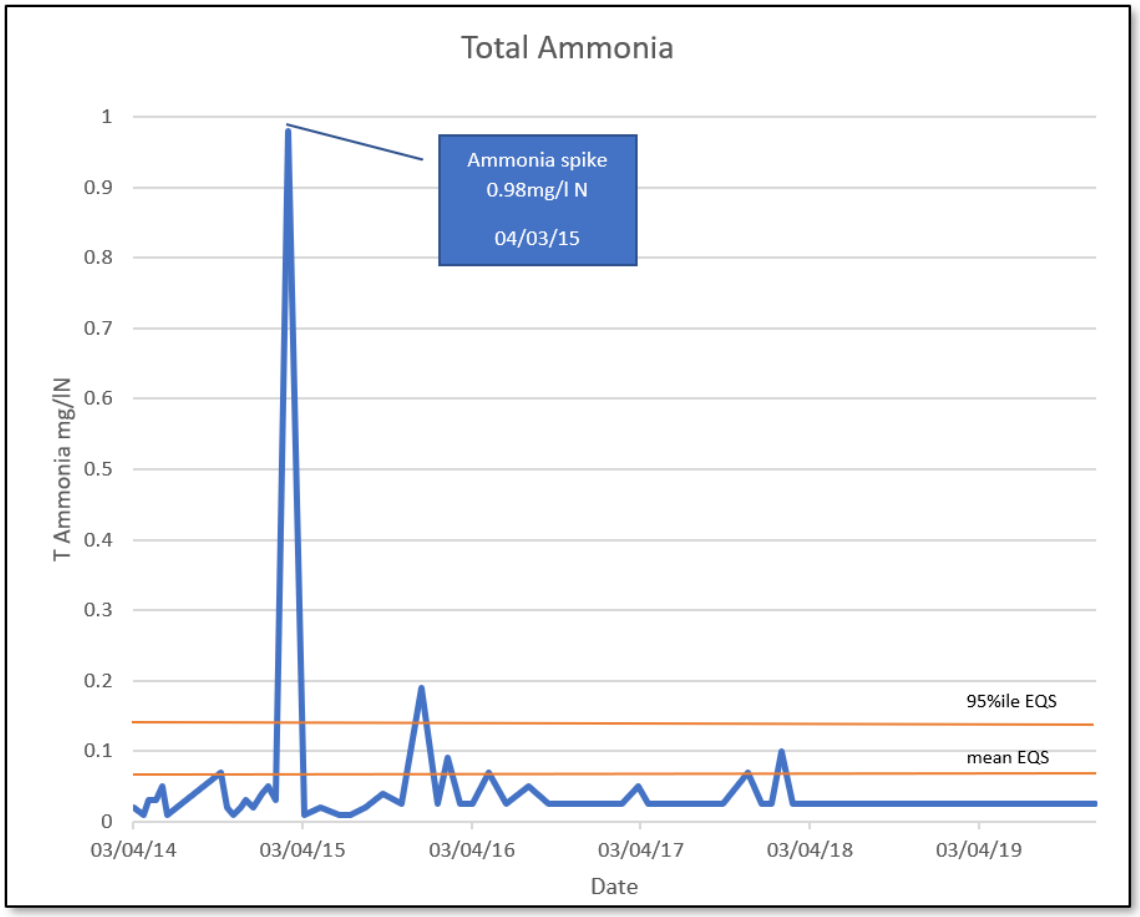


*Table A-(ii) Results for a high spike taken at Br. N of Tulloram 22D010060

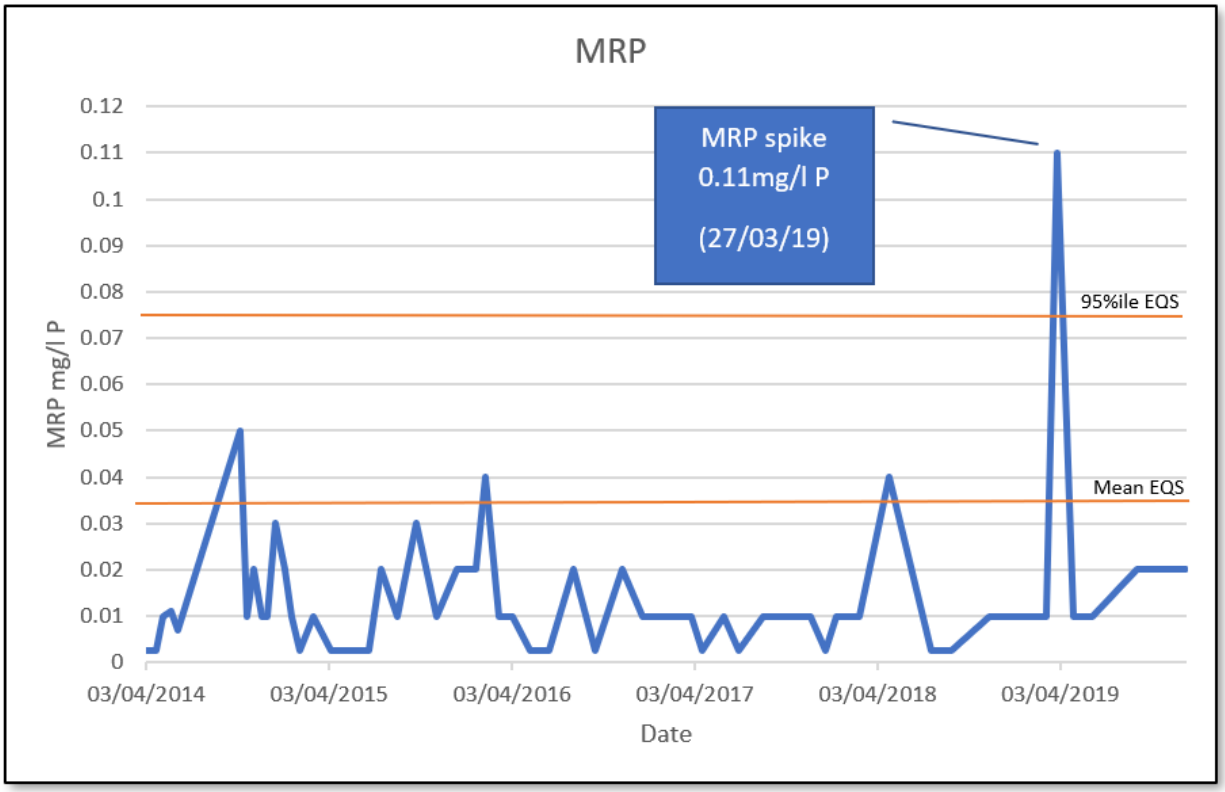
Sample date 04/03/15	Result
Total Ammonia mg/l N	**0.98**
Ortho – Phosphate mg/l P	0.01
Total Phosphorus mg/l P	0.019
D.O. ppm	10.9
Conductivity uS/cm	124
ph units	6.4
Nitrite NO2-N mg/l	****0.179 (0.588 mg/l $NO2^-$)**
Nitrate NO3-N mg/l	1.1
True Colour Hazen	50

(**to convert NO2-N mg/l to $NO2^-$, multiple by 3.284), Codified Freshwater Fish Directive used 95%ile of ≤0.05 mg/l NO^{2-})

- Ortho-Phosphate

Figure A-(ii) shows Ortho-phosphate levels mostly well below mean Good Status EQS. Elevated MRP levels at times are relatively infrequent with a spike of 0.11mg/l P on 27/03/19. There is no significant issue with MRP at this monitoring point.

Figure A-(ii) MRP mg/l P, data 2014 – 2019



- Total Phosphorus

Total phosphorus (TP) sampling is carried out to assess inputs to Lough Leane (a nutrient sensitive lake) from its contributing waterbodies and subsequent to the Lough Leane Project. In Figure A-(iii) the total phosphorus results are compared to the mean Good Status EQS value for lakes of 0.025mg/l P. As total phosphorus is associated with sediment, it is likely that sediment is an issue at this monitoring point given that nearly 53% of TP results were >0.025mg/l P (refer to Table A-(i) *Hydrochemistry Summary* above). Looking more closely at these spikes, they seem to occur more so during the months of winter into early Spring (Sept – April) with a higher occurrence in November and December. There is no biological monitoring at this site, the nearest downstream biological monitoring station is at 22D010100 Br. Near Woodpark which is Q4. There is no other information available for this site with regard to sediment, however peat extraction has been cited as a probable significant pressure in Deenagh_010 in the northern part of the sub-basin.

Figure A-(iii) Total Phosphorus mg/l P, data 2014 – 2019

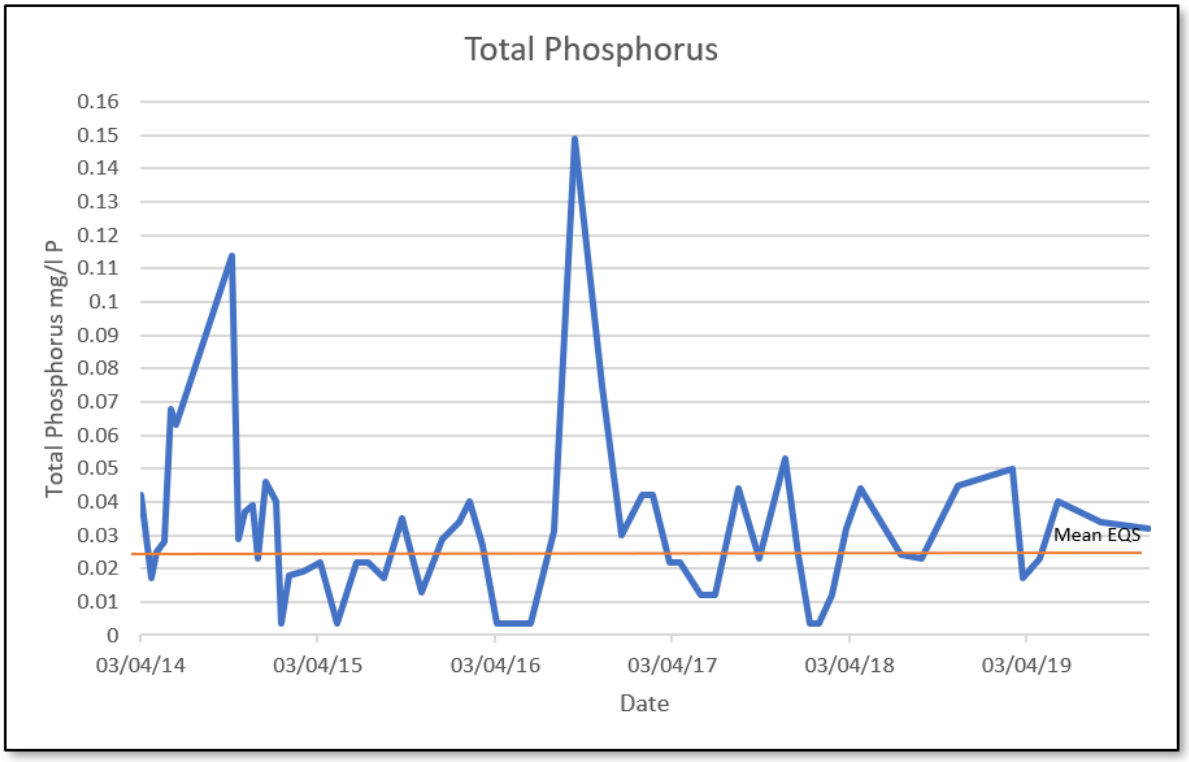
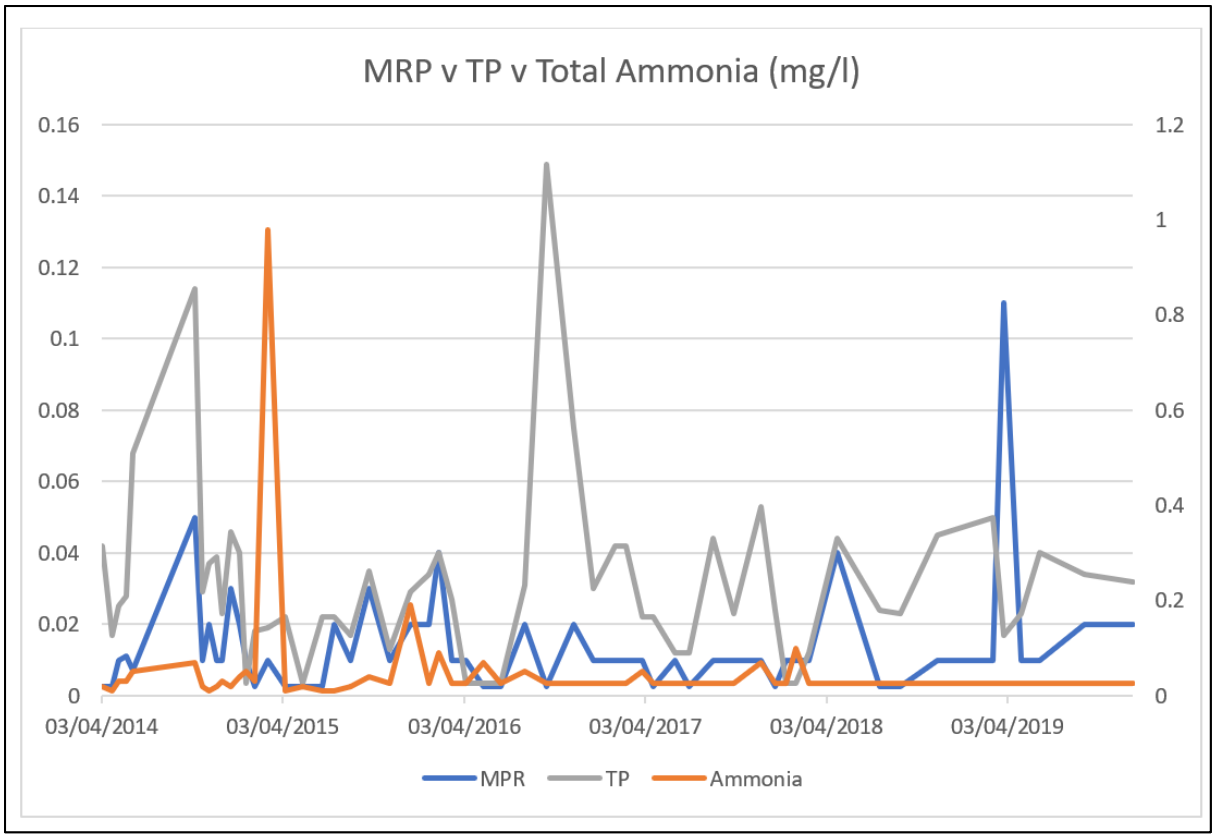


Figure A-(iv) Comparing levels of MRP, Total Phosphorus and Total Ammonia

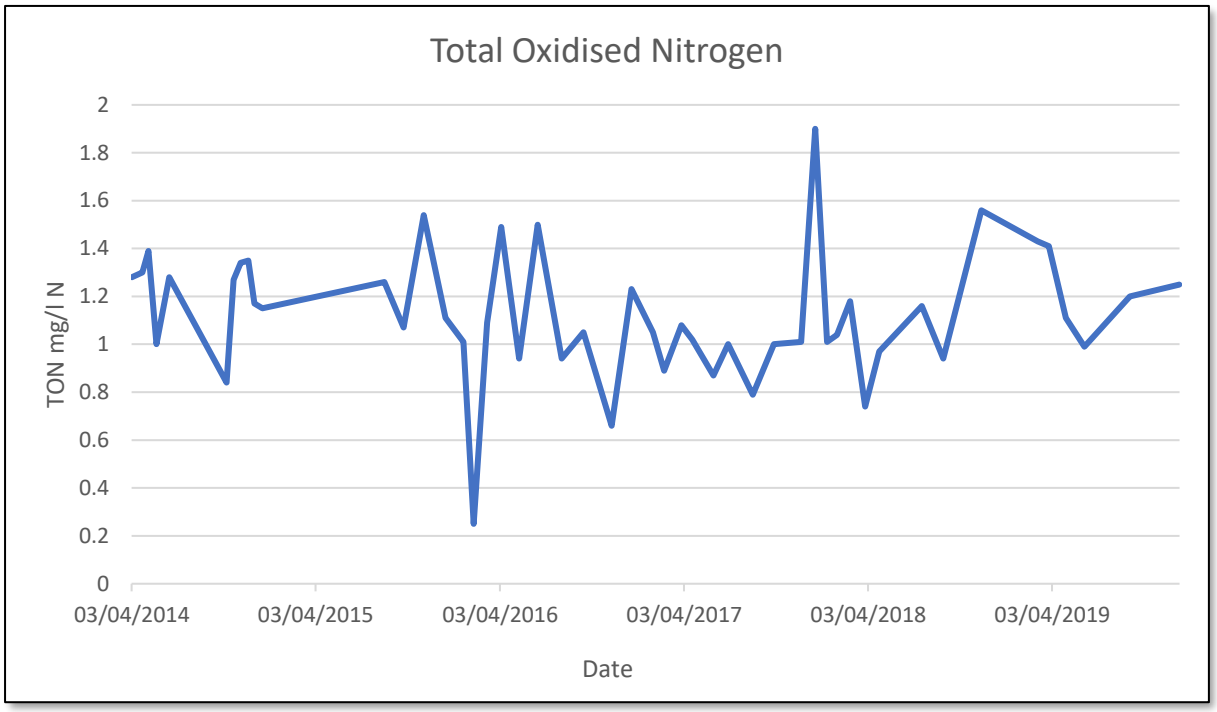


Total phosphorus and MRP show similar response only at times. Limited data to determine any correlation between all three parameters but overall appears to be unlikely.

- Total Oxidised Nitrogen

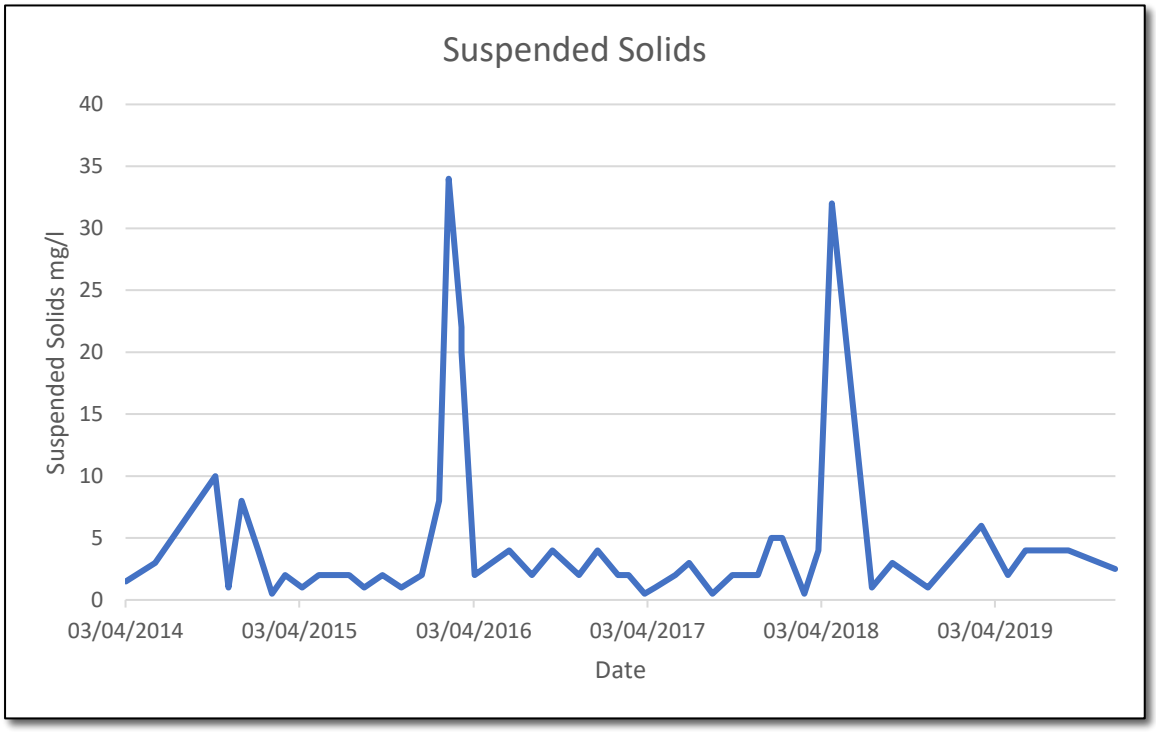
There are no issues with TON at this monitoring point

Figure A-(v) TON mg/l N, data 2014 - 2019



- *Total Suspended Solids*

Figure A-(vi) TSS mg/l, data 2014 - 2019



The overall average for suspended solids is 4.8 mg/l with elevated levels seen at times over 25mg/l. These elevated levels would suggest an issue with sediment but whether this is significantly impacting the site is not known at this stage. It would be of benefit to carry out biological monitoring at this monitoring point in the future to determine if there is impact from sediment here but will not be undertaken as part of this LCA but would be addressed during the third cycle where the Deenagh PAA is proposed to be expanded to include Deenagh_020.

Appendix B

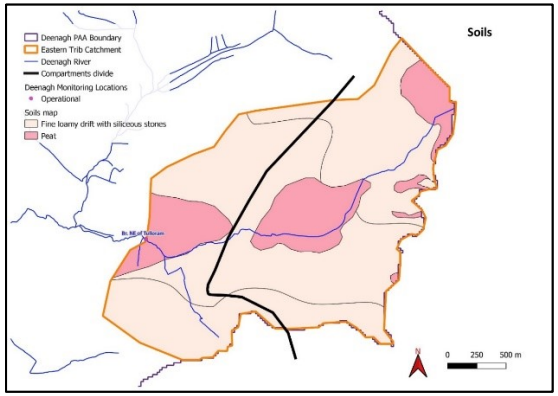


Figure B-(i) Soils map

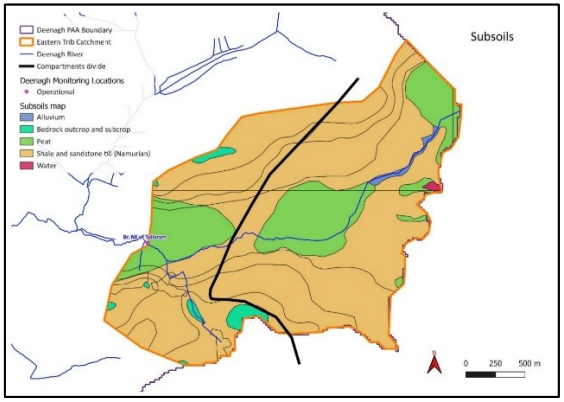


Figure B-(ii) Subsoil map

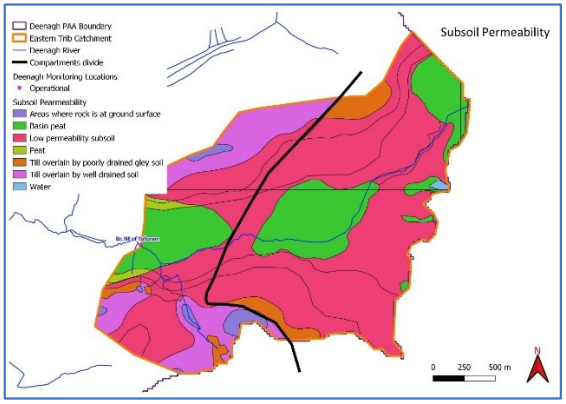


Figure B-(iii) Subsoil Permeability

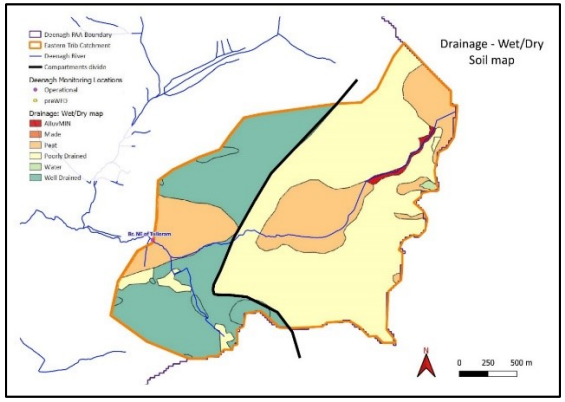


Figure B-(iv) Soil Drainage (Wet/Dry)

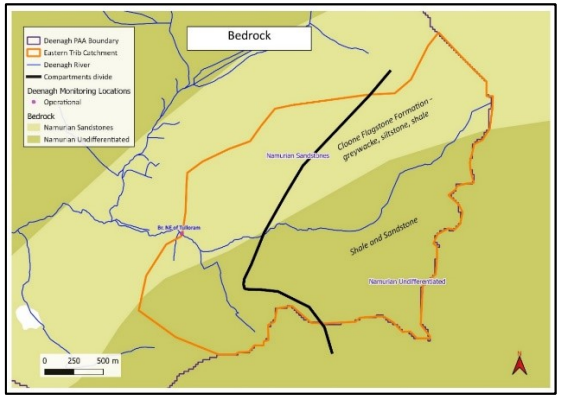


Figure B-(v) Bedrock Figure

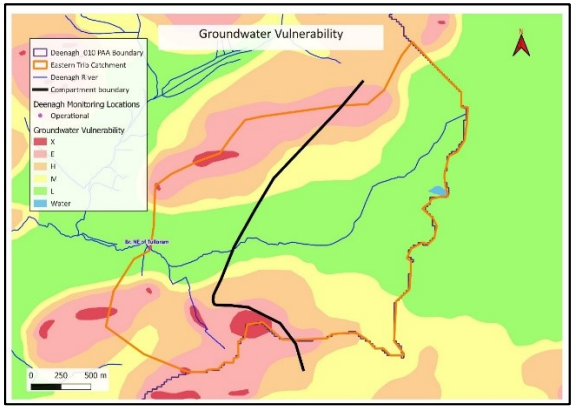


Figure B-(vi) Groundwater Vulnerability

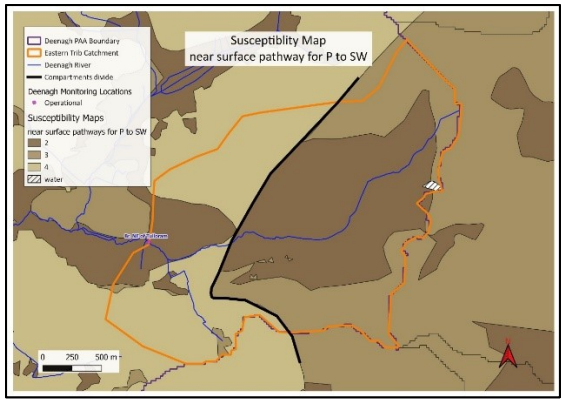


Figure B-(vii) Susceptibility Map – PO4/SW

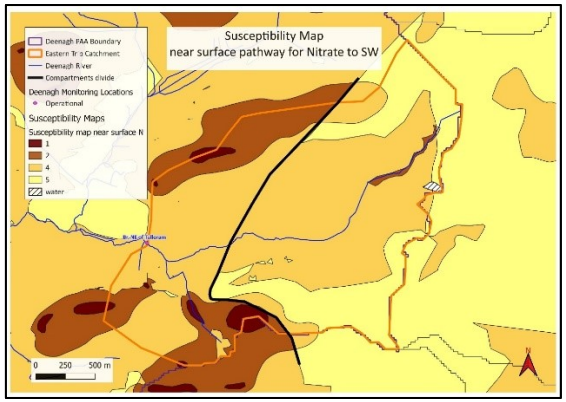


Figure B-(viii) Susceptibility Map – NO3/SW

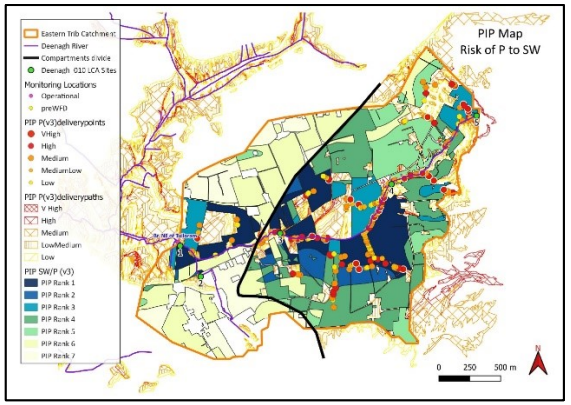


Figure B-(ix) PIP – SW/P

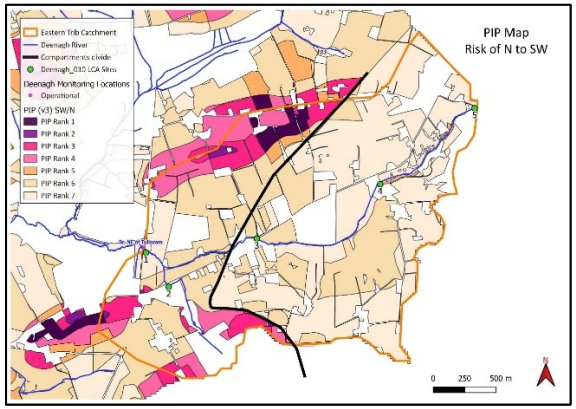


Figure B-(x) PIP – SW/N

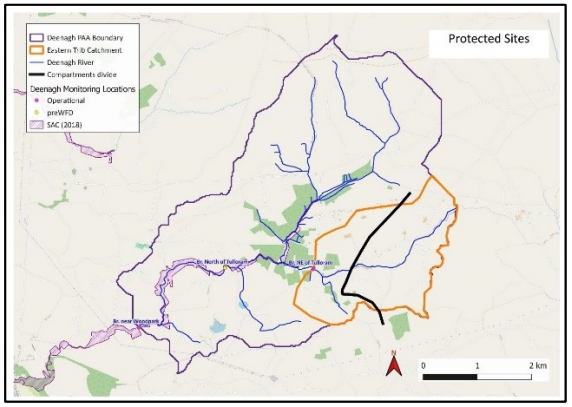


Figure B-(xi) SAC