



Blackwater (Longwood)

Desk Study Report

D01

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AFA0022 Desk Study Blackwater (Longwood)

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1 Non-technical Summary (Summary for WFD App)

The Blackwater Longwood Priority Area for Action (PAA), located in north County Kildare. It covers an area of approximately 140 km², with combined main channel length of 102 km. The total land area included in the PAA is based upon the combined catchment areas of each of the PAA rivers and tributaries. A river's catchment is derived from the topography of the landscape, where all water that falls onto that catchment area flows into one river. When the river is large, we split it into smaller, more manageable sections. Each of these river sections has a smaller catchment area with a unique code, which we call waterbodies. At the bottom of these waterbodies, there are monitoring points, which are used to measure the quality of the incoming water.

In the Blackwater Longwood PAA, there are four river waterbodies:

- Blackwater (Longwood)_010 – the river rises south of Staplestown and flows north. The BALCKWATER (LONGWOOD)_010 waterbody area includes the townlands of Timahoe, Gilltown and Clogheraun.
- Blackwater (Longwood)_020 – the main Blackwater channel continues north-west through the area of the Blackwater (Longwood)_020 and is joined by a large tributary south of Johnstown.
- Blackwater (Longwood)_030 – the waterbody area includes Martinstown, Newcastle and Kilmurry. Along this stretch, the main channel is joined by the Togher river.
- Blackwater (Longwood)_040 – the main channel flows between waterbody Blackwater Bridge and Longwood in the Blackwater (Longwood)_040. Along its course, it is joined by the Aleckafin River.

The geology, soil type and topography within a catchment determines how water moves. In the Blackwater (Longwood) PAA, the catchment is made up of well drained soils with a substantial proportion of peaty soils and areas of peat extraction. There are also poorly draining soils throughout the PAA, mainly located around the margins of the catchment streams. On the poorly draining soils in the PAA, water cannot easily soak into the ground and collects. On the well-drained soils in the PAA, water is able to soak into the ground. From there it travels vertically into the underlying bedrock. The water then moves horizontally through the bedrock and flows upward into the streams in the PAA.

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| Waterbody | 2013-2018 Status | Our findings |
|---------------------------|------------------|--|
| Blackwater (Longwood)_010 | Poor | <p>The Poor ecological status in 2013-2018 is as a result of Poor Invertebrate Status. Invertebrates are insect species and include mayfly, stonefly, caddisfly and various worms and bivalves. They are food for fish and aquatic birds and are vital for healthy rivers. Status in the Blackwater (Longwood)_010 was last Good in 2009. Since then, it has been at Poor status.</p> <p>Our investigation revealed that nutrient levels (in particular phosphate and ammonium) at this location are a likely contributing factor to status. In addition, excessive siltation was noted during the EPA's ecological assessment.</p> <p>This part of the river is part of the Boyne Arterial Drainage Scheme. This may have resulted in modification to the natural profile of the river.</p> |
| Blackwater (Longwood)_020 | Moderate | <p>The Moderate ecological status in 2013-2018 is because of Moderate Invertebrate Status. The waterbody deteriorated from Good to Moderate in 2009 and has remained Moderate since.</p> <p>Our investigation revealed that nutrient levels, and in particular nitrogen, have been showing a rising pattern since 2016.</p> <p>This part of the river is part of the Boyne Arterial Drainage Scheme. This may have resulted in modification to the natural profile of the river.</p> |
| Blackwater (Longwood)_030 | Unassigned | <p>The Blackwater (Longwood)_030 has not been characterised by the EPA. LAWPRO will carry out ecological assessments along this section of the river to determine impact.</p> |
| Blackwater (Longwood)_010 | Moderate | <p>The Moderate ecological status in 2013-2018 is because of Moderate Invertebrate Status. This section of the river last achieved Good status in 1990. Since then, it has remained at Moderate. Nutrient levels, particularly phosphate, at this section of the stream were consistently above acceptable levels since 2016.</p> <p>The waterbody is on the Boyne Arterial Drainage Scheme, which may have resulted in modifications to the natural profile of the river.</p> |

2 Introduction

2.1 Background to the Priority Area for Action (PAA)

The Blackwater (Longwood) Priority Area for Action (PAA) is made up of four waterbodies (Figure 1.1). Blackwater (Longwood)_010 and Blackwater (Longwood)_020 are situated in 07_6 Blackwater[Longwood]_SC_010 sub-catchment. Blackwater (Longwood)_030 and Blackwater (Longwood)_040 are situated in 07_16 Boyne_SC_020 sub-catchment. Both sub-catchments are within the Boyne catchment. Flowing generally in a south-east to north-west direction and with sub-basins covering an area of approximately 140 km² the four waterbodies have a combined channel length of circa 102 km. The River Blackwater forms the boundary between Kildare and Meath Local Authority areas for part of its reach. Most of the PAA is situated to the south of the River Blackwater in County Kildare. North of the river and west-north-west of the town of Enfield an area of approximately 15 km² of the PAA is in County Meath.

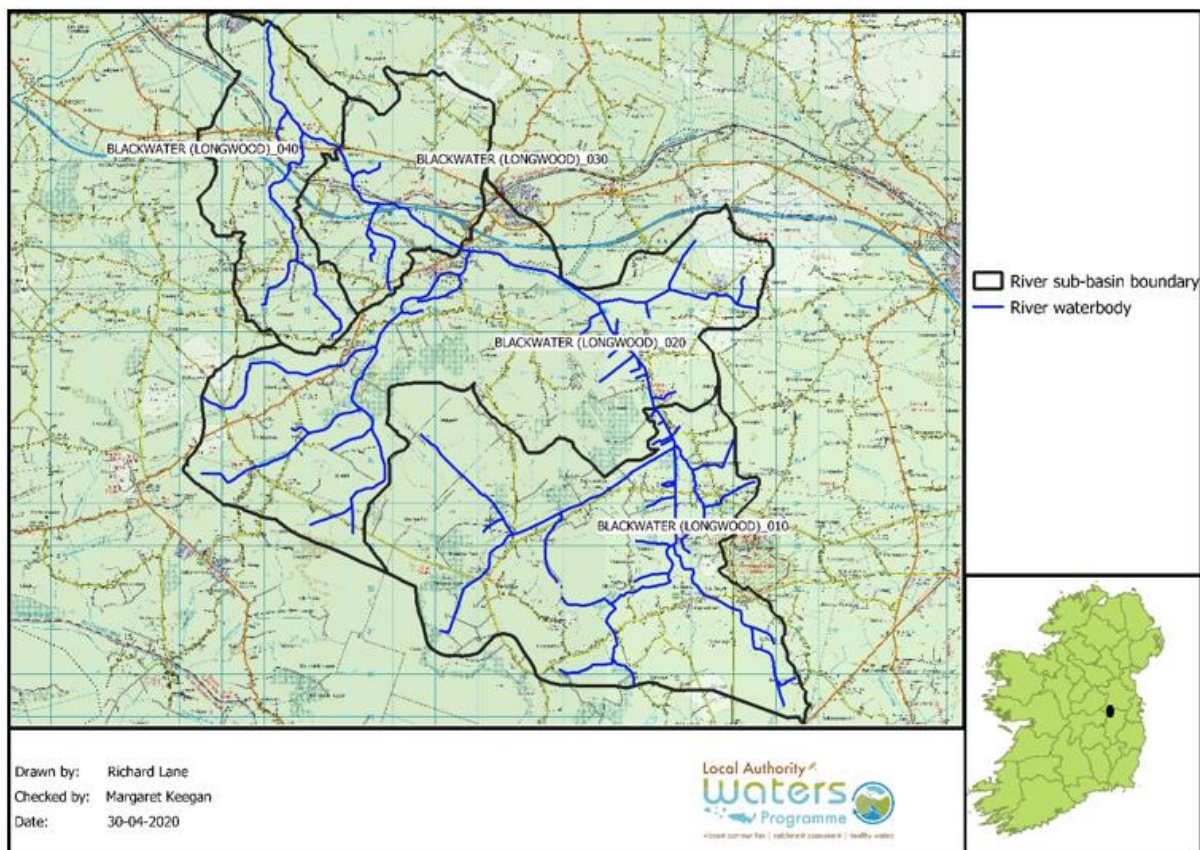


Figure 1.1: Location of waterbodies within the Blackwater (Longwood) Priority Area for Action.

According to the EPA, the Blackwater (Longwood) was prioritised as a PAA based upon the following criteria:

- Building on work completed by Kildare County Council.

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- Opportunity to address spikes in ammonia from peat.
- Headwaters of Blackwater (Longwood).
- Opportunity to work with Bord na Mona (BnM) and Office of Public Works (OPW).

2.2 Information Sources Consulted

Several information sources were consulted during the preparation of the desk study including:

- WFD web application – EPA characterisation data
- Enfield WWTP AER
- Local Authority data
- IW DATA
- OPW FSU Portal

2.3 PAA Summary Information

The four waterbodies in Blackwater (Longwood) PAA as presented in Table 2.1 are *at risk* of not achieving their WFD objectives as the ecological status for each is less than *good*.

The ecological status for Blackwater (Longwood)_010 is *poor* and has been so since 2010-2012 cycle. Blackwater (Longwood)_020 is at *moderate* ecological status since the 2007-2009 cycle. The significant pressures are anthropogenic (agriculture, peat harvesting and hydromorphology) in both waterbodies however it is not certain which pressure or combination of pressures are contributing to the less than *good* ecological condition.

Blackwater (Longwood)_030 has had unassigned status since 2010. Previous to 2010, the ecological status for this waterbody was *poor*. Agriculture (pasture) is deemed to be a significant pressure. Hydromorphology (channelisation) and urban wastewater (agglomeration PE of 2,001 to 10,000 - Enfield) are listed as non-significant pressures.

Moderate ecological status has existed in Blackwater (Longwood)_040 since 2010. Extractive industry (peat harvesting) and another unknown anthropogenic pressure are listed as significant pressures. Urban wastewater (agglomeration PE of 2,001 to 10,000 -Enfield) is listed as non-significant despite biologists suspecting the UWWTP to be a cause of pollution in the downstream waterbody.

Overall, the ecological status for Blackwater (Longwood) PAA has been consistently less than satisfactory since 2010. This is being exacerbated by the complexities of the likely pressures present.

The initial characterisation sub-catchment assessment recommended that the actions outlined in Table 2.2 be undertaken.

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Table 2.1: WFD risk, environmental objective, ecological status (2007-2009, 2010-2012, 2010 -2015, 2013-2018), and pressures for Blackwater (Longwood) PAA.

| Waterbody | | | Risk | High Status Objective | Ecological Status | | | | Number present | Pressures | | | LCA |
|---------------------------|-----------------|-------|---------|-----------------------|-------------------|---------|---------|---------|----------------|-------------------------|-------------------------------------|---------------|-----|
| Name | Code | Type | | | 2007-09 | 2010-12 | 2010-15 | 2013-18 | | Category | Sub-Category | Significant ? | |
| Blackwater (Longwood)_010 | IE_EA_07B020060 | River | At risk | No | G | P | P | P | 1 | Anthropogenic Pressures | Unknown | Yes | IA7 |
| Blackwater (Longwood)_020 | IE_EA_07B020100 | River | At risk | No | M | M | M | M | 1 | Anthropogenic Pressures | Unknown | Yes | IA7 |
| Blackwater (Longwood)_030 | IE_EA_07B020200 | River | At risk | No | P | U | U | U | 3 | Agriculture | Pasture | Yes | IA1 |
| | | | | | | | | | | Hydromorphology | Channelisation | No | |
| | | | | | | | | | | Urban Waste Water | Agglomeration PE of 2,001 to 10,000 | | |
| Blackwater (Longwood)_040 | IE_EA_07B020300 | River | At risk | No | U | M | M | M | 3 | Anthropogenic Pressures | Unknown | Yes | IA1 |
| | | | | | | | | | | Extractive Industry | Peat - Harvesting | | |
| | | | | | | | | | | Urban Waste Water | Agglomeration PE of 2,001 to 10,000 | No | |

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Table 2.2 : Action from the initial characterisation for Blackwater (Longwood) PAA.

| Waterbody | Investigative Assessment | Assigned Organisation | Description of IA |
|---------------------------|--------------------------|----------------------------------|---|
| Blackwater (Longwood)_010 | IA7 | Local Authority Waters Programme | Focus initial actions on peat, followed by agriculture and hydromorphology. |
| Blackwater (Longwood)_020 | IA7 | Local Authority Waters Programme | Focus initial actions on peat, followed by agriculture and hydromorphology. |
| Blackwater (Longwood)_030 | IA1 | Irish Water | Discuss upgrade plans with Irish Water. No recent biological data. Ammonia elevated between 2013-2015. MH CoCo: WWTP issue with capacity that needs improved, could have d/s impact. WWTP is at capacity; IW are looking at WWTP regarding upgrade but no conclusive proposals yet; WWTP can be subject to flooding in severe weather conditions. |
| Blackwater (Longwood)_040 | IA1 | Local Authority Waters Programme | Wait to see an improvement in the upstream water body (significant pressure is WWTP). If no improvement, IA7. |

3 Receptor information & assessment

3.1 Context and Setting

The four waterbodies of the Blackwater (Longwood) PAA are headwaters to the Boyne River. Rising north of the towns of Prosperous and Clane in County Kildare, the Blackwater River generally flows in a north-westerly direction to its confluence with the Boyne River north of Longwood in County Meath. Locally called the Clogheraun Stream at the headwaters, the main channel of the Blackwater is fed by a dendritic network of 1^o and 2^o order streams emanating from a low-lying peatland area. Moving downstream the 3^o order Ballycarron and Fear English rivers join the Blackwater upstream of the town of Enfield. The Togher and the Aleckafin rivers join the main channel upstream and downstream of Blackwater Bridge respectively (Appendix Figure 1). Additional to these natural features, this PAA is incised by the M4 motorway and the Royal Canal.

3.2 WFD Information

Blackwater (Longwood)_010, Blackwater (Longwood)_020, Blackwater (Longwood)_030 and Blackwater (Longwood)_040 waterbodies are *At Risk* of not achieving their WFD objectives due to their less than *good* ecological status.

Blackwater (Longwood)_010

Ecological status was *poor* in Blackwater (Longwood)_010 in the 2013-2018 WFD cycle. This is driven by the biological status due to the absence of hydrochemistry data (Table 3.1) at the operational monitoring station-Br S of Hortland. Biology has been persistently *poor* since 2012. This deterioration in status followed a period when *good* biological status existed at the monitoring station in the 2006 and 2009 Q-value assessments. In 2018, the EPA biologists noted a 10-25% cover of Cladophora, slight substrate siltation and compacted substrate features at the monitoring station in this slow flow velocity, lowland straight channel type waterbody.

Blackwater (Longwood)_020

Ecological status was *moderate* in Blackwater (Longwood)_020 in the 2013-2018 WFD cycle. Biological status has been *moderate* since 2009 at the operational monitoring station-Br at Johnstown. This deterioration in status followed a period when *good* biological status existed at the monitoring station from 1994 to 2006. In 2018, the EPA biologists noted a 2.5-5% cover of Cladophora, moderate substrate siltation, loose substrate features and moderate bank erosion at the monitoring station in this slow flow velocity, lowland straight channel type waterbody. Orthophosphate and ammonium concentrations show large temporal exceedances at the monitoring station-Br at Johnstown. Though presenting with a slight downward trend, annual average ammonium concentrations were 0.093mg/l and 0.084 mg/l in 2018 and 2019 respectively (Figure 2, Appendix). Since 2007 average annual

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orthophosphate concentrations have hovered around the EQS however, the temporal data showed episodic spikes up to 4-5 times the EQS on several occasions (Figure 3, Appendix).

Blackwater (Longwood)_030

Blackwater (Longwood)_030 has *unassigned* status. The most recent biological assessment was carried out in 2009. The historic record shows that the biological status (Q values) fluctuated between good and poor at the investigative monitoring station-Blackwater Br since 1981 (Figure 3.1).

Hydrochemical monitoring at Blackwater Bridge shows that apart from 2017 the annual mean ammonium concentrations exceeded the EQS from 2006 to 2018 (monitoring discontinued thereafter). Temporal spikes in ammonium, 4 to 7 times the environmental threshold occurred as indicated by Figure 4 Appendix. Upstream the annual mean ammonium concentration at the monitoring station-d/s of Enfield WWTP exceeded the EQS only in 2018 (0.080 mg/l) otherwise the mean environmental threshold was not breached in any other year. However, two significant ammonium spikes of 0.436 and 0.253 mg/l occurred in 2018 and 2019 respectively (Figure 6 Appendix). From this one would conclude that there is an ammonium source downstream of the d/s of Enfield WWTP monitoring station.

The data shows that orthophosphate concentrations spiked in 2008 and 2011 at Blackwater Bridge however, annual mean orthophosphate concentrations have remained at or below the EQS from 2012 to 2018 (monitoring discontinued thereafter) despite minor spikes in that period (Figure 5 Appendix). Upstream, the d/s of Enfield WWTP monitoring station had an annual mean orthophosphate concentration of 0.050 mg/l in 2019. This was caused by a spike in orthophosphate of 0.122 mg/l. Otherwise, the annual mean orthophosphate remained at or close to the EQS for the years for which data is available (Figure 7 Appendix).

Blackwater (Longwood)_040

Ecological status was *moderate* in Blackwater (Longwood)_040 in the 2013-2018 WFD cycle. Biological assessments resumed at the operational monitoring station-Br ESE of Longwood in 2012. The biological status has been *moderate* there since 2012. The biological status was *good* when last assessed in 1990. In 2018, the EPA biologists noted a 10-25% cover of *Cladophora* sp, 2.5-5% cover of *Vaucheria* sp, slight substrate siltation, loose substrate features and moderate bank erosion at the monitoring station in this slow flow velocity, lowland straight channel type waterbody.

Since 2008, ammonium concentrations show large temporal exceedances (2-3 times the EQS) at the monitoring station-Br ESE of Longwood. Despite this, the annual average ammonium concentration has been below the EQS from 2016 to 2019. The baseline concentration is 0.053 mg/l. This phase was preceded by a period (2013-2015) where annual average ammonium concentrations exceeded the EQS (Figure 8, Appendix).

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Since 2007 average annual orthophosphate concentrations have hovered around the EQS however, the temporal data showed episodic spikes up to 4-5 times the EQS on several occasions (Figure 9, Appendix).

Apart from 2014, 2015 and 2019 mean annual orthophosphate concentrations have exceeded the EQS since 2008. Despite presenting with a downward trend mean annual orthophosphate concentrations exceeded the EQS in the years 2016 to 2018 inclusive corresponding with temporal spikes 2-3 times the EQS. In 2019 (the last full year of data) the annual mean orthophosphate concentration was 0.030 mg/l. The baseline concentration is 0.047 mg/l.

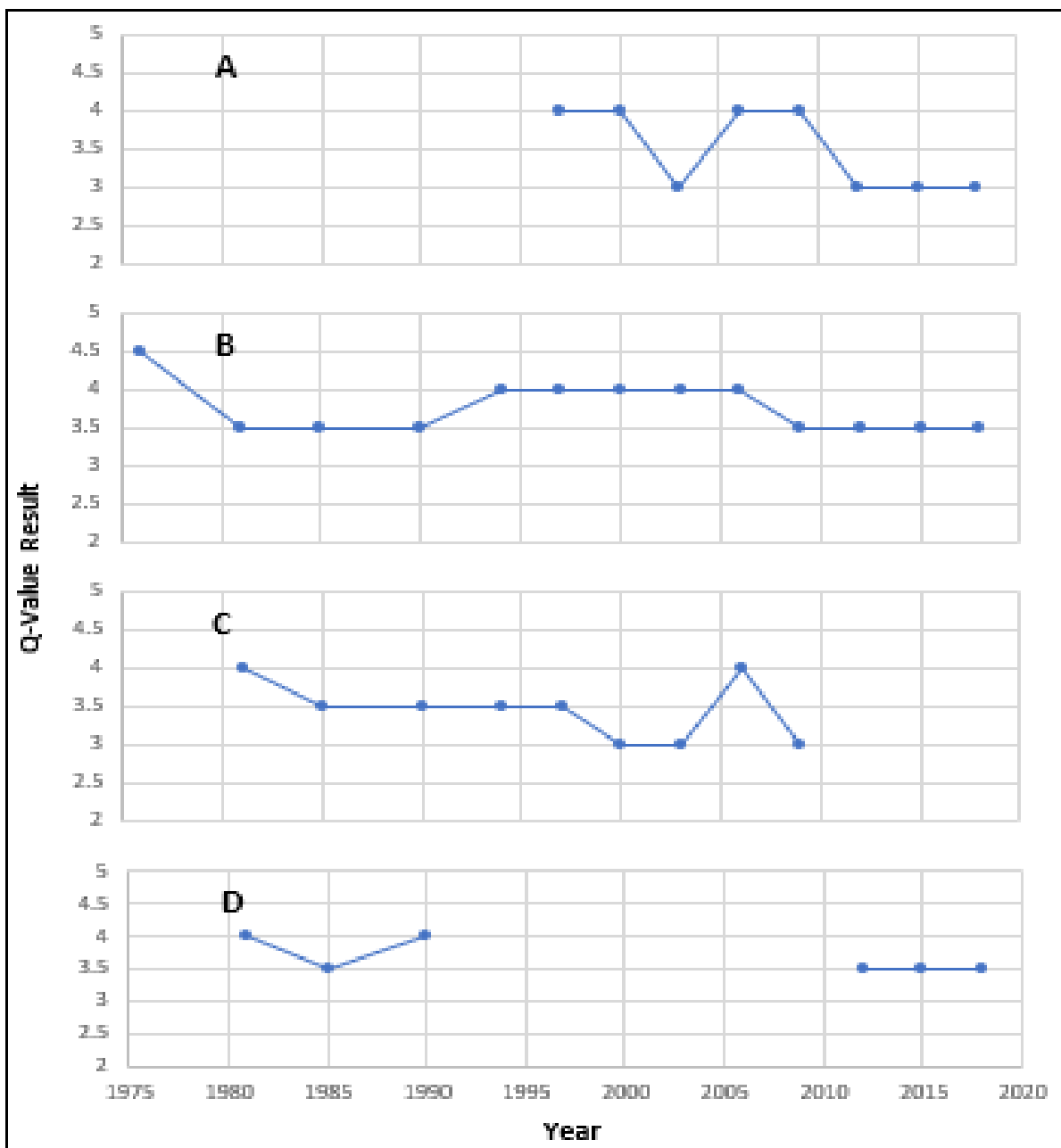


Figure 3.1: Q-Value results for the monitoring stations (A) Blackwater (Longwood)_010, (B) Blackwater (Longwood)_020, (C) Blackwater (Longwood)_030 and (D) Blackwater (Longwood)_040.

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Table 3.1: Risk, biological status, water chemistry, ecological status and significant issues.

| Waterbody | Blackwater (Longwood)_010 | Blackwater (Longwood)_020 | Blackwater (Longwood)_030 | | Blackwater (Longwood)_040 |
|-------------------------------------|--|---------------------------|---------------------------|---------------|---------------------------|
| Risk Category | At risk | At risk | At risk | | At risk |
| HYMO | | | | | |
| Monitoring station | Br S of Hortland | Br at Johnstown | d/s Enfield WWTP | Blackwater Br | Br ESE of Longwood |
| Monitoring station type | Operational | Operational | Investigative | Investigative | Operational |
| Biological Status | | | | | |
| Variations/trends in Q values | 2009 | G | M | | P |
| | 2010 | | | | |
| | 2011 | | | | |
| | 2012 | P | M | | |
| | 2013 | | | | |
| | 2014 | | | | |
| | 2015 | P | M | | |
| | 2016 | | | | |
| | 2017 | | | | |
| 2018 | P | M | | | M |
| Water chemistry | | | | | |
| Monitoring station | | Br at Johnstown | d/s Enfield WWTP | Blackwater Br | Br ESE of Longwood |
| PO ₄ ⁺ | 2010 | | 0.033 | | 0.040 |
| | 2011 | | 0.029 | | 0.058 |
| | 2012 | | 0.036 | | 0.036 |
| | 2013 | | 0.033 | | 0.032 |
| | 2014 | | 0.030 | | 0.034 |
| | 2015 | | 0.026 | 0.033 | 0.026 |
| | 2016 | | 0.038 | 0.029 | 0.032 |
| | 2017 | | 0.038 | 0.036 | 0.035 |
| | 2018 | | 0.036 | 0.040 | 0.017 |
| | 2019 | | 0.044 | 0.047 | |
| | 2020 | | 0.047 | | |
| Comments | | | | | |
| NH ₄ ⁺ | 2010 | | 0.088 | | 0.118 |
| | 2011 | | 0.063 | | 0.071 |
| | 2012 | | 0.093 | | 0.093 |
| | 2013 | | 0.077 | | 0.085 |
| | 2014 | | 0.065 | 0.042 | 0.074 |
| | 2015 | | 0.078 | 0.064 | 0.073 |
| | 2016 | | 0.047 | 0.041 | 0.130 |
| | 2017 | | 0.040 | 0.037 | 0.049 |
| | 2018 | | 0.093 | 0.084 | 0.132 |
| | 2019 | | 0.084 | 0.055 | |
| | 2020 | | 0.045* | | |
| Comments | | | | | |
| NO ₃ ⁻ | 2010 | | | | 1.94 |
| | 2011 | | | | 1.98 |
| | 2012 | | | | 1.90 |
| | 2013 | | | | 1.75 |
| | 2014 | | | | 1.95 |
| | 2015 | | | 2.67 | 2.21 |
| | 2016 | | | 2.90 | 1.94 |
| | 2017 | | | 3.21 | 2.14 |
| | 2018 | | | 4.95 | 2.54 |
| | 2019 | | | 3.29 | |
| | 2020 | | | | |
| Conceptual model required (Y/N) | Y | Y | Y | | Y |
| Ecological Status | | | | | |
| | P | M | U | | M |
| EPA Biologist comments | The dominance of pollution tolerant and paucity of pollution sensitive macroinvertebrate taxa indicated unsatisfactory ecological conditions at all sites surveyed on the Blackwater (Longwood) River in 2018. Enriched conditions were evident with enhanced algal growth noted at all sites and siltation evident at Johnstown (0100). | | | | |
| Significant issue: monitoring point | Nutrients & sediment | Nutrients & sediment | Nutrients | | Nutrients |
| Significant issue: Waterbody | Nutrients & sediment | Nutrients & sediment | Nutrients | | Nutrients |

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3.3 Receptor significant issues

Exceedances of the annual average thresholds for orthophosphate (PO_4^{+}), nitrate (NO_3^{-}) and ammonium (NH_4^{+}) are used to inform the significant issue.

It is clear from the annual average ammonium and phosphate concentrations (Table 3.1) that nutrients are an issue in the catchment. Rivers are typically P limited and as such orthophosphate is a significant issue in all of the waterbodies where monitoring data is available. Likewise, ammonium concentrations show exceedances in all of the waterbodies where monitoring data is available. In order to improve water quality in the PAA, mitigation measures must focus on reducing both phosphate and ammonium.

The significant issues (preliminary) in the river are a combination of Table 2.1 & Table 3.1. Based upon available data at this time, the significant issues are as follows:

- ❖ Blackwater (Longwood)_010: Inconclusive (no hydrochemistry) but likely issues are nutrients from agriculture and peatlands (based on conceptual understanding) and sediment mainly from peatlands. Natural sediment accumulation maps indicate high to extensive accumulation of peat sediment.
- ❖ Blackwater (Longwood)_020: Nutrients (PO_4^{+} and NH_4^{+} from agriculture and/or peatlands (based on conceptual understanding and Table 2.1 and Table 2.2). Natural sediment accumulation maps indicate moderate accumulation of sediment.
- ❖ Blackwater (Longwood)_030: Nutrients
- ❖ Blackwater (Longwood)_040: Nutrients.

3.4 Supplementary Information

The dendritic nature of the waterbodies in this entire large PAA required that the tributaries be characterised and the paucity of hydrochemical data in Blackwater (Longwood)_010 required that sampling be carried out to inform the planning of the future work needed in the local catchment assessment (LCA). Furthermore, Cloncurry_010, an unassigned waterbody that flows into Blackwater (Longwood)_020 upstream of Enfield required further characterisation.

The map in Appendix Figure 11 shows the monitoring sites selected for hydrochemistry sampling in May 2020. Table 3.3 shows the list of site ids corresponding with those on Appendix Figure 11. pH, conductivity, dissolved oxygen, total dissolved solids and temperature data measured simultaneously with the water sample collection are presented for the sampled sites along with the hydrochemistry results.

Data analysis showed that nutrient concentration at the EPA monitoring locations (Sites 1, 4, 6 and 17) were well below their EQSs on the sampling day (28/05/2020). However, at smaller scale exceedances for all nutrients occurred locally throughout the four waterbodies. Cloncurry_010

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(unassigned waterbody) had an ammonium concentration of 0.120 mg/l, low DO and high BOD (Site 9).

Estimation of orthophosphate loads and required reduction

Daily orthophosphate load to the four waterbodies in the Blackwater (Longwood) PAA are shown in Figure 3.2. The load calculations are based on the Q30 flow and the baseline orthophosphate concentration (mean of 2017, 2018 and 2019). Load reduction required in kg/ha/yr, assuming that orthophosphate is from diffuse agricultural and is the sole source of PO⁴⁺ is presented in Table 3.2.

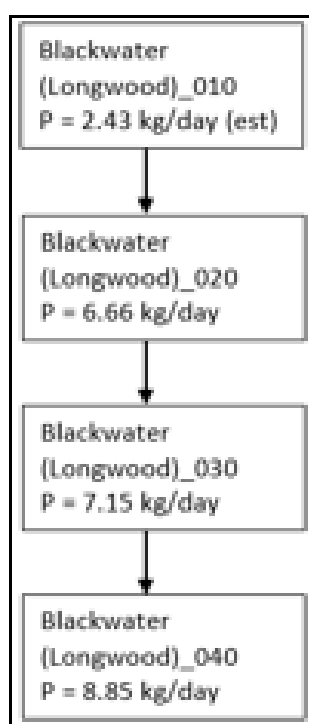


Figure 3.2: Estimation of the daily orthophosphate loads in the Blackwater (Longwood) PAA waterbodies.

Table 3.2: Estimation of the phosphate load reduction required in kg/ha/yr in the Blackwater (Longwood) PAA waterbodies.

| | Units | Blackwater (Longwood)_010 | Blackwater (Longwood)_020 | Blackwater (Longwood)_030 | Blackwater (Longwood)_040 |
|-------------------------|----------|---------------------------|---------------------------|---------------------------|---------------------------|
| Flow | l/s | 700 | 1975 | 2018 | 2328 |
| P conc | mg/l | 0.039 | 0.039 | 0.041 | 0.044 |
| P load | kg/yr | 861 | 2429 | 2609 | 3230 |
| EQS | mg/l | 0.03 | 0.03 | 0.03 | 0.03 |
| Required load reduction | kg/yr | -199 | -561 | -700 | -1028 |
| Catchment area | ha | 5130 | 10340 | 13800 | 16000 |
| Target P reduction | kg/ha/yr | -0.04 | -0.05 | -0.05 | -0.06 |

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Table 3.3: Hydrochemistry and physiochemical parameters for the May 2020 sampling round in Blackwater (Longwood) PAA.

| Site id | Site description | pH | Conductivity (µS) | DO (% sat) | DO (mg/l) | TDS (ppm) | Temp (°C) | Ammonium (mg/l) | BOD (mg/l) | Ortho-P as P (mg/l) | TON as N (mg/l) |
|---------|--|------|-------------------|------------|-----------|-----------|-----------|-----------------|------------|---------------------|-----------------|
| 1 | Br S of Hortland | 7.97 | 754 | 89.8 | 8.27 | 376 | 19.5 | 0.035 | 2.0 | < 0.02 | 2.00 |
| 2 | Clogheraun Stream | 7.95 | 765 | 87.3 | 7.83 | 381 | 20.9 | 0.037 | 2.9 | 0.022 | 3.10 |
| 12 | Derrylea | 7.78 | 590 | 80.9 | 6.96 | 289 | 23.1 | 0.050 | 2.5 | < 0.02 | < 1 |
| 3 | Derryvarroge_br_forest | 7.78 | 784 | 78.4 | 7.17 | 390 | 17.8 | 0.100 | 3.2 | < 0.02 | 2.10 |
| 11 | Gilltown | 7.53 | 790 | 82.9 | 8.10 | 395 | 16.7 | 0.049 | 1.5 | 0.046 | 4.80 |
| 10 | SE Staplestown | 7.75 | 753 | 75.8 | 7.12 | 378 | 19.9 | < 0.02 | 1.4 | < 0.02 | 1.70 |
| 13 | Timahoe | 7.68 | 935 | 90.8 | 8.21 | 464 | 20.1 | 0.066 | 2.8 | 0.021 | 2.20 |
| 15 | Art's Br | 7.85 | 780 | 52.4 | 4.80 | 387 | 18.9 | 0.220 | 4.2 | 0.11 | < 1 |
| 16 | Ballynamullagh | 7.98 | 762 | 73.5 | 7.18 | 404 | 18.2 | 0.160 | 4.7 | 0.025 | 1.50 |
| 4 | Br at Johnstown | 8.00 | 790 | 100.7 | 9.37 | 395 | 19.0 | 0.038 | 1.4 | < 0.02 | 1.80 |
| 5 | Fear English | 7.94 | 810 | 116.2 | 10.80 | 397 | 19.1 | 0.026 | 1.2 | < 0.02 | 2.80 |
| 14 | Sweep River | 7.96 | 838 | 90.1 | 8.34 | 411 | 19.2 | 0.055 | 1.5 | 0.025 | 4.10 |
| 6 | Blackwater Br | 7.80 | 833 | 86.2 | 8.05 | 418 | 17.8 | 0.044 | 1.3 | < 0.02 | 2.70 |
| 7 | Togher River d/s Enfield Service Station | 7.87 | 882 | 103.2 | 10.40 | 440 | 18.1 | < 0.02 | < 1 | < 0.02 | 6.10 |
| 17 | Br ESE of Longwood | 8.58 | 815 | 70.0 | 6.94 | 408 | 16.0 | 0.020 | < 1 | < 0.02 | 2.70 |
| 18 | Cosgrove's Br | 7.75 | 911 | 82.8 | 7.81 | 454 | 18.4 | 0.095 | 2.8 | 0.053 | 1.50 |
| 9 | Harris Br | 7.91 | 825 | 73.0 | 6.90 | 413 | 18.2 | 0.120 | 3.1 | 0.028 | 1.70 |

3.5 Conclusion on Significant issues

Table 3.4: Significant issue in the Blackwater (Longwood) PAA.

| Waterbody | Significant Issues |
|---------------------------|------------------------|
| Blackwater (Longwood)_010 | Nutrients and sediment |
| Blackwater (Longwood)_020 | Nutrients and sediment |
| Blackwater (Longwood)_030 | Nutrients |
| Blackwater (Longwood)_040 | Nutrients |

3.6 Initial EPA Characterisation

The initial characterisation as presented in Table 3.5 deemed anthropogenic pressures as significant with agriculture, peat and hydromorphology all potential significant pressures in Blackwater (Longwood)_010 and Blackwater (Longwood)_020. Land area under peat extraction constitutes circa 45% of Blackwater (Longwood)_010 with the remainder mainly under agriculture. The morphological changes caused by drainage for both land uses has altered the habitats which support good ecological conditions.

The pressures deemed significant in Blackwater (Longwood)_030 were nutrient pollution from agriculture (pasture) and hydromorphology (channelisation). The pressure deemed not significant in was Enfield WWTP.

One unknown anthropogenic pressure along with peat extraction are the pressure deemed significant at the initial characterisation stage. Though not deemed significant a watching brief on improvements in Enfield WWTP is recommended.

Table 3.5: Initial EPA characterisation

| Waterbody Name | Id | Category | Sub-Category | Name | Significant? | Pressures and impact details |
|---------------------------|------------|-------------------------|-------------------------------------|---------|--------------|---|
| Blackwater (Longwood)_010 | WBP0006988 | Anthropogenic Pressures | Unknown | n/a | Yes | Organic pollution Altered habitat due to morphological changes |
| Blackwater (Longwood)_020 | WBP0006989 | Anthropogenic Pressures | Unknown | n/a | Yes | Organic pollution Altered habitat due to morphological changes |
| Blackwater (Longwood)_030 | WBP0002630 | Urban Wastewater | Agglomeration PE of 2,001 to 10,000 | Enfield | No | |
| | WBP0002631 | Agriculture | Pasture | n/a | Yes | Nutrient pollution |
| | WBP0006034 | Hydromorphology | Channelisation | n/a | No | |
| Blackwater (Longwood)_040 | WBP0002632 | Anthropogenic Pressures | Unknown | n/a | Yes | |
| | WBP0006366 | Extractive Industry | Peat - Harvesting | n/a | Yes | |
| | WBP0002633 | Urban Wastewater | Agglomeration PE of 2,001 to 10,000 | Enfield | No | Organic pollution |

3.7 Issues and pressures not identified as significant – Urban Wastewater

WWTP is noted to be overloaded at peak flows. 3rd Cycle Update - Plant Design PE 3500 Agglomeration PE4690 with P treatment. Plant appears to be reasonably compliant with ELVs, however, EPA Audit, July 2019; Enfield WWTP is significantly overloaded. Irish Water are currently considering options for improvement / upgrade works to increase the treatment capacity in the plant. No significant network issues reported. 14/09/2020 - Unassigned WB, supporting chemistry conditions score assigned pass. Ammonia indicative quality improved from moderate to good at station RS07B020120 (d/s Enfield WWTP) between the 10-15 and 13-18 iterations. A spike in 2018 annual mean (ammonia) due to an extremely high sample conc. recorded on 16.10.18 was also experienced upstream of the plant potentially due to Storm Callum. Plant does not appear to be impacting significantly (Source: WFD App).

Figures 3.2 and 3.3 in the Appendix illustrate the time series (2014 –2019) for the ambient monitoring of ammonium and orthophosphate concentrations respectively for upstream and downstream of Enfield WWTP. Generally, the trends follow a similar pattern however apart from a few exceptions the downstream station had lower concentrations for both parameters. Spikes in ammonium and ortho-P concentrations showed mixed relationships to extreme rainfall events. For instance, October 2015 to March 2016, the prolonged rainfall spike did not materialise in an extreme ammonium spike but there was an extended period when ammonium concentrations were greater than 0.100 mg/l at both stations. In comparison despite a lower amount of rainfall in October 2018 a massive concentration of 0.450 mg/l was recorded. The ortho-P spike in May 2016 at u/s WWTP monitoring stations is confounding as the d/s WWTP monitoring station was showed 0.020 mg/l ortho-P for the same date. The total rainfall for the previous 30-days was c.70 mm with no significant rainfall event. The upstream monitoring station is showing more frequent exceedances of EQS's for both parameters which would suggest one or more pressures in the upstream waterbodies.

Suitability of ambient monitoring location.

Communications with Meath CoCo staff established that the ambient monitoring location for Enfield WWTP is approximately 2.5 km downstream of the WWTP and labelled d/s Enfield WWTP (actual) in Figure 12. The monitoring location is to be relocated during future upgrade work to the UWWTP.

Wastewater treatment plant

The wastewater treatment plant is not listed as a significant pressure and is hydraulically and organically overloaded with a plant design PE of 3,500 and an agglomeration PE of 4690.

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SWOs

Figure 15 outlines the WWT system layout plan for Enfield and Johnstown Bridge with SWO03 circled in red. It is not clear where effluent from here flows but this SWO might discharge into the Ballycarron River/Cloncurry_010, a biologically unassigned status waterbody and at review for risk status. Ballycarron River/Cloncurry_010 joins the Blackwater upstream of the u/s WWTP monitoring point which is at moderate status and could potentially cause of the elevated nutrients seen at u/s Enfield WWTP monitoring station.

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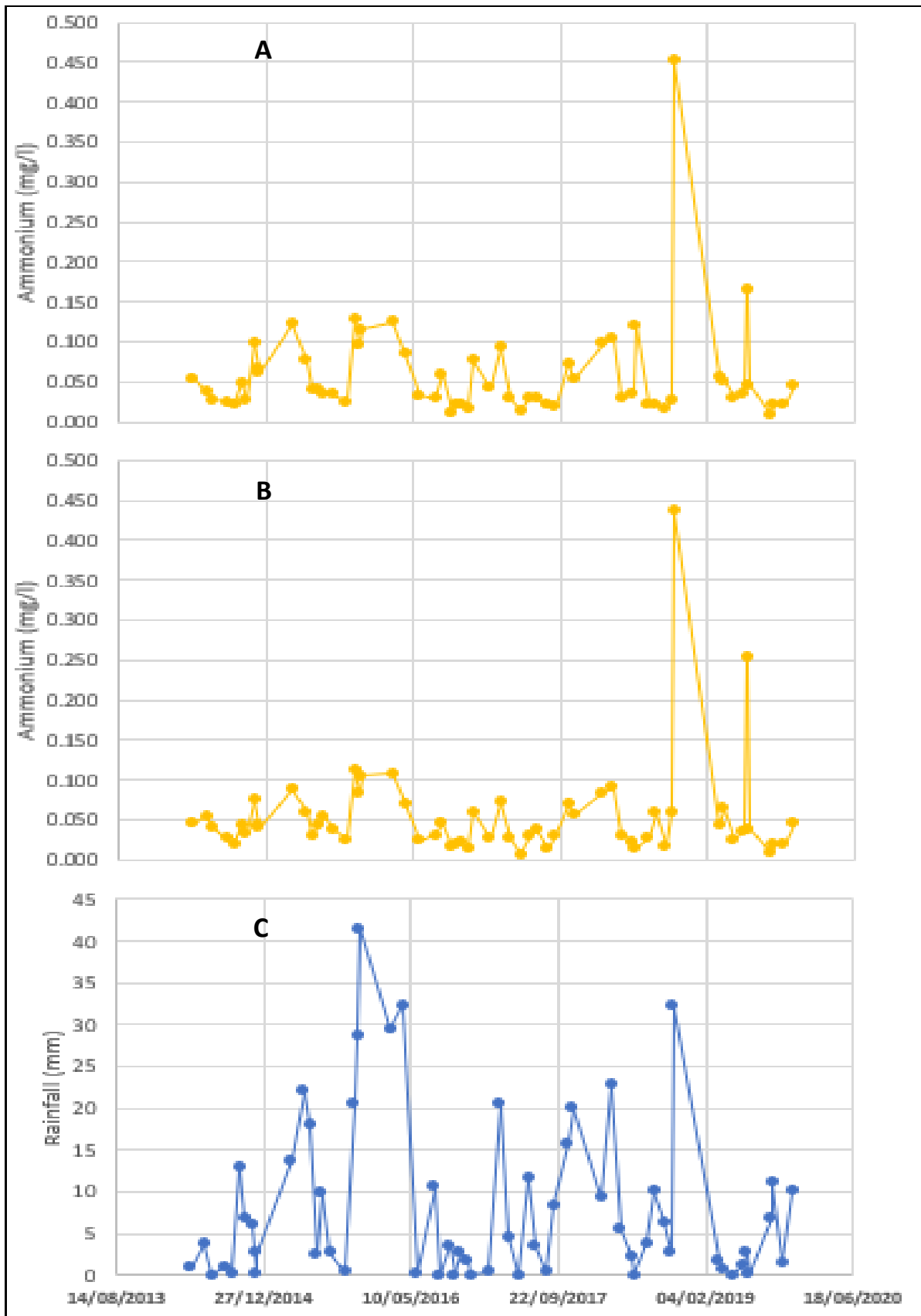


Figure 3.3: Time series for ammonium concentration (April 2014 – November 2019) at upstream (A) and downstream (B) of Enfield WWTP. Rainfall data (C) are for the climatological station at Dunsany County Meath.

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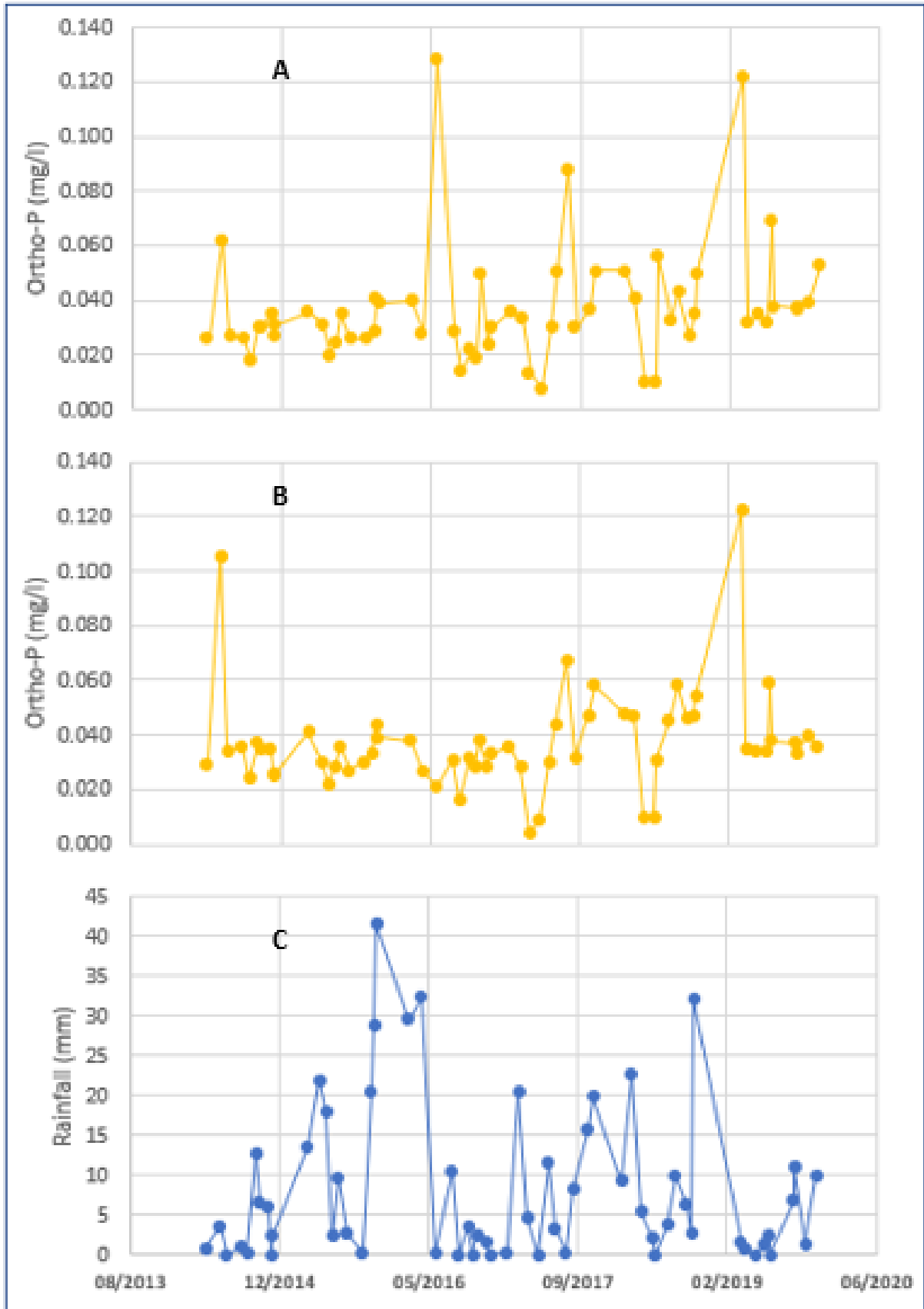


Figure 3.4: Time series for ortho-phosphate concentration (April 2014 – November 2019) at upstream (A) and downstream (B) of Enfield WWTP. Rainfall data (C) are for the climatological station at Dunsany County Meath.

3.8 Hydromorphology

Peat extraction operations have been ongoing at an industrial scale for the last eight decades in the Blackwater (Longwood) PAA. This required the lowering of the water table to allow the use of mechanisation on the peatlands. Additionally, on the ‘heavy’ soils under agriculture, drainage was necessary to improve trafficability. Therefore, more than 90% of the channel length is under the remit of the Office of Public Works (OPW) for maintenance under their Arterial Drainage Scheme in this PAA (Figure 16 Appendix). The channelisation processes would have altered the habitats due to the resultant morphological changes. These changes would also have changed the hydrological regime from its natural state. The EPA morphology quality index (MQI) class of mainly moderate and poor in Blackwater (Longwood)_010. Some stretches in Blackwater (Longwood)_020 are classified as good MQI but moderate class is more commonplace. Approximately, 50% of the main channel in Blackwater (Longwood)_030 has MQI class poor and the remainder moderate. These are classified as such due to the impact of OPW maintenance works which seems to have reduced the lateral connectivity to the surrounding landscape. Apart from a short stretch which is classified as good, MQI is mainly moderate class in Blackwater (Longwood)_040. In a similar way to the reaches upstream of the monitoring stations in Blackwater (Longwood)_020 and Blackwater (Longwood)_030 the reach at the monitoring station in Blackwater (Longwood)_040 is poor.

The geographical setting of the PAA is in flat to gently undulating landscape with slow moving rivers for the most part. The natural sediment accumulation map (Figure 17 Appendix) shows that the main channel, tributaries and drains have high to extensive levels of peat sediment, and some reaches with moderate sediment accumulation. This sediment regime is more apparent in Blackwater (Longwood)_010 and to a lesser extent in Blackwater (Longwood)_020. Moderate sediment accumulations are found in short reaches in Blackwater (Longwood)_030 main channel. High to extensive levels of peat sediment accumulation is associated with a peatland area of c.1 km² just south of the M4 motorway in Blackwater (Longwood)_040. Local catchment assessment will establish if this sediment is encroaching on the main channel.

3.9 Conclusion on Significant Pressures

❖ Blackwater (Longwood)_010:

- Agriculture: Lack of hydrochemistry data however, phosphate PIP map indicates very high risk from farmland adjacent to the waterbody for extended stretches. Lands reclaimed for agriculture from peat may be ammonium sources.
- Extractive Industry: peat erosion from exposed surfaces and banks, sub-soil erosion of cutaway areas that are unvegetated. The natural sediment accumulation maps indicate high to extensive accumulation of peat sediment.

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Lack of hydrochemistry data however, it is expected that ammonium emanating from drained peatland would be an issue.

- Hydromorphology: Most of this waterbody has been altered from its natural physical state and therefore could be loosely classified as 'heavily modified'.

❖ Blackwater (Longwood)_020:

- Agriculture: Phosphate PIP map indicates very high to high risk from farmland adjacent to the main channel, the headwaters of the Fear English tributary and the inputting, unassigned Cloncurry_010. Orthophosphate chemistry data shows persistent exceedances at the monitoring station.

Note: The location of SWO03 in Enfield wastewater treatment system would suggest that if a this was activated during high rainfall events, the impact from the effluent overflow could present at the u/s Enfield WWTP monitoring station as elevated nutrients.

- Extractive Industry: The peatland operations in Blackwater (Longwood)_010 are likely influencing the sediment status in the Blackwater (Longwood)_020. The natural sediment accumulation maps indicate high to extensive accumulation of peat sediment at the upstream section of the waterbody and is moderate in the downstream section. Ammonium concentration at the monitoring station Br at Johnstown would suggest that another pressure is contributing to the exceedances.
- Hydromorphology: The main channel in Blackwater (Longwood)_030 has MQI class moderate mainly. Good hydromorphology conditions occur on the Newtown tributary and on the main channel up stream of the Cloncurry_010 confluence.

❖ Blackwater (Longwood)_030:

- Urban wastewater: The location of the d/s Enfield WWTP monitoring station (2.5km downstream) is distorting the actual impact of the wastewater treatment plant on the waterbody. Taking into consideration the exceedances at u/s Enfield WWTP monitoring station, account should be taken of the additional dilution effect.
- Agriculture: Phosphate PIP map indicates mainly high to medium risk with small localised very high-risk areas from farmland adjacent to the main channel. Ammonium concentrations at Blackwater Bridge monitoring station have been persistently high since 2007 to 2018 (Operational monitoring of this station was discontinued in 2019 and 2020). This contrasts strongly with the d/s Enfield WWTP monitoring station bearing in mind the distance between both stations is c.1 km.

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- Hydromorphology: Morphology quality indices indicate significant alteration to the waterbody due to channelisation and the likely presence of the associated embankments. Though not classified as not significant at the initial characterisation stage, hydromorphology cannot be ruled out as a significant at this desk study stage due to the historic and future impact of OPW maintenance.
- ❖ **Blackwater (Longwood)_040: Nutrients.**
 - Agriculture: Hydrochemistry shows annual mean exceedances with much larger persistent temporal exceedances for orthophosphate. Phosphate PIP map indicates areas with very high to high risk from farmland adjacent to the main channel (large CSA 500m upstream from monitoring station) and on the Aleckafin River tributary. Temporal ammonium exceedances have been masked by the low annual means concentrations for 2016 to 2019 however, these temporal exceedances may be indicative of point sources.
 - Extractive Industry: slight siltation was note by the EPA biologists at the monitoring station ad LCA will determine the source.

4 Pathway information & analysis

Figure 4.1 illustrates the conceptual model for orthophosphate and nitrate pathways, including conceptual model compartments, waterbody sub-basin areas and the locations of the EPA monitoring stations. Table 4.1 gives an overview of conceptual model compartment properties. The properties of each compartment were informed by the geological, hydrogeological and pedological characteristics of the PAA (Figures 19 to 23 Appendix). The regional pathway context for the Blackwater (Longwood) PAA is provided by the aquifers in the PAA (Figure 19). Four compartments are identified based on four aquifer categories PI, Lm, Lk and LI.

Table 4.1: Conceptual model descriptors for Blackwater (Longwood) PAA.

| | Compartment 1 (C1) | Compartment 2 (C2) | Compartment 3 (C3) | Compartment 4 (C4) |
|--|--|--|---|---|
| Bedrock unit | Dinantian Upper Impure Limestone | Dinantian Pure Unbedded Limestone | Dinantian Pure Bedded Limestone | Namurian Undifferentiated |
| Aquifer | Generally Moderately Productive (Lm) (100%) | Generally Moderately Productive (Lm) (~70%), Moderately Productive only in Local Zones (LI) (~20%), Karstified bedrock (Lk) (~5%) | Karstified (Lk) | Generally Unproductive except for Local Zones (PI) |
| Aquifer properties | Trim Groundwater Body (GWB): This GWB comprises a large area of limestone which is extremely heterogeneous. It is therefore impossible to quote a single figure for the hydrogeological properties of the aquifer. Evidence suggests that the degree of karstification throughout the area is highly variable, as is the degree of structural deformation, the occurrence of open fractures in a connected network which will allow groundwater flow, the degree of confinement by impermeable tills, and the additional storage provided by the many gravel deposits overlying the aquifer. All these factors can alter the nature of groundwater flow within the aquifer. | | | |
| Topography | Flat to undulating lowlands | | | |
| Soil | Well drained (~65%), poorly drained (~25%), peat (~5%) and alluvium (~5%) | Peat (~50%), poorly drained (~25%), well drained (~20%) and alluvium (~5%) | Well drained (~50%), poorly drained (~10%) and peat (~40%) | Well drained (~50%) and poorly drained (~50%) |
| Subsoil | Limestone till (Carboniferous) (~80%), Limestone sands and gravels (Carboniferous) (~10%), Cutover peat (~5%), Alluvium undifferentiated (~5%) | Cutover peat (~50%), Limestone till (Carboniferous) (~40%), Limestone sands and gravels (Carboniferous) (~5%), Alluvium undifferentiated (~5%) | Limestone till (Carboniferous) (~80%) and Cutover peat (~20%) | Limestone till (Carboniferous) (~90%) and Cutover peat (~10%) |
| Groundwater vulnerability | Generally moderate to high | Low to high | Mostly moderate | Moderate to X-extreme |
| PO ₄ ³⁻ susceptibility | Very low to high | Very low to high | Mostly low but high near WB | Moderate to high |
| NO ₃ susceptibility | Very low to low (ns), high (subS) along main channel | Mainly low/very low. Small areas of high to very high | Low to moderate | Moderate to high |

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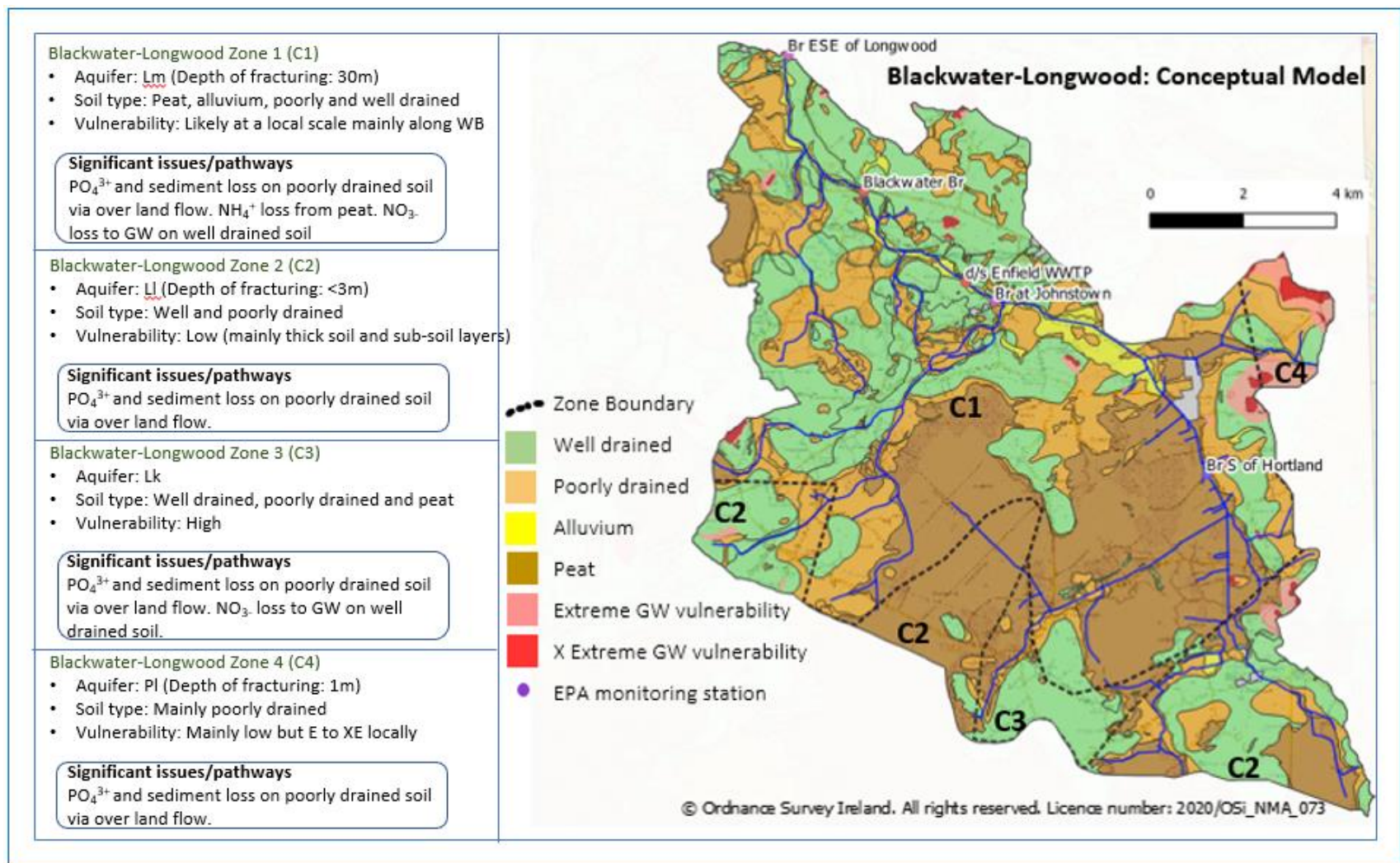


Figure 4.1: Conceptual understanding of the water pathways in Blackwater (Longwood) Priority Area for Action

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

The Blackwater (Longwood) and its several tributaries incise a diverse landscape of modified peatland to intensively managed agricultural land as it flows through the north Kildare and south Meath countryside. The town of Enfield is the major urban settlement in the Blackwater (Longwood) catchment.

The four waterbodies in the Blackwater (Longwood) PAA are *at risk* of not achieving their WFD objective of at least *good* status. The pressures on the aquatic environment are extractive industry (peat harvesting), agriculture, hydromorphology and urban wastewater. At this interim stage, the main issues at the monitoring stations and in the waterbody are nutrients and sediment.

Blackwater (Longwood)_010:

The current (2013-2018) *poor* ecological status is driven by the invertebrate status. The nutrient status is inconclusive in the absence of a hydrochemistry record but based on the conceptual understanding nutrients from agriculture and peatlands are likely issues. PIP maps indicate that the risk from phosphate is ranked as 1 (highest risk) with the main area of concern just upstream of the EPA monitoring station. Soil maps indicate peat is the main soil type and the Corine system classifies the land use as pasture. This suggests that this land was improved overtime thus the ‘heavy’ nature of the soil signifies that overland flow and near surface are the dominant pathways for nutrients. Extensive areas of peatland are exploited for peat harvesting thus exposing the peat substrate to erosion. Sedimentation as indicated by the natural sediment accumulation maps indicate high to extensive accumulation of peat sediment in the watercourses. Extensive drainage maintenance under the Arterial Drainage Scheme is evident from the straightening of the main channel and the creation of the drainage network associated with the peat industry. This is supported by the poor MQI score signifying that hydromorphological pressures may overshadow other significant pressures in this waterbody.

Blackwater (Longwood)_020

Ecological status is *moderate*. Hydrochemistry data shows that nutrients are an issue. The baseline (2017 to 2019) concentrations for orthophosphate and ammonium are 0.039 mg/l and 0.070 mg/l respectively however these values do not capture the persistent temporal EQS breaches which have occurred. PIP maps indicate that the risk from phosphate is ranked 1 for most of the lengths of the main channel and the Newtown tributary. Much of the catchment area of the Cloncurry_010 (a non-PAA waterbody) which joins the Blackwater River upstream of Enfield is ranked as very high PIP from phosphate. Furthermore, the temporal orthophosphate spikes may signify losses from point sources. One such point source requires information has been furnished by Irish Water for the UWWT system

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for Enfield/ Johnstown Bridge as questions have arisen over the SWO's and other infrastructure associated with the system. Hydromorphology is likely to be significant as the channels are maintained by the OPW. MQI condition is moderate. The peatland operations in Blackwater (Longwood)_010 are likely influencing the sediment status in the Blackwater (Longwood)_020. The natural sediment accumulation maps indicate high to extensive accumulation of peat sediment at the upstream section of the waterbody and is moderate in the downstream section.

Blackwater (Longwood)_030 Nutrients

The ecology has unassigned status as biological assessment have not been carried out for this waterbody since 2009. The location of the d/s Enfield WWTP monitoring station is 2.5km downstream from the wastewater discharge point. Hydrochemistry data shows that apart from two spikes, the annual mean ammonium concentrations have hovered at or near the EQS since monitoring started there. It must be noted that one of the spikes in ammonium corresponds with a similar spike at the u/s Enfield WWTP in October 2018. One remarkable spike in orthophosphate observed at d/s Enfield WWTP in March corresponds to a similar spike at the upstream monitoring station. Phosphate PIP map indicates mainly high to medium risk with small localised very high-risk areas from farmland adjacent to the main channel. The distance of the d/s Enfield WWTP monitoring station is possibly distorting the actual impact of the wastewater treatment plant on the waterbody. Therefore, taking into consideration the exceedances at u/s Enfield WWTP monitoring station, account should be taken of the additional dilution effect. Ammonium concentrations at Blackwater Bridge monitoring station have been persistently high since 2007 to 2018 (operational monitoring of this station was discontinued in 2019 and 2020). This contrasts strongly with the d/s Enfield WWTP monitoring station bearing in mind the distance between both stations is c.1 km. This might suggest that a point source(s) is the pressure causing the exceedances in this short stretch of channel. Morphology quality indices indicate significant alteration to the waterbody due to channelisation and the likely presence of the associated embankments. Though classified as not significant at the initial characterisation stage, hydromorphology cannot be ruled out as a significant pressure at this desk study stage due to the historic impacts of OPW maintenance.

Blackwater (Longwood)_040

Hydrochemistry shows annual mean exceedances with much larger persistent temporal exceedances for orthophosphate. Phosphate PIP map indicates areas with very high to high risk from farmland adjacent to the main channel (large CSA 500m upstream from monitoring station) and on the Aleckafin River tributary. Temporal ammonium exceedances have been masked by the low annual means concentrations for 2016 to 2019 however, these temporal exceedances may be indicative of point sources. The peat extraction site mentioned by the Local Authority at the initial

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characterisation stage may be the source of siltation noted by the EPA biologists at the monitoring station. LCA will confirm or otherwise.

6 Workplan

Given the scale of the nutrient issue (particularly phosphate and ammonium) in the PAA and the scale of the PAA itself (140 km²), prior to entering into detailed catchment assessment, it is necessary to refine the areas of worst impact. In order to formulate an effective workplan, the Blackwater (Longwood) PAA has been split up into tributaries and sub-catchments. The sub-catchments were derived from the supplementary water chemistry monitoring points described in section 3.4. Figure 6.1 shows the location of each sub-catchments, which are labelled BWL 1 to BWL 19. Also shown are the location of supplementary monitoring points which are at the base of each sub-catchment.

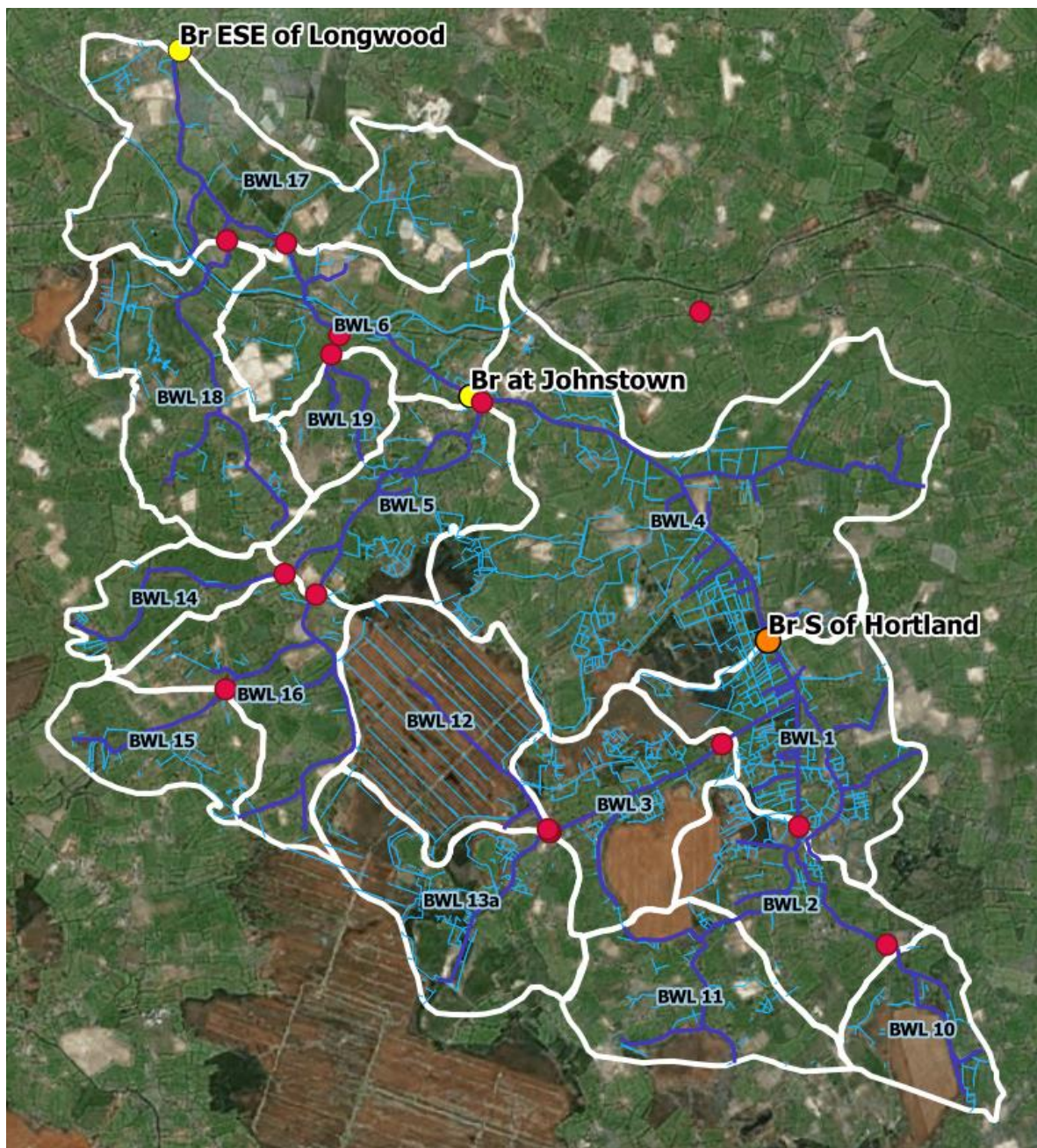


Figure 6.1: Summary statistics for each sub-catchment in the Blackwater (Longwood PAA)

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Summary statistics were developed for each of the 19 PAA sub-catchments as shown in Table 6.1. The table provides statistics on soil drainage, the proportion of PIP Rank 1-3 for phosphate and nitrate, comparative drainage density and the no. of high and very high phosphate delivery points on a sub catchment vs. sub catchment basis. Note, at the time the deskstudy was initially written (2020), phosphate delivery points (derived from the EPA Diffuse Tools Project) were not yet available. This has been added to the workplan in 2021.

As a first step in the Local Catchment Assessment plan, a large-scale water chemistry and streamflow analysis, incorporating each of the tributaries and sub-catchments is required. To date, a single water chemistry round was carried out in summer of 2020. Two more sampling rounds are planned in 2021 to capture different flow conditions and pressures within the PAA. Based upon this data, a nutrient load apportionment analysis will be undertaken. This will allow the sub-catchments to be ranked in terms of proportional nutrient losses per hectare to each of the WFD waterbodies and ecological monitoring points.

The nutrient load analysis, in conjunction with the statistical output shown in table 6.1 will form the basis for a more detailed investigative plan which will be proposed for each waterbody. The plan will focus on refining the waterbody significant pressures identified in Section 3. Further work will include SSIS ecological assessments, hydro morphology assessment and targeted stream walks.

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Table 6.1: Summary statistics for each sub-catchment in the Blackwater (Longwood PAA)

| Waterbody | Location | Subcatchment ID | Subcatchment Size (Ha) | Soil Type | | | PIP-P (% Rank 1-3 per SC) | P - CSA Delivery pts (high and V High per SC) | P - CSA Delivery pts (high and V High per SC) / per Km2 | Drainage density | PIP-N (% Rank 1-3 per SC) |
|------------------------------|------------------------|-----------------|------------------------|-------------------|-----------------|-------|------------------------------|--|--|------------------|---------------------------------|
| | | | | Poorly Drained | Well Drained | Peat | | | | | |
| Blackwater (Longwood)_010 | Gilltown Tributary | ME BWL 11 | 727 | 19.4% | 49.1% | 31.1% | 17.8% | 17 | 2.3 | 0.6% | 10.2% |
| | | ME BWL 10 | 420 | 14.5% | 28.7% | 55.6% | 22.1% | 12 | 2.9 | 0.8% | 3.5% |
| | | ME BWL 2 | 684 | 16.0% | 44.3% | 35.0% | 21.3% | 6 | 0.9 | 1.1% | 14.6% |
| | Derryvarroge Tributary | ME BWL 12 | 879 | 0.5% | 0.4% | 99.1% | 0.9% | Questionable data | | 1.9% | 0.0% |
| | | ME BWL 13a | 870 | 11.8% | 38.6% | 48.5% | 10.8% | Questionable data | | 0.9% | 16.6% |
| | | ME BWL 3 | 719 | 8.4% | 6.5% | 85.2% | 15.4% | 57 | 7.9 | 1.3% | 4.9% |
| | EPA Monitoring Point | ME BWL 1 | 867 | 18.1% | 25.6% | 56.2% | 27.3% | 16 | 1.8 | 1.9% | 4.8% |
| Blackwater (Longwood)_020 | Fear English Tributary | ME BWL 14 | 329 | 23.2% | 67.9% | 6.8% | 20.3% | 6 | 1.8 | 0.7% | 17.5% |
| | | ME BWL 15 | 461 | 31.2% | 67.6% | 0.0% | 11.5% | 15 | 3.3 | 0.8% | 14.4% |
| | | ME BWL 16 | 737 | 52.7% | 24.4% | 22.9% | 46.4% | 29 | 3.9 | 0.7% | 9.8% |
| | | ME BWL 5 | 738 | 28.5% | 49.6% | 18.4% | 15.3% | 10 | 1.4 | 1.1% | 13.4% |
| | EPA Monitoring Point | ME BWL 4 | 2818 | 33.4% | 29.7% | 27.4% | 32.0% | 82 | 2.9 | 1.2% | 6.5% |
| Blackwater (Longwood)_030 | Togher River | ME BWL 19 | 260 | 26.6% | 70.0% | 0.0% | 25.4% | 2 | 0.8 | 0.7% | 27.2% |
| | | ME BWL 7 | 260 | 26.6% | 70.0% | 0.0% | 25.4% | 2 | 0.8 | 0.7% | 27.2% |
| | EPA Monitoring Point | ME BWL 6 | 799 | 24.3% | 66.3% | 0.0% | 9.6% | 14 | 1.8 | 1.6% | 19.5% |
| Blackwater (Longwood)_040 | Cosgrove's Tributary | ME BWL 18 | 997 | 47.1% | 42.9% | 9.5% | 21.6% | 47 | 4.7 | 1.2% | 6.8% |
| | EPA Monitoring Point | ME BWL 17 | 1397 | 28.2% | 63.2% | 1.5% | 16.3% | 20 | 1.4 | 0.8% | 12.6% |

7 Review of mitigation options

Agriculture is cited as a significant pressure in all of the PAA waterbodies. The desktop assessment has demonstrated that phosphate and ammonium are persistent issues in all of the waterbody monitoring points where data is available. Table 6.1 provides a summary of potential agricultural measures for prevention for preventing phosphate and ammonium loss, broken down in pathway interception, mobilisation control and source control categories.

In areas of the catchment with a steeper gradient, coupled with high phosphate susceptibility, ASSAP should emphasise pathway interception and mobilisation control as the preferred diffuse P loss mitigation strategy. Farmyard issues, stream connectivity and drainage will also need to be targeted.

Source control measures will also be needed to tackle nitrate leaching from the well-drained sections of each sub-catchment. The areas in which these measures are targeted will be refined using the sub catchment/nutrient loading approach outlined in Section 6.

Table 7.1: Summary of potential agricultural measures for prevention of phosphate and ammonium loss.

| Pathway Interception | Source Control | Mobilisation Control |
|---|--|--|
| Management of Critical Source Areas (CSA's) | Informing and educating farmers | Avoid application at high-risk times |
| Riparian Buffers - Fenced/Unfenced | Implementation of Nutrient Management Plan | Avoid application at high-risk places (CSA's) |
| Infield grass buffers | Fertiliser Application limits | Adopt latest manure application techniques |
| Establish field boundaries & hedges | No P on index 4 | Precision application of nutrients at correct rate |
| Woodland planting | No P on sensitive (CSA's) areas | Change from slurry to solid manure |
| Suitable gateway location | Test peat soil for Organic Matter (OM) | Winter – plant cover or catch crops |
| Alleviate compacted areas in fields | Prudent P use on Peat soils | Prevent tramline rutting and compaction |
| Improved farm road/tracks design and location | Precision application of nutrients at correct rate | Adopt spring cultivation |
| Establish/preserve wetlands | Nutrient mining | Appropriate re-seeding management |
| Constructed Wetlands | Liming | Crop type |
| Run off attenuation features | Precision placement of fertilisers | Adopt min till |
| Ditch/drain maintenance and management | Use of straight fertilisers | Adopt contour ploughing |

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| Pathway Interception | Source Control | Mobilisation Control |
|---|---|--|
| Ditch/drain blocking | Calibrated spreading equipment | Leave rough seedbeds |
| Attenuate drainage stone filled (to surface) field drains | Change to feed/diet | Maintain/improve soil structure |
| Allow grassed waterways and vegetated ditches | Reduce Stocking Rate (SR) | Use of amendments |
| Allow field drainage system to deteriorate | Destock/reduce stock for Winter | Appropriate use of feeders/troughs/out-wintering |
| Reduced field drainage and backfill amendment | Intensification (land use conversion from tillage) | Prevent livestock access to waters |
| Intake wells on subsurface drains | Improved management of collection and storage of farm wastes | Improved farm road/tracks design and location |
| Farm Drainage Plans | Additional storage for farm wastes required | |
| Large woody debris for detention ponds | Separation of clean, grey, soiled and dirty water in farmyard | |
| Offline bunds/in stream diversion structures | Soil management plan | |
| Prevent livestock access to waters | | |

8 Communications

8.1 Community information meeting

On the 9th of September 2020, we held a community information meeting (via Zoom) to tell the public about our work and to hear about water quality concerns from people living in the area. The attendees raised concerns about water quality and shared the concern of LAWPRO that the river was not as good as it could be. Number of attendees excluding LAWPRO and ASSAP representatives:12

8.2 ASSAP Agricultural meeting

Agricultural Sustainability Support and Advice advisors from Teagasc and the Dairy Co-Ops will hold an information meeting for farmers within the PAA in late 2021. During this meeting, the advisors will give details of the supports available for farmers in this catchment.

Appendix

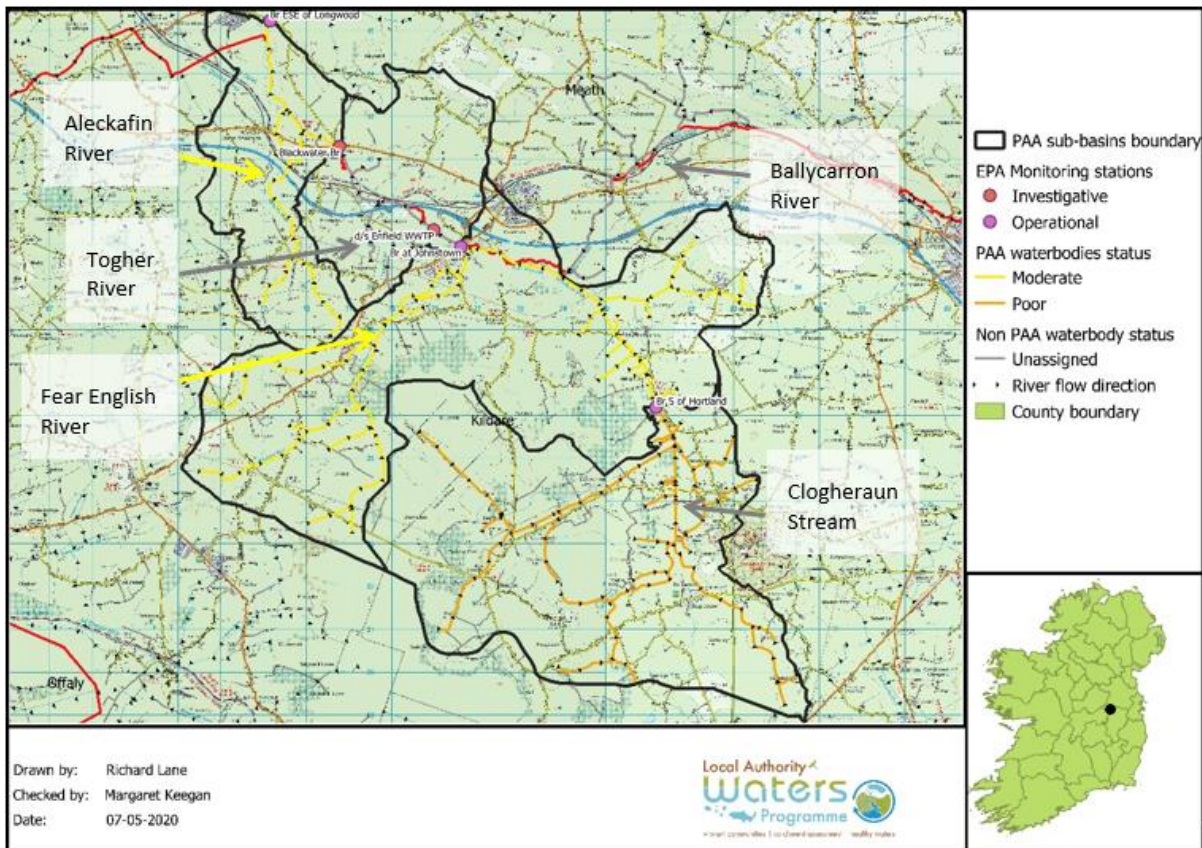


Figure 1: Map showing sub-basin boundaries, EPA monitoring stations, non-PAA inputting waterbodies and river flow direction for Blackwater (Longwood) PAA.

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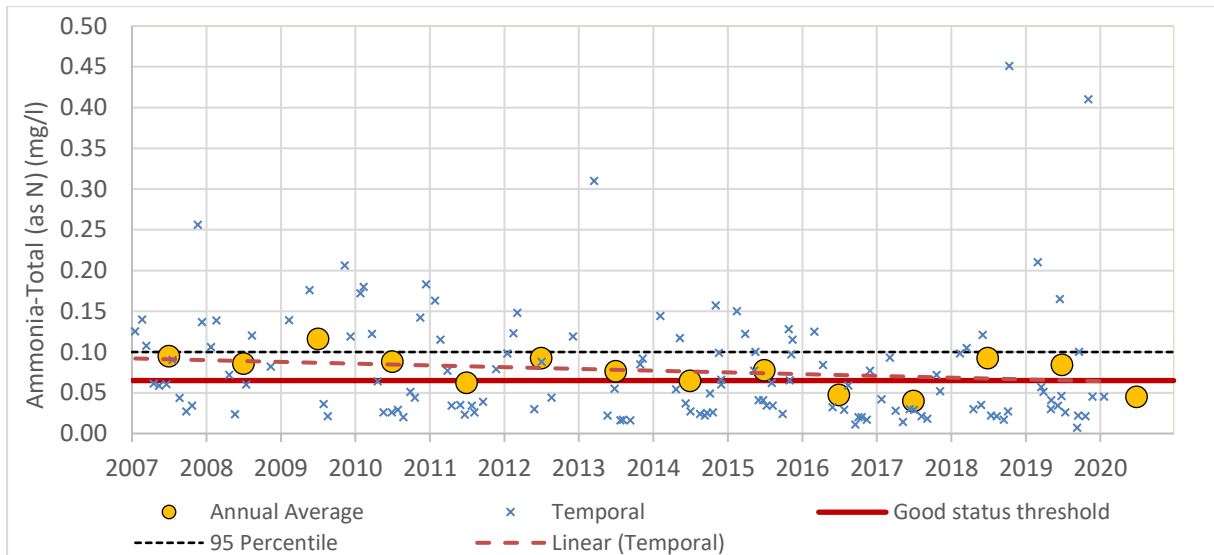


Figure 2: Annual averages, temporal concentrations and trend for ammonium for Br at Johnstown.

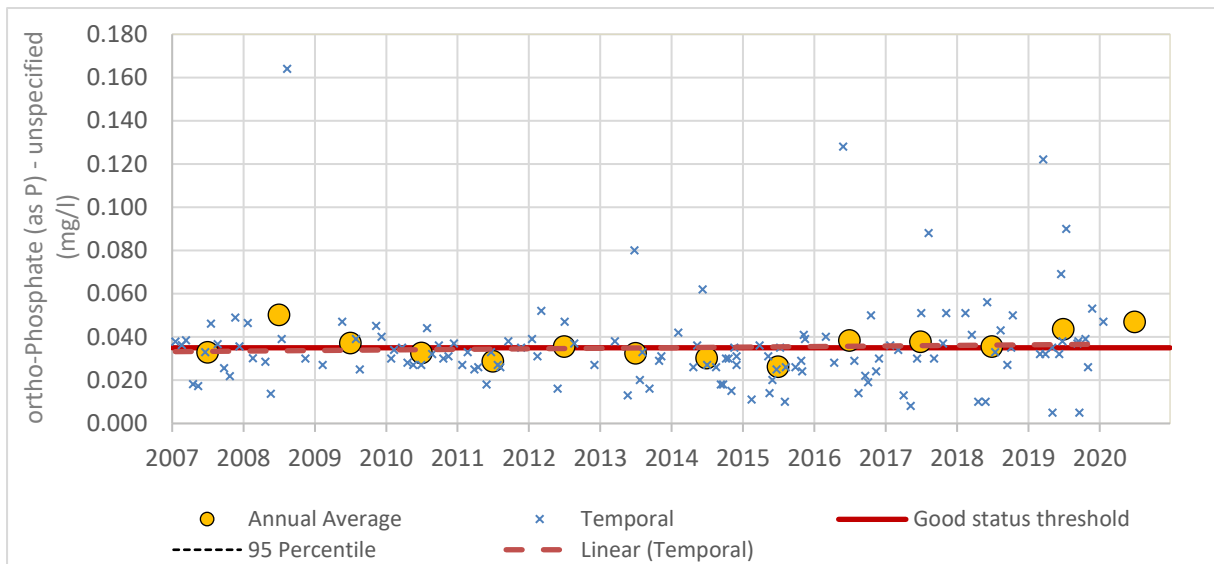


Figure 3: Annual averages, temporal concentrations and trend for orthophosphate at Br at Johnstown.

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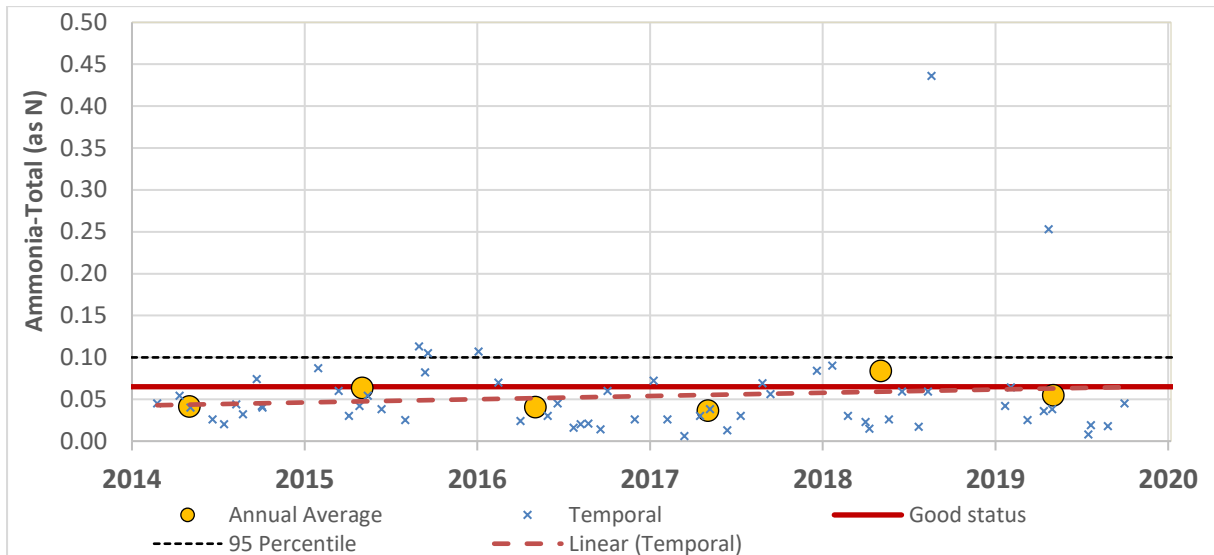


Figure 4: Annual averages, temporal concentrations and trend for ammonium at monitoring station d/s Enfield WWTP.

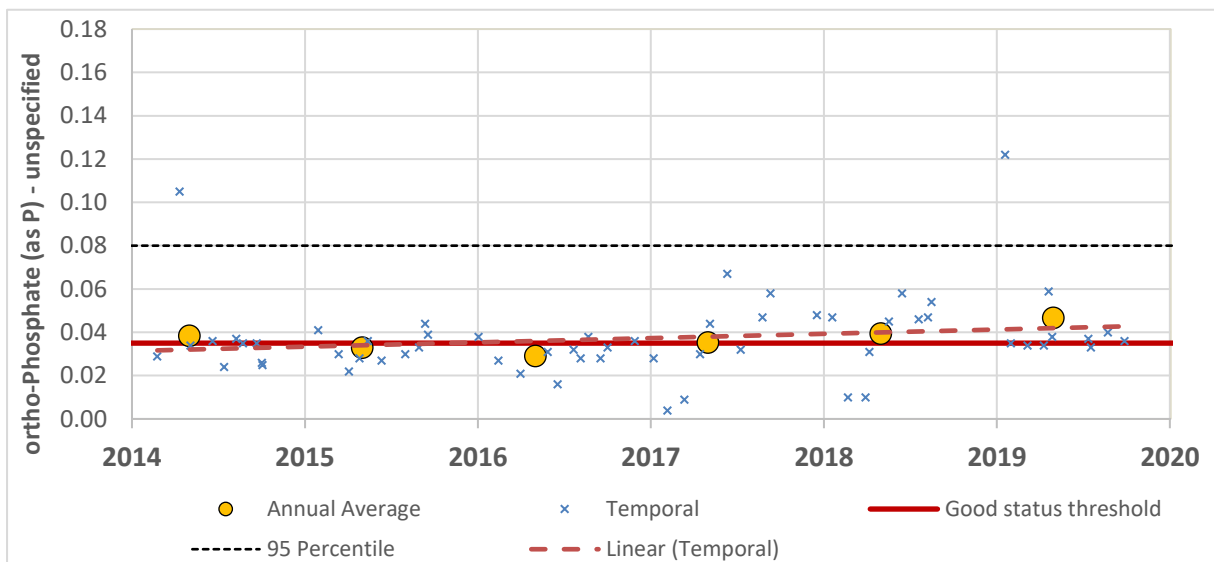


Figure 5: Annual averages, temporal concentrations and trend for orthophosphate at monitoring station d/s Enfield WWTP.

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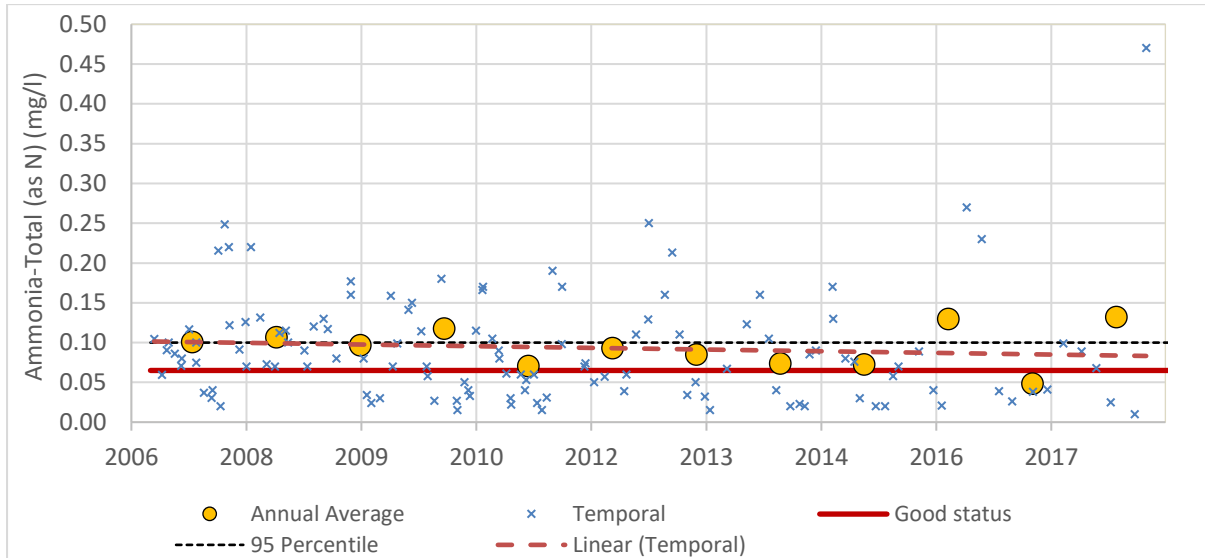


Figure 6: Annual averages, temporal concentrations and trend for ammonium at Blackwater Br.

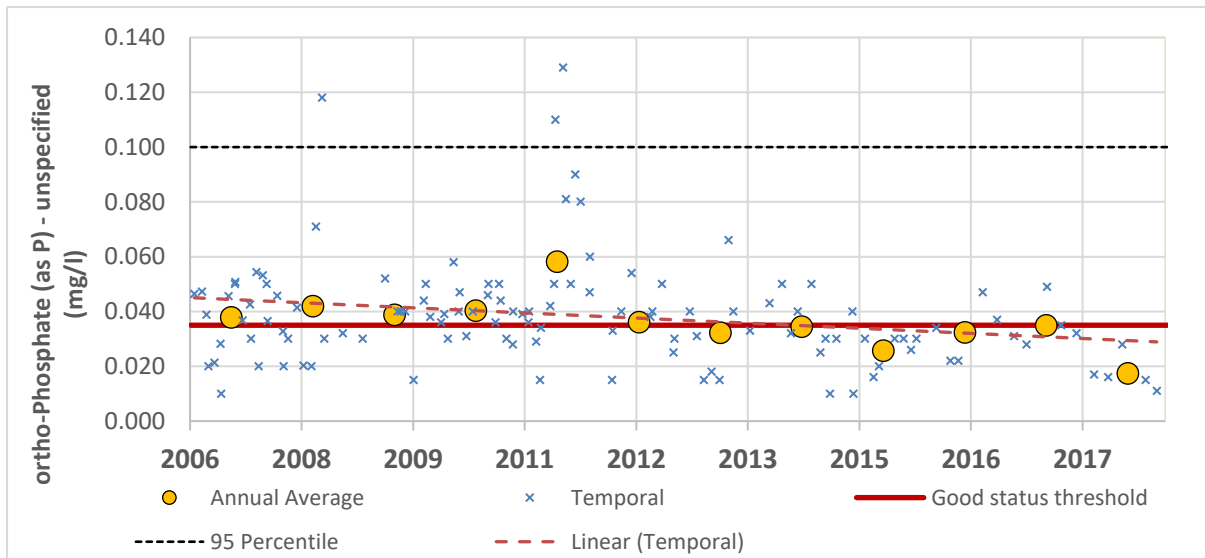


Figure 7: Annual averages, temporal concentrations and trend for orthophosphate at Blackwater Br.

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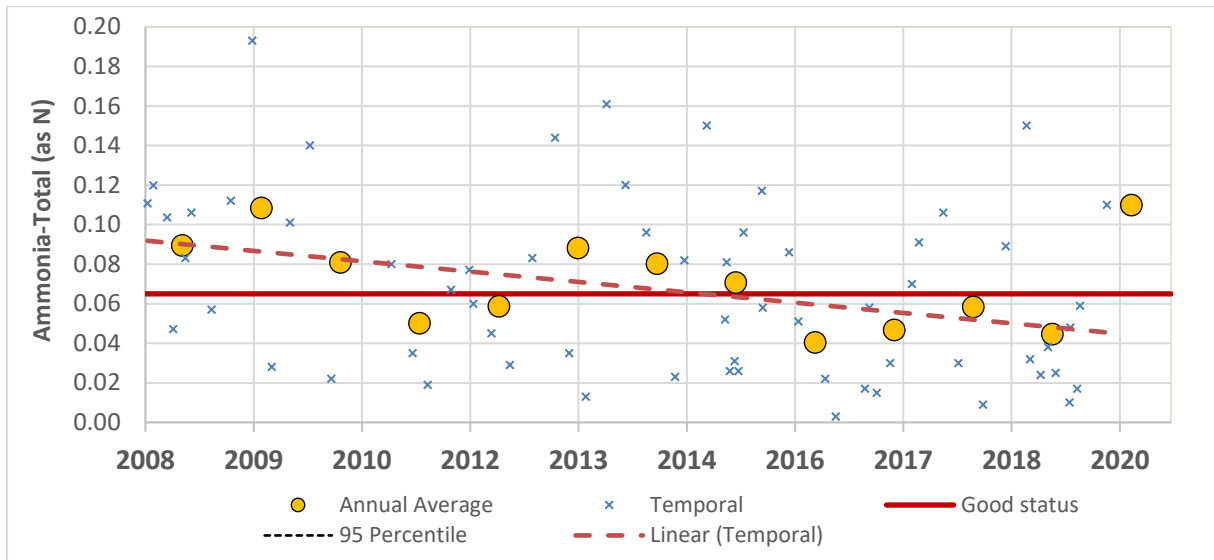


Figure 8: Annual averages, temporal concentrations and trend for ammonium at monitoring station Br ESE of Longwood.

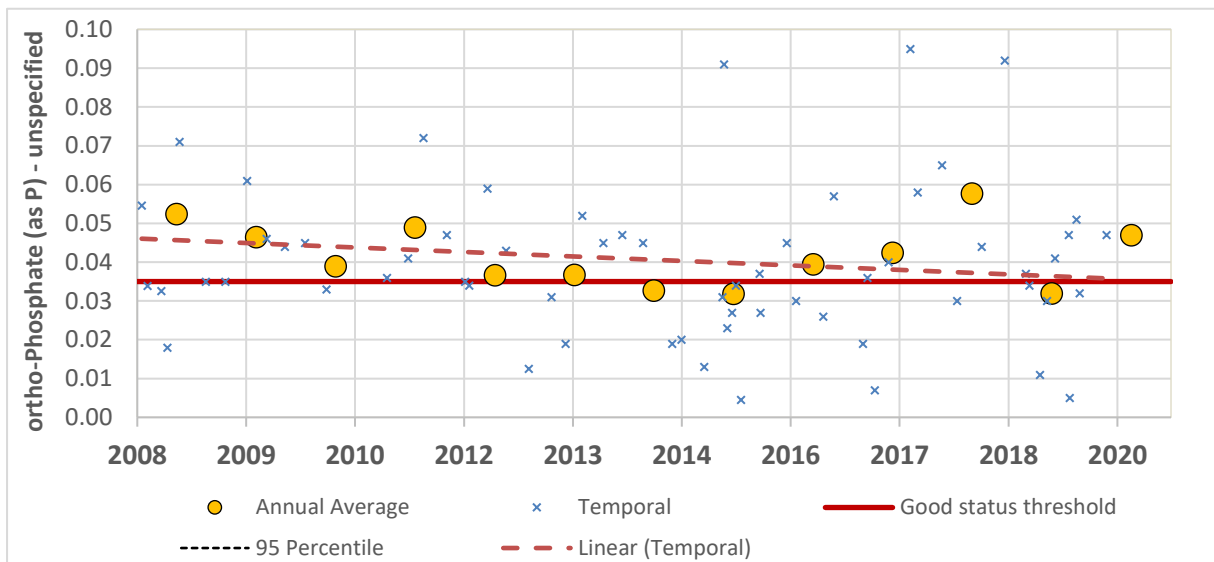


Figure 9: Annual averages, temporal concentrations and trend for orthophosphate at monitoring station Br ESE of Longwood.

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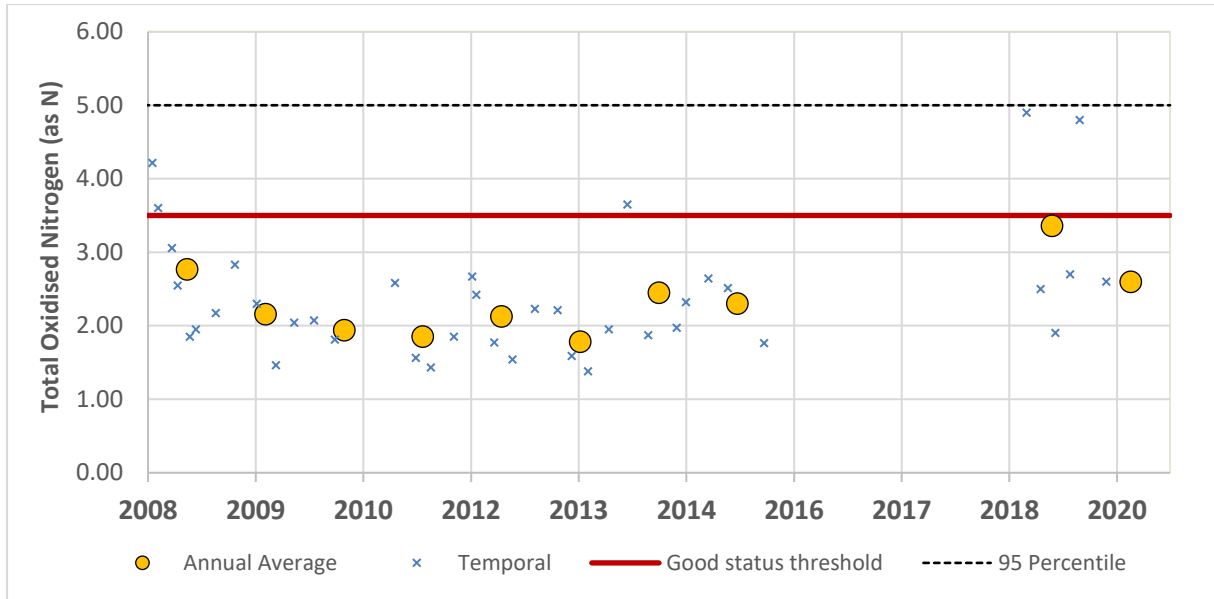


Figure 10: Annual averages, temporal concentrations and trend for total oxidised nitrogen (as N) at monitoring station Br ESE of Longwood.

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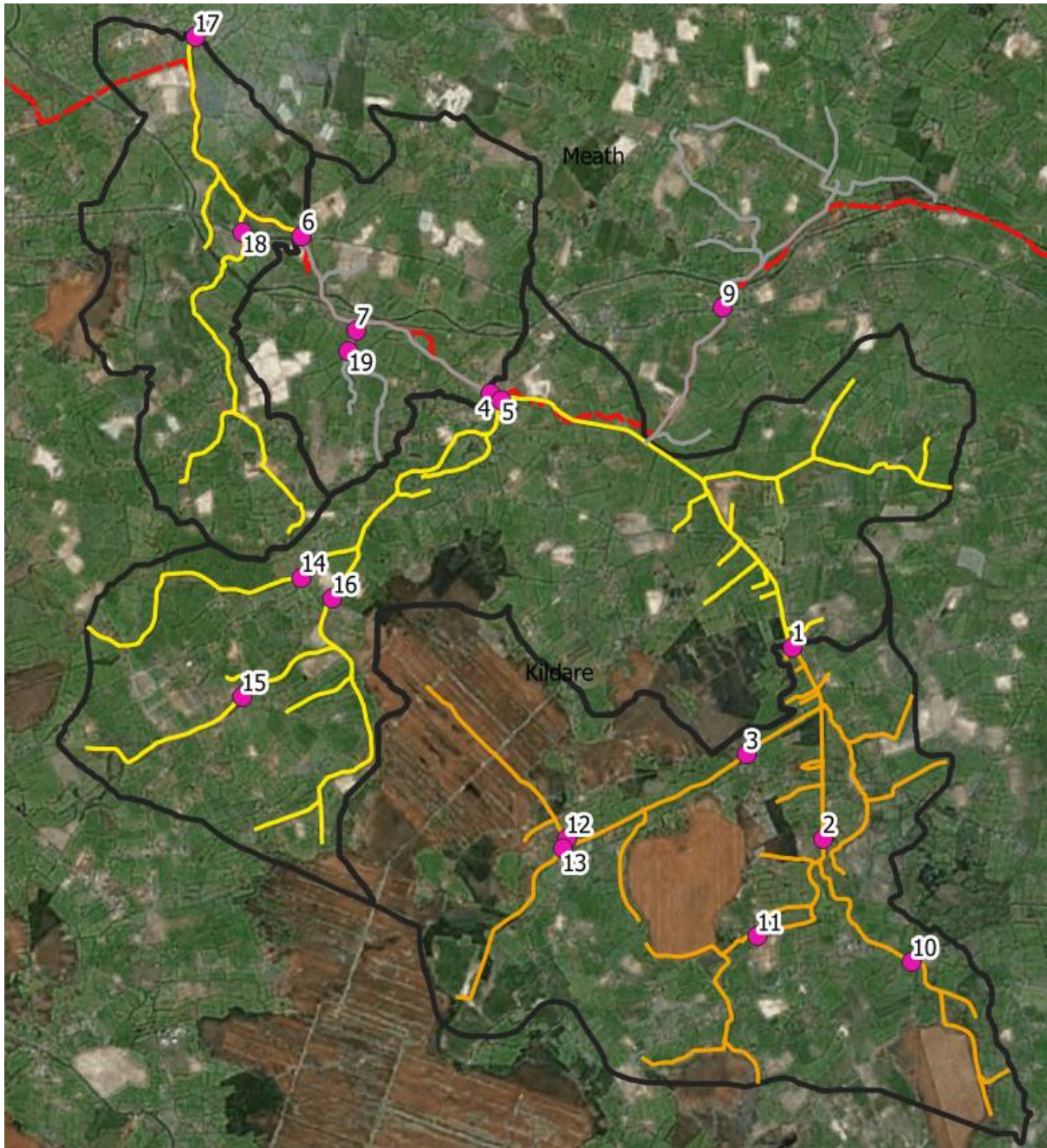


Figure 11: Locations for the hydrochemistry sampling round for May 2020.

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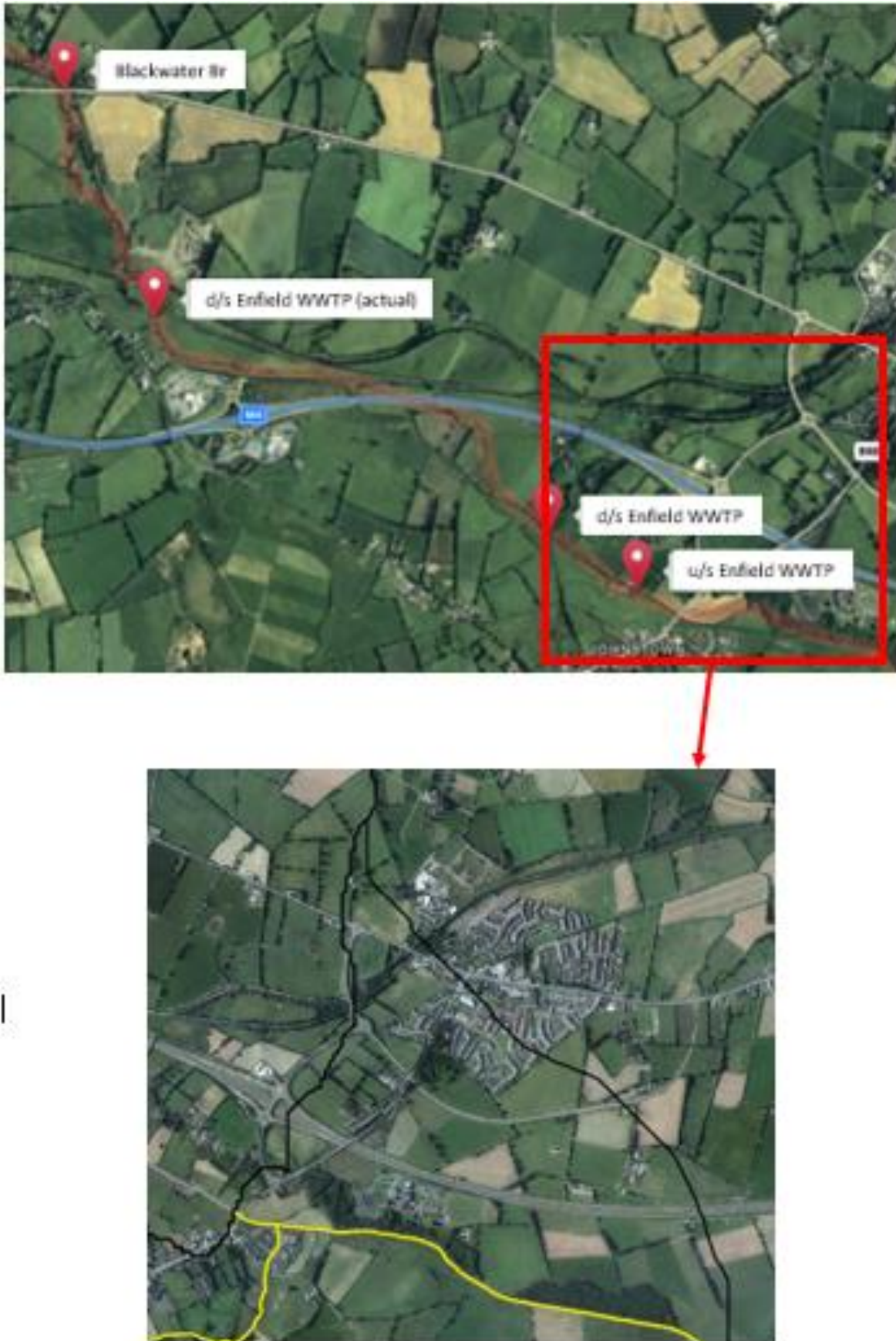


Figure 12: Locations of monitoring locations u/s Enfield WWTP, d/s Enfield WWTP, d/s Enfield WWTP (actual) and Blackwater Bridge.

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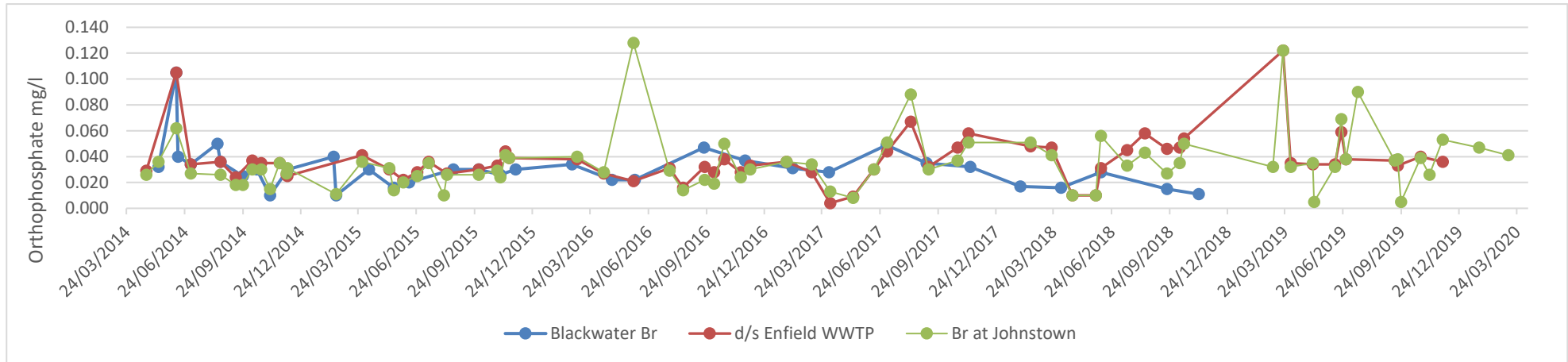


Figure 13: Time series for ortho-phosphate concentration for the monitoring stations in Blackwater (Longwood)_030.

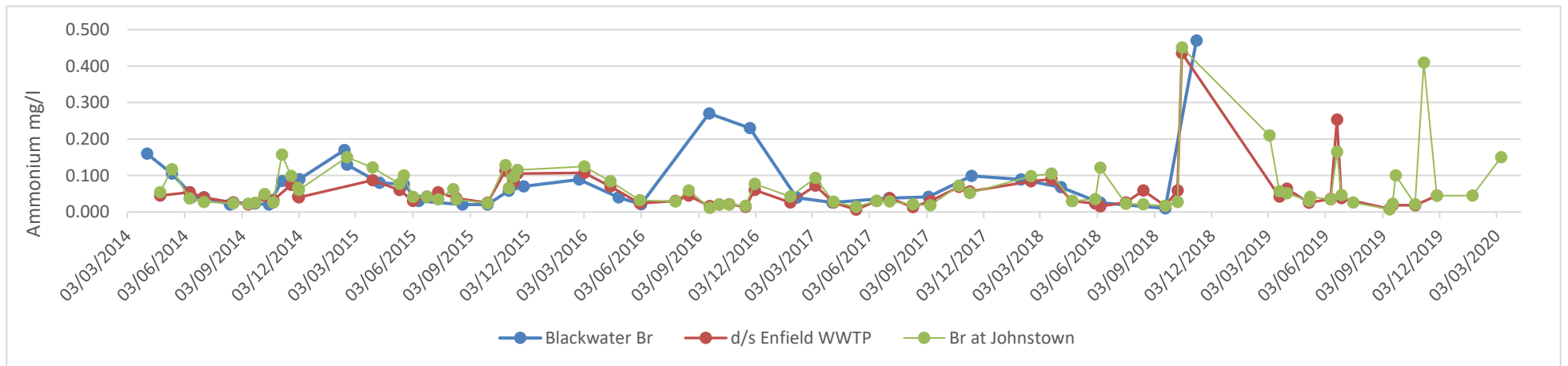


Figure 14: Time series for ammonium concentration for the monitoring stations in Blackwater (Longwood)_030.

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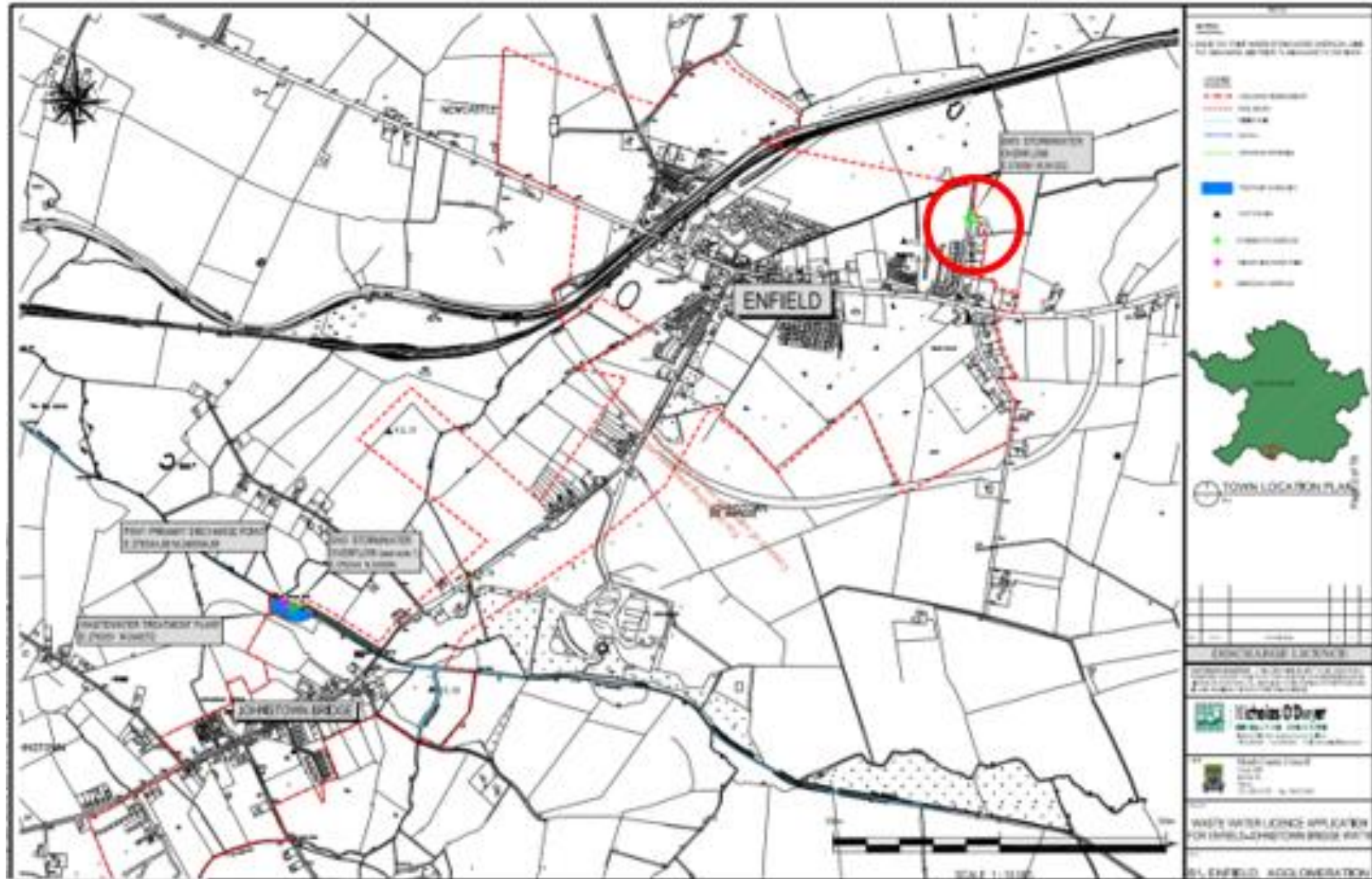


Figure 15: Map of Enfield and Johnstown WWT system (Source: EPA, Wastewater licence application for WWTW).

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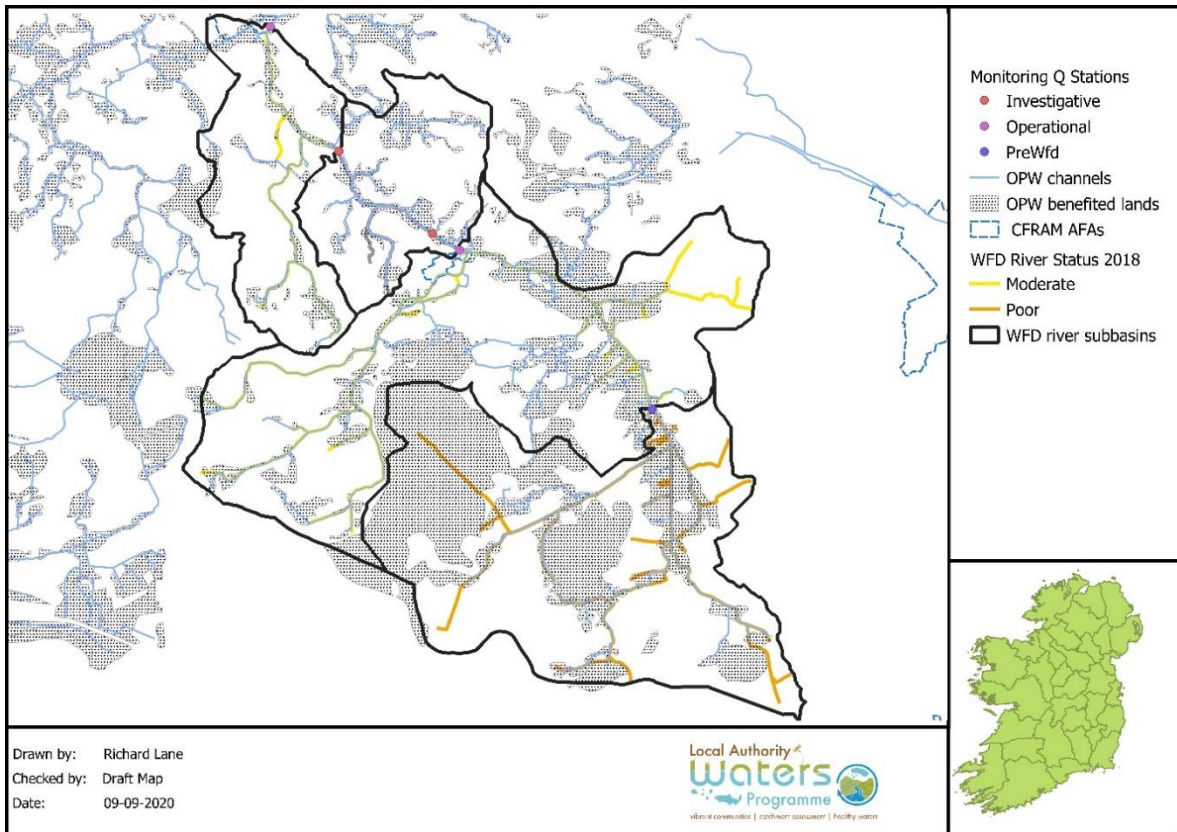


Figure 16: OPW maintained channels/ benefited lands and CFRAM AfAs.

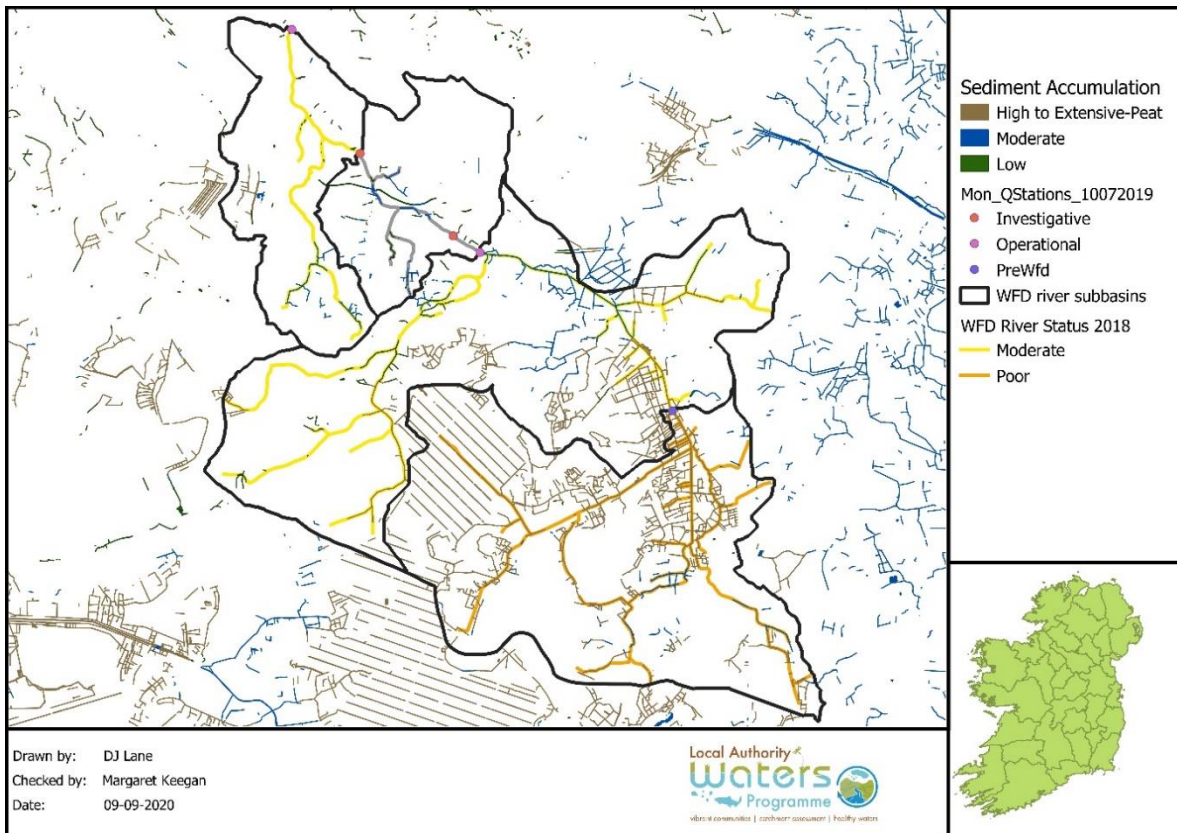


Figure 17: Natural sediment accumulation map for the Blackwater (Longwood) PAA.

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Figure 18:

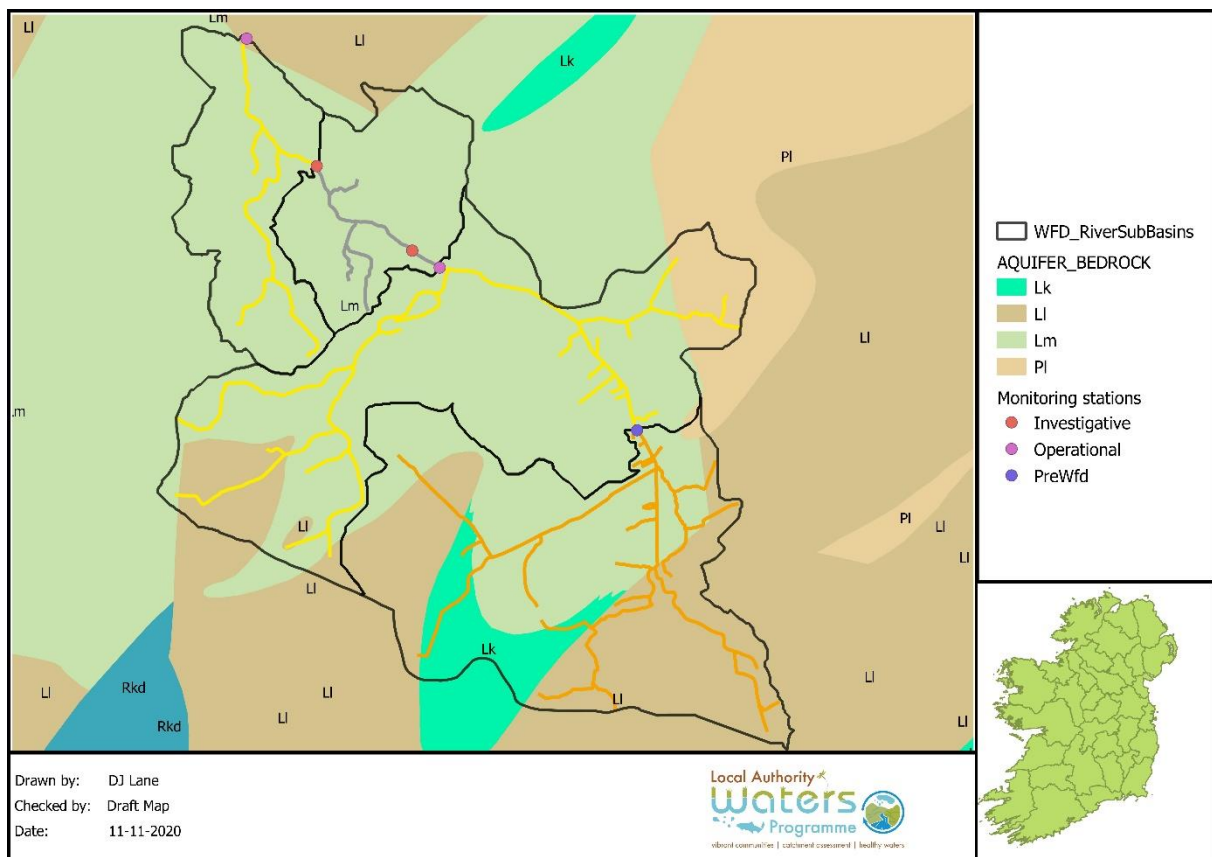


Figure 19: Aquifer map for Blackwater (Longwood) PAA.

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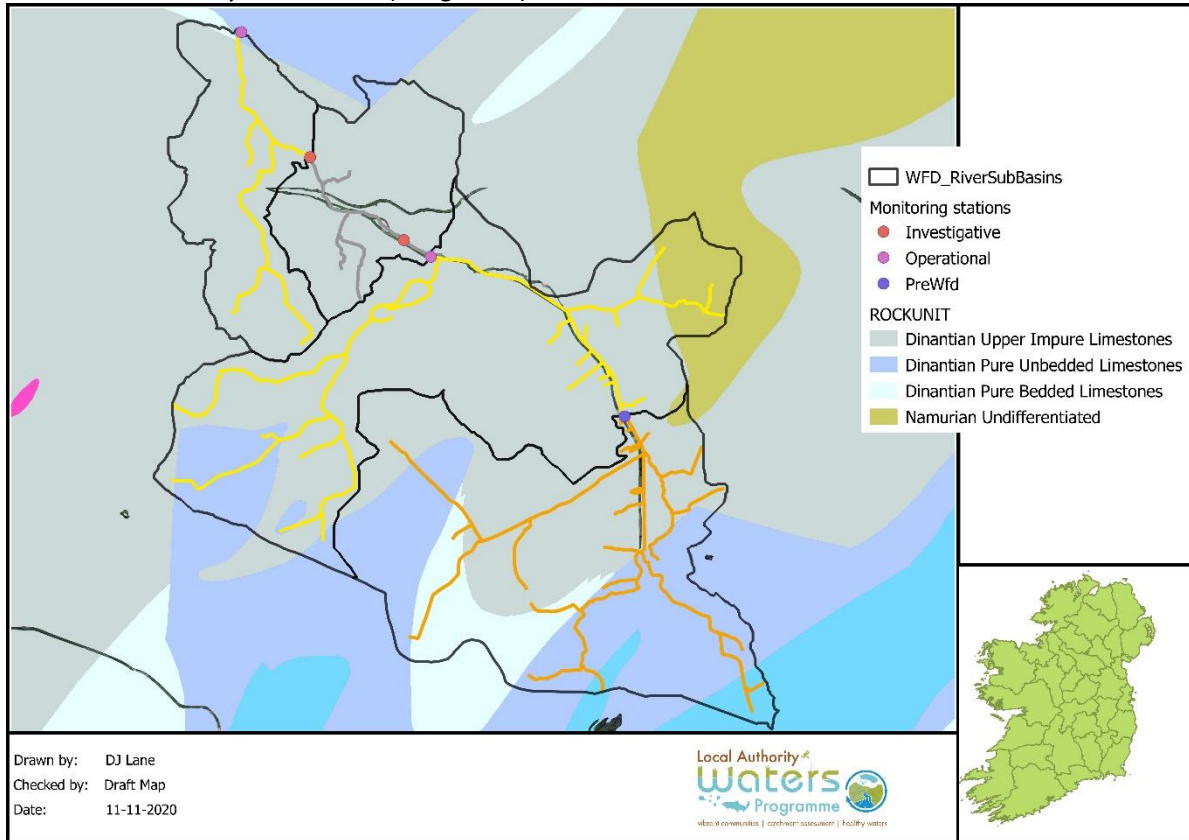


Figure 20: Bedrock map for Blackwater (Longwood) PAA.

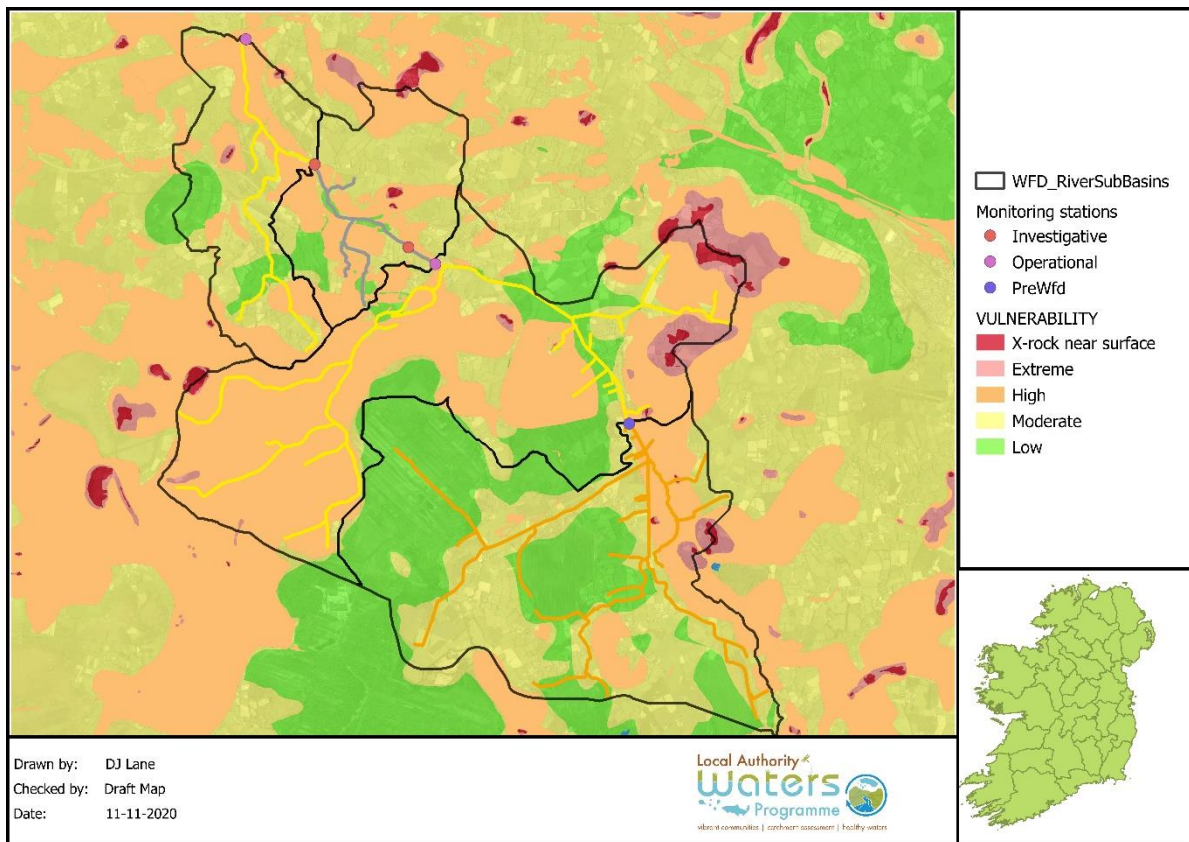


Figure 21: Groundwater vulnerability map for Blackwater (Longwood) PAA.

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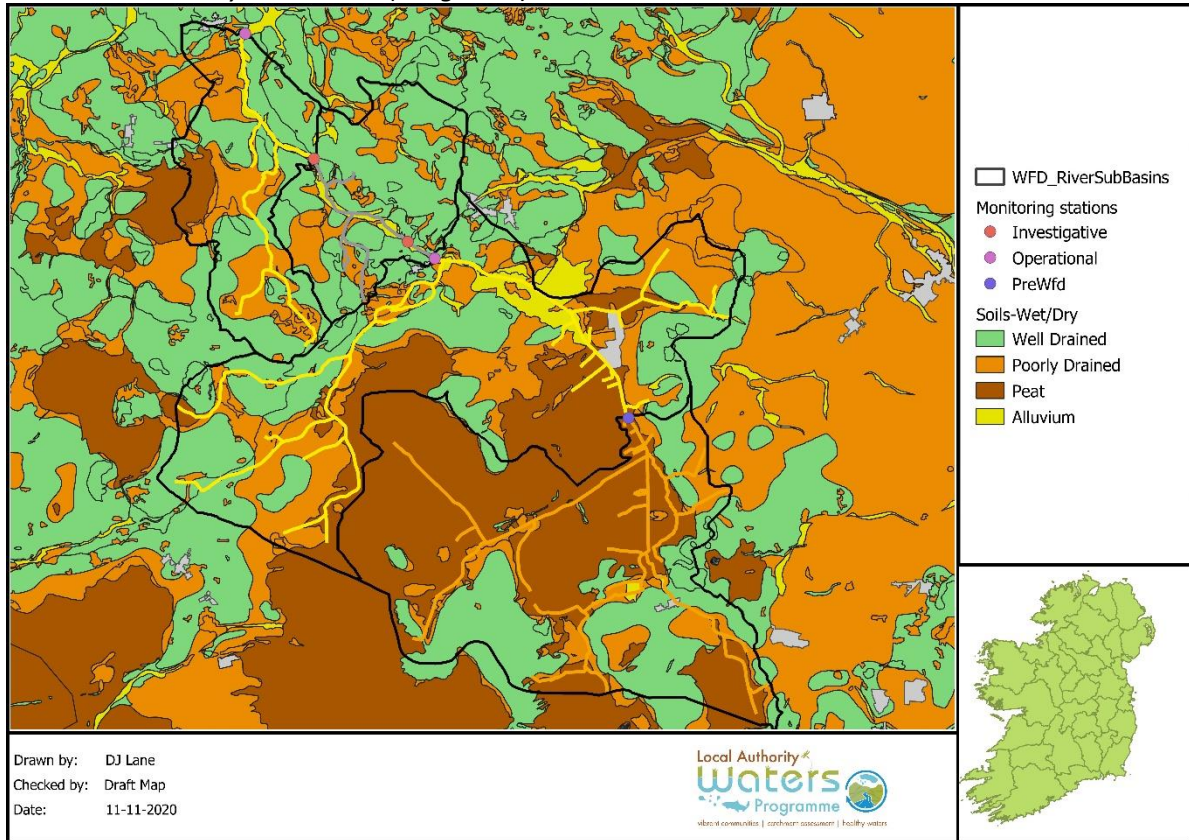


Figure 22: Soil drainage map for Blackwater (Longwood) PAA.

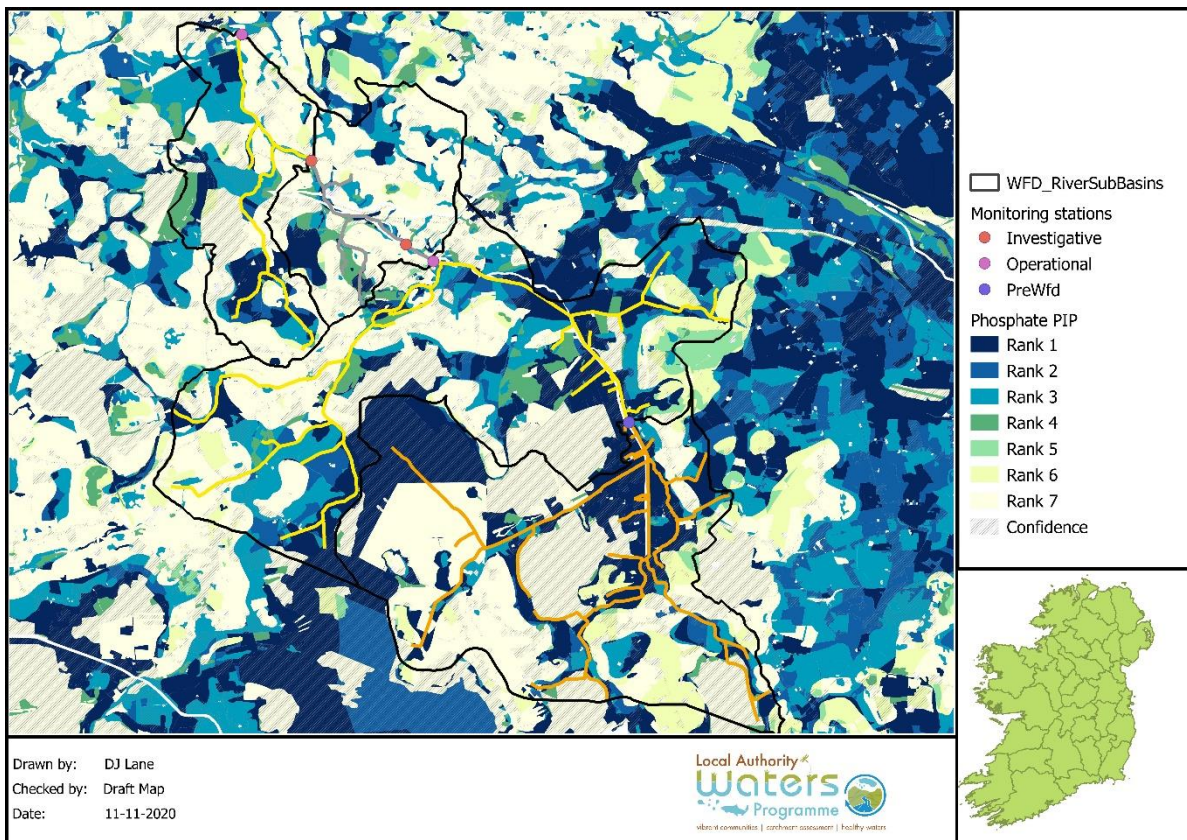


Figure 23: Phosphate Pollution Impact Potential map for Blackwater (Longwood) PAA.

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Table 2: Estimation of the phosphate load reduction required in kg/ha/yr in the Blackwater

(Longwood) PAA waterbodies

| | Units | Blackwater (Longwood) _010 | Blackwater (Longwood) _020 | Blackwater (Longwood) _030 | Blackwater (Longwood) _040 |
|-------------------------|----------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Flow | l/s | 700 | 1975 | 2018 | 2328 |
| P conc | mg/l | 0.039 | 0.039 | 0.041 | 0.044 |
| P load | kg/yr | 861 | 2429 | 2609 | 3230 |
| EQS | mg/l | 0.03 | 0.03 | 0.03 | 0.03 |
| Required load reduction | kg/yr | -199 | -561 | -700 | -1028 |
| Catchment area | ha | 5130 | 10340 | 13800 | 16000 |
| Target P reduction | kg/ha/yr | -0.04 | -0.05 | -0.05 | -0.06 |