Upper Shannon (Boyle) Catchment Assessment 2010-2015 (HA26B)

Catchment Science & Management Unit

Environmental Protection Agency

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Preface

This document provides a summary of the characterisation outcomes for the water resources of the Upper Shannon (Boyle) Catchment, which have been compiled and assessed by the EPA, with the assistance of local authorities and RPS consultants. The information presented includes status and risk categories of all water bodies, details on protected areas, significant issues, significant pressures, load reduction assessments, recommendations on future investigative assessments, areas for actions and environmental objectives. The characterisation assessments are based on information available to the end of 2015. Additional, more detailed characterisation information is available to public bodies on the EPA WFD Application via the EDEN portal, and more widely on the catchments.ie website. The purpose of this document is to provide an overview of the situation in the catchment and help inform further action and analysis of appropriate measures and management strategies.

This document is supported by, and can be read in conjunction with, a series of other documents which provide explanations of the elements it contains:

1. An explanatory document setting out the full characterisation process, including water body, subcatchment and catchment characterisation.
2. The Final River Basin Management Plan, which can be accessed on: www.catchments.ie.
3. A published paper on Source Load Apportionment Modelling, which can be accessed at: http://www.jstor.org/stable/10.3318/bioe.2016.22
4. A published paper on the role of pathways in transferring nutrients to streams and the relevance to water quality management strategies, which can be accessed at: http://www.jstor.org/stable/pdf/10.3318/bioe.2016.19.pdf
5. An article on Investigative Assessments which can be accessed at: https://www.catchments.ie/download/catchments-newsletter-sharing-science-stories-june-2016/

Table of contents

1 Introduction

This catchment covers an area of 674km². It is characterised by uplands (the highest of which are the Curlew Mountains) running along the northern catchment boundary, which is comprised mainly of red sandstone, and a lowland area in the southern part of the catchment, which is underlain by limestones, some of which are karstified.

The Anaderryboy River follows a sinuous route eastward from its source area northeast of Ballyhaunis. It is joined by the Lissydaly Stream before continuing to the northeast until it becomes known as the Lung River south of Ballaghaderreen. The Lung continues past Ballaghaderreen being joined by numerous tributaries before it flows into Lough Gara, where it is joined by the Breedoge River from the south.

The Breedoge drains the area from Bellanagare, Frenchpark and Elphin to Lough Gara. At the north-eastern end of Lough Gara the Boyle River flows from the north of the Plains of Boyle, a karstified area where little surface drainage exists. The karst drainage from this area makes its way to the Boyle and Shannon Rivers underground and discharges via a number of springs. The Boyle River continues east and into Lough Key, leaving the lough at Knockvicar and heading southeast through Oakport Lough and Lough Eidin, where it meets the River Shannon. An arterial drainage scheme was completed on the Boyle River by the OPW between 1982 and 1992.

The Upper Shannon (Boyle) catchment comprises six subcatchments (Table 1, Figure1) with 28 river and 15 lake water bodies, and eight groundwater bodies.

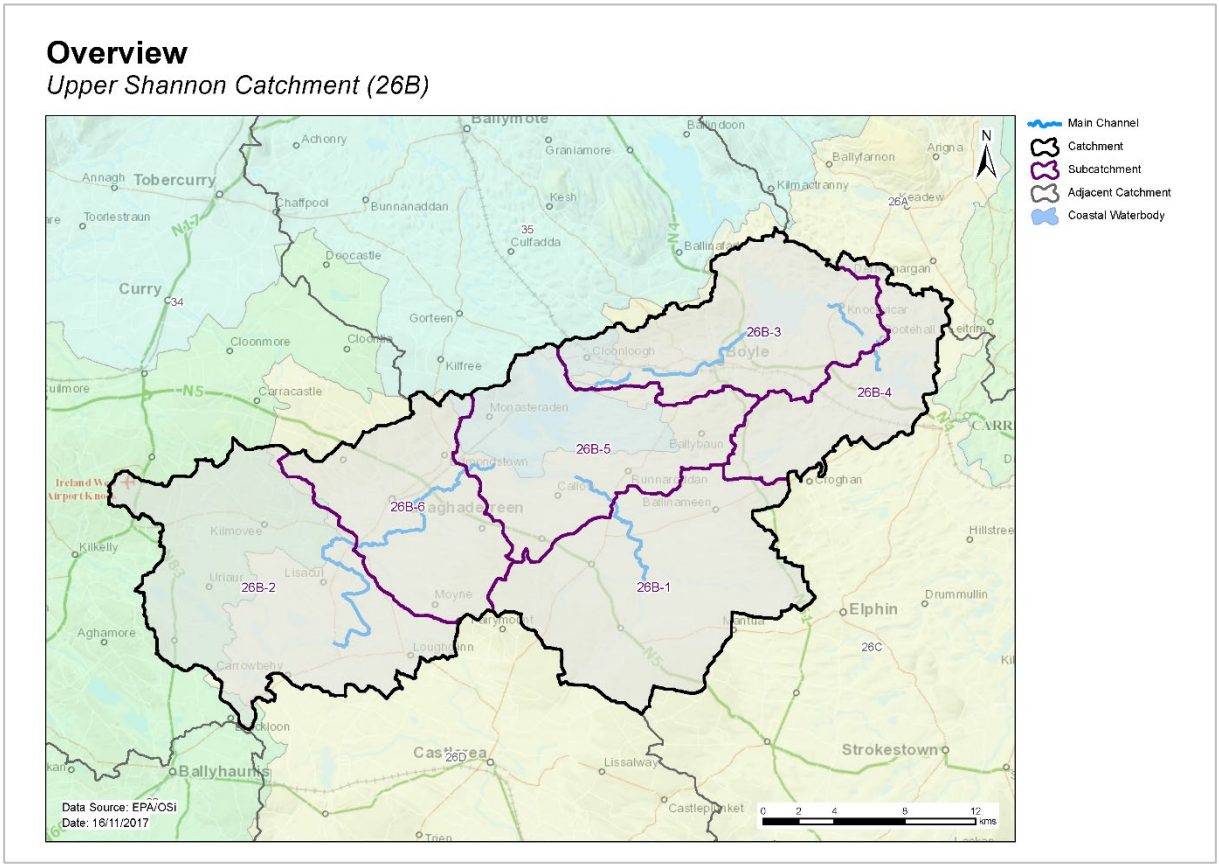


Figure 1. Subcatchments in the Upper Shannon (Boyle) catchment

Table 1. List of subcatchments in the Upper Shannon (Boyle) catchment

Subcatchment ID	Subcatchment Name
26B_1	Breedoge_SC_010
26B_2	Lung_SC_010
26B_3	Boyle_SC_020
26B_4	Boyle_SC_030
26B_5	Boyle_SC_010
26B_6	Lung_SC_020

2 Water body status and risk of not meeting environmental objectives

2.1 Surface water ecological status

2.1.1 Rivers and lakes

- There were 11 (26%) rivers and lake water bodies at Good or High status, and 12 (28%) at less than Good status in 2015 (Table 2, Figure 2). Twenty (47%) river and lake water bodies are Unassigned.
- One river water body (Lung_040; IE_SH_26L030350) has a high status environmental objective. In 2015, this water body was at High status (Figure 3; Appendix 1).
- The numbers of water bodies at each status class in 2007-09 and 2010-15 are shown in Figures 4 (rivers) and 5 (lakes).
- One water body has improved in status and seven have deteriorated since 2007-09 (Figure 6).
- The variation in nutrient concentrations and loads in the Shannon Upper and Lower, and in the Lung and Boyle main channels is illustrated in Appendix 2.

Table 2. Summary of water body status and risk results for rivers and lakes

	Number of water bodies	2010-15 Status						Risk Categories		
		High	Good	Mod	Poor	Bad	Unassigned	*Not at Risk*	*Review*	*At Risk*
Rivers	28	1	10	4	3	0	10	12	9	7
Lakes	15	0	0	4	0	1	10	1	9	5

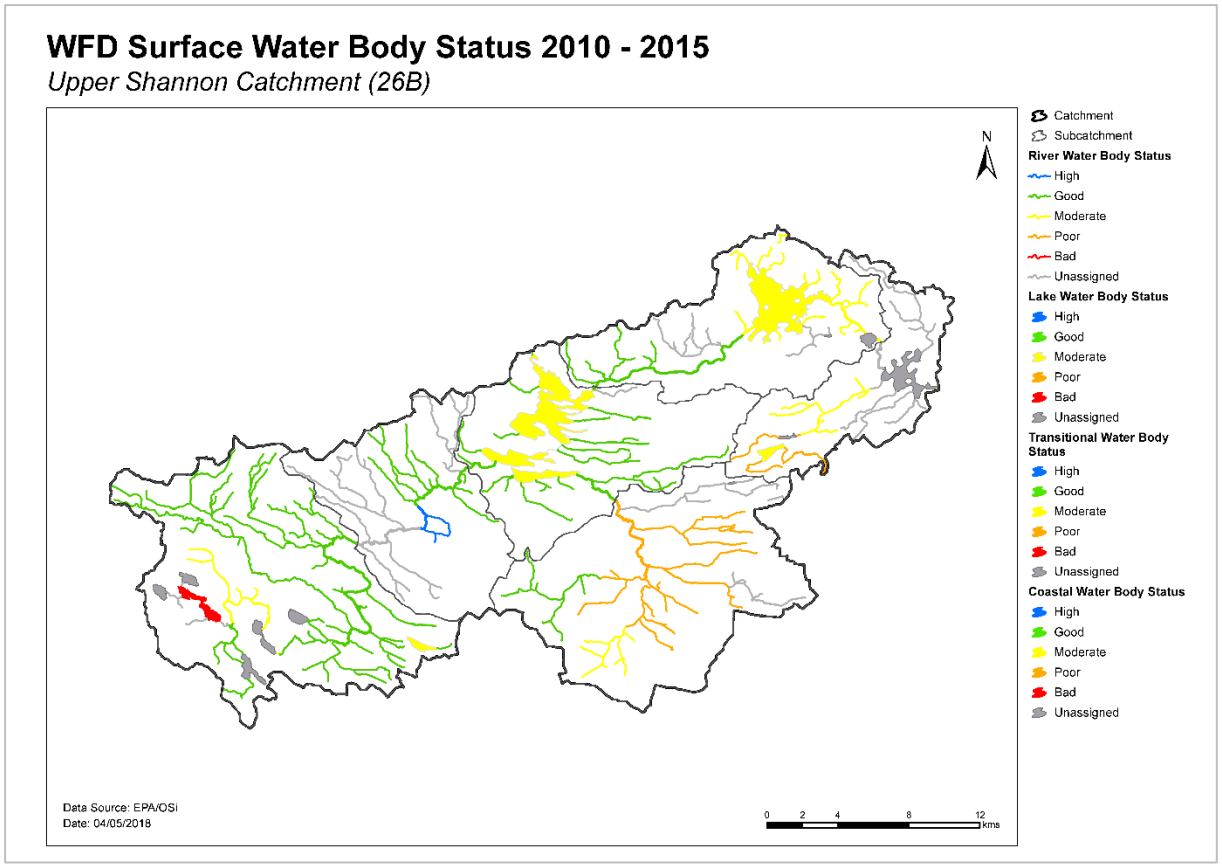


Figure 2 Surface water ecological status

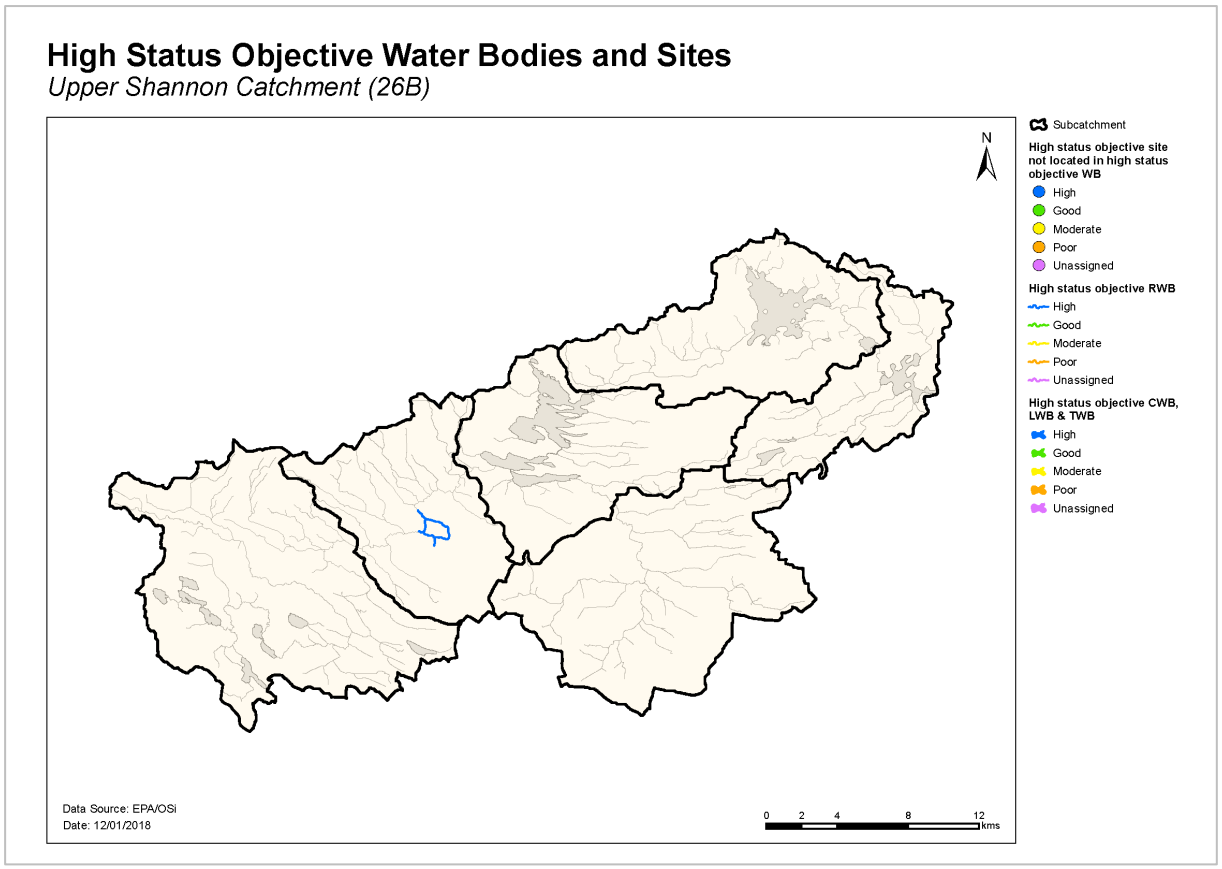


Figure 3. High ecological status objective water bodies and sites

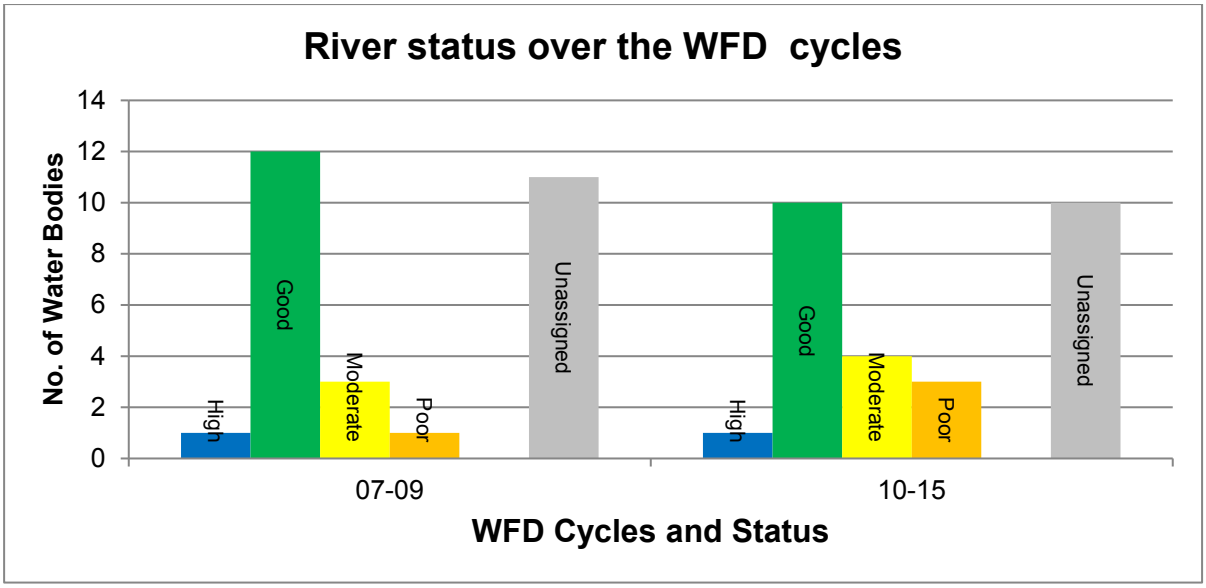


Figure 4. Number of rivers at each status class in 2007-09 and 2010-15

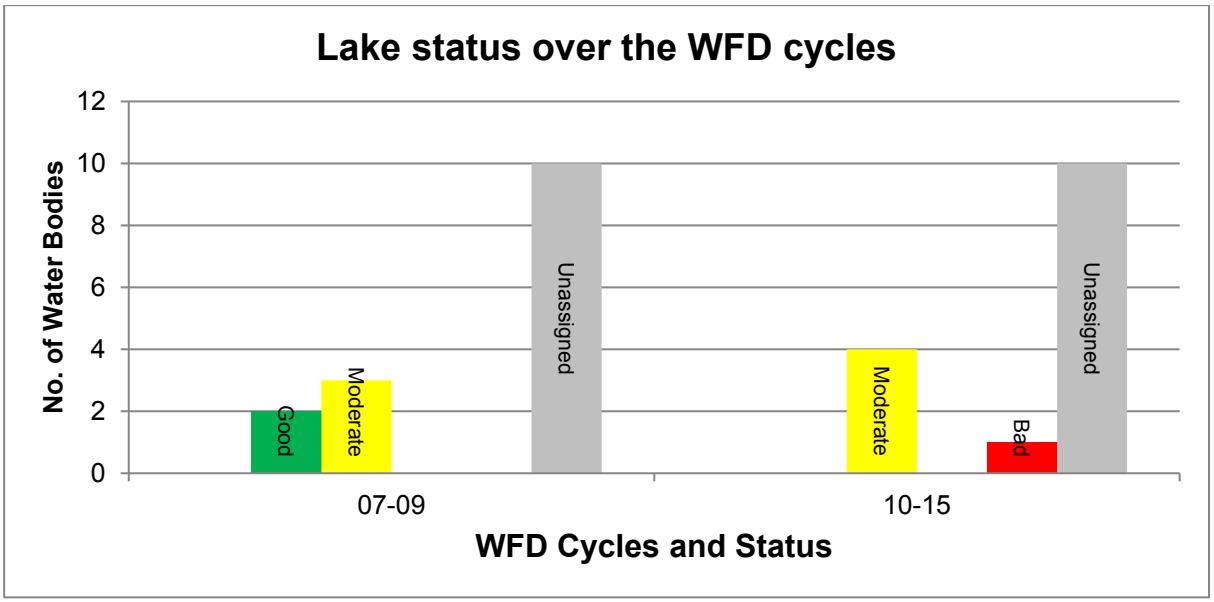


Figure 5. Number of lakes at each status class in 2007-09 and 2010-15

2.2 Groundwater status

- All eight groundwater bodies were at Good status in 2015 (Table 3).

Table 3. Summary of water body status and risk for ground waters

	Number of water bodies	2010-15 Status		Risk Categories		
		Good	Poor	*Not at Risk*	*Review*	*At Risk*
Groundwater	8	8	0	5	2	1

2.3 Risk of not meeting surface water environmental objectives

2.3.1 Rivers and lakes

- There are 12 *Not at Risk* river water bodies and one lake water body (Figure 7, Table 2) which require no additional investigative assessment or measures to be applied, other than those measures that are already in place.
- There are nine river and nine lake water bodies in *Review*. This applies to 15 water bodies where more information is required and three water bodies where measures have recently been implemented and improvements have not yet been realised.
- Seven river water bodies and five lake water bodies in the catchment are *At Risk* of not meeting their water quality objectives. Measures will be needed in these water bodies to improve the water quality outcomes. Summary information for the *At Risk* water bodies is given in Appendix 3.

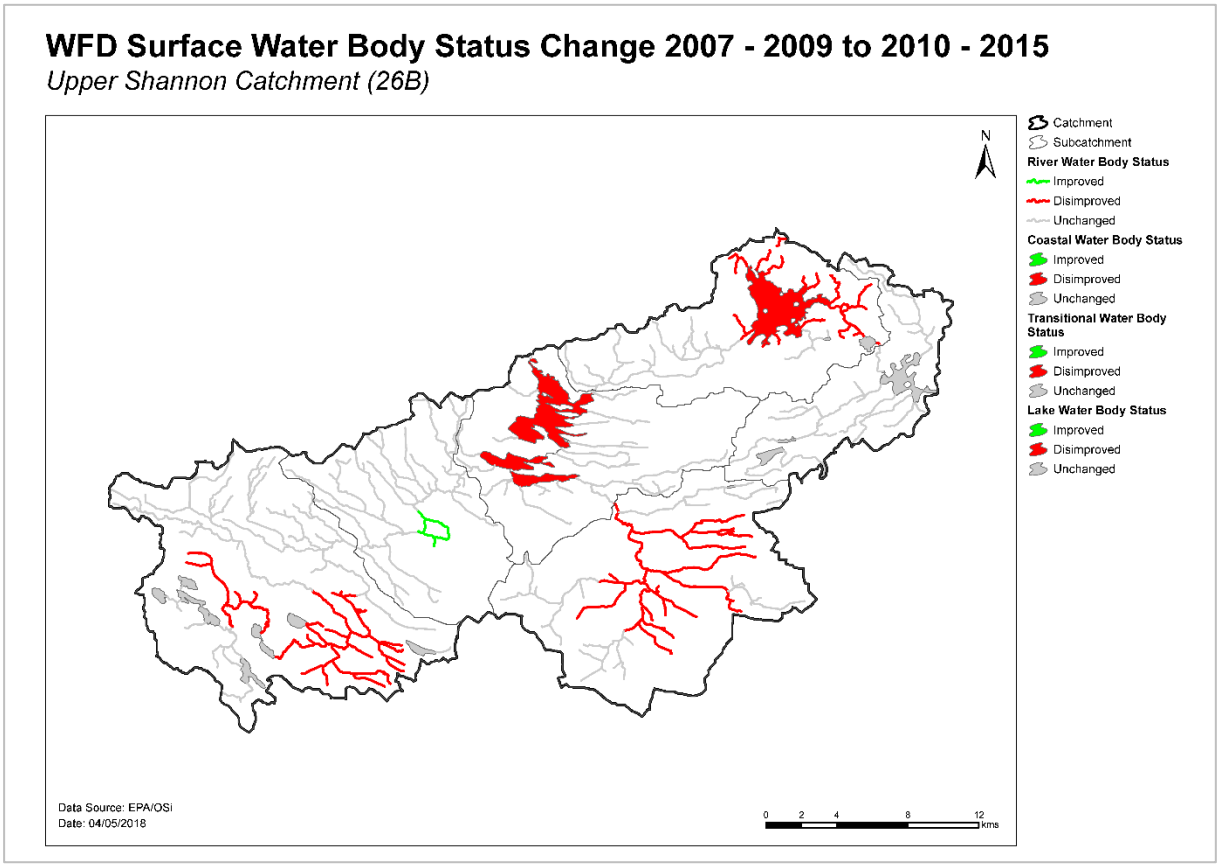


Figure 6. Surface water body status changes from 2007-09 to 2010-15

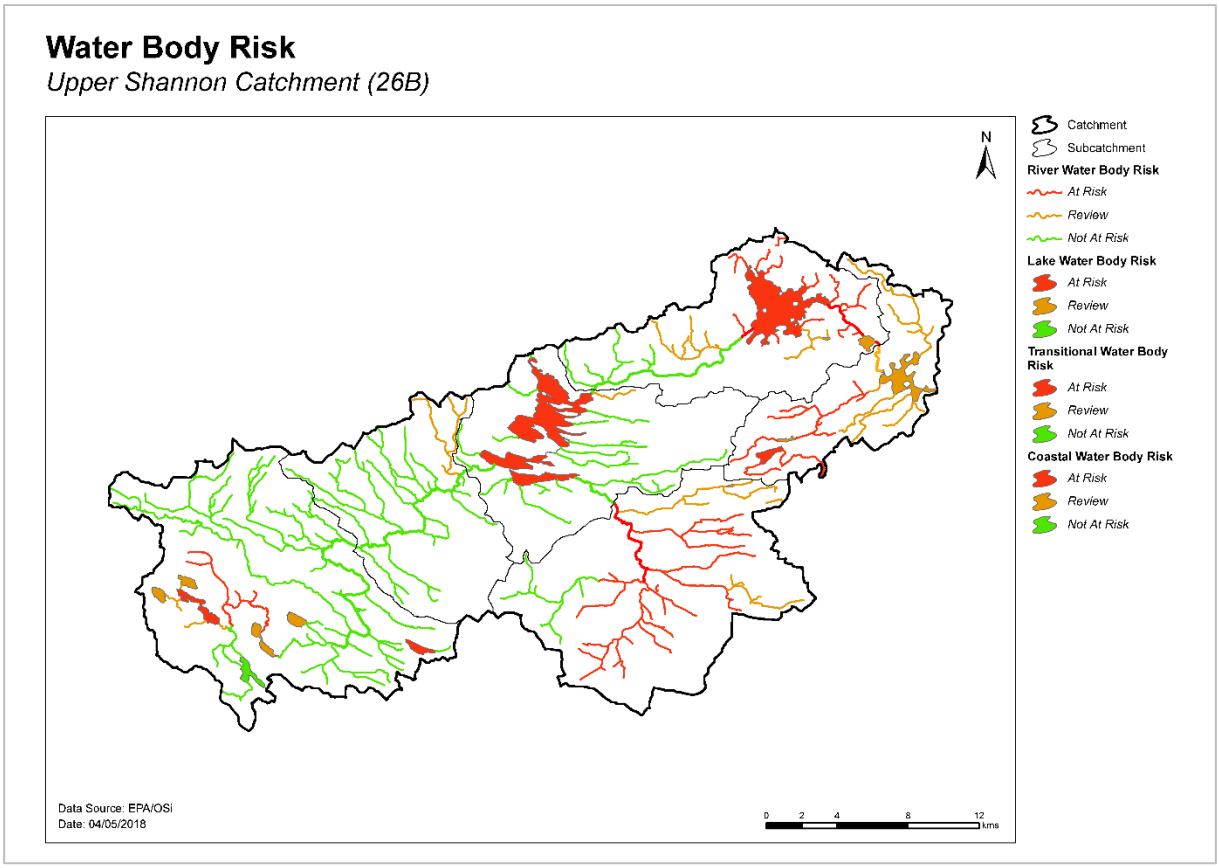


Figure 7. Surface water body risk

2.4 Risk of not meeting groundwater environmental objectives

- Five groundwater bodies are *Not at Risk* (Figure 8, Table 3) and require no additional investigative assessment or measures to be applied, other than those measures that are already in place.
- Two groundwater bodies are in *Review* (Figure 8) because they are hydrologically linked to surface waters that are not meeting water quality objectives where it is considered likely that groundwater is a contributing source of phosphorus (Table 4).
- One groundwater body is *At Risk* Carrick on Shannon IE_SH_G_048, due to potential groundwater contribution of phosphate to associated *At Risk* surface water bodies (Table 4).

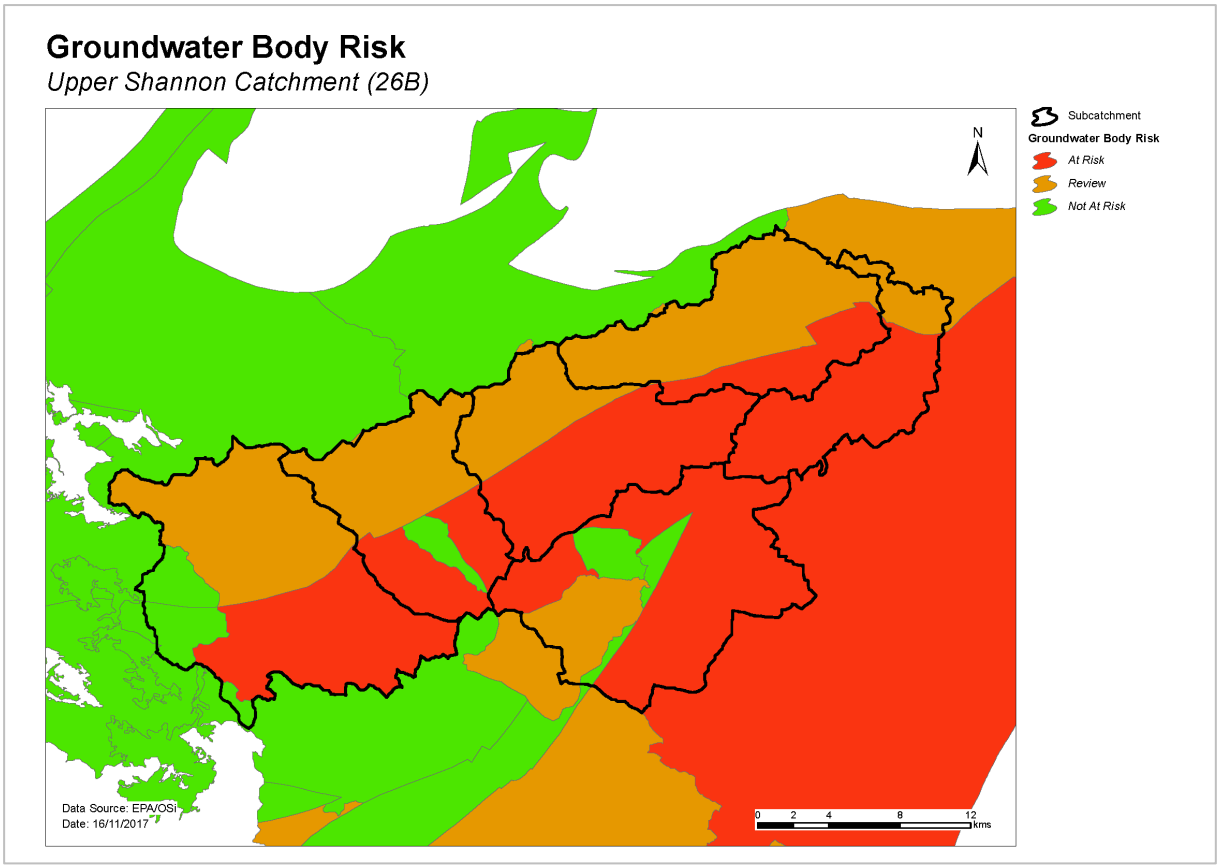


Figure 8. Groundwater body risk

Table 4. Summary of *At Risk* surface water bodies where phosphate from groundwater may contribute to an impact.

Groundwater body name	Receiving water body code	Receiving water body name
Carrick on Shannon	IE_SH_26B080600	BREEDOGE_010
Carrick on Shannon	IE_SH_26B090300	ESLIN_010
Carrick on Shannon	IE_SH_26O040100	KILLUKIN_010
Carrick on Shannon	IE_SH_26L040500	LISSAPHOBBLE_010
Carrick on Shannon	IE_SH_26M030100	MOUNTAIN (ROSCOMMON)_010
Carrick on Shannon	IE_SH_26O040100	OWENNAFOREESHA_010
Carrick on Shannon	IE_SH_26O060500	OWENUR_020
Carrick on Shannon	IE_SH_26S010050	SCRAMOGE_010
Carrick on Shannon	IE_SH_26S010200	SCRAMOGE_020
Carrick on Shannon	IE_SH_26S021010	SHANNON (Upper)_060

2.5 Protected areas

2.5.1 Drinking water abstractions

- There are 12 abstractions in the Upper Shannon (Boyle) Catchment comprising four public water supplies and five private supplies (Appendix 4).
- Seven of the abstractions are from one groundwater body (Carrick on Shannon), three are from lakes (Errit, Cavetown and Gara), and two are from lakes linked to rivers (Urlaur and Treenamarly). The list of the public supplies and the associated water bodies is provided in Appendix 4.
- All sources were compliant with the standard for nitrate in 2015.
- One source was non-compliant for pesticides in 2015 – the Lough Gara North Roscommon Regional Supply Scheme. The key issues in this source were MCPA and Glyphosate. All other sources were compliant.

2.5.2 Bathing Waters

- There are no designated bathing waters in the Upper Shannon (Boyle) catchment.

2.5.3 Shellfish Areas

- There are no designated shellfish areas in the Upper Shannon (Boyle) catchment.

2.5.4 Nutrient Sensitive Areas

- There are no designated nutrient sensitive areas in the Upper Shannon (Boyle) catchment.

2.5.5 Natura 2000 Sites

- There are eight Special Areas of Conservation (SACs) in the catchment (Appendix 5), not all of which have water quality and/or quantity conservation objectives for their qualifying interests.
- One lake water body (Urlaur) has been prioritised for action as the water conservation objectives for their habitats and/or species are not being supported by ecological status (Appendix 5).
- There are two Special Protected Areas (SPAs) in the catchment:
    - Bellanagare Bog SPA
    - Lough Gara SPA

  As there are no specific water quality and quantity supporting conditions identified in the site-specific conservation objectives for these SPAs, the intersecting water bodies are not assigned priority action for WFD protected area purposes in the second cycle.

2.6 Heavily modified water bodies

- There are no heavily modified water bodies (HMWBs) in the catchment.
- There are no artificially modified water bodies (AMWBs) in the catchment.

3 Significant issues in *At Risk* water bodies

- Alteration of hydromorphological (or physical) conditions is one of the most significant issues in rivers in the Shannon (Boyle) Catchment. This includes inputs of excess fine sediment and alteration of the morphology of the river channel, which in turn alter habitat conditions. This can occur

because of, for example, implementing river and field drainage schemes, forestry activities, animal access, and in river structures.

- Another significant issue is the presence of zebra mussels in lakes. The zebra mussels can alter the composition of nutrients and chlorophyll in the water column, thus impacting on ecology.
- Excess phosphate and ammonia are also a pressure in some water bodies, whilst chemical impacts from pesticides (Lough Gara) and habitat modifications from siltation are also pressures in a limited number of water bodies.
- There is potential phosphate contribution from groundwater, originating most likely from diffuse agriculture. Groundwater bodies act as a pathway to surface waters and may be contributing some of the phosphate in some areas.

4 Significant pressures

4.1 Water bodies

- Where water bodies have been classed as *At Risk*, by water quality or survey data, significant pressures have been identified.

4.1.1 Rivers and lakes

- Significant pressures have been identified through the initial characterisation process in 12 water bodies, six of which have multiple pressures. These significant pressures will be refined as further characterisation is carried out.
- The significant pressure affecting the greatest number of water bodies is hydromorphological pressures, followed by agriculture, other, peat, diffuse urban, domestic waste water, forestry and urban waste water.
- Figures 9 and 10 show a breakdown of the number of *At Risk* water bodies in each significant pressure category for rivers and lakes.

4.1.2 Groundwater

- The significant pressure affecting the Carrick on Shannon (IE_SH_G_048) groundwater body is potentially diffuse agriculture where concentrations of phosphate are an issue in the *At Risk* surface water bodies.

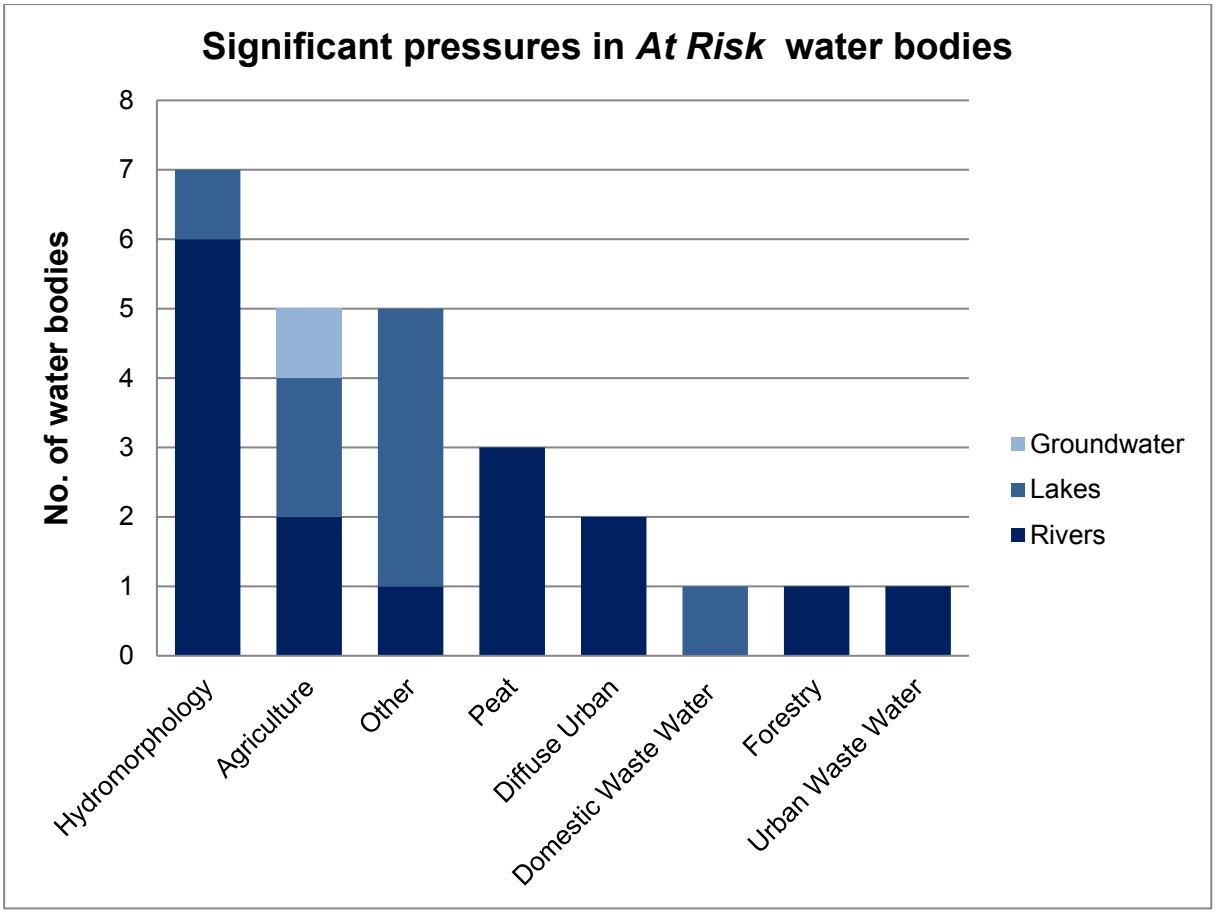


Figure 9. Significant pressures impacting on *At Risk* water bodies

4.2 Pressure type

4.2.1 Hydromorphology

- Hydromorphological modification is a significant pressure in six river water bodies. These river water bodies, within the Breedoge, Lung and Boyle subcatchments, are subject to extensive modification due to arterial drainage schemes. In addition, there is one lake water body that was created by blocking the outlet to allow flooding upstream. It has been recommended to remove this water body from the monitoring network. Water bodies that are *At Risk* and impacted by hydromorphological pressures are shown in Figure 10 and listed in Appendix 3.

Table 4a – Hydromorphological Pressures on the Shannon (Boyle) Catchment

Pressure	Sub-Catchment	Water body Code
Modification due to Drainage Schemes (Channelisation)	Lung_SC_010 Boyle_ SC_030	Anaderryboy_020 Clogher (Roscommon)_010
	Boyle_ SC_030	Clogher (Roscommon)_020
Land Drainage	Breedoge_ SC_010	Breedoge_010
	Breedoge_ SC_010	Carricknabraher_020
	Breedoge_ SC_010	Owennaforeesha_010
In River Structures	Lung_ SC_010	Glinn

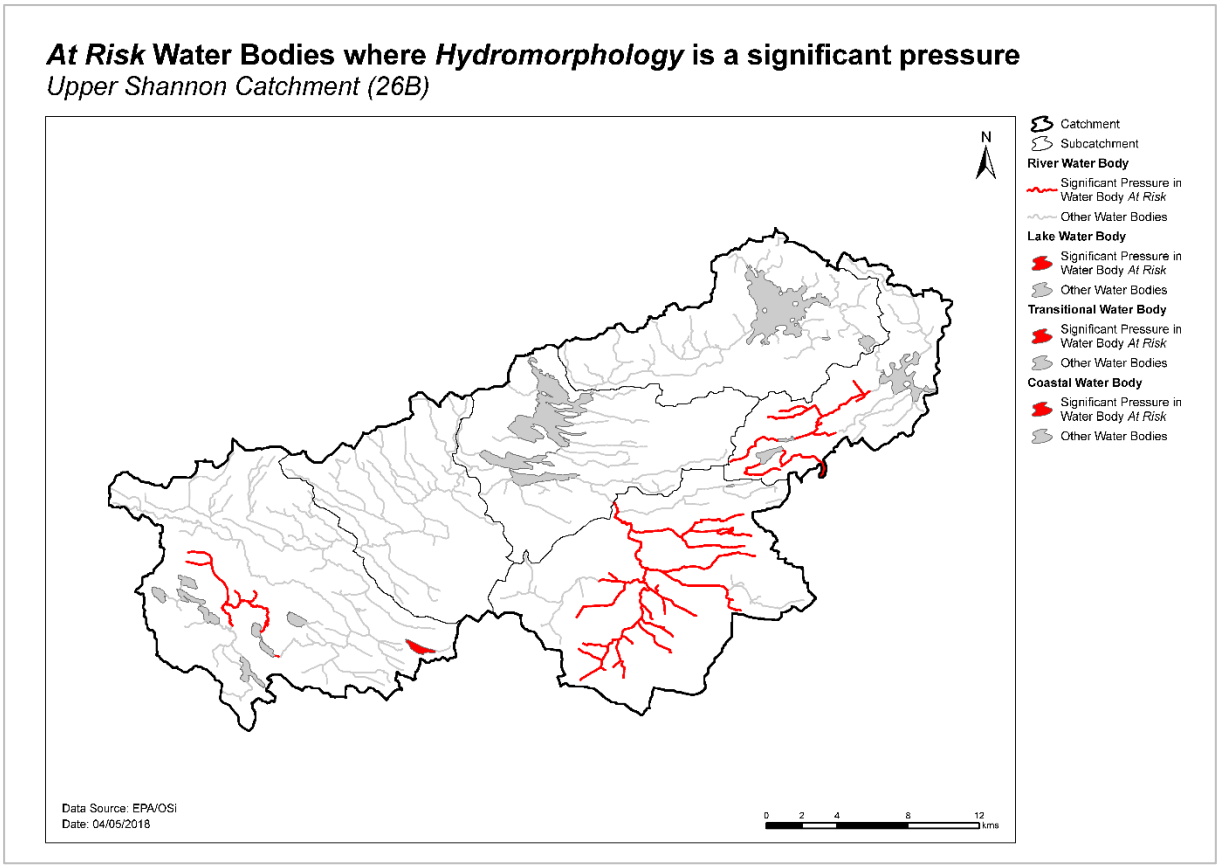


Figure 10. Water bodies that are *At Risk* and are impacted by hydromorphological pressures

4.2.2 Agriculture

- Agriculture is a significant pressure in two river and two lake water bodies – Owennaforeesha_010, Breedoge_010, Cavetown Lough and Lough Gara (Figure 11). The issues related to farming in this catchment are the use of MCPA (impacts in Lough Gara and Breedoge_010) for control of rushes and diffuse phosphorus loss to surface waters from, for example, direct discharges; or runoff from yards, roadways or other compacted surfaces, or runoff from poorly draining soils. Sediment can also be a problem from land drainage works, bank erosion from animal access or stream crossings. The pollution impact potential map showing areas of relative risk for phosphate loss from agriculture to surface water is given in Appendix 6. The groundwater body IE_SH_G_048 Carrick-On-Shannon is also impacted by diffuse agriculture.

4.2.3 Other significant pressures

- Invasive species – Zebra mussels – have been identified a four lake water bodies, Loughs Urlaur, Key, Cavetown and Gara (Figure 12). There is also an unknown pressure on Boyle_040 (Figure 13).

4.2.4 Extractive industry

- *Peat*

  Peat drainage and extraction has been identified as a significant pressure in three river water bodies - Breedoge_010, Anaderryboy_020 and Carricknabraher_020 (Figure 14). The significant issues arise from peat harvesting which results in hydromorphological pressure with elevated sediment loads. In addition, ammonia concentrations are elevated.

4.2.5 Diffuse urban

- Diffuse urban pressures, caused by misconnections, leaking sewers and runoff from paved and unpaved areas, have been identified as a significant pressure in two river water bodies –

Breedoge_010 and Owennaforeesha_010 (Figure 15), resulting in elevated nutrients and organic contamination.

4.2.6 Domestic waste water

- Domestic waste water has been identified as a significant pressure in one lake water body, Cavetown Lough IE_SH_26_705. (Figure 16).

4.2.7 Forestry

- Forestry has been identified as a significant pressure in one water body Breedoge_010. (Figure 17). The significant issues are clearfelling and increased sediment loading which impacts habitat/morphology.

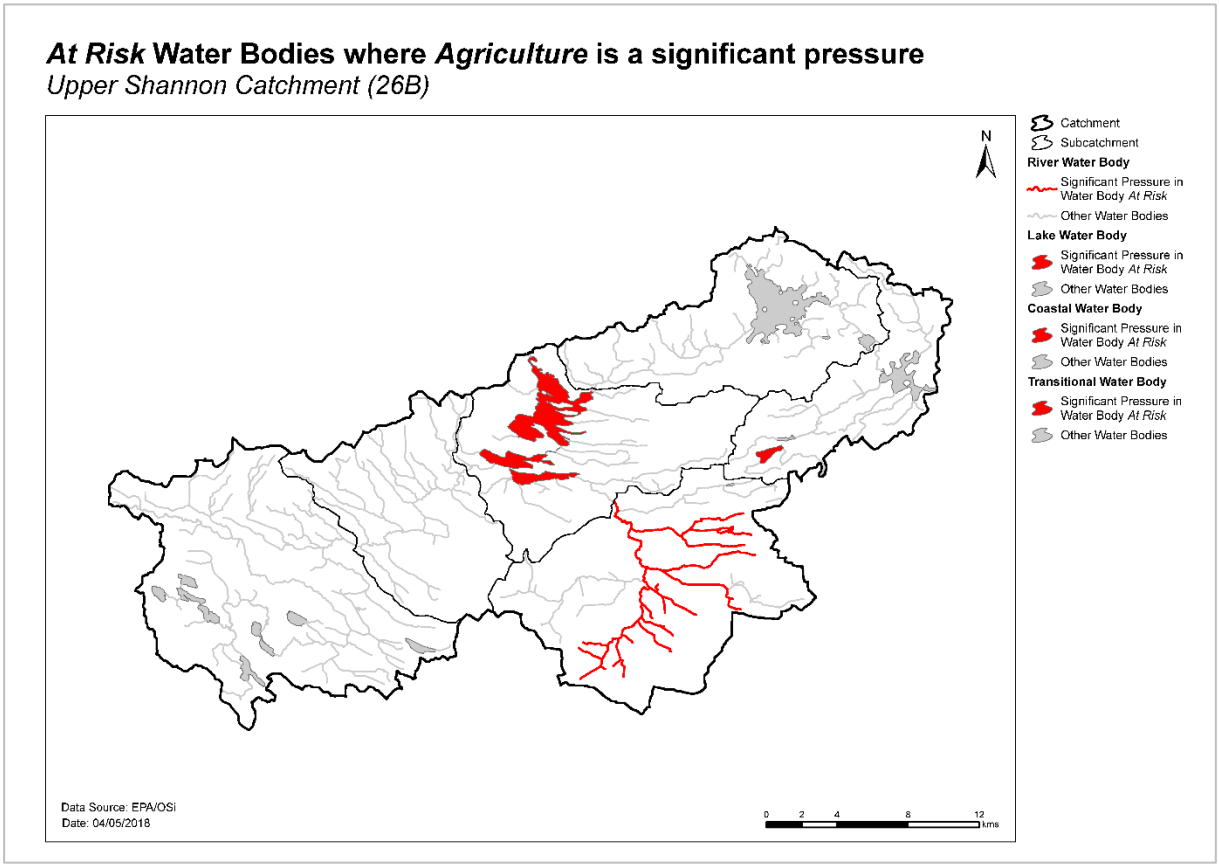


Figure 11. Water bodies that are *At Risk* and are impacted by agricultural activities

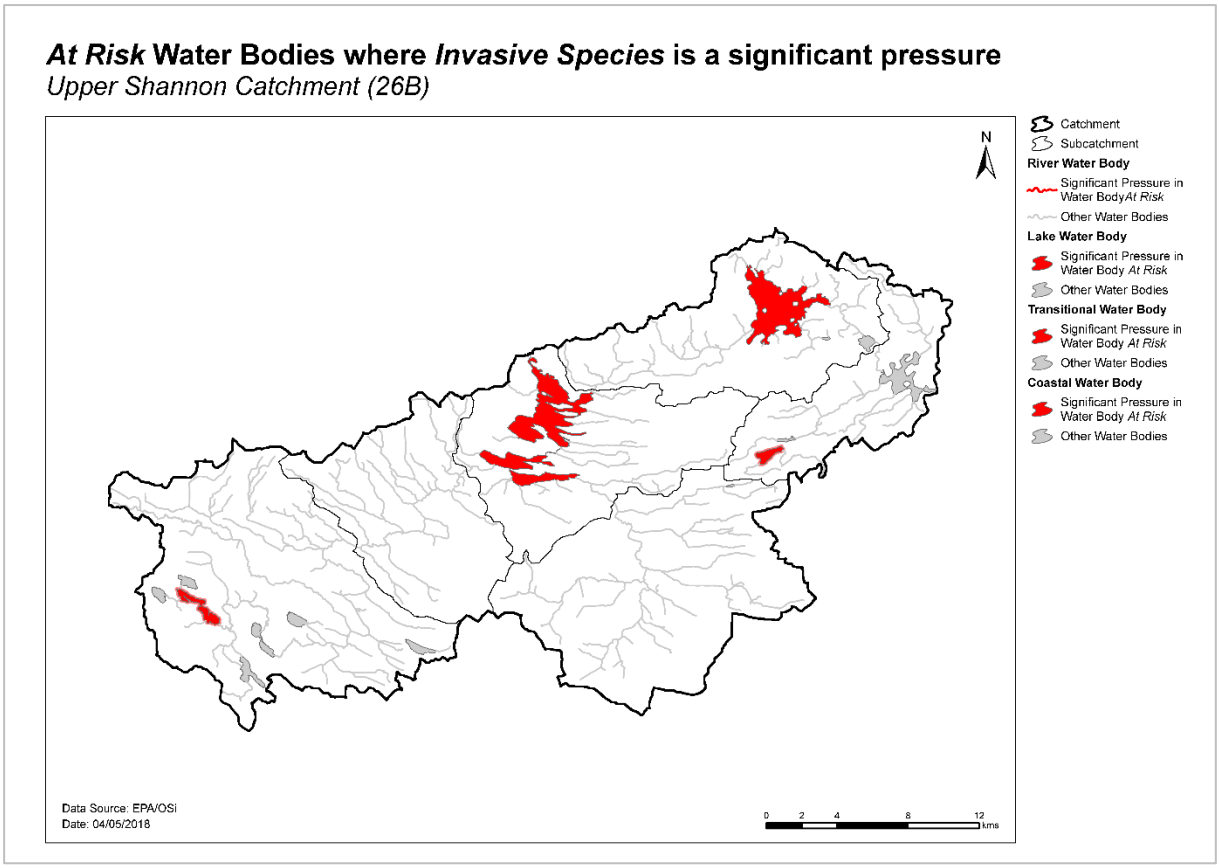


Figure 12. Water bodies that are *At Risk* and are impacted by invasive species

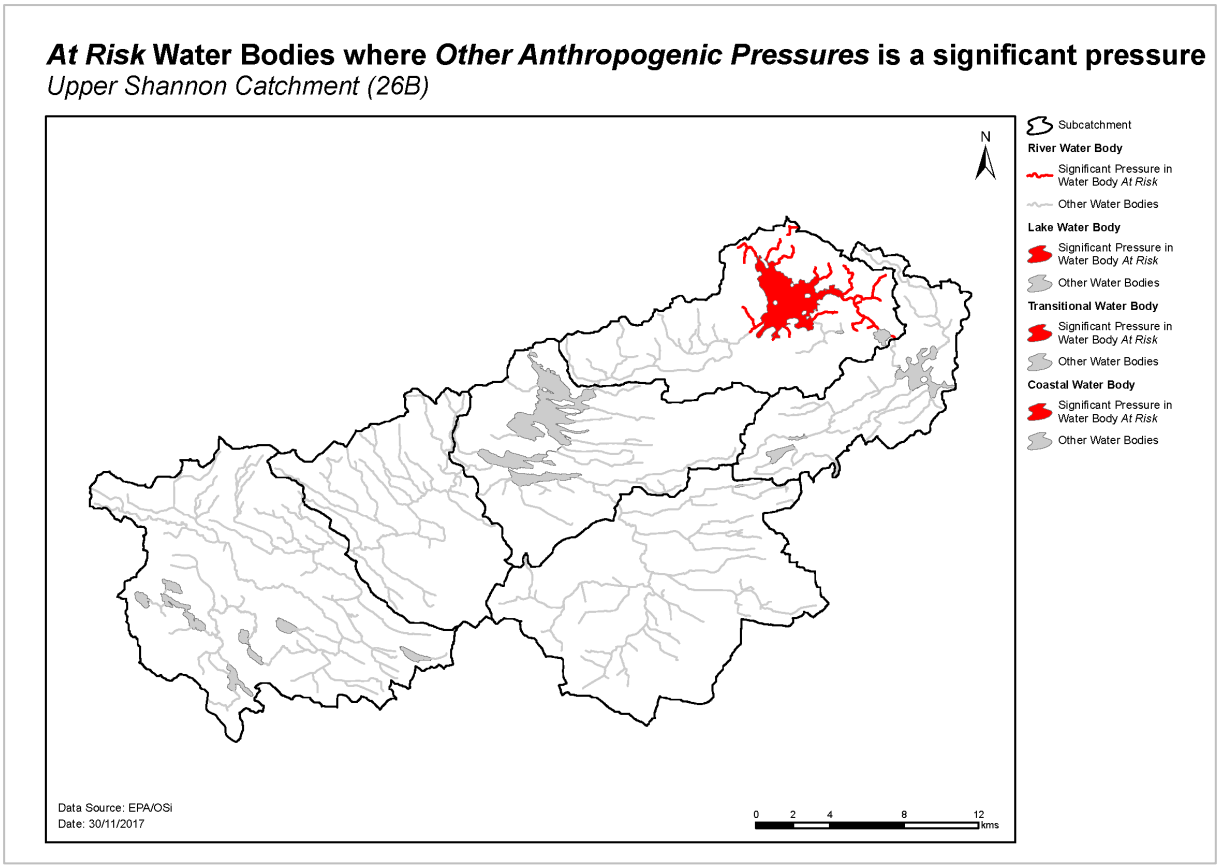


Figure 13. Water bodies that are *At Risk* and are impacted by other anthropogenic pressures

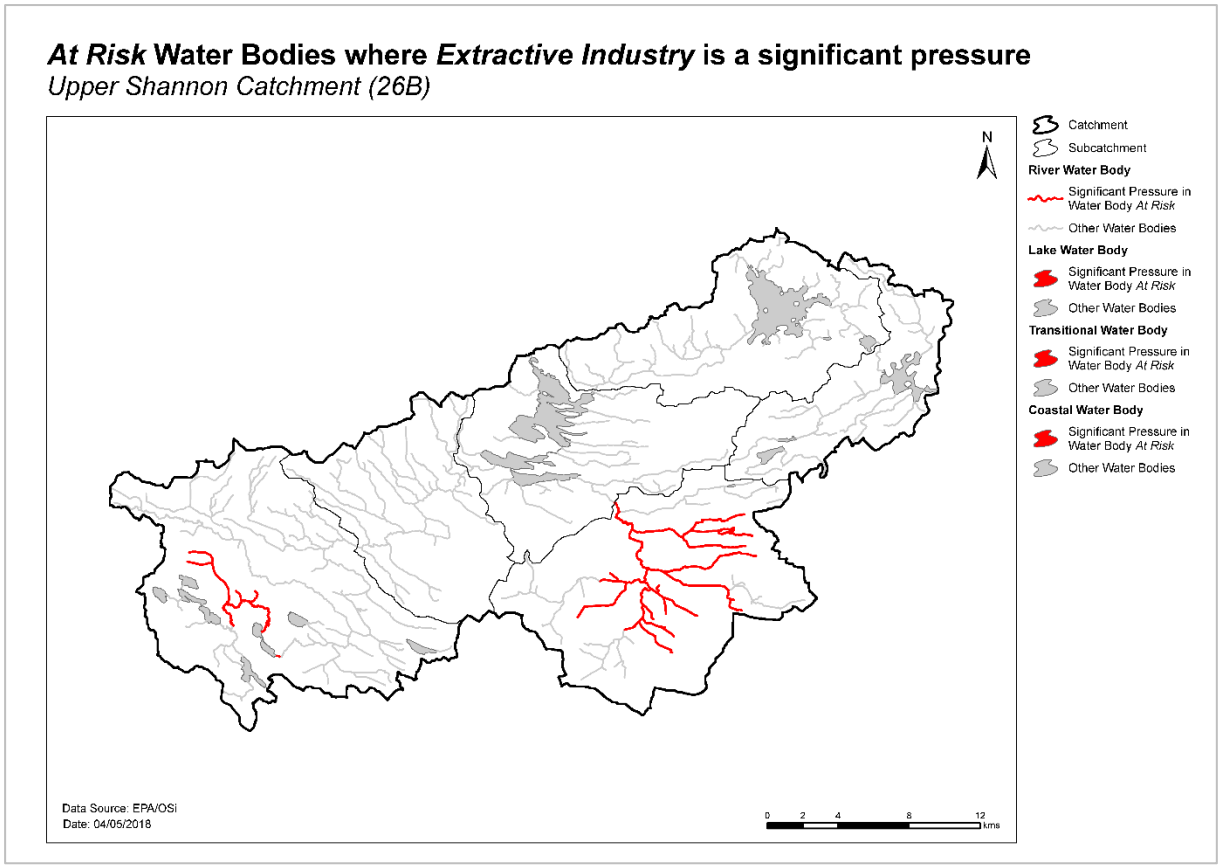


Figure 14. Water bodies that are *At Risk* and are impacted by peat

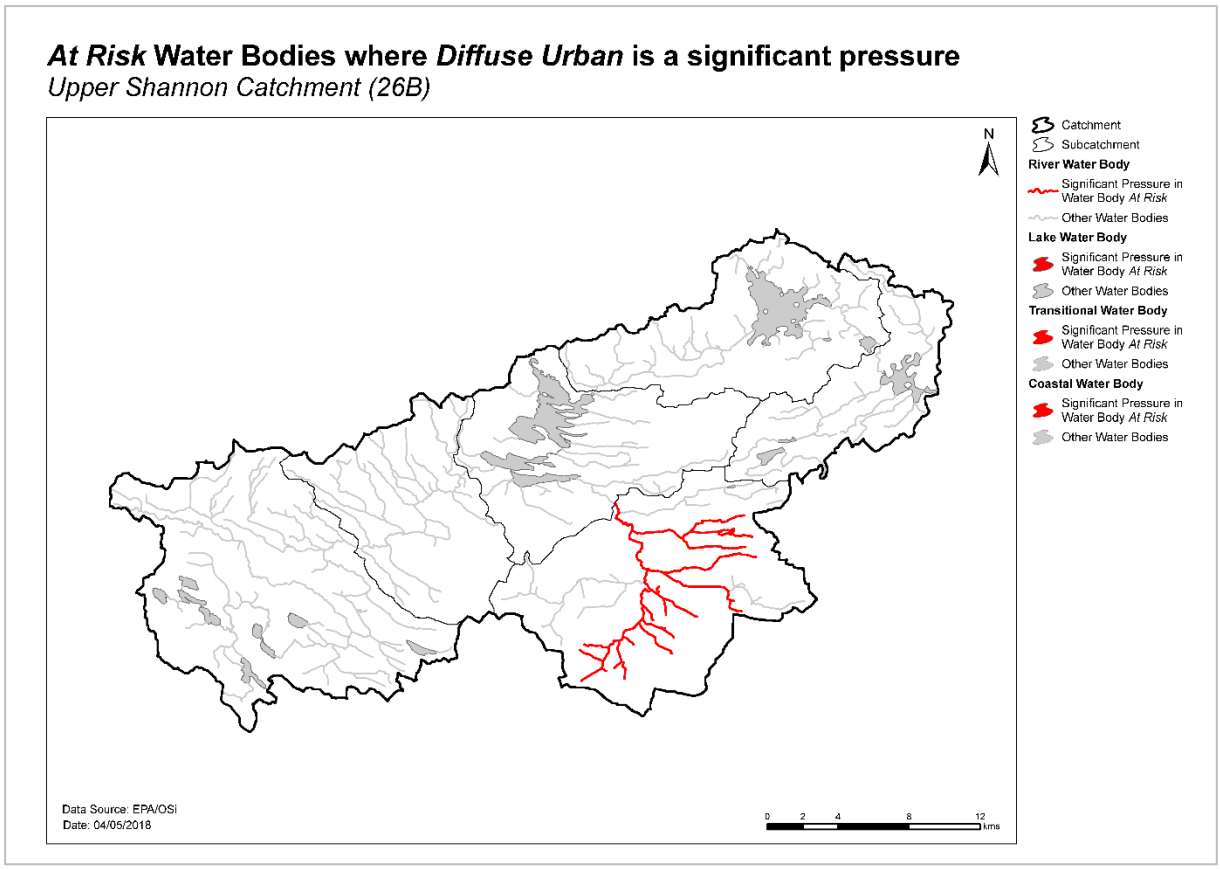


Figure 15. Water bodies that are *At Risk* and are impacted by diffuse urban pressures

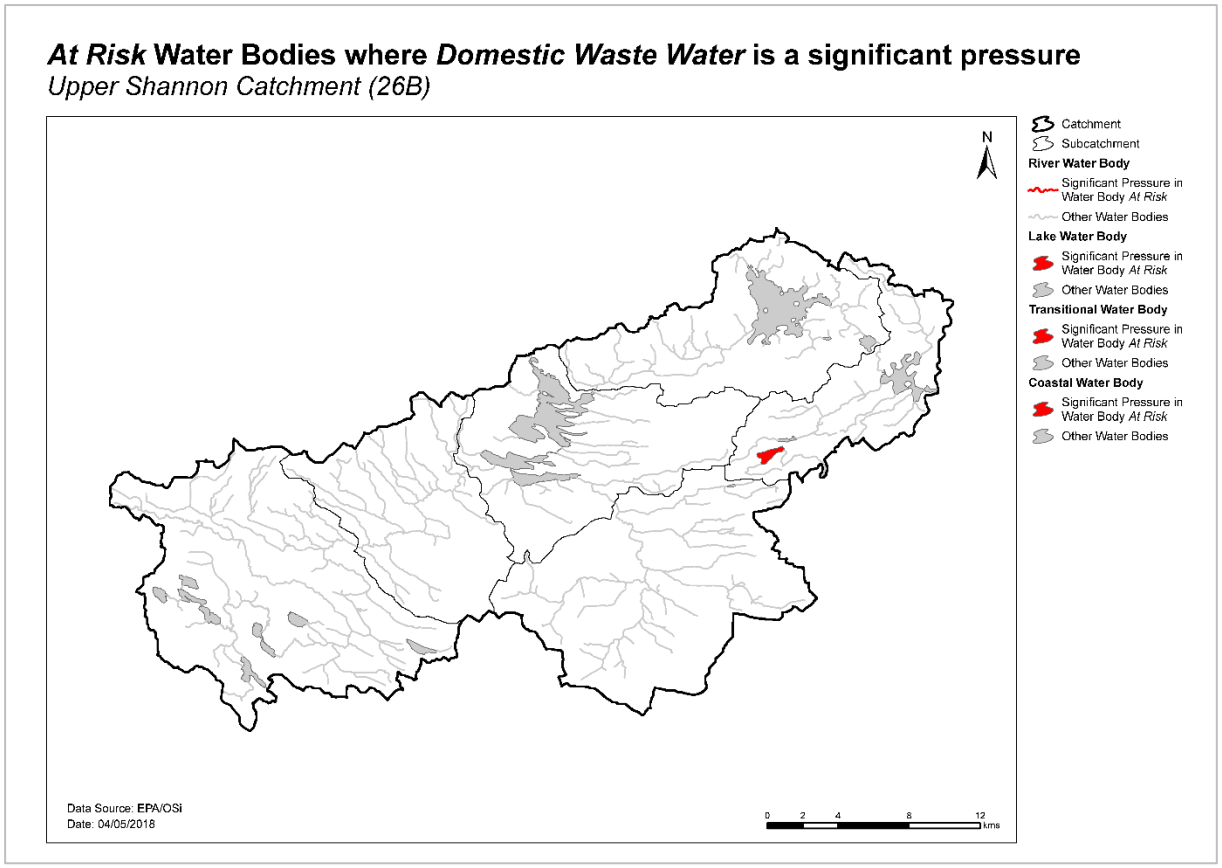


Figure 16. Water bodies that are *At Risk* and are impacted by domestic waste water

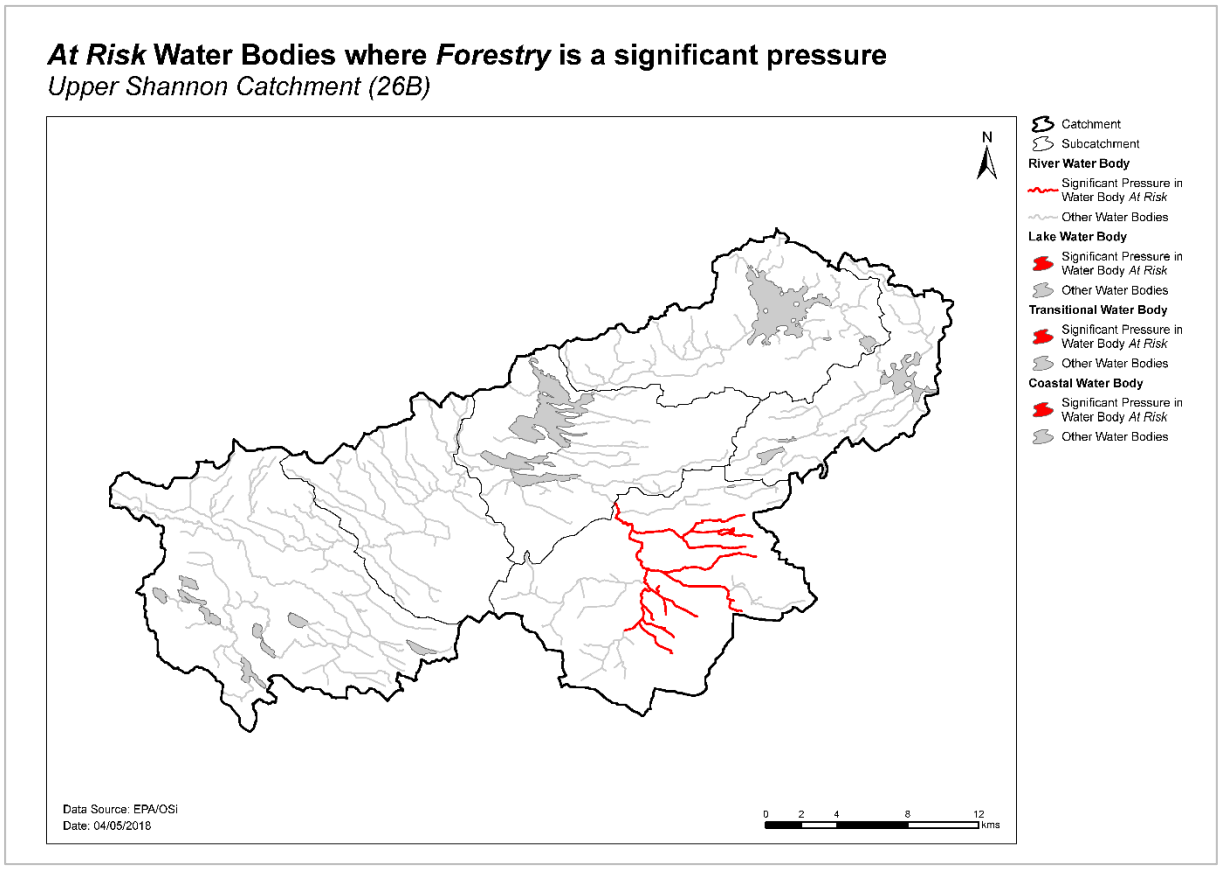


Figure 17. Water bodies that are *At Risk* and are impacted by forestry

4.2.8 Urban waste water treatment plants

- Frenchpark WWTP has been identified as a significant pressure in one *At Risk* water body, Carricknabraher_020; details are given in Table 5 and Figure 18. Frenchpark WWTP is not currently specified in improvement plans.

Table 5. Waste Water Treatment Plants identified as significant pressures in *At Risk* water bodies and expected completion dates for associated upgrade works, where applicable.

Facility name	Facility Type	Water Body	2010-15 Ecological Status	Expected Completion Date
Frenchpark D0376	500 to 1,000 p.e	Carricknabraher_020	Poor	*NA* [1]

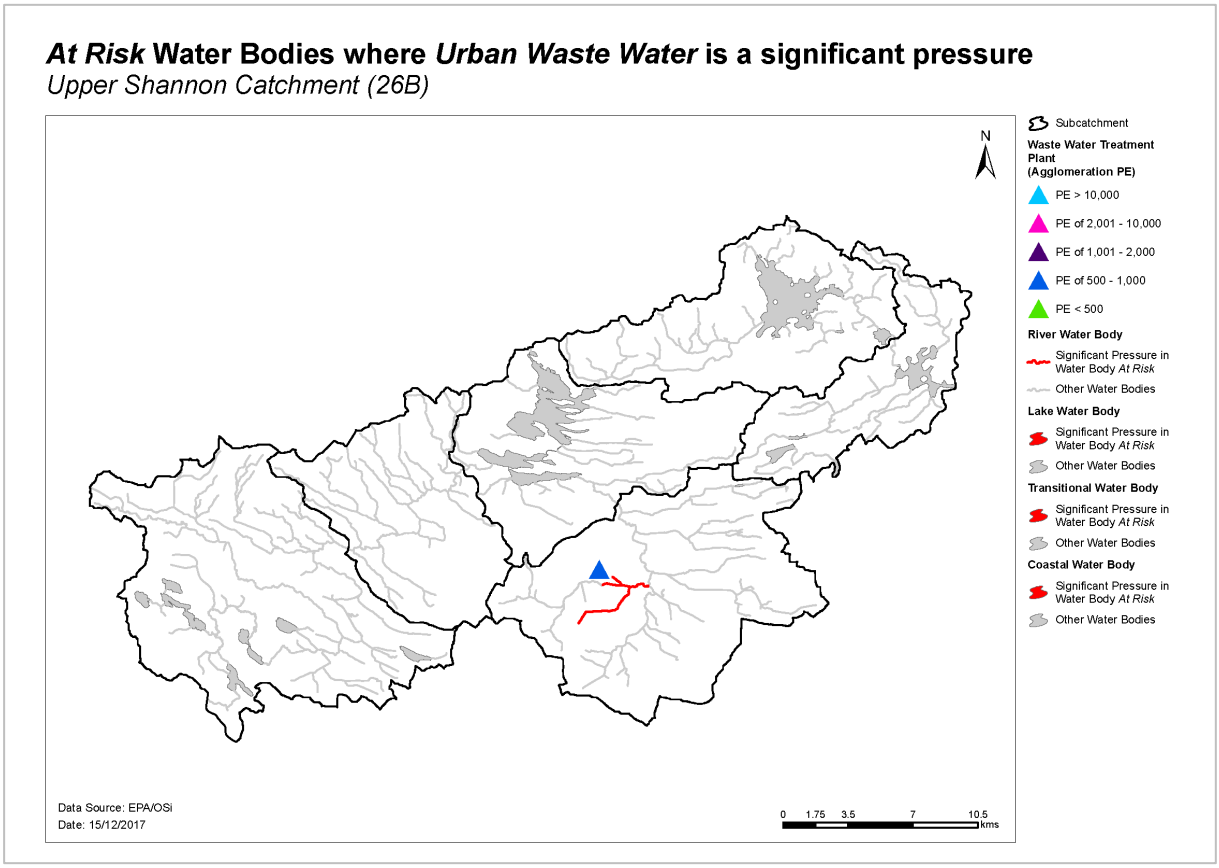


Figure 18. Water bodies that are *At Risk* and are impacted by urban waste water

[1] *Currently not specified in improvement plans.*

5 Load reduction assessment

5.1 River water body load reductions

- Phosphate is the main parameter influencing water quality in rivers in the catchment.
- Using the available monitoring data, it has been calculated that in order to achieve mean phosphate concentrations below the EQS of 0.035 mg/l (mean), in the monitored water bodies across the catchment, additional load reductions are required in the Owennaforeesha_010 river water body (Table 7).
- The figures given below should be taken as a guide which is aimed at i) enabling resources to be targeted to specific areas requiring improvement and ii) estimating the amounts of reductions needed so that appropriate measures can be considered. While some of the load reductions required may be achieved from measures that are already in place (but water quality improvements are not yet evident), it is also possible that additional load reductions will be required as a result of increased pressures in some places.

  Investigative assessments will also likely provide evidence for additional load reduction requirements, especially in unmonitored water bodies.

Table 7. Relative load reductions required in monitored water bodies that are *At Risk*.

Water Body	P Load Reduction Required
Owennaforeesha_010	V. High

6 Further Characterisation and Local Catchment Assessments

- Further characterisation through local catchment assessments is needed in 12 of the *At Risk* water bodies to refine the understanding of the significant pressures at the site/field scale so that specific and targeted measures can be identified.
- Further characterisation through local catchment assessments is needed in 18 *Review* water bodies to refine the understanding of the significant pressures at the site/field scale so that specific and targeted measures can be identified.
- Brief definitions on the 10 assessment scenarios are given in Appendix 7.

Table 8. Local catchment assessment allocation for *At Risk* and *Review* river and lake water bodies

Risk	IA 1	IA 2	IA 3	IA 4	IA 5	IA 6	IA 7	IA 8	IA 9	IA 10	Total
At Risk	16	0	0	0	0	2	6	0	4	0	28
Review	10	0	15	0	0	0	0	0	0	0	25
Note water bodies may have multiple categories of Local Catchment Assessments											

7 Catchment summary

- Of the 43 surface water bodies, 12 are *At Risk* of not meeting their WFD objectives.
- Hydromorphological (or physical) conditions (including the input of high levels of fine sediment) and poor habitat quality are major issues for several surface water bodies. This includes the presence of zebra mussels in lakes. The zebra mussels can cause hydromorphological impacts and alter the composition of nutrients and chlorophyll in the water column, thus impacting ecology.
- Excess nutrient loss, mainly phosphate, leading to eutrophication is also a major issue for rivers and lakes in the catchment. The significant pressures relating to excess nutrients are a combination of peat, agricultural, forestry, diffuse urban and urban waste water.
- There is an issue with pesticides (MCPA, Glyphosate) in Lough Gara.
- One groundwater body is *At Risk (*Carrick on Shannon IE_SH_G_048) due to potential groundwater contribution of phosphate to associated *At Risk* surface water bodies.

8 Areas for Action

The characterisation outcomes described above have highlighted that there is significant work to do in the catchment to protect and restore water quality, and meet the objectives of the WFD. During the development of the draft river basin management plan it became apparent that there would be a need to prioritise areas for collective action so that the best return on investment could be achieved. 190 Areas for action have been selected nationally in a process as described below. There are 2 areas for action in the Shannon (Boyle) catchment.

8.1 Process of Selection

Following the publication of the draft river basin management plan in early 2017, the EPA and the Local Authority Waters and Communities Office (LAWCO) jointly led a collaborative regional workshop process to determine where, from a technical and scientific perspective, actions should be prioritised in the second cycle. The prioritisation process was based on the priorities in the draft river basin management plan, the evidence from the characterisation process, and the expertise, data and knowledge of public body staff with responsibilities for water and the different pressure types. The recommended areas for action selected during the workshops were then agreed by the Water and Environmental Regional Committees. Since this selection, the Local Authorities Water and Communities Office (LAWCO) have undertaken public engagement and feedback sessions in each local authority.

The recommended areas for action are an initial list of areas where action will be carried out in the second cycle. All water bodies that are At Risk still however, need to be addressed. As issues are resolved, or when feedback from the public engagement process is assessed, areas for action may be removed from the list and new areas will be added. If additional monitoring shows that new issues have arisen, new areas may become a priority and may need to be added to the work programme.

The initial list of areas for action is not therefore considered as a closed or finite list; it simply represents the initial areas where work will be carried out.

8.2 Overview of process

The outcomes for the Upper Shannon (Boyle) catchment are summarised below.

- Two recommended areas for action (Table 9, Figure 19) were selected.
- These are the Carricknabraher and Lough Key.
- These include 12 river and lake water bodies – five *At Risk* and seven in *Review.*
- Two groundwater bodies, which are in *At Risk* or *Review* due to groundwater contribution of nutrients to surface water bodies, intersect with the two recommended areas for action, see Table 10. Actions taken to improve surface water will need to take account of the groundwater contribution to surface water.

The remaining 18 *At Risk* and *Review* surface water bodies were not included in the recommended areas for action for the second cycle. The distribution of these is presented in Figure 20. These include:

- eight river water bodies – three *At Risk* and five *Review,* and
- ten lakes – four *At Risk* and six in *Review*.

Table 9. Recommended Areas for Action in the Upper Shannon catchment

Recommended area for action	Number of water bodies	SCs	Local authority	Reason for Selection
Carricknabraher	6	26B_1	Roscommon	• Building on completed improvements at Frenchpark WWTP. • Building on existing work on poorly draining soil. • Contributing to Lough Gara drinking water source which is failing its drinking water objectives for glyphosate. • Two deteriorated water bodies. • Headwaters that ultimately flow into Lough Gara.
Lough Key	6	26B_3	Roscommon	• Important for tourism. • Two deteriorated water bodies, Lough Key (low confidence deterioration) and Boyle_040 Comment: low confidence in the lake status deterioration. Prioritisation of this project will depend on the next monitoring results; the recent survey was in 2014 so next monitoring likely to be 2017. If there is deterioration, prioritise this project; however, if Good status is recorded, do not prioritise project.

Table 10 Groundwater bodies intersecting with surface water bodies in Recommended Areas for Action

Groundwater bodies			Intersecting surface water bodies		Recommended Areas for Action
Code	Name	Risk	Code	Name	
IE_SH_G_048	Carrick on Shannon	At risk	IE_SH_26B090300	BREEDOGE_010	Carricknabraher
			IE_SH_26C020200	CARRICKNABRAHER_020	
			IE_SH_26G780950	GRANNY 26_010	
			IE_SH_26M010200	MANTUA_010	
			IE_SH_26O040100	OWENNAFOREESHA_010	
			IE_SH_26_584	Treanamarly	
			IE_SH_26B080600	BOYLE_040	Lough Key
			IE_SH_26D090760	DEMESNE_26_010	
			IE_SH_26_576	Fin Boyle	
			IE_SH_26_721	Oakport	
IE_SH_G_073	Curlew Mountains	Review	IE_SH_26B080600	BOYLE_040	
			IE_SH_26M910890	MOCMOYNE_010	
			IE_SH_26_724	Key	

9 Environmental Objectives

9.1 Surface Water

- Assuming resources are available and actions are taken in the recommended areas for action, of the five *At Risk* surface water bodies, it is predicted that two (40%) will improve by 2021 and three (60%) will achieve their objectives by 2027. For the seven *Review* surface water bodies, the absence of information on these water bodies means that there is no scientific basis to quantify an environmental objective date and therefore a 2027 date is set, see Table 10.

Table 10. Environmental objective dates for water bodies in the Recommended Areas for Action

Risk Category	No. of Water Bodies	No. of WBs for 2021 Improvement	No. of WBs for 2027 Status Improvement
Rivers			
At Risk	4	1	3
Review	4	0	4
Not at Risk	0	0	0
Lake			
At Risk	1	1	0
Review	3	0	3
Not at Risk	0	0	0
Total	12	2	10

- Thirteen surface water bodies have met their 2015 environmental objective.
- As action is not yet planned to be taken in the remaining seven *At Risk* surface water bodies, a 2027 date is applied to all seven of these water bodies.
- For the 11 *Review* surface water bodies, the absence of information on these water bodies means that there is no scientific basis to quantify an environmental objective date and therefore a 2027 date is applied, see Table 11.

Table 11. Environmental objectives dates in the *At Risk* and *Review* surface water bodies not included in Recommended Areas for Action

Risk Category	No. of Water Bodies	No. of WBs for 2021 Improvement	No. of WBs for 2027 Status Improvement
Rivers			
At Risk	3	0	3
Review	5	0	5
Lakes			
At Risk	4	0	4
Review	6	0	6
Total	18	0	18

9.2 Groundwater

- All eight groundwater bodies in the catchment are Good status and, therefore, have met their environmental objectives.

10 Acknowledgements

This Upper Shannon (Boyle) Catchment Assessment (Version 3) has been produced by the Catchment Science & Management Unit, EPA, with the assistance of the following:

- Roscommon County Council
- Sligo County Council.
- Mayo County Council.
- Inland Fisheries Ireland.
- Local Authorities Waters & Communities Office.
- Irish Water.
- RPS Group.
- Ecological Monitoring & Assessment Unit, EPA.
- Hydrometric & Groundwater Section, EPA.
- Informatics Section, EPA.
- Laboratories, EPA.
- Office of Environmental Enforcement, EPA.
- DAFM Agriculture.
- DAFM Forest Service.
- Coillte.
- Teagasc.
- Geological Survey Ireland.
- National Parks and Wildlife Service.
- Marine Institute.

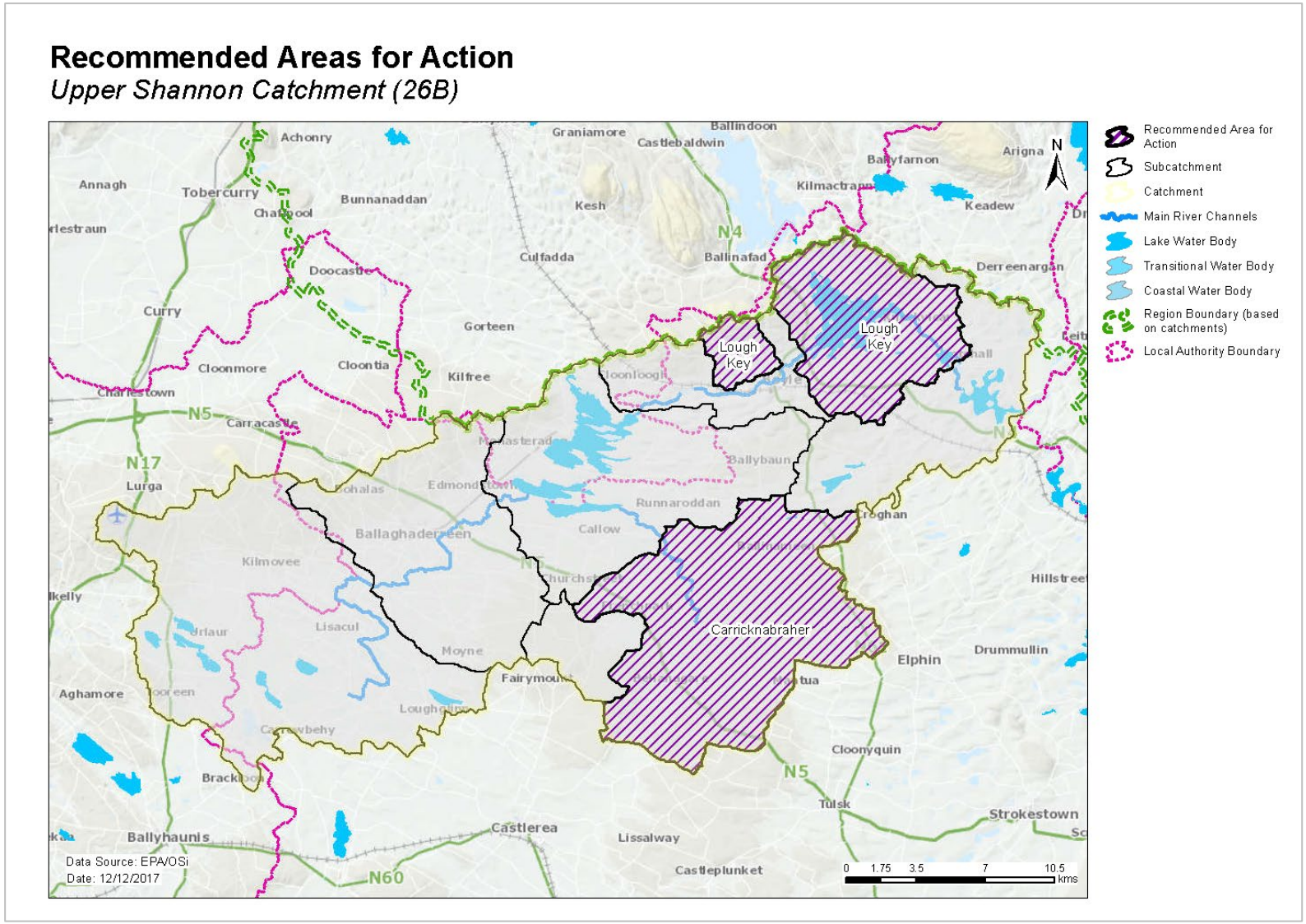


Figure 19. Location of Recommended Areas for Action in the Upper Shannon (Boyle) Catchment

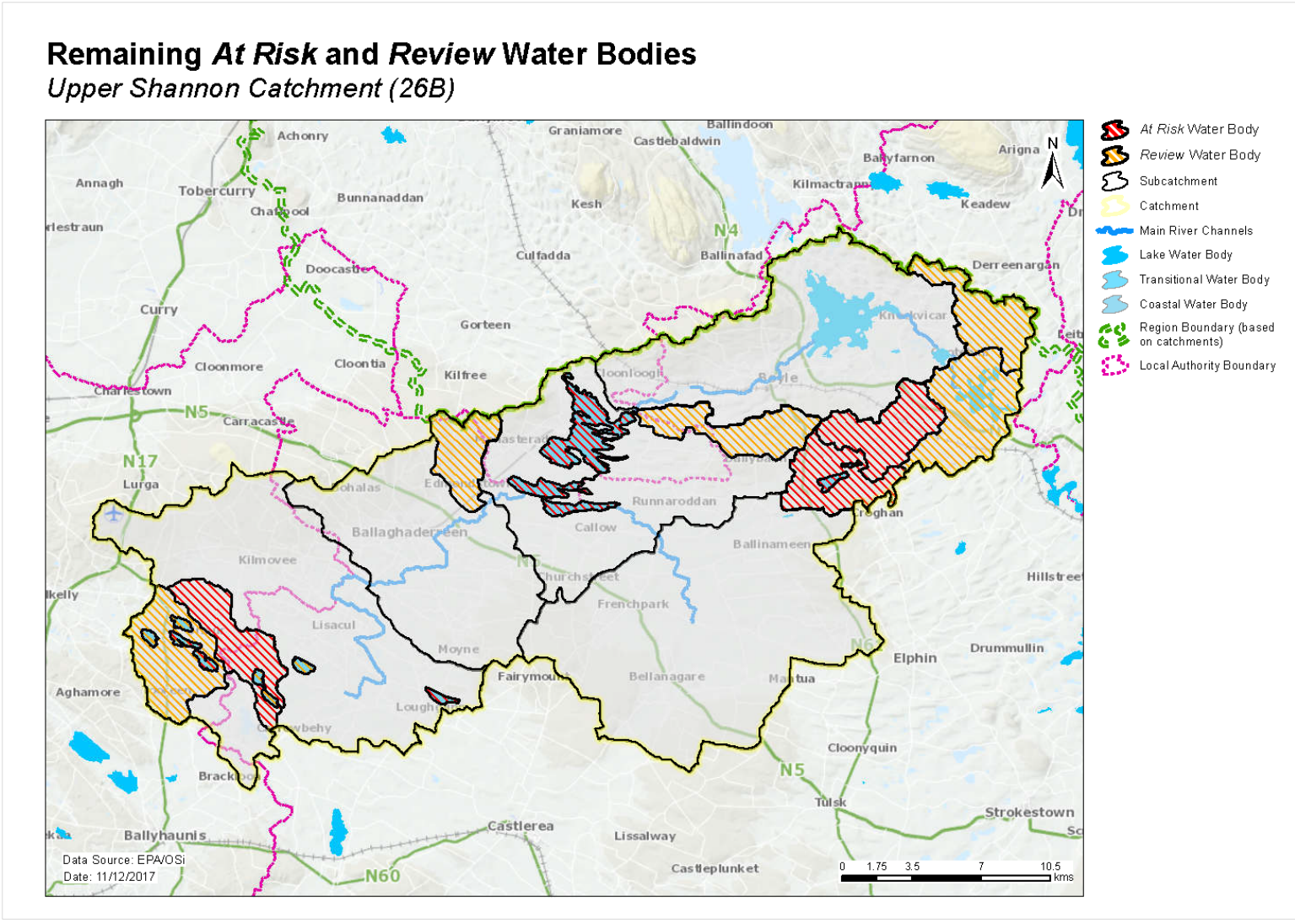


Figure 20. Location of *At Risk* and *Review* water bodies located outside Recommended Areas for Action in the Upper Shannon (Boyle) Catchment

Appendix 1 High ecological status objective water bodies

Water body/Site	Type	Codes	2015 Status
Lung_040	River	IE_SH_26L030350	High

Appendix 2 Catchment scale nutrient concentrations and in-stream loads

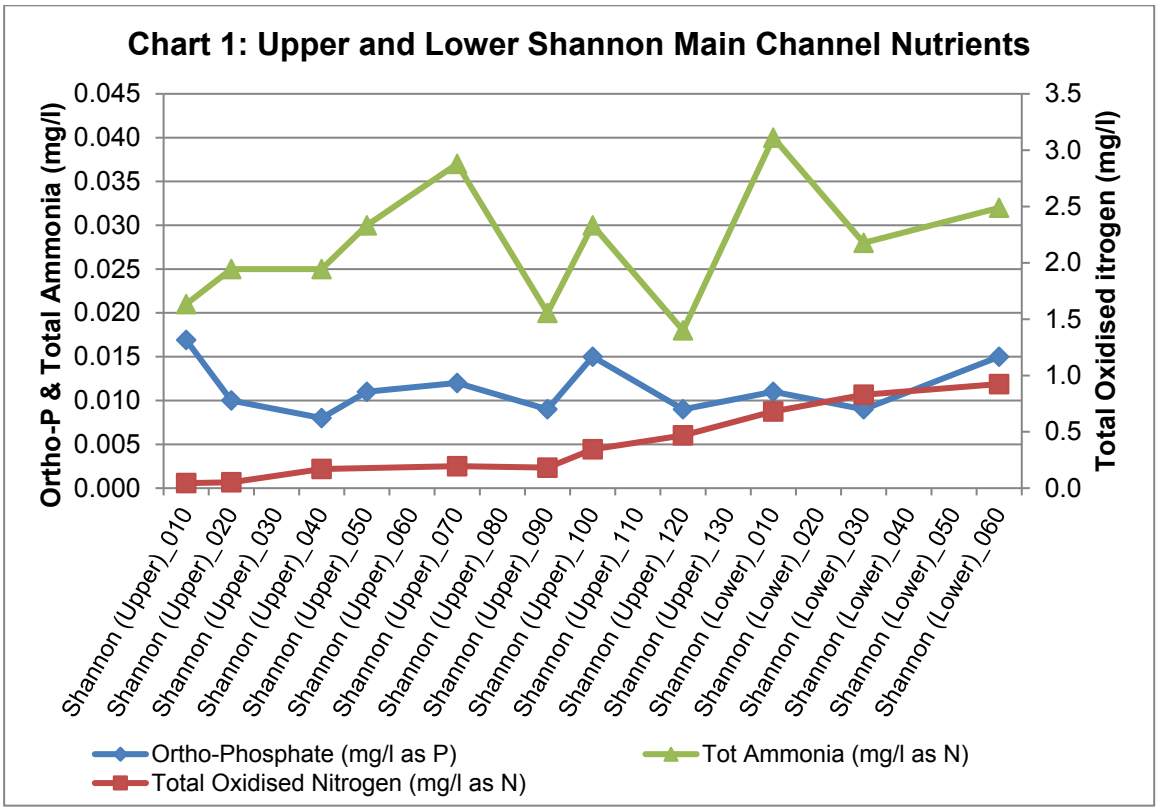
River Shannon Main Channel Nutrient Trends

The results of the instream water quality assessment for the Shannon (Upper & Lower) main channel are illustrated in Chart 1. The assessment is based on the mean concentrations between 2013 and 2015 at each site where water quality data are available. Twelve of the 17 main channel water bodies have water quality data associated with them.

The results show that average nutrients concentrations in the Shannon main channel are below their corresponding threshold values. Concentrations of orthophosphate range from 0.008 to 0.017mg/l, with the highest concentration observed in the headwater SHANNON (UPPER)_010. Small spikes of orthophosphates are observed in the SHANNON (UPPER)_100, which receives water from the FEORISH (TARMONBARRY)_020 of poor ecological status, and the SHANNON (LOWER)_060 which is the receives the primary discharge from the Castleroy Waste water Treatment Plant (WWTP).

Ammonia concentrations show no significant trend along the main channel and range from 0.018 to 0.037mg/l. The small concentration spikes of ammonia are observed in SHANNON (UPPER)_070 and SHANNON (LOWER)_010. The SHANNON (UPPER)_070 is the receiving water body for several small WWTPs including Dromod, Drumsna, Jamestown and Roosky & Environs. The SHANNON (LOWER)_010 is the receiving water body for the Banagher WWTP.

Total Oxidised Nitrogen (TON) concentrations are low at the head waters but increase from 0.018mg/l in the SHANNON (UPPER)_090 to 0.92mg/l in the SHANNON (LOWER)_060. TON remains well below the 2.6mg/l drinking water threshold value throughout the channel.



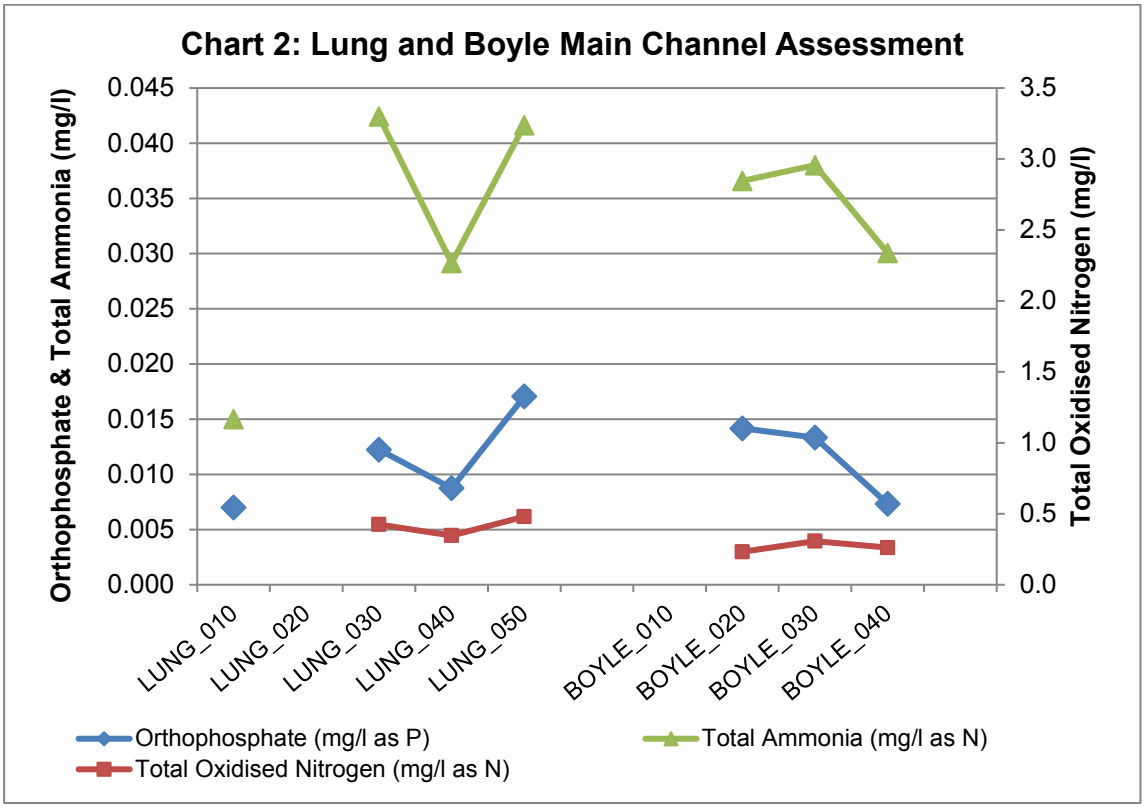
26B Lower Shannon Main Channel Nutrient Trends

The results of the water quality assessment for the Lung and Boyle rivers are presented in Chart 2 and Chart 3.

Orthophosphate concentrations in the Lung River increase from 0.007mg/l at the headwaters to 0.017mg/l at LUNG_050. In the Boyle River, orthophosphate decreases from 0.014mg/l at BOYLE_020 to 0.007mg/l at BOYLE_040. In both channels, concentrations were well below the EQS for orthophosphate (0.035mg/l).

TON concentrations are uniformly low in both rivers and do not exceed the threshold (2.6mg/l) at any water body where monitoring data is available.

In the Lung River, ammonia ranged from 0.015 to 0.042mg/l with highest concentrations at LUNG_030. In the Boyle channel, ammonia ranged from 0.030 to 0.037mg/l. The EQS for ammonia (0.065mg/l) was not exceeded in either the Lung or the Boyne Rivers



Estimated Q30 flows ranged from 3 to 6.5m^3/s and from 15.9 to 17.4m^3/sec in the Lung and Boyle Rivers, respectively. Orthophosphate, TON and ammonia loads followed trends in concentration.

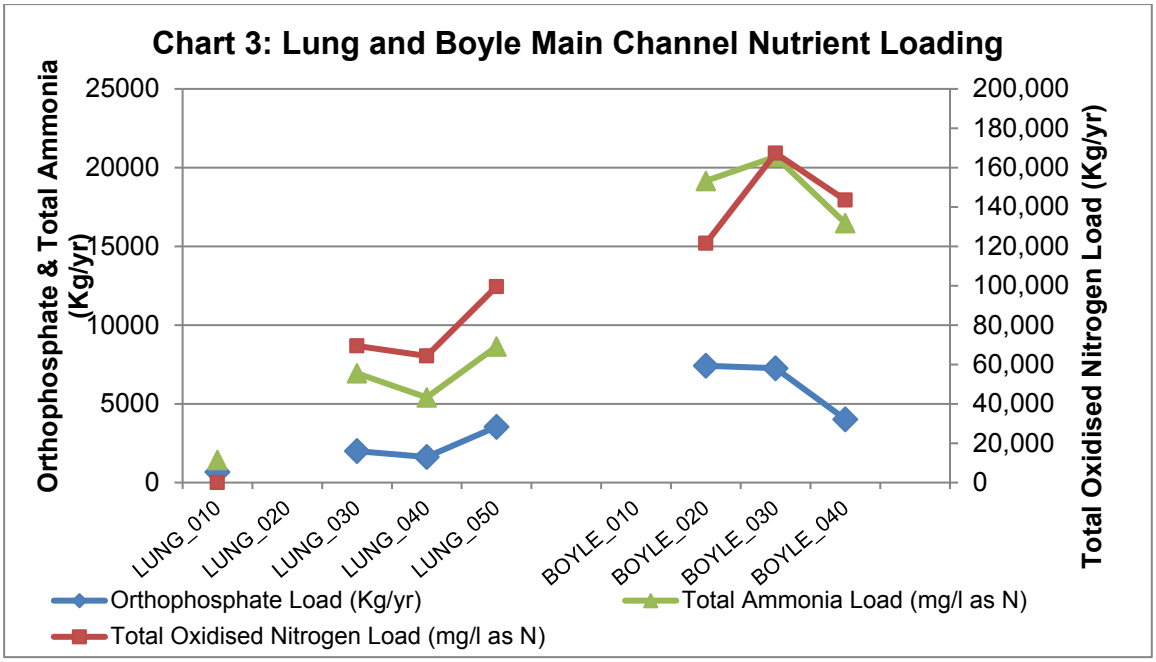


Chart 3: Lung and Boyle Main Channel Nutrient Loading
Orthophosphate & Total Ammonia (Kg/yr)
Total Oxidised Nitrogen Load (Kg/yr)
25000
20000
15000
10000
5000
0
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
LUNG_010
LUNG_020
LUNG_030
LUNG_040
LUNG_050
BOYLE_010
BOYLE_020
BOYLE_030
BOYLE_040
Orthophosphate Load (Kg/yr)
Total Ammonia Load (mg/l as N)
Total Oxidised Nitrogen Load (mg/l as N)

Appendix 3 Summary information on *At Risk* and *Review* surface water bodies

Subcatchment code	Water body code	Water body name	Water body type	Risk	Ecological Status 07-09	Ecological Status 10-15	High Ecological Status Objective Water Body Y/N	Significant Pressures	Date to Meet Environmental Objective	Recommended Area for Action Name
26B_1	IE_SH_26_584	Treanamarly	Lake	Review	Unassigned	Unassigned	N		2027	Carricknabraher
26B_1	IE_SH_26G780950	Granny 26_010	River	Review	Unassigned	Unassigned	N		2027	Carricknabraher
26B_1	IE_SH_26M010200	Mantua_010	River	Review	Unassigned	Unassigned	N		2027	Carricknabraher
26B_1	IE_SH_26B090300	Breedoge_010	River	At Risk	Good	Poor	N	Ag,DU,For,Hymo,Peat	2027	Carricknabraher
26B_1	IE_SH_26C020200	Carricknabraher_020	River	At Risk	Moderate	Poor	N	Hymo,Peat,UWW	2027	Carricknabraher
26B_1	IE_SH_26O040100	Owennaforeesha_010	River	At Risk	Moderate	Moderate	N	Ag,DU,Hymo	2027	Carricknabraher
26B_2	IE_SH_26_580	Nanoge	Lake	Review	Moderate	Unassigned	N		2027	
26B_2	IE_SH_26_590	Cloonacolly	Lake	Review	Unassigned	Unassigned	N		2027	
26B_2	IE_SH_26_630	Roe	Lake	Review	Unassigned	Unassigned	N		2027	
26B_2	IE_SH_26_697	Cloonagh	Lake	Review	Unassigned	Unassigned	N		2027	
26B_2	IE_SH_26C270690	Cummer_26_010	River	Review	Unassigned	Unassigned	N		2027	
26B_2	IE_SH_26_661	Glinn	Lake	At Risk	Moderate	Moderate	N	Hymo	2027	
26B_2	IE_SH_26_689	Urlaur	Lake	At Risk	Unassigned	Bad	N	Other	2027	
26B_2	IE_SH_26A030400	Anaderryboy_020	River	At Risk	Good	Moderate	N	Hymo,Peat	2027	
26B_3	IE_SH_26_576	Fin Boyle	Lake	Review	Unassigned	Unassigned	N		2027	Lough Key
26B_3	IE_SH_26_721	Oakport	Lake	Review	Unassigned	Unassigned	N		2027	Lough Key
26B_3	IE_SH_26D090760	Demesne_26_010	River	Review	Unassigned	Unassigned	N		2027	Lough Key
26B_3	IE_SH_26M910890	Mocmoyne_010	River	Review	Unassigned	Unassigned	N		2027	Lough Key
26B_3	IE_SH_26_724	Key	Lake	At Risk	Good	Moderate	N	Other	2021	Lough Key
26B_3	IE_SH_26B080600	Boyle_040	River	At Risk	Good	Moderate	N	Other	2021	Lough Key
26B_4	IE_SH_26_684	Clogher RN	Lake	Review	Unassigned	Unassigned	N		2027	
26B_4	IE_SH_26_722	Eidin	Lake	Review	Unassigned	Unassigned	N		2027	
26B_4	IE_SH_26E290990	Eidin_26_010	River	Review	Unassigned	Unassigned	N		2027	
26B_4	IE_SH_26W010200	Boyle_050	River	Review	Unassigned	Unassigned	N		2027	
26B_4	IE_SH_26_705	Cavetown	Lake	At Risk	Moderate	Moderate	N	Ag,DWW,Other	2027	
26B_4	IE_SH_26C180500	Clogher (Roscommon)_010	River	At Risk	Poor	Poor	N	Hymo	2027	
26B_4	IE_SH_26C180900	Clogher (Roscommon)_020	River	At Risk	Moderate	Moderate	N	Hymo	2027	

Subcatchment code	Water body code	Water body name	Water body type	Risk	Ecological Status 07-09	Ecological Status 10-15	High Ecological Status Objective Water Body Y/N	Significant Pressures	Date to Meet Environmental Objective	Recommended Area for Action Name
26B_5	IE_SH_26D110290	Derrymaquirk_26_010	River	Review	Unassigned	Unassigned	N		2027	
26B_5	IE_SH_26_728	Gara	Lake	At Risk	Good	Moderate	N	Ag,Other	2027	
26B_6	IE_SH_26F360990	Fallsollus_010	River	Review	Unassigned	Unassigned	N		2027	

Ag: Agriculture

DWW: Domestic Waste Water

For: Forestry

Hymo: Hydromorphology

Ind: Industry

M+Q: Mines and Quarries

Peat: Peat Drainage and Extraction

DU: Diffuse Urban

UWW: Urban Waste Water

Note: Significant Pressures for Review water bodies have not been included as they will need to be confirmed as part of an Investigative Assessment.

Protected Area: If a water body is one or more of the following: Drinking Water Protected Area; Bathing Water; Shellfish Area; Nutrient Sensitive Area or; a Natura 2000 site with a water dependent qualifying interest with a water quality and/or quantity conservation objective, then it has been highlighted as a protected area in this table.

Appendix 4 Drinking water supplies in the catchment

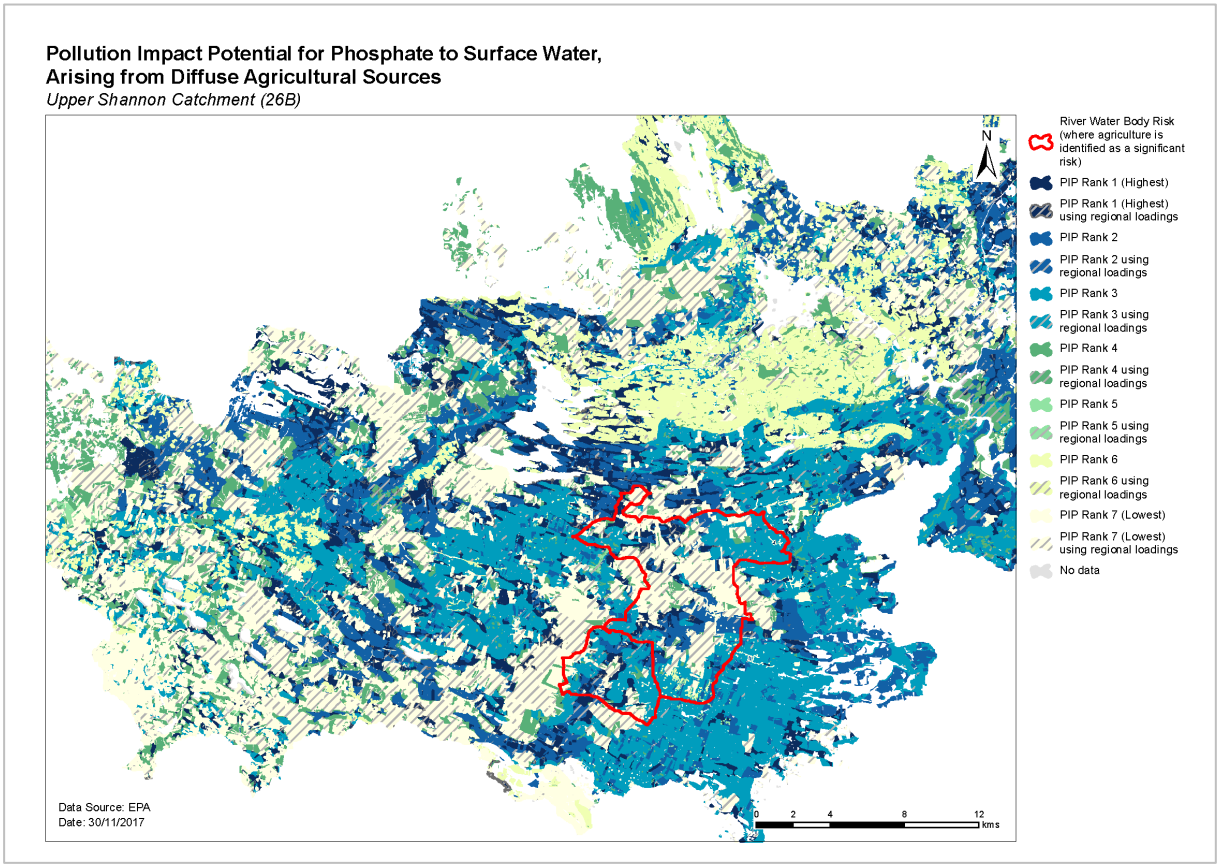
Scheme Code	Scheme Name	Water Body	Water Body Code	Objective Met?	Reason why not?
2600PUB1027	Boyle/Ardcarne 1	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
	Boyle/Ardcarne 2	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
	Boyle/Ardcarne 3	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
	Boyle/Ardcarne 4	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
2600PUB1017	Bellanagare Springs	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
2600PRI3051	Peake Mantua	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
2600PRI3058	Tartan/Scurmore	Carrick on Shannon (GWB)	IE_SH_G_048	Yes	N/A
2600PRI3042	Gorthaganny	Errit (LWB)	IE_SH_26_702	Yes	N/A
2600PUB1012	North Roscommon Regional WSS	Lough Gara (LWB)	IE_SH_26_728	No	MCPA Glyphosate
2600PUB1013	Grangemore	Cavetown Lake (LWB)	IE_SH_26_705	Yes	N/A
2200PRI2133	Kilmovee/Urlaur	Lough Urlaur linked to Cummer 26_010 (RWB)	IE_SH_26_689 IE_SH_26C270690	Yes	N/A
2600PRI3009	Camlin	Treenamarly Lake linked to Granny 26_010 (RWB)	IE_SH_26G780950	Yes	N/A

Appendix 5 Prioritisation of water bodies with Natura 2000 site qualifying interests

SAC Name	Relevant Qualifying interests	Target status	Water body type	Water bodies	Status (risk)	Prioritise?	Code	Survey data?
Bellanagare Bog SAC 000592	none							
Callow Bog SAC 000595	none							
Cloonshanville Bog SAC 000614	none							
Derrinea Bog SAC 000604	none							
Drumalough Bog SAC 002338	none							
Errit Lough SAC 000607	3140	At least Good	Lake	Errit	Unassigned (NAR)	No	IE_SH_26_702	No
Tullaghanrock Bog SAC 002354	none							
Urlaur Lakes SAC 001571	3140	At least Good	Lake	Nanoge	Unassigned (R)	No	IE_SH_26_580	No
			Lake	Roe	Unassigned (R)	No	IE_SH_26_630	No
			Lake	Urlaur	Bad (AT RISK)	Yes	IE_SH_26_689	No

Appendix 6 Pollution Impact Potential (PIP) Map for Phosphate

For areas where agriculture is deemed as the significant pressure, areas of high risk to surface water can be targeted. The map below shows relative risk of loss of phosphate to surface water. The risk of phosphate losses are strongly correlated on whether the land is poorly draining or free draining and the loadings applied i.e. significant loadings applied on poorly draining areas result in a high potential risk to surface water. However, this figure does not imply that actual losses from these areas are occurring but is a useful tool for informing where resources should be focused (i.e. by allowing high risk areas to be identified and prioritised for further investigation). PIP maps are available online at a scale of 1:20,000 and can be accessed by public bodies via the EDEN process.



Appendix 7 Local Catchment assessment categories

Category	Assessment & Measures Evaluation Details
IA1	Further information provision (e.g. from IFI, LAs, EPA)
IA2	Point source desk-based assessment
IA3	Assessment of unassigned status water bodies, requiring field visit(s)
IA4	Regulated point sources, requiring field visit/s
IA5	Stream (catchment) walk to evaluate multiple sources in a defined (1 km) river stretch (used as the basis for estimating resource requirements)
IA6	Stream (catchment) walk in urban areas
IA7	Stream (catchment) walk along >1 km river stretches
IA8	Stream (catchment) walk along high ecological status (HES) objective rivers
IA9	Lakes assessment, requiring field visits
IA10	Groundwater assessments, requiring field visits