Faecal Contamination Pressure Narrative

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1. Background

This summary document is one of a series of pressure focused evidence narratives. A pressure is defined as a factor affecting the water environment. These narratives, or stories, have been produced to support the 2019 challenges and choices consultation as these pressures affect, or are affected by, the challenges described in the consultation. These pressure narratives cover chemicals, phosphorus, nitrate, fine sediment, physical modification, abstraction and flow, faecal contamination, invasive non-native species and drinking water protected areas.

The pressure narratives support engagement at national level and help build a common understanding of the issues. They also provide the national context for discussions at the local level during the consultation period from October 2019 for six months.

1.1 Relevance and accuracy of data

This document has been produced by bringing together the readily available information on the topic. Quality assurance of the information included so far is not complete. As a result the document may contain some errors or inaccuracies. Please let us know of any other relevant evidence or if you are aware of any issues with the information. This will help us to build a comprehensive and robust evidence base to underpin decision-making in river basin management planning. Contact details are given in Section 5 of the document.

2. The problem

Faecal bacteria are an important factor to consider when protecting the environment in order to safeguard public health, particularly preventing ingestion of contaminated drinking water, shellfish or water whilst swimming.

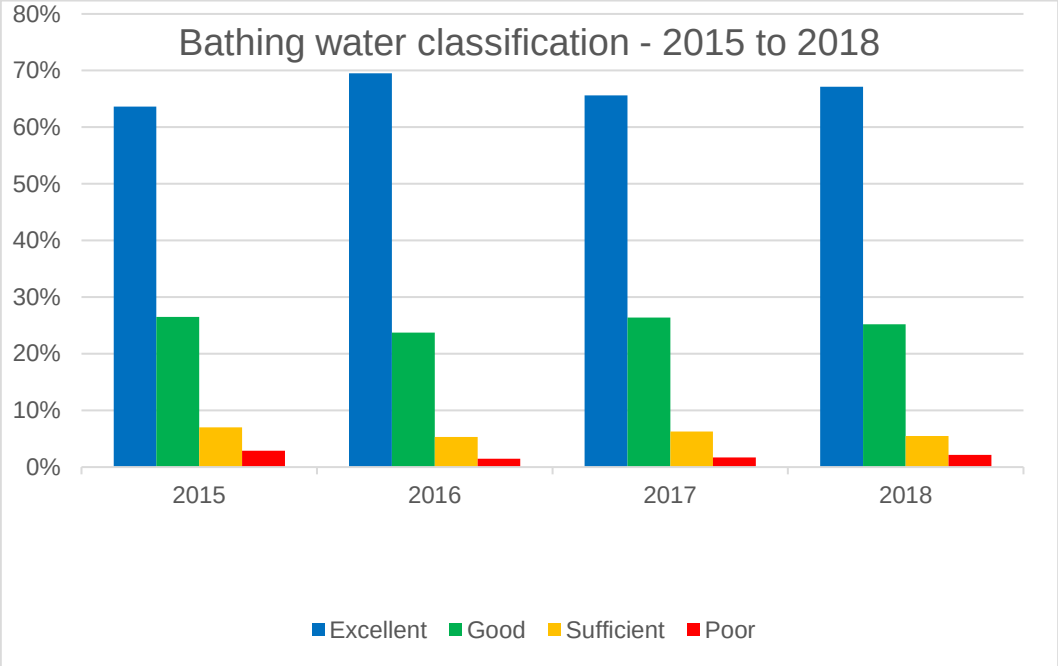
Faecal contamination has been identified as a significant issue for the second round of river basin planning, because of its inclusion in ‘Protected Area’ objectives for bathing waters, shellfish waters and drinking waters.

2.1 Evidence for the problem

2.1.1 Bathing waters

Compliance with bathing water standards in 2018 was 97.9%[i], with only nine waters receiving the lowest classification of 'poor'. This continues to build on improvements measured over the last 20 years. If today's standards had been in force in the early 1990s over half of the designated waters would have been classified as 'poor'. Note that, since the data were reported in the autumn of 2018 (Figure 2), one of the waters classified as 'poor' has been de-designated because of its low use for bathing.

Figure 2: Percentage of designated waters according to classification 2015-2018



In addition to the eight bathing waters that were classified as 'poor' in 2018, there are a further 18 bathing waters that are 'at risk' of becoming 'poor'[ii].

The Environment Agency also monitors to determine whether any bathing waters have deteriorated in quality. There are 33 bathing waters that have shown deterioration[iii].

These waters are prioritised for investigation to determine the sources of pollution and the required measures to improve their quality.

2.1.2 Shellfish waters

Compliance with the shellfish water microbial standard in 2018 was 20%[iv], the same level recorded in 2017 and 2016. The lower compliance in shellfish waters is a reflection that shellfish are filter feeders which accumulate and thrive on faecal bacteria and the very tight microbial standard in the Shellfish Directions. Research has shown that in order to consistently achieve the microbial standard of less than 300 E.coli per 100g of shellfish flesh, the water column must contain fewer than 5 E.coli per 100ml. In comparison, the 'excellent' classification of the Bathing Water Regulations requires the 95 percentile of water column samples to be less than 250 E.coli per 100ml.

As with bathing waters, the Environment Agency assesses where any shellfish water has deteriorated over recent years. Assessing deterioration in shellfish waters is more difficult due to:

- the relatively small number of samples taken each year. The monitoring frequency is 10 samples a year for those shellfish waters with the smallest amounts of harvesting activity. Waters that are harvested more are monitored more frequently
- monitoring points move frequently, to reflect where shellfish are currently being harvested, which means that long data-sets (which are required to identify trends with confidence are rare
- the lack of a clear and consistent relationship between shellfish flesh quality and water quality

A statistical method has been developed to identify the waters at greatest risk of deterioration. This information is used with other information to understand where deterioration has occurred. This is called the weight of evidence approach. In 2017 and 2018, analysis indicated that approximately half of shellfish waters needed further assessment to determine whether deterioration was likely. The weight of evidence assessment indicates that 25 shellfish waters have shown some deterioration.

2.1.3 Drinking waters

Faecal bacteria can cause pollution of drinking water sources and present a risk to human health. Drinking Water Protected Areas (DrWPAs) require us to ensure that environmental quality does not deteriorate to the extent that it requires additional treatment at water treatment works. This includes additional treatment for faecal bacteria or other pathogens such as cryptosporidium if there is an increase in their concentration in water supply sources.

2.2 Sources of faecal bacteria and reasons for failure

Bathing and shellfish water quality is affected by a range of sources. The most important sources are agricultural diffuse pollution, sewage related pollution and urban diffuse pollution (including contamination from dogs and birds). The relative contribution from these sources will vary between sites depending on the nature of the catchment and its land use. Most sites are affected by more than one source.

2.2.1 Bathing waters

59 bathing waters are at risk of being 'poor', have shown deterioration, or are currently 'poor'. The source of the faecal bacteria is from a number of sources, including:

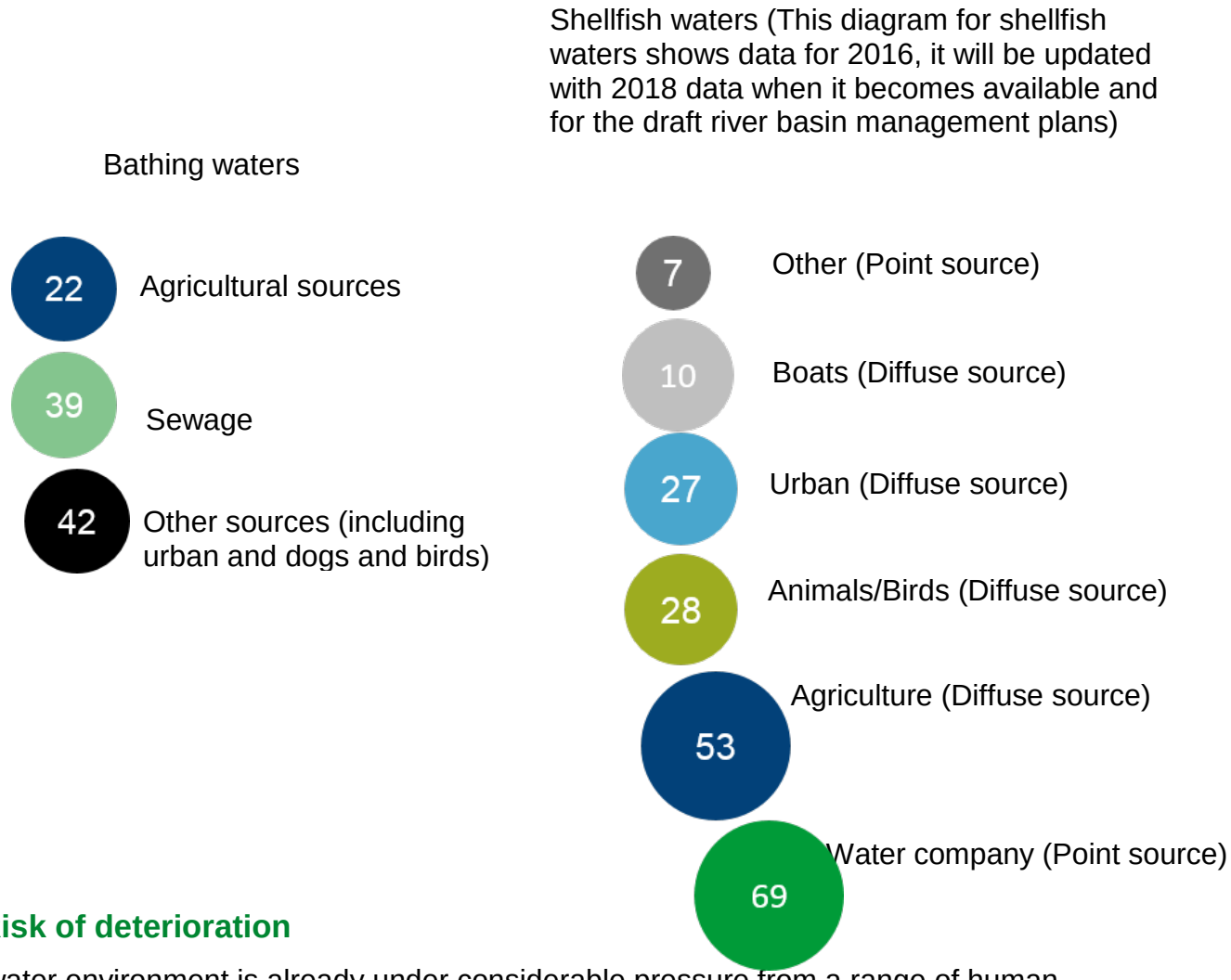
- agricultural sources contribute more than 10% of the total contamination at 22 waters
- sewage contributes more than 10% of the total contamination at 39 waters
- other sources (including urban and dogs and birds) contribute more than 10% of the total contamination at 42 waters

2.2.2 Shellfish waters

Of the shellfish waters that do not consistently achieve the Shellfish Directions microbial standard, the two main sources of contamination are the water industry and agricultural sectors:

- sewage contributes more than 10% of the total contamination at 69 waters
- agricultural sources contribute more than 10% of the total contamination at 53 waters

Figure 3: Number of protected areas failing protected areas standards due to faecal contamination, by sector responsible (there is usually more than one reason for not achieving the relevant standard at any individual protected area i.e. the numbers don't add up to the total number of non-compliant bathing/shellfish waters)



2.3 Risk of deterioration

The water environment is already under considerable pressure from a range of human activities and a growing population. In the longer term, bathing and shellfish waters are at risk of deterioration due to these pressures. Climate change adds to this pressure.

Our climate is changing and this is set to continue. The UK climate change projections (UKCP18) predict that hotter drier summers, milder wetter winters, rising sea levels and more extreme weather events are expected.

Climate change has a range of water quality impacts. We will see changes to river flow, groundwater recharge and water temperatures. Rainfall patterns will change; winter rainfall will occur in heavy events whilst summer rainfall will decrease. The trend of more intense rainfall events is expected to continue.

Increased periods of heavy rainfall can have a significant impact on bathing and shellfish waters as they can result in more frequent sewer overflows. Heavy rainfall is more likely to wash pollutants from agricultural and urban land into rivers and the sea[v]. It also increases the total amount of sewage (the rain means there is a bigger volume of more dilute sewage) and puts further pressure on sewerage systems and the environment.

However, drier, hotter summers may be beneficial for bathing and shellfish waters, as bacteria are killed off more quickly when there is increased sunlight and there could be fewer combined sewer overflow (CSO) discharges[vi].

Adaptation to climate change is key. For example, farmers and land managers have a role to play to minimise agri-chemical runoff resulting from heavier rainfall events by adapting their land management practices[vii].

2.4 Evidence gaps

The majority of bathing and shellfish waters with problems are affected by multiple diffuse sources of faecal contamination. The main evidence gap is confirming the source of the faecal bacteria, which is very challenging due to:

- the multitude of potential pathways and sources
- The varying decay rates of different pathogens under different weather conditions
- The intensity and cost of monitoring that is required.

A further potential evidence gap may exist in the use of the generic faecal indicator organism (E.coli*)* when the actual health risk could differ between sources.

The Environment Agency does not routinely monitor DrWPAs for bacterial contamination; water companies are required to monitor their supplies and alert us if they detect an issue.

3. Current control measures

We take a catchment approach to identify actions to improve bathing and shellfish water quality. The most significant sources of bacterial pollution across the catchments of these protected areas are identified through modelling and investigations. We then focus our actions to address these sources, but take an integrated approach to ensure that other measures to address other water quality problems in the catchment complement them.

3.1 Evidence for control measures

3.1.1 Water Industry

Between the years 2015-2020, 37 improvements have been completed or are underway at water company assets (e.g. sewerage infrastructure) affecting 21 shellfish waters. There are an additional 59 improvements completed or underway to protect a further 25 bathing waters.

Water company measures are being developed for the 2020-2025 to tackle the contribution from water company assets. During this period, 26 event duration monitors are due to be installed at bathing waters. Improvements will be made to assets affecting 22 bathing waters and investigations will be carried out at 104 bathing waters. For shellfish waters, actions are planned at 20 water company assets, investigations at 19 shellfish waters and 214 event duration monitors will be installed.

This continued investment will build on the approximately £2.5bn and £140m capital already invested by the water industry since privatisation to improve assets that discharge to bathing and shellfish waters respectively.

3.1.2 Agriculture

Incentives, advice and regulation are targeted where they will make the most difference and achieve real outcomes for the water environment. Protected areas such as bathing waters and DrWPAs are prioritised.

We work with partners including farming representatives, catchment sensitive farming (CSF), forestry and wider agricultural supply chain sectors through the Catchment Based Approach (CaBA) and local catchment partnerships. Their work aims to minimise local environmental impacts on the water environment. This includes minimising impacts on the services a healthy water environment provides such as drinking water, recreation, navigation and supporting wildlife.

CSF advice and Countryside Stewardship (CS) funding are currently targeted to address faecal pollution in 23 bathing waters. Mitigation measures advised through one-to-one CSF advice are estimated to have reduced agricultural loadings of nutrients, suspended sediment, pesticides and faecal contamination by between 4 and 12 per cent[viii] on average. Engagement in bathing water catchments has secured a total of 1009 CS agreements by October 2018 and £20m investment by Government through the previous CFS capital grant. This is match funded by farmers so represents £40m investment in these catchments:

Year	Farms Engaged	Specialist Visits	Countryside Stewardship agreements
2007 to date	7630	Approx. 5000	1009

This work has delivered improved infrastructure addressing both sources and their pathways. It is underpinned by advice from both catchment sensitive farming officers and specialist contractors on livestock management, soil husbandry, manure management and water management all of which contribute to reduced faecal pollution.

3.1.3 Urban diffuse pollution

Bathing and shellfish waters are often affected by localised diffuse sources of faecal contamination from urban and highway drainage. In addition, uncontaminated surface water runoff can become contaminated by misconnected drains from households and businesses as well as background faecal contamination from birds, wildlife and pets. Joint working between local authorities, water companies and the Environment Agency has been successful in many cases in identifying and remediating these misconnections. Where surface water drainage can reach bathing waters the risk from faecal contamination will be present and long term partnerships are likely to be the only effective way to mitigate this risk.

3.2 Control measures acting in combination with other pressures

The control measures, outlined in Section 3.1, reinforce the fact that bathing and shellfish waters are affected by pollution from multiple diffuse sources.

Pollution arising from agricultural activities may require remedial measures to be applied to a large number of farms. Agricultural measures may result in multiple benefits in addition to lowering levels of faecal contamination, such as lowering sediment loading, nutrient run off (nitrogen and phosphorus) and contamination from other substances such as ammonia and increasing dissolved oxygen levels.

For bathing and shellfish water sites with significant urban contamination, much of this will be due to misconnections and highway drainage to urban streams. Urban control measures may also result in multiple benefits in these catchments, such as a decrease in domestic or industrial levels of phosphorus and a variety of other chemical pollutants.

3.3 Are our current control measures sufficient to achieve our objectives?

3.3.1 Faecal bacteria standards (targets) and their application

The Environment Agency continues to work with partners to tackle the sources of pollution at the bathing waters classified as 'poor', at risk of becoming 'poor' or have shown deterioration as well as at shellfish waters that do not consistently comply with the Shellfish Directions microbial standard or have shown deterioration.

The greatest challenge we face in further raising compliance and ensuring we maintain the quality that has been achieved is being able to meaningfully tackle sources of urban and agricultural diffuse pollution. While sewage from water company assets currently remains a risk to compliance, targeted water company investment will continue in future investment periods and so this risk will continually decrease. Increasing compliance is particularly challenging at shellfish waters, most of which are located in estuaries, where dense

coastal populations from sewage, urban runoff and agricultural runoff can create high levels of faecal pollution. The effect is particularly pronounced in the west of the country, where rainfall is heavier, resulting in more pollution from intermittent sewage overflows and runoff.

Consideration is now being given to what measures would be required to ensure that all bathing waters are classified in the top two classes of 'good' or 'excellent'. As a result of the 2019 water company price review, water companies are obliged to undertake investigations to understand what action they would need to take to address the cause for bathing waters not achieving 'good' or 'excellent'. The outcome of these investigations will help inform the future ambition for bathing waters and potentially lead to further investment in the next water company price review in 2024 (PR24).

3.3.2 Evidence gaps

The main evidence gap regarding current control measures is identifying where the faecal bacteria are coming from. This is very difficult as there are so many potential pathways and sources and each protected area has a unique combination of inputs. More monitoring of faecal bacteria in the catchments of shellfish waters and ‘at risk’ bathing waters would help fill this gap. This monitoring would involve taking water samples from rivers in the catchment and analysing them for faecal bacteria. There is currently no national, long term data set relating to the presence of faecal bacteria in catchments or rivers.

A national bathing water group is working to bring stakeholders together including water companies, local authorities and non-governmental organisations with an interest in bathing waters. The group works to provide a common understanding of the issues facing bathing waters and how these can be addressed, together with producing a common communication narrative.

3.3.3 Actions to close the evidence gaps

Annex 1 shows a table of Environment Agency and Defra projects that are ongoing to address the evidence gaps in relation to the management of faecal contamination. It also contains a second table showing projects that are ongoing address the evidence gaps that are relevant across a broad range of pressures.

4. Other considerations – opportunities and risks

The 25 Year Environment Plan (25 YEP) recognises the importance of bathing water quality and commits to "minimising by 2030 the harmful bacteria in our designated bathing waters and continuing to improve the cleanliness of our waters. We will make sure that potential bathers are warned of any short-term pollution risks".

In England, recreational bathing activity has traditionally occurred at coastal sites; of the total 421 designated waters in England 409 are coastal and 12 are inland lake sites. Anecdotal evidence suggests that bathing practice is changing, particularly in relation to the increasing popularity of “wild swimming” and sporting events including triathlons. Rivers and other open water locations that are not designated as bathing waters are managed for the purpose of protecting fish and wildlife, not people, so health risks from using these locations may be higher than at designated bathing waters. Applications for sites which are attracting a large number of bathers to be designated as bathing waters can be made to Defra under the Bathing Water Regulations 2013. Further information is available at: https://www.gov.uk/guidance/bathing-waters-apply-for-designation-or-de-designation

Shellfish waters are recognised in the commitment to achieve "good environmental status in our seas while allowing marine industries to thrive".

However, there is a conflict between using energy to treat water to improve its quality and the resulting emissions of greenhouse gases. There is a perceived reliance on high energy treatment solutions such as ultra-violet (UV) treatment to support protected area targets[ix]. We need to balance the impacts associated with improving individual protected areas with the wider impacts on the environment.

5. Contacts

If you have any feedback or comments on the evidence contained in the summary then please contact: enquiries@environment-agency.gov.uk

6. Annex 1 – evidence gap projects

The table below summarises projects that are planned or ongoing by the Environment Agency in order to address the evidence gaps in relation to pressures from faecal contamination.

Organisation	Reference	Summary
EA	SC160015	Bathing Water Pollution Risk Forecasting. To extend our existing evidence base of data considered to affect water quality at bathing waters according to our current knowledge and understanding. To make the evidence base available as 'open data' for internal data and subject to licensing for external data; To fully implement the short term pollution (STP) provision of the Bathing Water Regulations by applying our Pollution Risk Forecasting (PRF) method to all bathing waters where possible. To improve the accuracy of PRF by quantifying the explained variance from other environmental variables and developing the method accordingly. To develop a plan to disseminate PRF knowledge for in-house resilience by tool development, documentation and training.

The table below summarises projects that are planned or ongoing in the Environment Agency or for Defra in order to address evidence gaps that are relevant across a broad range of pressures.

Organisation	Reference	Summary
EA	SC160001	UKCP18 Project. To shape the next set of UK Climate Change projections (UKCP18) to ensure they meet user needs.
EA	SC160020	Assessing the Statistical Significance of Changes: OOG Monitoring. The overall aim is that we should have a proportionate approach to environmental monitoring requirements for OOG. The project aims to identify techniques for statistical analysis for the design of monitoring programmes and the assessment of data. It should give early information on changes and their causes, in order to discriminate local environmental or seasonal conditions so that OOG impacts can be addressed.
EA	SC170019	Mapping residence time in English rivers for water quality risk screening. The aim of this project is to produce a map of ‘at risk’ river locations using a modification of an approach developed and used by CEH in previous investigations of climate change impacts. This will consist of two primary tasks: 1. Adapt, test and automate the existing approach to

Organisation	Reference	Summary
		deriving residence time 2. Apply this to the river network of England to identify areas of potential risk to water quality.
EA/JWEP	SC180006	Future resilience (SRoC funded) Peer review. To explore how catchment resilience can be measured and managed for the benefit of communities, business and wildlife, given pressures including climate change, population growth and changing land use. Catchment resilience has many definitions and concepts, including resisting change, recovering after change, and recovering to perform a similar function after change. We will commission approximately 13 small expert reviews on catchment resilience to understand the current state of knowledge and perspectives from different disciplines.

JWEP – Joint Water Evidence Programme

7. References

[i] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/763499/EMBARGOED_STATS_bathing-water-release-revised20182.pdf

[ii] EA Internal spreadsheet: Poor bathing waters based on planning class

[iii] EA Internal spreadsheet: Baseline class assessment

[iv] EA Internal document: Shellfish water results 2018

[v] Bathing Waters: working in partnership in England and Wales, Environment Agency, October 2010

[vi] Kay, D. et. al. Decay of intestinal enterococci concentrations in high-energy estuarine and coastal waters: towards real time T90 values for modelling faecal indicators in recreational waters, Water Research 39 (2005) 655-667

[vii] Climate change impacts and adaptation, Environment Agency, November 2018

[viii] http://publications.naturalengland.org.uk/publication/6510716011937792

[ix] Transforming wastewater treatment to reduce carbon emissions. Environment Agency SC070010/R2. 2009