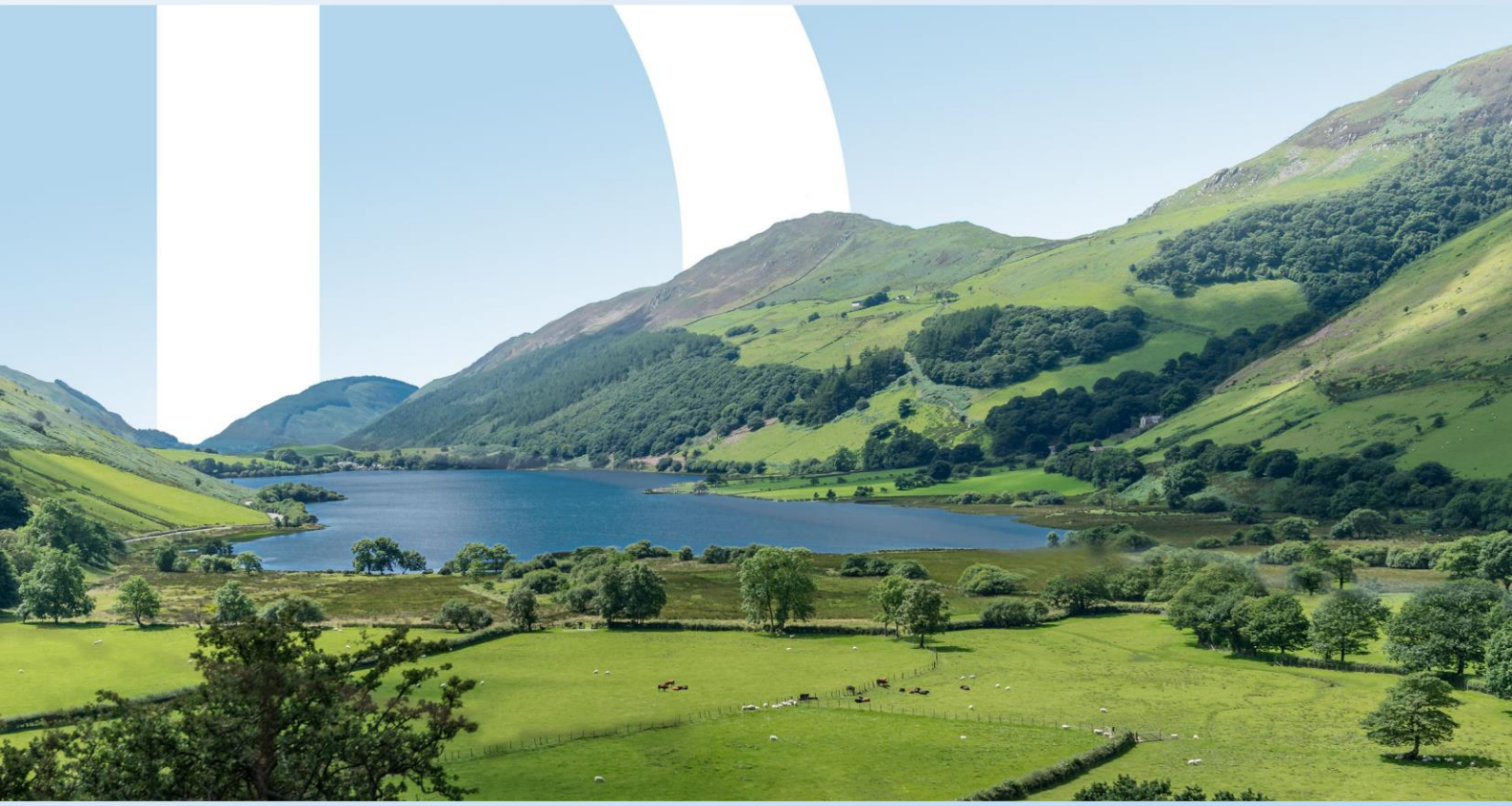
Office for Environmental Protection

COMPARATIVE APPROACHES TO RIVER BASIN MANAGEMENT PLANS

Final Report



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COMPARATIVE APPROACHES TO RIVER BASIN MANAGEMENT PLANS

FINAL REPORT (VERSION) PUBLIC

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PROJECT AIMS AND OBJECTIVES

The aim of this project was to support the Office for Environmental Protection (OEP) in developing an independent view of the challenges related to the protection of the water environment in England and Northern Ireland (NI) and how these challenges might be addressed. The project investigated the management of the water environment in a number of jurisdictions, including both EU Member States and non-EU jurisdictions. This report provides an overview of current practices and compare both practices and outcomes in England and Northern Ireland with those elsewhere in the UK, in EU Member States and in non-EU countries.

This project consisted of four different tasks:

- Task 2A: Comparison against progress and performance in EU countries:
  - In this task, the progress and performance in achieving the Water Framework Directive (EFD) outcomes was compared in England and NI against progress from all EU Member States (27 countries).
- **Task 2B:** Comparison against progress and performances in Scotland and Wales:
  - In this task, the differences taken in approaches by competent authorities for implementing the WFD legislation in Scotland and Wales was compared to England and NI.
- **Task 2C:** Assessment of lessons and practices from selected EU jurisdictions:
  - In this task, detailed practices from four EU jurisdictions (Northern Ireland, the Netherlands, Germany and Denmark) were assessed to explore lessons learnt from those countries which have had more success in implementing the same underpinning Directive.
- **Task 2D:** Assessment of lessons and practices from selected non-EU jurisdictions:
  - In this task, detailed practices were assessed from three non-EU jurisdictions (New Zealand, California and South Africa), with another five countries reviewed as part of the initial scoping and selected best practices.

This report contains the combined outputs of Tasks 2A-D.

1

Task 2A - Comparative Approach to River Basin Management in Jurisdictions Outside England and Northern Ireland

1 Introduction

1.1 Objectives of Task 2A

The aim of this task was to compare the progress and performance in achieving the Water Framework Directive (WFD) outcomes in England and Northern Ireland against progress from all EU Member States (27 countries). These differences have been described and assessed to understand whether specific learning could be identified to then improve the overall compliance, or rate of improvement of water bodies in England and Northern Ireland.

The findings from this report have also been used to inform the selection of EU Member States to focus on in Task 2C focusing on an assessment of lessons learned and practices from selected EU jurisdictions.

1.2 Approach Undertaken

A key challenge of this comparison is that while the objectives of the WFD are the same in all countries, the local context varies immensely throughout Europe. As such, factors such as the number of waterbodies, climate, urbanisation have an impact on the achievement of the objectives of the WFD. As such, in order to compare countries, it was important to identify a series of common indicators that could be used for this purpose. The indicators were selected and defined to collate and assess the information from the EU Member States. The indicators enable us to perform a quantitative and qualitative analysis of the 27 EU Member States progress in comparison to England and Northern Ireland. They are:

- General context (land use, population sizes, the scale of assessment and significant pressures);
- Ecological status and changes since the first River Basin Management Plans (RBMPs);
- Chemical status and changes since the first RBMPs;
- Environmental objectives and use of exemptions;
- Water pricing and cost recovery; and
- Governance.

For the overall coherence of the project, these indicators are the same as those used in Task 2B.[1]

The information upon which our analysis is based includes:

- Country-specific assessments for EU Member States' 2nd River Basin Management Plans;[2]
- The European Environment Agency report 'European water – Assessment of status and pressures 2018';[3]

[1] Task 2B compared the approaches taken to implement the WFD legislation in Scotland and Wales to those in England and Northern Ireland. The purpose was to evaluate any differences to determine if there were learnings that could be applied to England and Northern Ireland to improve overall compliance or rate of improvement of water bodies.

[2] European Commission. Implementation Reports. Available at: Implementation Reports (europa.eu)

[3] European Environment Agency. (2018). European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

- European Environment Agency Land Cover Statistics;[4] and
- Where relevant the 3rd RBMPs for England (RBMP progress report for England) and the draft 3rd RBMPs for Northern Ireland (RBMPs for Northern Ireland, containing the North Western, Neagh Bann and North Eastern RBD).[5]

1.3 Gaps and Limitations

In carrying out Task 2A some challenges were encountered with some impacts on the analysis. These challenges included:

- There is currently not enough information in the public domain to assess progress made in the 3rd RBMPs as only two Member States have completed their WISE reporting (i.e. Austria and Netherlands). As such for quantitative data, we had to rely on the information from the 2nd RBMPs which is not the most up to date but is the most comprehensive. We have referenced information from England 3rd RBMPs and Northern Ireland's draft 3rd RBMP where appropriate to provide a comparator with the most current state of progress/performance.
- There was variation in the way that Member States reported information as well as the level of detail available for each indicator. This meant information was not always directly comparable for the same indicators, or it was sometimes inconclusive due to incomplete information. The fact that insufficient information is available for a specific Member State on some indicators does not mean that the Member State had not carried out the activity but rather that the information was not available.
- As there are 27 EU Member States with which to compare data, we needed a method of quantification to be able to assess and compare information. To do this we defined an assessment framework which was made up of a range of appropriate indicators including the context of the country, statistical results on ecological status and chemical status, changes in water quality since the first RBMPs and use of exemptions. Although this provided many useful comparisons and conclusions, the granularity of the indicators meant it could be difficult to link results to overall success/good progress of Member States. Indicators should not be considered on their own but rather in conjunction with contextual information. For example, some countries with very high rate of urbanisation and agriculture will naturally have a greater challenge in reaching good status or might rely more heavily on derogations.

[4] European Environment Agency (2019). Land cover and change accounts 2000-2018. Available at: https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics

[5] Environment Agency. (2022). River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report, Northern Ireland Environment Agency (2021). Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available : https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

2 Key Messages

The purpose of this task is to compare the progress and performance in achieving the WFD outcomes in England and Northern Ireland with progress in EU Member States. These differences have been described and analysed to understand whether there are any learnings that could improve the overall compliance, or rate of improvement of water bodies in England and Northern Ireland. We developed a set of indicators to enable us to perform a quantitative and qualitative comparison, the key findings for each indicator are summarised below:

- Firstly, it is important to note that there was variation both between and within Member State's RBDs in terms of how information was reported as well as the level of detail available on specific indicators. This means that information was not always directly comparable, or that in some instances comparisons could not be done due to incomplete information. Additionally, the granularity of the indicators meant it was often difficult to link a specific result to overall success/good progress of Member States.

  - Comparison of **ecological status** for the 2nd RBMPs showed that the UK and many Member States reported similar improvements in the knowledge and understanding of water bodies with fewer surface water bodies classified as unknown ecological status. This was largely due to improved monitoring programmes with a greater number of monitoring sites. Similarities were found between the UK and several other Member States in that they did not report a significant improvement on ecological status since the 1st RBMPs. A general conclusion from the 2nd RBMPs was that across all water bodies in EU Member States there was a low percentage meeting the objective of high or good ecological status. Due to differences in methodologies and assessments, it is challenging to draw direct comparisons between Member States and the UK.

  - When looking at England 3rd RBMPs and Northern Ireland's draft 3rd RBMP the percentage of good **ecological status** or potential in England in 2019 was similar to that in 2015 in the 2nd RBMPs. Whilst the overall change is minimal (1%), there were changes to the status classes for individual bodies. In Northern Ireland's draft 3rd RBMP, there were no changes reported to the ecological status of water bodies since the 2nd RBMPs.

  - The outlook for **chemical status** in Europe is changing due to stricter standards for some priority substances coming into force and new substances being added to the list for the 3rd RBMPs. In the 2nd cycle, a total of 38% of surface water bodies in the EU were in good chemical status and overall, the improvement in chemical status for groundwater between the 1st and 2nd RBMPs has been less marked than for surface water. The proportion of water bodies with unknown surface water chemical status dropped significantly from 39% to 16%.

  - In the 2nd RBMP, the UK had a high percentage of **surface water bodies classified at a good chemical status**, with 96% of surface water bodies classified as good, which is higher than a lot of Member States for the same reporting period. However, this has now changed in the 3rd RBMP, with England including assessments ubiquitous persistent and bio accumulative toxic substances (uPBTs) in the classification of chemical status and reporting that no water bodies achieve good chemical status. Northern Ireland also reported that all water bodies fail with the inclusion of uPBTs.

- Several Member States (including the UK in the 2nd RBMP) reported a significant influence of uPBT substances on the overall chemical status. The way Member States assessed their monitoring results and any extrapolation of their data appeared to have a large impact on their results. In general, those who did not widely apply extrapolation approaches had good chemical status and those who extrapolated results had widespread failures to achieve good chemical status when uPBTs were considered in the assessment. It is yet to be seen what all other Member States have reported with respect to uPBTs and surface water chemical status in the 3rd RBMPs.
    - There was little reported change in **chemical status of groundwater bodies** between the 1st RBMPs to the 2nd (improving by 2% at the EU Level). Reasons include the lag time for groundwater recovery from pollution after an intervention to manage the source has taken place, or because effective measures have yet to be taken. In the 2nd RBMPs, a total of 16 Member States reported >80% of their groundwater bodies to be at good chemical status. In comparison, the UK reported 69% of its groundwater bodies to be at good chemical status which was below average (due to anthropogenic pressures and pollution) in comparison to other Member States.
    - The 3rd RBMPs identified that England has more groundwater bodies with poor chemical status than with good and Northern Ireland has a higher number of groundwater bodies at good status.
    - Results from the 2nd RBMPs demonstrated that around 92% of groundwater bodies in the EU are at **good quantitative status**, with around 5% failing good quantitative status while the other 3% had unknown status. In the 2nd RBMP, the UK reported that 85% of groundwater bodies were in good quantitative status and 15% failed to achieve good quantitative status. This means the UK had an about average quantitative status compared to other Member States. In the 3rd RBMPs, England and Northern Ireland have reported improvements to their quantitative status with more groundwater bodies classified as good compared to poor.
    - **Exemptions** are used extensively across the UK and other Member States, particularly those provided by Article 4(4). The number of exemptions applied in different Member States varied, but it was noted that Article 4(5) exemptions increased for all Member States between the 1st and 2nd RBMPs. Exemptions were more often applied to surface waters in UK and Member States than to groundwaters (potentially due to better chemical status of groundwater in general).
    - Justifications for **exemptions** were more detailed and more consistently reported on in the 2nd RBMPs compared to the 1st, though the level of detail could still have been improved on. Justifications in many cases were still generic. For example, the European Commission's analysis of the 2nd RBMPs reported that in the use of Article 4(5), several Member States provided inadequate information on the assessment of disproportionate costs (including Denmark, Poland, Romania, Slovakia and Austria). On the other hand, countries that demonstrated some good practice with more detailed justifications of disproportionate costs included Sweden, Spain, Italy, Malta, France and the UK.
    - Similar conclusions apply to the use of Article 4(7); the European Commission's analysis of the 2nd RBMPs showed that while some Member States, such as Germany, Spain, and the UK, made progress in assessing impacts on the status of a water body, further improvements, increased transparency, and comprehensive documentation of all steps required by Article 4(7) are still needed.

- The reliance on exemptions in England, in the 3rd RBMPs, continue to be significant, in particular for chemical pressures and the presence of uPBTs. The comparison of the approach to exemptions in Northern Ireland's draft 3rd RBMP is challenging due to the lack of information provided on the application of exemptions in the draft plan.
- The comparison of the **Programme of Measures** is difficult, due to the number of pressures and the variety of issues faced on a regional level within Member States. The UK applies more basic than supplementary measures, which is a common theme throughout Member States. This is due to the supplementary measures only being used when a pressure arises which is not adequately covered by the basic measures. The main Key Type Measures (KTMs)[6] that the UK implements are KTM 21 (Measures to prevent or control the input of pollution from urban areas, transport and built infrastructure) and KTM 13 (drinking water protection measures). The UK also provides information as to why they have applied the KTMs, which is partially missing in a number of other countries.
- Overall, based on the 2nd RBMPs, it is likely that most Member States will not reach the **objective of achieving good status** (or good potential) by 2027. This appears to be confirmed in the England with 3rd RBMP data including extending the deadlines to achieve the objectives well into the future. Most surface water bodies have extended the deadline to achieve good chemical status to 2063. A main cause of the majority of deadline extensions are due to the identification of new uPBT substances. These uPBT substances are expected to prevent many other Member States from achieving their chemical objectives and at EU level, extensions of deadlines to beyond 2027 are expected to be observed in a number of Member States 3rd RBMPs.
- The assessment of **economic analysis** for the 2nd RBMPs showed that most Member States had limitations with either how they carried out the assessment of cost recovery of water services or with the level of detail provided about the methodology used. The UK was no different as cost recovery was explained in general terms, but it was not transparently presented in all RBDs. Progress appears to have been made in England's 3rd RBMPs and Northern Ireland's draft 3rd RBMP, as both clearly detail the methods used for cost recovery analysis.
- In comparison to other Member States, the UK appears to be more transparent in terms of completing the qualitative cost-effectiveness of measures and providing an explanation of how selections were made in the 2nd RBMPs. This information is not as clearly made available in the 3rd RBMPs for England and the draft 3rd RBMP for Northern Ireland.
- The approaches to **governance** and **public consultation** showed that almost all Member States reported that the documents were available for the minimum six months as required. The same was found for England and Northern Ireland for the 3rd RBMPs.

[6] Basic and supplementary measures are reported against Key Type Measures (KTMs). KTMs are a concept developed in 2012 to simplify reporting.

- Very few Member States published their 2nd RBMPs by the December 2015 deadline, the UK included. As seen by the lack of currently available 3rd RBMPs this trend is largely continuing for the 3rd cycle. The level of comprehensiveness of the draft 2nd RBMPs consulted on varied between Member States.
- Mechanisms for active **engagement of stakeholders** in the consultation process as well as an indication of the types of stakeholders involved were provided for the majority of Member States. In comparison, the 3rd RBMPs for England provided very detailed information about the consultation process and the changes made in response to the feedback received. The final 3rd RBMPs for Northern Ireland are not yet available, therefore the extent of the changes to be made following the stakeholder consultation is not yet known.

3 Comparison Against Progress and Performance in EU Countries

3.1 Introduction

This section provides a description and analysis of progress and performance across EU countries in comparison to England and Northern Ireland.

3.2 Contextual Information

The WFD came into force in 2000 and established a framework for the assessment, management, protection, and improvement of the quality of water resources across the EU. A key requirement of the WFD is the adoption of an RBMP that must be updated every six years. The first sets of RBMPs were published in 2009, followed by the second iterations in 2015. This report relies on 2nd RBMPs data as for the 3rd cycle only the Netherlands and Austria have provided full datasets.

Contextual information is important to take into account when considering differences and similarities between Member States and their implementation of the WFD. This section will give an overview of key indicators including types of land cover, population size, the significant pressures and where England and Northern Ireland fit.

Types of land cover

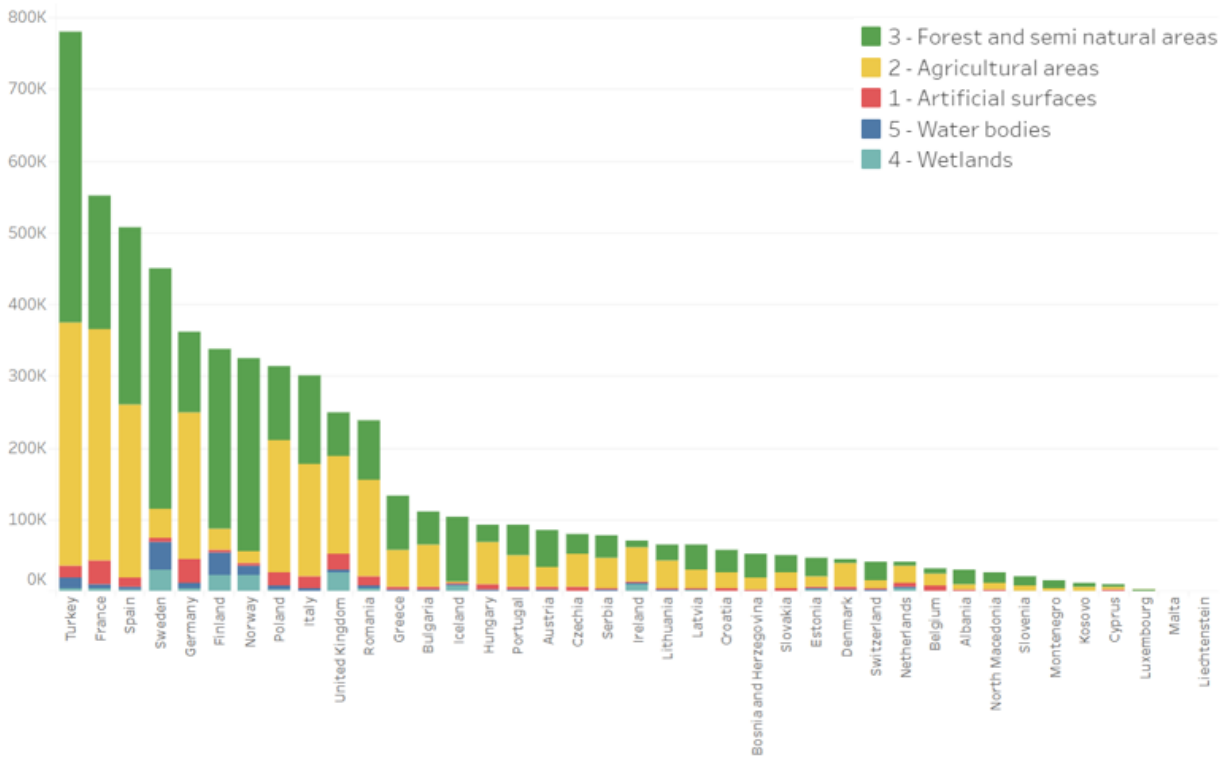
CORINE land cover data series (a European programme that provides a consistent classification system of long-term land cover in Europe[7]) provides an overview of the land cover statistics for the EU Member States.[8] The data showed that the most common land cover types across all Member States include forest and semi natural areas (49%), agricultural areas (42%), artificial surfaces (4%), water bodies (3%) and wetlands (3%).[9] This is illustrated at the Member State level in Figure 3-1.

7 Balzter, H., Cole, B., Thiel, C., Schmullius, C., 2015. Mapping corine land cover from sentinel-1a SAR and SRTM Digital Elevation Model data using random forests. Remote Sensing, 7(11), 14876–14898.

8 The figures are sourced from CORINE which covers also non-EU countries such as Norway, Switzerland and Turkey. These countries are shown in the figures sourced from CORINE data, but they are not included as part of our assessment which focuses only on EU Member States.

9 European Environment Agency (2019). Land cover and change accounts 2000-2018. Available at: Land cover and change accounts 2000-2018 — European Environment Agency (europa.eu)

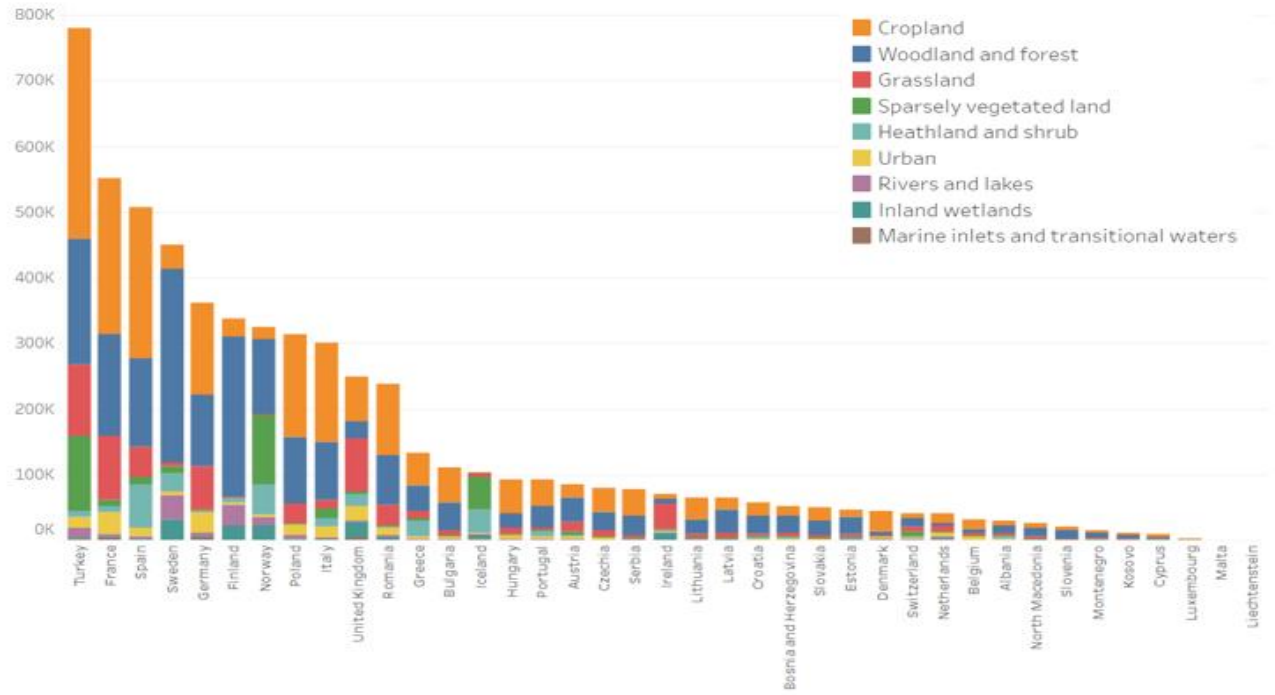
Figure 3-1 - Land cover by country (km²)



Source: European Environment Agency (2019). Land cover and change accounts 2000-2018. Available at: Land cover and change accounts 2000-2018 — European Environment Agency (europa.eu). Note CORINE covers also non-EU countries e.g., Norway, Switzerland, Turkey not included as part of our assessment that focuses on EU Member States.

The information provided from the mapping and assessment of ecosystems also provides data on the land cover of the different Member States. It shows that the most common types of land are woodland and forest (34%), cropland (34%) and grassland (11%). This is illustrated in further detail and at Member State level in _Figure_2.2:_Mapping These figures allow us to visualise and compare the different type of land uses in the context of the countries' size (in km^2). Figure 3-1 above illustrates that most Member States have a mix of mainly forest and semi natural areas and agricultural areas. It also illustrates that the dominant land cover in the United Kingdom (UK) is forest and semi natural areas and agricultural areas, and that UK has fewer water bodies in comparison to Member States such as Sweden and Finland.

Figure 3-2 - Mapping and assessment of ecosystems data by country (km ²)



Source: European Environment Agency (2019). Land cover and change accounts 2000-2018. Available at: Land cover and change accounts 2000-2018 — European Environment Agency (europa.eu). Note CORINE covers also non-EU countries e.g., Norway, Switzerland, Turkey not included as part of our assessment that focuses on EU Member States.

Figure 3-2 shows increased variation between countries and that the UK is mostly dominated by cropland and grassland in comparison to a lot of other countries that are mostly cropland and woodland and forest.

Urbanisation

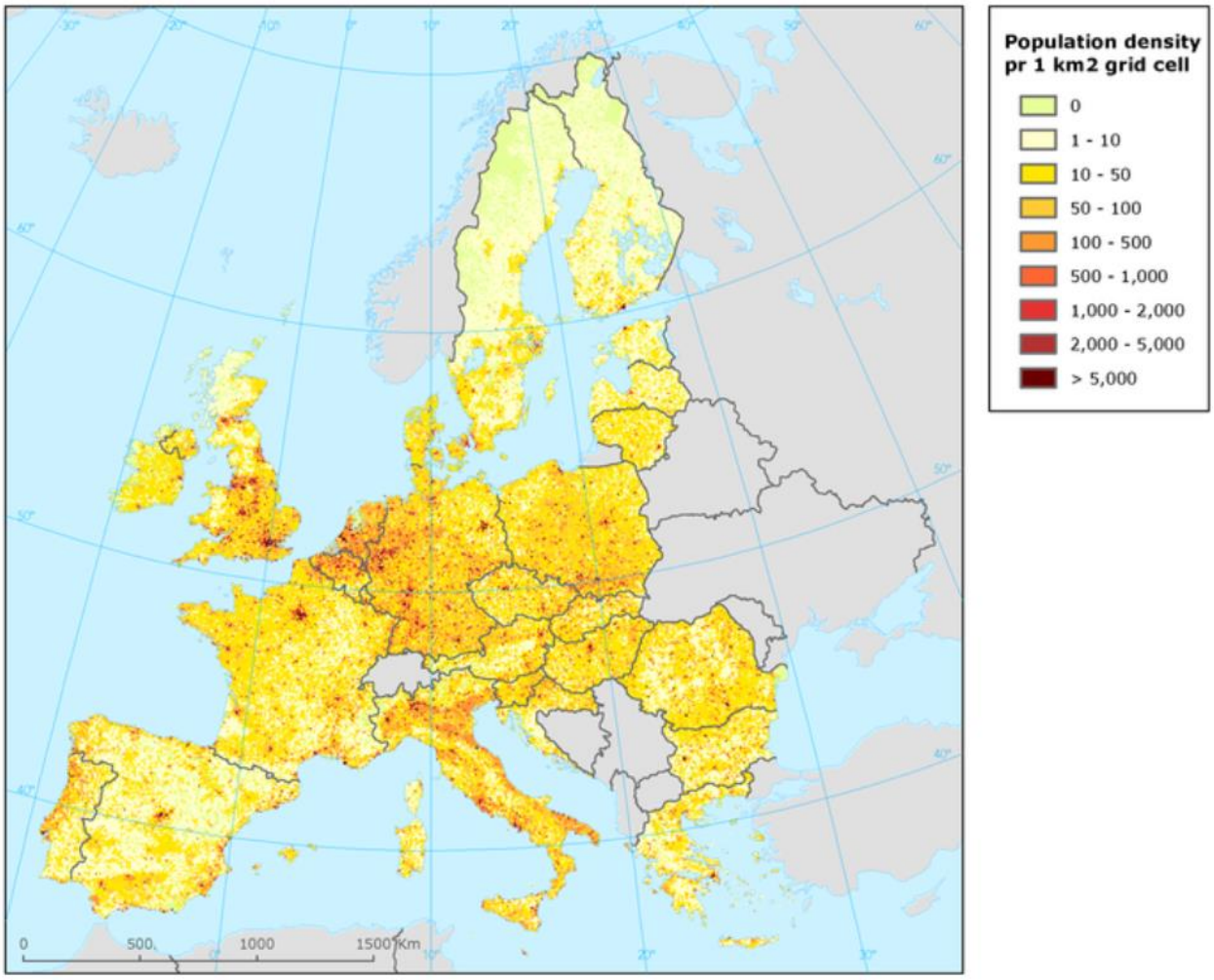
This data shows that as of 1 January 2022 the three most populated EU Member States are Germany (83,237,124), France (67,842,582) and Italy (59, 030,133).[10] In comparison, in 2021, the population of England was 56,489,800[11] and the population of Northern Ireland was 1,904,600.[12] This is further illustrated in Figure 3-3 which shows the population density of EU Member States.

[10] European Union, 2022. Facts and figures on life in the European Union. Available at: https://european-union.europa.eu/principles-countries-history/key-facts-and-figures/life-eu_en

[11] Environment Agency, 2022. Population and household estimates, England and Wales: Census 2021. Available at: https://www.gov.uk/government/publications/census-2021-first-results-england-and-wales/population-and-household-estimates-england-and-wales-census-2021

[12] Northern Ireland Statistics and Research Agency, 2022. 2021 Mid-year Population Estimates for Northern Ireland. Available at: https://www.nisra.gov.uk/system/files/statistics/MYE21-Bulletin.pdf#:~:text=Northern%20Ireland%E2%80%99s%20population%20on%2021%20March%202021%20was,between%2021%20March%202021%20and%2030%20June%202021.

Figure 3-3 - Population density of EU Member States



Source: European Environment Agency. Population Density. Available at: https://www.eea.europa.eu/data-and-maps/figures/population-density-2

Significant pressures

Overall, based on the information reported in the 2nd RBMPs the main significant pressures on surface water bodies were hydro morphological pressures (40%) diffuse sources (38%), particularly from agriculture; and atmospheric deposition (38%), particularly of mercury; followed by point sources[13] (18%), particularly urban waste water (12%) and storm overflows (4%); followed by water abstraction (7 %).[14] In comparison, the most significant pressures on surface waters in the UK in the 2nd cycle were reported to be anthropogenic unknown (28%), followed by diffuse agricultural (20%) and physical alteration of channel/bed/riparian area/shore – other (20%). These pressures varied across regions in the UK.

[13] point source pollution is defined as coming from a single source (such as leaks from a pipe) this is different than diffuse pollution which is sourced from undefined pollution events (such as nutrient run off from a farm).

[14] European Environment Agency. 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

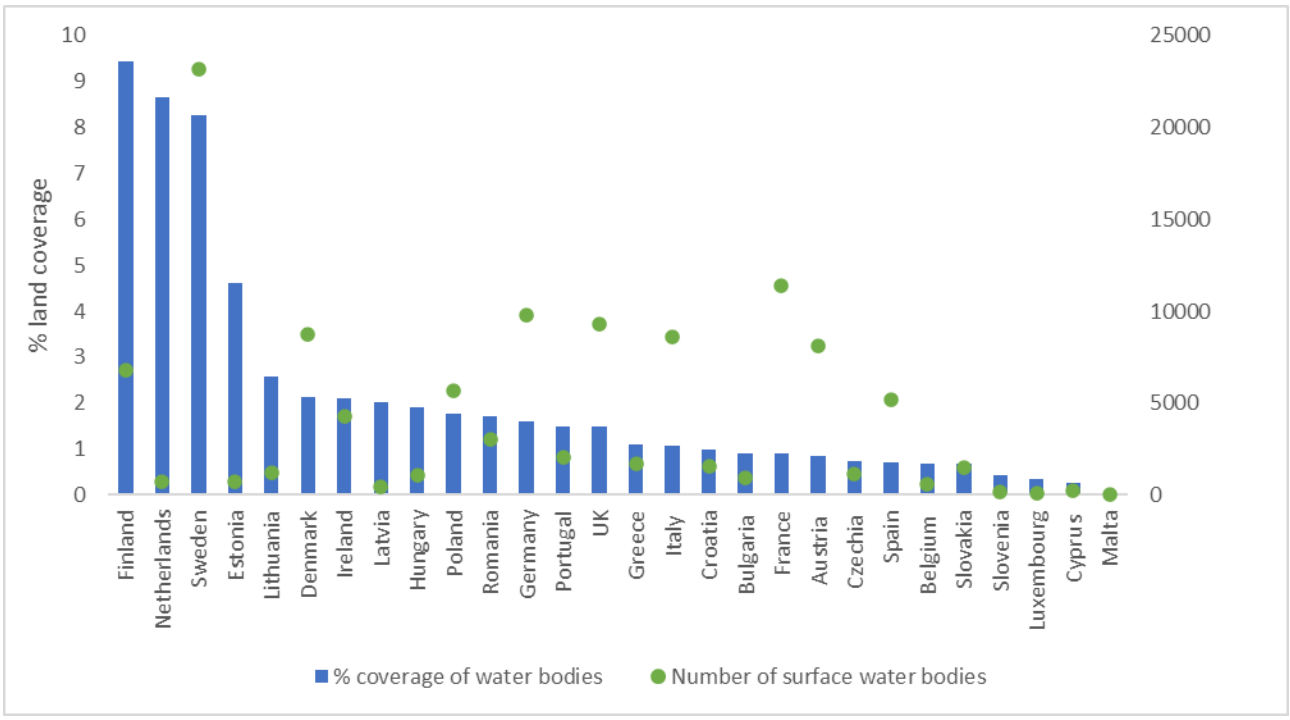
The 3rd RBMPs showed that the main pressures in the water environment in England, are physical modifications, pollution from agriculture and rural areas, pollution from towns cites and transport and pollution from water industry wastewater.[15] The main pressures faced in Northern Ireland's water environment include issues surrounding nutrients from agricultural land use activities and sewage related impacts. Other relevant pressures include pollution from chemicals and pesticides; abstraction, fisheries and morphology; non-native invasive species, forestry and waste and contaminated land.[16]

3.3 Surface Water Status

Figure 3-4 represents the number of surface water bodies and percentage coverage of water bodies in each Member State. A table of this data is provided in Appendix A. The variation in the number and type of water bodies, along with the different pressures facing surface water bodies, varies both within countries and internationally, creating significant differences between countries.

This section presents the overview of the results of ecological classification status from the 2nd RBMPs for the EU Member States and the UK. The UK, in particular England and Northern Ireland, will be focused on and compared to the EU Member States for a critical assessment.

Figure 3-4 - The % of land coverage that water bodies cover in a country in comparison with the UK, along with the absolute number of surface water bodies in that country



[15] Gov.UK, 2023. River basin planning process overview. Available at: https://www.gov.uk/government/publications/river-basin-planning-process-overview/river-basin-planning-process-overview (accessed 13th June 2023).

[16] Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

Ecological Status

Ecological status is an assessment of the quality of the structure and functioning of surface water ecosystems. It is determined for surface water bodies of rivers, lakes, transitional waters, and coastal waters and can reveal the influences of pressures on aquatic ecosystems (e.g., pollution or habitat deterioration). Ecological status is based on biological quality elements, and is supported by physico-chemical and hydro morphological quality elements briefly:

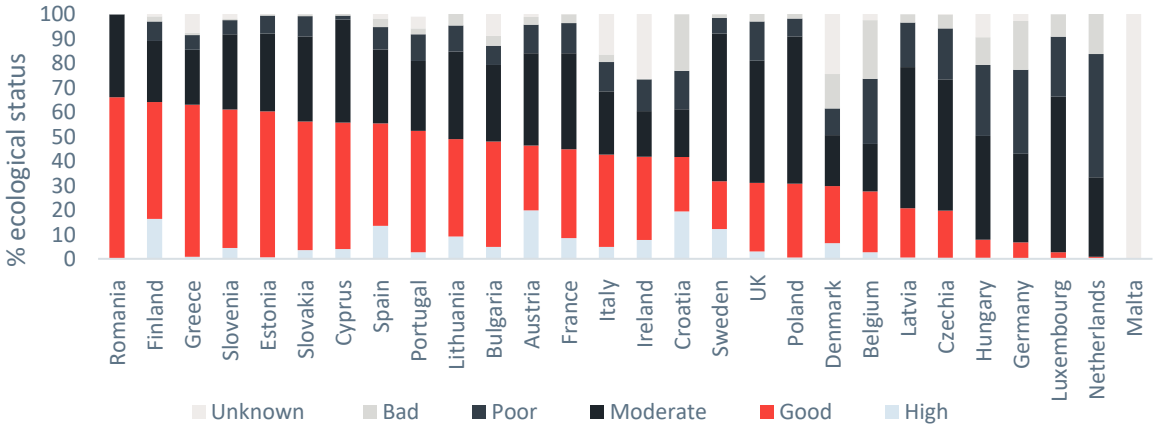
- Biological quality elements are biological indicators used to assess the ecological health of aquatic ecosystems. The combination of biological quality elements used varies depending on the category of water body but can include, macroinvertebrates, fish, macrophytes, phytobenthos and phytoplankton;
- Chemical quality elements are indicators that measure and monitor the chemical composition of water in aquatic ecosystems. These include a range of river basin specific pollutants, but also nutrients, metals, and organic compounds; and
- Hydro morphological quality elements are used to assess the physical structure and conditions of the water body (e.g., channel morphology).

An overall ecological classification is given for a water body, and this is based upon a **"one out, all out"** principle. This is the method where the element with the worst status out of all the biological and supporting quality elements determines the overall status of the water body. Rather than focusing on individual elements, this principle considers them as a whole, recognising that ecosystems are interconnected and that a failure in one aspect can have significant negative impacts on the entire ecosystem.

Ecological status results

Figure 3-5 to Figure 3-8 show the breakdown of ecological status in each water body category (river, lake transitional and coastal) for EU Member States compared to the UK with data from the 2nd RBMPs.

Figure 3-5 - Ecological status of EU Member States rivers compared to the UK with data from the 2nd RBMPs



Note: the order of countries is based off the sum of the percentages of high and good chemical status.

Figure 3-6 - Ecological status of EU Member States lakes compared to the UK with data from the 2nd RBMPs

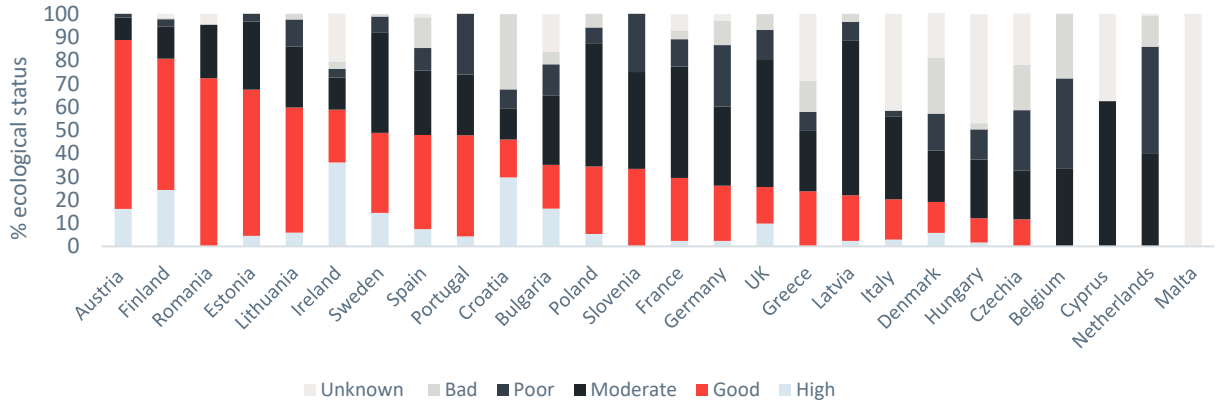
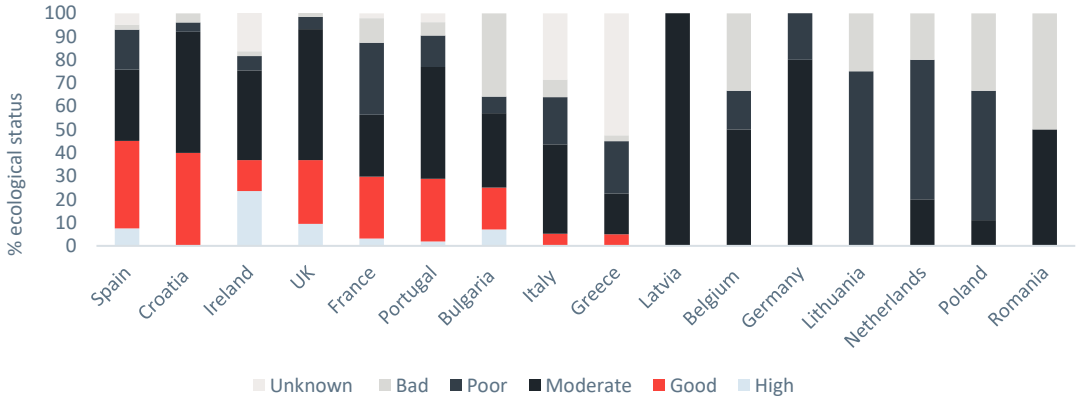


Figure 3-7 - Ecological status of EU Member States transitional[17] bodies compared to the UK with data from the 2nd RBMPs



17 Note: A transitional water body is one that can be found in the vicinity of river mouths, which are partially saline due to their close proximity to surface waters (https://www.eea.europa.eu/help/glossary/eea-glossary/transitional-waters). Not all MS have transitional bodies (e.g. ones that are landlocked), however some MS that do have coastal waters have not always defined any water bodies as transitional. Reasoning for this have included difficulties in distinguishing transitional water bodies from coastal water bodies (e.g. Sweden), or that there are only very gradual changes in salinity from the near-shore areas to the open sea (e.g. Denmark). Instead, these water bodies can sometimes be defined as coastal water bodies instead of transitional.

Figure 3-8 - Ecological status of EU Member States coastal bodies compared to the UK with data from the 2nd RBMPs

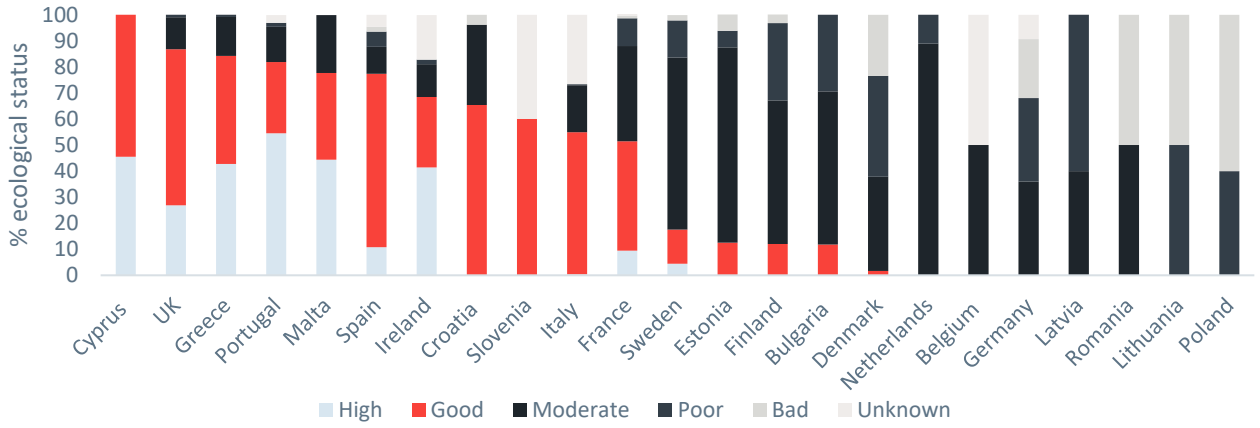
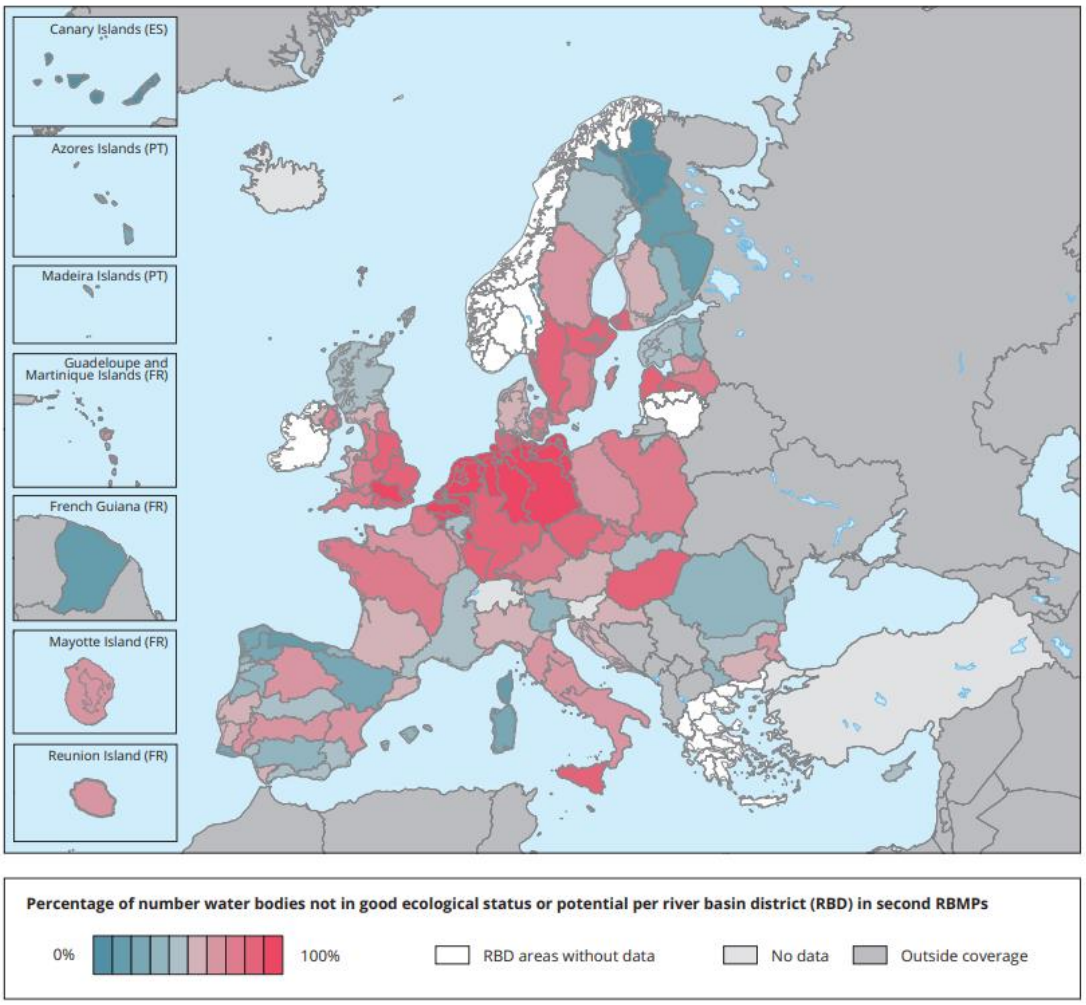


Figure 3-9 - Percentage of water bodies in Europe's RBDs not in good ecological status/potential, results from the 2nd RBMPs



Ecological Status Discussion

England/Northern Ireland Status

In the European Commission's analysis of the UK's 2nd RBMPs, it was reported that ecological status/potential had not improved significantly since the 1st RBMPs, and that the status/potential changes reported at the quality element-level did not display a reliable or steady pattern or trend.[18] This was reported in the European Commission's analysis to be due to changes in monitoring and assessment methods. Furthermore, the 2nd RBMPs reported that the large majority of water bodies in the UK are still in less than good ecological status/potential.

In the 2nd RBMPs, 5% of rivers in the UK had unknown ecological status. The most recent assessment of England's water body status in 2019 for the 3rd RBMPs found this had improved with no surface water bodies classified as 'unknown'. In comparison Northern Ireland's draft 3rd RBMP reported still a very small number (0.4%) of surface bodies in unknown condition.

The percentage of surface water bodies at good ecological status or potential in England in 2019 was similar to that in 2015 in the 2nd RBMPs (16% in 2019 versus 17% in 2015). Whilst the overall results showed only a small change, there were changes to the status classes for individual bodies. For example, the Environment Agency reported that 151 water bodies improved from moderate or worse ecological status in 2015, to good or better ecological status in 2019. In contrast, 171 water bodies dropped from good or better ecological status in 2015, to moderate or worse ecological status in 2019.[19,20] This shows a net deterioration of 20 water bodies changing from good or better to moderate or worse.

There has been no significant change in the status of individual quality elements at the national scale. This is shown through the fact that most sampled rivers remain at good or high status for invertebrates, ammonia and dissolved oxygen, but under half are at good or high status for fish, macrophytes or phosphate.[21]

In Northern Ireland, no changes to the ecological status of water bodies since the 2nd RBMPs were reported. Due to the stagnation in the overall percentage of water bodies at good or better, Northern Ireland Environment Agency reported that the initial objective of good status in all water bodies (100%) by 2027 is unlikely to be achieved. In 2015 Northern Ireland Environment Agency's objective was to have 70% of all Northern Ireland's water bodies at good status in 2021, but this objective has only been partially achieved in the draft 3rd RBMPs with 31% at good or higher ecological status.[22]

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18 European Commission assessment report, United Kingdom, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

19 Environment Agency, 2021. Trends in pressures on biodiversity: surface water status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025323/21_Surface_water_status.pdf

20 Environment Agency, 2021. River Basin planning: progress report. Available at: River basin planning: progress report - GOV.UK (www.gov.uk)

21 Environment Agency. 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report

22 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

Comparison to EU Member States

Between the 1st and the 2nd RBMPs, many Member States reported similar improvements to the UK with a reduction in the number of surface water bodies classified with unknown ecological status, this included Belgium, Italy, Hungary, Portugal, and Spain. Italy highlighted that ecological status had been assessed for the majority of its water bodies, in contrast to the 1st RBMPs, where many water bodies were classified as unknown. Belgium also reported that almost all water bodies have been assessed in the 2nd RBMPs, with the proportion of water bodies with unknown status/potential decreasing from 7% in the 1st RBMPs to 3% in the 2nd RBMPS.[23]

Similar to the findings from the UK's 2nd RBMPs, several other Member States did not report a significant improvement on ecological status since the 1st RBMP. This included Finland, Estonia, Croatia, Slovakia, Sweden, Ireland, France, Spain (coastal only) and Latvia. Germany reported a slight deterioration of ecological status of rivers from the 1st to the 2nd RBMPs in several RBDs, and for lakes in at least two RBDs. This shows that other countries, and not just the UK have found it difficult to achieve progress with regard to ecological status.

Some Member States reported higher percentages of water bodies at high or good ecological status in the 2nd RBMPs. The EEA have reported that northern countries (including Scotland, the Scandinavian region) and Estonia, Romania and Slovakia had a higher proportion of water bodies in high or good ecological status. This contrasted to a large majority of the central European RBDs, and Hungary, with a high number in poor or bad ecological status (as shown in Figure 3-9).[24] Some other trends were drawn from this report, including that highland rivers and lakes have better status than lowland water bodies.[25] The better ecological status of these water bodies is likely due to the reduced pressures on highland water bodies (e.g. reduced anthropogenic input).

On a similar theme, downstream sections of large European rivers had less than good status (likely due to accumulation of pollutants), with large lakes in Europe having better than average status (when considering lakes only).[24] Regarding the ecological status of downstream rivers, this is likely due to the variance of different pressures that the water body received drainage and baseflow from upstream (e.g. highly urbanised areas or agricultural intensive areas).

Other reasons for differences could be on the chosen monitoring and methodology approaches used by different Member States. Therefore, caution should be taken when drawing conclusions between different countries results. [19] Several factors could result in difficulties in making direct comparisons between the 1st and 2nd RBMPs. This includes changes in the delineation of water bodies, a decrease in the number of water bodies from unknown status as more data is collected and an increase in the number of biological quality elements used to assess ecological status.

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23 European Commission, 2019. SWD (2019) 37, Second River Basin Management Plans - Member State: Belgium: HYPERLINK "https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:37:FIN&qid=1551205988853&from=EN"https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:37:FIN&qid=1551205988853&from=EN

24 European Environment Agency. (2018). European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

25 TBD

Some countries have increased their knowledge on ecological status. For example, Denmark reported an increase in the proportion of surface water bodies at good or better ecological status/potential, from 25% in the 1st RBMPs to 42% in the 2nd. At the same time, there was a significant reduction in the proportion of surface water bodies with unknown status/potential, from 56% to 18%.[26]

As mentioned for the UK's 2nd RBMPs, a large majority of the water bodies were reported as less than good ecological status/potential. This was in line with a conclusion drawn from the 2nd RBMPs across all water bodies in the EU Member States (rivers, lakes, transitional and coastal), that there was a low percentage of water bodies meeting the objective of high or good ecological status.[27] The EEA reported that overall ecological status had not improved since the 1st RBMPs.

Monitoring

In the UK's 2nd RBMP, a small increase in the proportion of surface water bodies included in surveillance monitoring[28] occurred between the 1st and 2nd cycles in 14/15 RBDs. The largest increase in surveillance monitoring was the North Western RBD in Ireland, where an increase in this type of monitoring of 80-87% was reported.

With regards to surveillance monitoring in the UK's 2nd RBMPs, the number of biological quality elements varied significantly between RBDs. For example, only six of the RBDs in the UK (Solway-Tweed, Western Wales and the three RBDs in Northern Ireland) had any coastal water bodies where all required biological quality elements were monitored There were no lake water bodies in the 15 RBDs where all required biological quality elements were monitored.

In the 2nd RBMPs, a total of 551 monitoring programmes were reported by Member States. It is acknowledged that there are many differences in how these are designed and implemented, and this included monitoring programmes related to the WFD (e.g., Nitrates Directive programmes).[29] The changes in the number of monitoring sites varied significantly between Member States, for instance for lake surveillance monitoring there were five Member States reporting a decrease of at least 50% and for six Member States there was an increase of at least 50%. Reasons behind these changes varied, including increased experience from the 1st RBMP, new delineation of water bodies, or adoption of a risk-based monitoring approach (this is the approach that the UK has adopted[30]).

At the EU level there are only two cases where biological quality elements were monitored at the minimum recommended frequency at all sites. This was for macroalgae and angiosperms in transitional waters.[29]

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26 European Commission, 2019. Second River Basin Management Plans - Member State: Denmark. SWD (2019) 38 final. Pages used: Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:38:FIN&qid=1551205988853&from=EN

27 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

28 Two types of water quality monitoring are used in the context of the WFD 1) Surveillance monitoring, this involves regular monitoring of water quality to assess status and trends of water bodies 2) Operational monitoring, this tends to be focused on monitoring specific water quality parameters that can inform water treatment processes are operating correctly.

29 European Commission 2019. European Overview – River Basin Management Plans. Available at :https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

30 Gov.UK, 2022. River basin management plans, updated 2022: current condition and environmental objectives. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-current-condition-and-environmental-objectives

Challenges with comparison between RBMPs cycles

The challenges with comparison between the different RBMP cycles were highlighted by many Member States. Reasons included changes in delineation, variation in the number and location of monitoring sites and differences in methodologies and assessments applied. The UK also reported that a number of surface water bodies were re-delineated[31] (i.e. re-defined) between the 1st and 2nd RBMPs, with 10,961 surface water bodies being identified for the 1st RBMPs and 9,325 for the 2nd RBMPs. This resulted in a 15% decrease in numbers overall, which adds complexity when comparing between cycles. This is likely to remain a challenge and similar difficulties are expected when comparing water bodies between 2015 and 2021.

Confidence in ecological status assessment

Confidence in the classification status of a given water body must be reported by Member States and has been defined in the CIS reporting Guidance No 35 as being either low (no monitoring); medium (limited or insufficiently robust monitoring data); or high (good monitoring data and understanding of the ecological system).[32]

In England, for the 3rd RBMPs 'low confidence' was applied in over 40% of the surface water bodies ecological status. While high, this has greatly improved since the 2nd RBMPs which reported that 83% of the surface water bodies ecological status were reported with low confidence.

Overall, at EU level the 2nd RBMPs marked an improvement in the confidence of the status assessments, with high or medium ecological status confidence increasing from 33% of surface water bodies in the 1st RBMPs to 58% in the 2nd RBMPs (this included the UK).[33] For many Member States, the improvement is due to increased monitoring and assessment of biological quality elements. For example, Belgium reported in its 2nd RBMPs that confidence in the classification of ecological status/potential was high for almost all water bodies. This was a major improvement since the 1st RBMPs which gave no information on confidence. Luxembourg, Slovenia, and Finland also reported improved confidence in classification between the 1st and the 2nd RBMPs.

In contrast, Austria's confidence in the classification of ecological status/potential significantly decreased between the two cycles due to changes in the assessment methodology.[34] It is likely that this change in approach was the use of a uniform methodology rather than different methodologies being used across RBDs. Estonia also reported that the confidence in classification of ecological status/potential has deteriorated with low confidence in 62% of its rivers in the 2nd RBMPs, in contrast to around 45% in the 1st RBMP.

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31 The WFD requires Member States to characterise their water bodies by identifying location and the boundaries (this is known as delineation). The term re-delineated refers to the process of redefining or altering boundaries of a RBD to reflect a change in conceptual understanding or management boundary.

32 EC, 2016a. WFD Reporting Guidance 2016, Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document No 35— WFD Reporting Guidance. Technical Report, WFD Common Implementation Strategy. Available at:http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm

33 European Environment Agency. 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

34 European Commission, 2019. Second River Basin Management Plans – Member State: Austria. SWD(2019) 36 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:36:FIN&qid=1551205988853&from=EN

Chemical Status

Chemical status in surface water bodies is assessed using a range of chemical quality elements, which can indicate the level of chemical pollution in a water body. This section gives an overview of the chemical status of surface water bodies from the 2nd RBMPs, and comparisons of the UK with EU Member States.

The number of chemicals monitored in each RBMP can vary and is dependent on the specific requirements of each Member State. The EU has identified 45 priority substances as posing a significant risk to the aquatic environment and human health, and they have therefore been designated for priority action in the EU WFD. The number of substances monitored by a country should therefore include the 45 priority substances and any others identified as a concern in that country.

The EEA in their 2018 assessment report, have previously highlighted that in most Member States, it is a few priority substances that cause the majority of water bodies to be classified as “poor” (the most common pollutant being mercury).[35] These priority substances tend to be ubiquitous in the environment, bioaccumulate in and are toxic to biota, and are highly persistent, resulting in the name ubiquitous, persistent, bioaccumulative and toxic (uPBT) substances. It is very difficult to achieve environmental quality standard targets for these groups and they are a common reason why there are failures to achieve good status.[36] According to Article 8(a) of the EQS Directive[37], eight priority substances and groups of priority substances are behaving like uPBT substances.[38] These substances include mercury, polybrominated diphenyl ethers (PBDEs), tributyltin and polycyclic aromatic hydrocarbons (PAHs).

To show the progress made in tackling other priority substances, Member States present the information related to chemical status with and without these uPBT Priority Substances. Figure 3-10 illustrates the chemical status of surface water bodies from the 2nd RBMPs with uPBT Priority Substances included and Figure 3-11 illustrates the chemical status without.

35 European Environment Agency. 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

36 WISE, n.d. Surface water chemical status. Available at: https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive/surface-water-chemical-status-pressures#:~:text=The%20Directive%20also%20identifies%20a%20smaller%20group%20of,ethers%20%28pBDE%29%2C%20tributyltin%20and%20certain%20polyaromatic%20hydrocarbons%20%28PAHs%29. (Accessed 16th March 2023).

37 Amended by Directive 2013/39/EU.

38 Brominated diphenylether, Mercury and its compounds, Polyaromatic hydrocarbons (PAH), Tributyltin, PFOS, dioxins, hexabromocyclodecane and heptachlor.

Figure 3-10 - Chemical status of surface water bodies with uPBT Priority Substances included - 2nd RBMPs data.

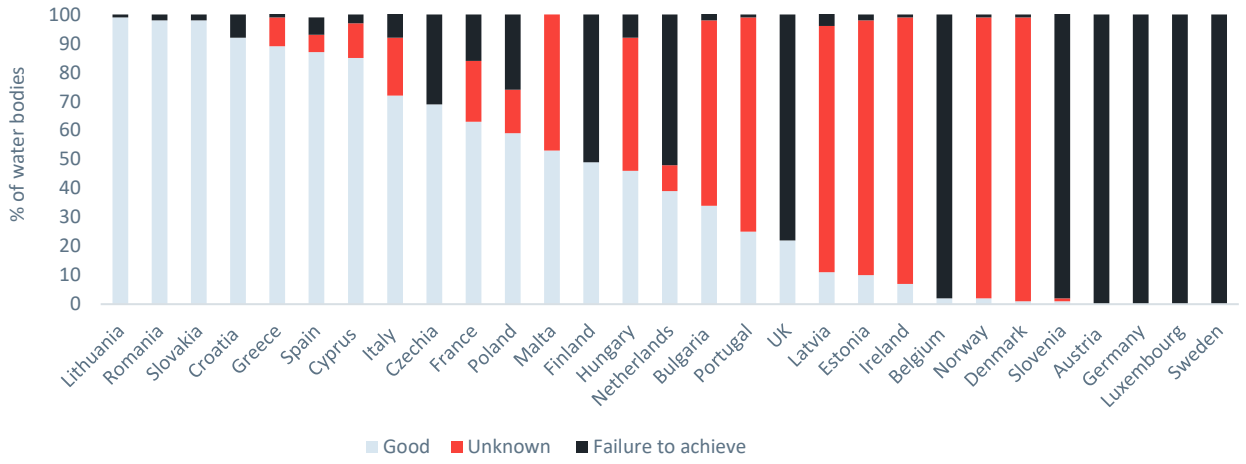
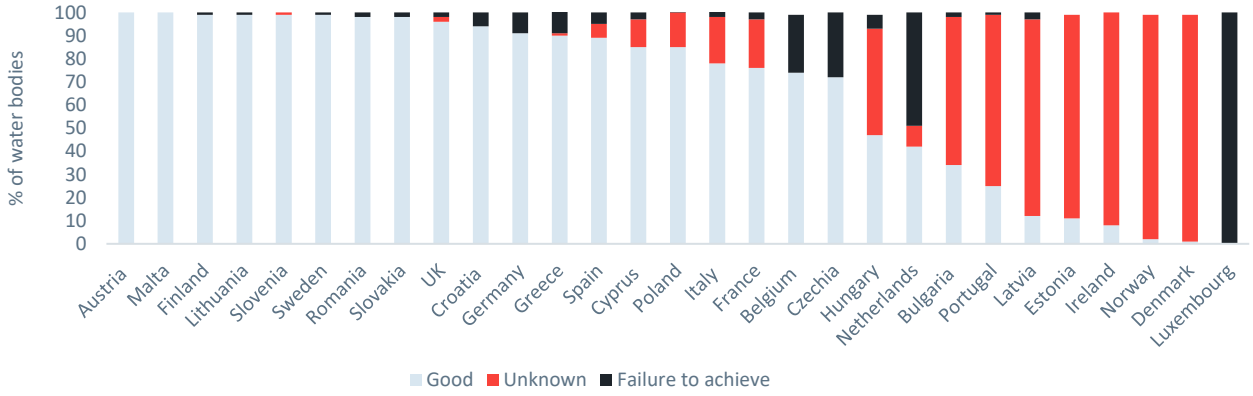


Figure 3-11 - Chemical status of surface water bodies without uPBT Priority Substances included - 2nd RBMPs data



Surface Waters Chemical Status Discussion

Monitoring for chemical status

In the UK's 2nd RBMPs, there has been a net reduction in the number of sites and water bodies monitored for chemical status. Only 16%, 2%, 3% and 8% of the total monitoring sites across the RBDs in the UK are used for the monitoring of chemical status in lakes, rivers, transitional and coastal waters respectively. This reduction was partially explained by the implementation of a risk-based approach (in England, Wales, and Scotland) to identify which water bodies require monitoring to rationalise the monitoring programme.

In the 3rd RBMPs for England, the Environment Agency continued to use a risk-based approach to monitoring and also introduced the River Surveillance Network, a new long-term surveillance monitoring programme for rivers.[39] This will be expanded in the future to include all parts of the water ecosystem including lakes and estuaries. Requests for additional funding and a wider use of sources for monitoring were key issues in the consultation of the 3rd RBMPs. Post consultation the Environment Agency stated that in the short-term citizen science programmes will be put in place and in the long term they aim to modernise the approach to monitoring.[40]

A risk-based approach is one that aims to use resources (e.g., monitoring equipment and staff) most efficiently by prioritising sampling in water bodies and focusing on the most pressing water management issues. A risk-based approach to environmental management has been highlighted by the EEA as having strengths in aiding decision-making and prioritising research needs.[41] However, the limitations include a possible over-reliance and over confidence in results. The UK has a high number of surface water bodies (i.e. 9,328 water bodies identified in the 2nd RBMPs) and monitoring all of these would require significant resources, therefore a risk-based approach does allow focus of the available resources to water bodies identified as high risk.

However, the monitoring networks used for status assessment have been reduced significantly over the past decade due to financial pressures on the Environment Agency in England. This means that long term trends in water quality data for individual locations are not as widely available as sites are reduced or moved limiting the capability of the Environment Agency to understand the impacts on water quality of pressures. Whilst numerical modelling can be used to compensate for gaps in understanding, the availability of long-term datasets is key to environmental protection both in identifying risk, status and the impacts of measures. Use of stakeholder data provided under permit regimes (e.g., water company monitoring data upstream and downstream of treated wastewater discharges) can help fill the gaps but may not be long term or sited at the same locations.

Article 8.1 of the WFD requires Member States to establish monitoring programmes for the assessment of the status of surface water to provide a coherent and comprehensive overview of water status within each RBD. As touched upon in the previous section, a variety of changes to monitoring programmes for chemical status were reported by Member States. This included increases and decreases in the numbers of monitoring sites used, different water bodies monitored and differing locations of monitoring sites. The extent of monitoring of Priority Substances across EU Member States was variable in the 2nd RBMPs, with between 1% to 98% of surface water bodies monitored for Priority Substances.

Furthermore, the EEA noted that direct comparisons between the 1st and 2nd RBMPs cannot be reliably made due to changes to the reporting format and structure (including the hosting database WISE).

39 Environment Agency, 2022. River basin management plans, updated 2022: summary programmes of measures. Available at: River basin management plans, updated 2022: summary programmes of measures - 5. Topic action plans - Guidance - GOV.UK (www.gov.uk)

40 Environment Agency, 2022. River basin management plans, updated 2022: summary programmes of measures. Available at: River basin management plans, updated 2022: summary programmes of measures - 5. Topic action plans - Guidance - GOV.UK (www.gov.uk)

41 European Environment Agency, 2016. Chapter 2: The use of risk assessment in environmental management, European Environmental Agency. Available at: https://www.eea.europa.eu/publications/GH-07-97-595-EN-C2/chapter2h.html

Overview on chemical status

The UK's 2nd RBMPs reported a large increase (from 36% to 96%) in the proportion of surface water bodies classified as good for the 2nd RBMPs compared to the 1st cycle. There was also a substantial decrease in the proportion with unknown status (from 63% to 2%).

The Environment Agency highlighted that despite minimal underlying change in most non uPBT substances assessed for the chemical status of surface waters between the 2nd and 3rd RBMPs, the overall picture of chemical status has changed significantly.[42] This is due to the introduction of new substances (such as cypermethrin) and updates in the techniques and methods used for chemical status classification. As a result of these changes, the 3rd RBMPs data are not directly comparable to previous years. The inclusion of uPBT substances and the extrapolation of data to be able to represent results in the 3rd cycle causes all surface water bodies in England to fail in terms of chemical status.

It is expected that Northern Ireland will also see widespread failure of chemical status in surface waters in the 3rd RBMPs, due to updates to their chemical status assessment. New priority uPBT substances will be included in the assessment of water bodies for the first time (apart from in lakes as new priority substances were considered for the update of lakes classification in 2020).[43] Monitoring of uPBTs in biota occurred in the 2nd cycle planning period at selected monitoring locations chosen using a risk-based approach.[44] Northern Ireland concluded that uPBTs would result in more failures if there was more monitoring and therefore extrapolated the results across all Northern Ireland water bodies, resulting in widespread failures.[45] The extrapolation approach is similar to that taken in England.

In the 2nd RBMPs, Member States reported an increase in water bodies at high or good chemical status. This occurred in both Spain and Poland. Spain reduced from 37% to 6% of unknown status and reported an increase in the proportion of good chemical status from 58% to 87% (and a small increase in the proportion of water bodies failing to achieve good status, from 5% to 6%). Poland's surface water bodies with unknown chemical status decreased from 92% in the 1st RBMPs to 15% in the 2nd. In turn the share of waterbodies at good chemical status increased from 3% to 59%, and the proportion of surface water bodies failing to achieve good chemical status increased from 5% to 26%.

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42 Environment Agency, 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report

43 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

44 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023).

45 Northern Ireland Environment Agency, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf

Member States with decreasing good chemical status from the 1st to the 2nd RBMPs, include Austria, Belgium, Bulgaria, Croatia, Estonia, Finland, Germany, Ireland, Luxembourg, Portugal, Slovenia. The explanations for deterioration in status varied. For example, Luxembourg reported all 110 surface water bodies classified as "failing to achieve good chemical status" in their 2nd RBMP, compared to 70% classified as "good chemical status" in the 1st cycle. The reason given for this change was the expansion of the monitoring programme.

Other reasons were given by Austria, who reported a large reduction in the proportion of surface water bodies achieving good chemical status from 99.5% to 0%. The reason given was the assessment of mercury in biota in the 2nd RBMPs. Belgium also reported a large decrease of surface water bodies achieving good chemical status from 35% to 2%, due to the enhanced monitoring of uPBT substances, and the extrapolation of those monitoring results to unmonitored water bodies.

Priority substances

The UK's 2nd RBMPs reported 19 priority substances causing failure to achieve good chemical status in surface water bodies.[46] There were also 23 priority substances where concentrations were reported to have improved between cycles. However, the number of surface water bodies affected by this improvement was very small representing less than 1% of the total surface water bodies in the UK.

A table of the 15 top Priority Substances most frequently causing failure to achieve chemical status in the 2nd RBMPs may be found in Appendix A, reported in the European Environment Agency's European waters, assessment of status and pressures 2018.[47] The top substance on the list was the uPBT mercury, which resulted in a total of 45,973 water bodies across 24 Member States (including the UK) not achieving good chemical status in all the 2nd RBMPs. This was followed by brominated diphenyl ethers and Benzo (g, h, i) perylene and indeno (1,2,3-cd) pyrene (both uPBTs) causing 23,331 and 3,091 water bodies to fail across 8 and 15 Member States (including the UK) respectively.

The UK reported its top three priority substances causing failure to be cadmium and its compounds, followed by lead and its compounds, and nickel and its compounds (Table 3-1). All the top 10 UK priority substances fall within the overall top 15 priority top priority substances causing failure to achieve chemical status in >100 water bodies from the 2nd RBMPs (Annex A). In the overall 15 top priority substances list; cadmium, lead and nickel come 6th, 8th and 9th respectively (impacting 1,014, 654 and 462 water bodies respectively).

46 European Commission, 2019. Second River Basin Management Plans – Member State: United Kingdom. SWD(2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

47 European Environment Agency. 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

Table 3-1 - Top 10 Priority Substances causing failure to achieve good chemical status in UK surface water bodies, and comparison to EU Member States.

Priority substance	uPBT	Type/use of chemical	Number of UK surface water bodies not achieving good chemical status	Percentage (%) of UK surface water bodies not achieving good chemical status	Number of EU Member States* surface water bodies not achieving good chemical status	Percentage (%) of EU Member States* surface water bodies not achieving good chemical status	Number of EU Member States with surface water bodies not achieving good chemical status for the listed substance	Percentage (%) of EU Member States* with surface water bodies not achieving good chemical status for the listed substance
Cadmium and its compounds	No	Metal	82	0.88	924	0.67	20	71
Lead and its compounds	No	Metal	60	0.64	410	0.30	17	61
Nickel and its compounds	No	Metal	35	0.38	733	0.53	20	71
Mercury and its compounds	Yes	Metal	30	0.32	45,822	33.40	25	89
4-nonylphenol	No	Surfactant	22	0.24	163	0.12	8	29
Tributyltin-cation (TBT)	Yes	Biocide	20	0.21	756	0.55	15	54
Hexachlorocyclohexane	No	Pesticide	12	0.13	92	0.07	9	32
Fluoranthene	No	PAH†	10	0.11	1,456	1.06	13	46
Benzo(a)pyrene	Yes	PAH	8	0.09	1,717	1.25	13	46

Priority substance	uPBT	Type/use of chemical	Number of UK surface water bodies not achieving good chemical status	Percentage (%) of UK surface water bodies not achieving good chemical status	Number of EU Member States* surface water bodies not achieving good chemical status	Percentage (%) of EU Member States* surface water bodies not achieving good chemical status	Number of EU Member States with surface water bodies not achieving good chemical status for the listed substance	Percentage (%) of EU Member States* with surface water bodies not achieving good chemical status for the listed substance
Total Benzo (g, h, i) perylene + Indeno(1,2,3-cd) pyrene	Yes	PAH	8	0.09	3,136	2.29	13	46
Di(2-ethylhexyl) phthalate (DEHP)	No	Plasticiser	5	0.05	104	0.08	11	39
Brominated diphenylethers (congener numbers 28, 47, 99, 100, 153 and 154)	Yes	Flame retardant	5	0.05	23,321	17.00	7	25

*The EU Member States includes Norway in this table as this is how the information is presented in WISE, Norway is not included in the analysis. † PAH: Polyaromatic hydrocarbons. Note there are 12 substances shown in the table above due to ties. Information taken from WISE[48] Water Framework Directive (data viewer)[49]

[48] WISE: Water Information System for Europe - an interactive Internet tool that provides information about water quality and EU water policy. It is jointly released by the European Commission and the European Environment Agency.

[49] https://tableau.discomap.eea.europa.eu/t/Wateronline/views/WISE_SOW_PrioritySubstance/SWB_SWPrioritySubstance_Europe?:embed=y&:showAppBanner=false&:showShareOptions=true&:display_count=no&:showVizHome=no

Challenges around chemical substances

Chemical pollution tends to be diverse and surface water bodies that have poor chemical status can be polluted from a range of different chemicals, ranging from heavy metals, industrial chemicals and pesticides.[50] Dominant pollutants can vary between water bodies, e.g., heavy metal pollution in lakes accounts for over 60% poor status in lakes versus river bodies where heavy metals account for approximately 20%.

It has been highlighted by the EEA that such extreme variation between Member States with regards to chemical status can be expected due to the significant differences in, for example, population density, industry, and geographic location. Differences in implementation of the legislation were also noted by the EEA. For example, some Member States applied in their 2nd RBMPs the revised Environmental Quality Standards (EQS), which were set out in the 2013 amendment to the Directive. This is generally observed to be stricter that the previous version from 2008. Member States that have applied the "stricter" standards included the Netherlands and Sweden while most countries, including the UK, used those from the 2008 Directive.

Other variations occurred from different approaches to monitoring, modelling and extrapolation of results (Table 3-2). Some Member States extrapolated failure to meet the standard at monitoring sites to all water bodies, whereas others reported failure only where failure was confirmed. The UK (along with Croatia, Cyprus, France, Italy, Poland, Romania, Slovakia, and Spain) did not widely apply extrapolation approaches in the 2nd RBMPs, and status tended to show confirmed status only. This in general led to a higher share of good chemical status. In comparison, Austria, Belgium, Finland, Germany, Luxembourg, Malta, Slovenia, and Sweden tended to extrapolate their monitoring results. This resulted in widespread failures to achieve good chemical status when uPBTs were considered in the assessment (particularly the case for extrapolating mercury in biota). Parts of the UK (England and Northern Ireland) extrapolated their monitoring results in the 3rd RBMPs, which also led to widespread failures to achieve good chemical status.

Table 3-2 - Broad approaches to assessing chemical status in the 2nd RBMPs[50]

Approach taken	Countries using this approach	With uPBTs	Without uPBTs
Extrapolation of monitoring results: usually mercury in biota	Austria, Belgium, Finland, Germany, Luxembourg, Malta, Slovenia, Sweden	Widespread failure to achieve good chemical status (50-100%)	Few failures to achieve good chemical status
Other priority substances identified as causing failure to achieve good chemical status	Czech Republic, Luxembourg, Netherlands	Frequent failure to achieve good chemical status (30-50%)	Frequent/widespread failure to achieve good chemical status
Extrapolation not widely applied: status shows confirmed status only	Croatia, Cyprus, France, Italy, Poland, Romania, Slovakia, Spain, UK	Widespread good chemical status	Widespread good chemical status

[50] European Environment Agency. 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

Approach taken	Countries using this approach	With uPBTs	Without uPBTs
Extrapolation not widely applied: status shows confirmed status only	Bulgaria, Denmark, Estonia, Hungary, Latvia, Portugal	Widespread/frequent unknown chemical status	Frequent/widespread unknown chemical status

Source: Information in table has been taken from the EEA 2018 assessment of status and pressures report[51]

Confidence in assessment of chemical status

Regarding confidence of chemical status, in the UK's 2nd RBMPs a total of 83% of surface water bodies in the UK (excluding Northern Ireland) were classified for chemical status with low confidence, 16% with medium confidence and 1.4% with high confidence. For lakes, 8% were classified with medium confidence and 92% with low confidence. There was no information on the confidence reported for RBDs in Northern Ireland. Regarding the 3rd RBMPs, confidence levels would be expected to improve as the knowledge and data improves. However, there is limited information on confidence in assessment of chemical status, so we are unable to determine if confidence has improved since the 2nd RBMP.

The UK clarified that in England, Scotland and Wales, water bodies have been classified as in good chemical status with low confidence where a risk assessment has been performed and there are no identified predicted risks from Priority Substances.[52] It is further reported in the UK's 2nd RBMPs compliance assessment, that these risk assessments may have included investigatory monitoring and modelling, and that water bodies where these risk assessments have been applied have not been part of the monitoring programme in the 2nd RBMP.[52] This approach was also not implemented in Northern Ireland where any unmonitored water bodies were classified as unknown status.

In comparison to other EU Member States, it has previously been highlighted that the confidence in the status assessments had generally improved between the 1st and the 2nd RBMPs. However, confidence in surface water body chemical status was relatively low, particularly when compared with other status assessments (e.g., ecological status or chemical status in groundwater). It was reported in the 2nd RBMPs that only 41% of the surface water bodies chemical status were reported with high or medium confidence.[53]

51 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

52 European Commission assessment report, United Kingdom, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

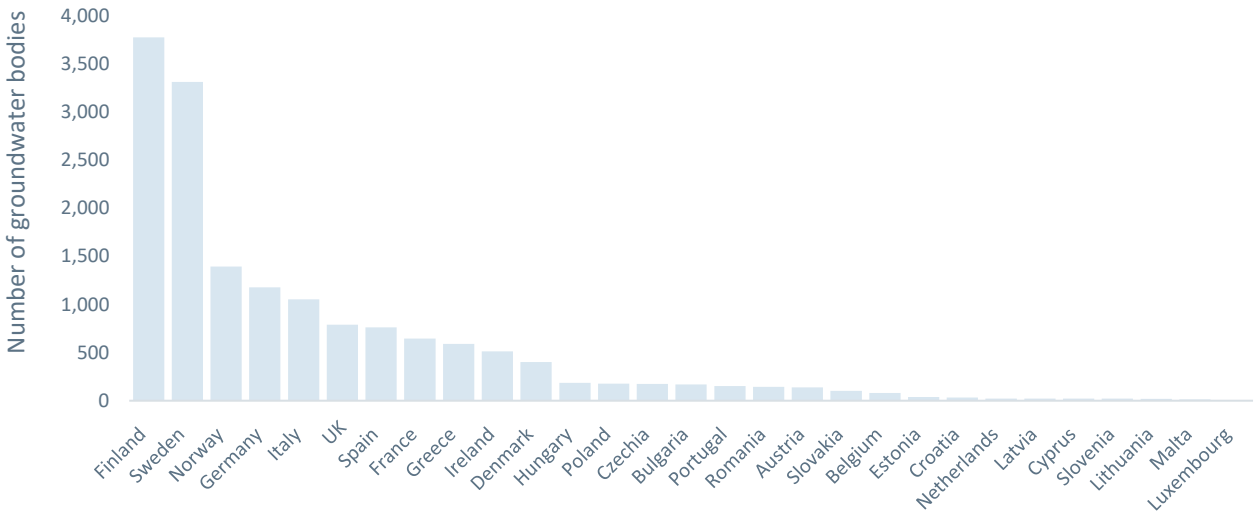
53 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

3.4 Groundwater Status

Groundwater aquifers provide around 42% of the total water abstraction in Europe, with an estimated half of the drinking water in Europe sourced from groundwater.[54] It is also a key water resource for agricultural activities (e.g., irrigation) and for use in industry. In the UK, almost all the groundwater bodies (786 of 788) are identified as Drinking Water Protected Areas.[55] Groundwater bodies in RBMPs are assessed on both chemical and quantitative status. Groundwater is classified using a series of tests related to the chemical condition of the groundwater body itself (including saline or mine water intrusion) and its receptors (drinking water, associated aquatic ecosystems, dependant terrestrial ecosystems). The tests are scored on a 'good' or 'poor' basis and the overall chemical status of the body is classified using the lowest score.[56]

Figure 3-12 presents the number of groundwater bodies in each EU Member State in comparison with the UK. A full breakdown on numbers may be found in Appendix A.

Figure 3-12 - Number of groundwater bodies identified across EU member States in comparison with the UK



54 European waters, 2018. Assessment of status and pressures 2018. EEA Report No 7/2018. Available at: https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive/groundwater-quantitative-status

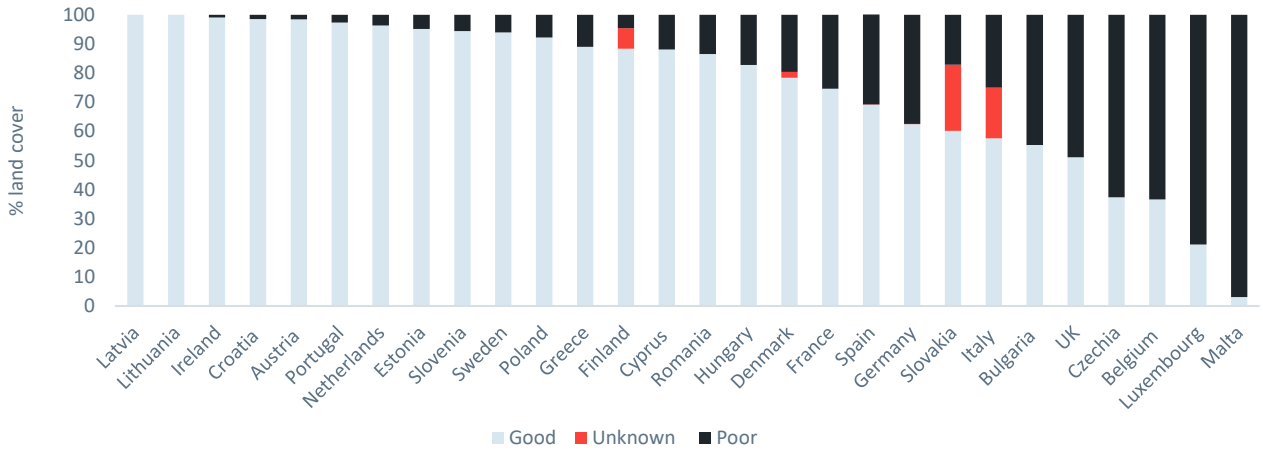
55 European Commission, 2019. Second River Basin Management Plans – Member State: United Kingdom . SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

56 UKTAG Paper 11b(i) Groundwater Chemical Classification for the purposes of the Water Framework Directive and the Groundwater Directive. Available at http://wfduk.org/resources/paper-11bi-groundwater-chemical-classification-april-2019

Groundwater Chemical Status

Figure 3-13 presents the chemical status of groundwater bodies of EU Member States compared to the UK with data from the 2nd RBMPs. This is presented as percentage of land coverage (km^2) to make a more representative comparison. In total 10,867 (81%) of groundwater bodies representing 74% of the total groundwater body area in the EU were at good chemical status.[57] A total of 2,021 (15%) of groundwater bodies were failing to reach good chemical status. For the remaining 489 groundwater bodies (4%), the chemical status is unknown.

Figure 3-13 - Percentage of land coverage (km^2) of the chemical status of groundwater bodies of EU Member States compared to the UK with data from the 2nd RBMPs.



Discussion on groundwater chemical status

In the 2nd RBMPs, a total of 16 Member States have reported >80% of their groundwater bodies to be at good chemical status. Latvia and Lithuania reported 100% of their groundwater bodies to be at good chemical status. Both countries are less densely populated in comparison to other Member States, with a small number of groundwater bodies (Latvia: 22 and Lithuania: 20). The majority of land is forestry in Lithuania with low inputs of fertilisers and pesticides as a result. In general, the low population density and potentially historically lower intensity agriculture compared to other Member States are likely to lead to fewer anthropogenic pressures on groundwater bodies.

There were some notable discrepancies in Latvia's 2nd RBMPs regarding the number of groundwater bodies (originally reported as 22 but later clarified by Latvia that there were 16 instead, in the European Commission's analysis). Three of the groundwater bodies were reportedly not subject to surveillance monitoring. Furthermore, the assessment of the RBMPs and background documents found no indication that grouping of groundwater bodies for monitoring and assessment of chemical status were applied, but again this was later clarified by Latvia that grouping had been applied but had not been well-described in the RBMP. No groundwater bodies were reported to be at risk of failing to meet chemical status.

[57] European Commission, 2019. European Overview – River Basin Management Plans. Available at:https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

In comparison, in Lithuania 90% (18/20) of groundwater bodies are monitored. It was reported that the drinking water quality standard for human consumption are used as a basis for assessing the chemical status of groundwater (the setting of threshold values), but the values of naturally occurring compounds, such as sulphates, chlorides, ammonium, iron and manganese concentrations, are not taken into account as they are normally removed in water purification plants. Therefore, there were clear deficits in the monitoring network (sampling of treated rather than raw groundwater) and non-compliance with WFD requirements by not taking natural background levels into account when setting threshold values for groundwater. The confidence has been rated high for 100% of the groundwater bodies.

Malta, Belgium, and Luxembourg all report high percentages of their water bodies achieving poor status at 97%, 63% and 79% respectively. All three Member States reported that the general assessment of chemical status for the groundwater body[58] failed. Climate, geology and pressures acting on individual Member States will play a significant role in the chemical status of groundwater bodies. Both Luxembourg and Belgium are small countries with a high population density, intensive agriculture (especially livestock with an excess of manures) and a high reliance on groundwater for drinking water and irrigation (meaning that groundwater is well monitored). Similar to the UK, the main aquifer types in these two countries are Chalk and Limestone which can be highly productive but are highly vulnerable to pollution and once polluted can take decades to recover.

Malta reported the highest number of water bodies failing to achieve good status. Whilst Malta has a small number of groundwater bodies (15), it is a small, population dense country with significant urbanisation. Malta's situation as an island in the southern Mediterranean means that it is very susceptible to drought conditions and climate change with a delicate balance between abstraction for agriculture and drinking water and saline intrusion to the groundwater bodies. Low rainfall means that the concentrations of pollutants such as pesticides and fertilisers leaching to groundwater will be high and slow to be flushed from the groundwater body. The combination of high population density with a natural shortage of water resource led to groundwater abstraction pressures, and significant agricultural pressures (e.g., nitrate and pesticide pollution of groundwater bodies).

In comparison, the UK reported 69% of its groundwater in good chemical status. It was previously highlighted by the EEA there was a high proportion of groundwater bodies classified as poor in central north-western Europe (i.e., where member states have been part of the EU prior to the WFD). This wide area of poor groundwater quality is linked to intensive agricultural activities and more localised pollution around areas of heavy industry. The 3rd RBMPs identified that England was the only nation in the UK to have more groundwater bodies in poor chemical status than good.

[58] This assessment considers the significant environmental risk from pollutants across a groundwater body and a significant impairment of the ability to support human uses.

Variation between Member States with regards to chemical monitoring may also be due to the approach of assessment. For example, Member States must identify substances that put groundwater bodies at risk of failing good chemical status and set 'threshold values' against which to assess good status.[59] Nitrate and pesticides (and their metabolites) have groundwater standards already set out in the WFD (Annex II). Where Member States identify natural occurring substances as posing a risk to groundwater (e.g., chloride) then the natural background levels must be taken into account when setting threshold values. Although Annex II of the Groundwater Directive sets out a list of parameters Member States should consider for threshold values, the pollutants identified should be based on those posing a risk to groundwater (i.e., at the Member States discretion). The variability in risk and in natural background levels have both been identified as the main causes of variation in threshold values and therefore in status assessment across different countries.[60] In general, the monitoring of a wider range of substances will lead to a greater chance of a water body failing to achieve good status.

Again, due to these differences in approaches and methodology, care should be taking when comparing results between different countries with regards to groundwater chemical status.

There was little reported change in chemical status of groundwater bodies between the 1st RBMPs to the 2nd (improving by 2% at the EU Level). Reasons include the lag time for groundwater recovery from pollution after an intervention to manage the source has taken place, or because effective measures have yet to be taken. The EEA also reported that there was limited improvement between status between the 1st and 2nd cycles due to sustained pressures from agriculture.[61]

Pollutants and pressures

A total of 160 chemicals have been identified as causing poor chemical status across the 2nd RBMPs.[61] In the UK's 2nd RBMP, the primary pollutant causing a failure of good status in 18% of groundwater bodies was nitrate. England's 3rd RBMPs have reported that nitrates are again a major cause of failure, along with orthophosphates, copper and chloride. The top 10 pollutants causing failure in the UK's 2nd RBMPs have been listed in Table 3-4 with a comparison to EU Member States. A table of the top 15 pollutants causing failure to achieve chemical status is provided in Appendix A. In comparison to Member States, nitrates, and pesticide pollution (predominantly from agriculture) were identified as the main pressures causing failure to achieve good chemical status in groundwater. For example, nitrate is estimated to cause failure in 18% of the total groundwater body area in the EU, and pesticides causing 6.5% of the groundwater area to fail.[62] Although Total Pesticides and individual pesticides did not make the top 10 pollutants causing failure in the UK but were still reported to cause failures in four groundwater bodies.

59 Threshold values are noted by the EEA to be "at the level of the Member State RBD or groundwater body" https://www.eea.europa.eu/publications/state-of-water

60 CIS Working Group Groundwater 2019. Threshold value variability analysis – Technical Report. Available at https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/eb87e8fb-89e7-4ea0-92e7-6e2ceb6d934a/details

61 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

62 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

Other industrial chemicals identified to lead to failure included tetrachloroethylene (a chlorinated solvent) and metals such as arsenic, nickel (e.g., which could be derived from historical mine water discharge, contaminated land sites, industrial discharges). Arsenic was identified in the list of top 10 pollutants causing failure in status across the EU Member States (with 130 groundwater bodies across 12 Member States). Interestingly, arsenic was not identified in the UK's top 10 list of Pollutants (probably because the natural background concentrations are taken into account in threshold values), but four groundwater bodies in the UK were reported as having arsenic levels causing a failure of chemical status.

Table 3-3 - Top 10 Priority Substances causing failure to achieve good chemical status in UK groundwater bodies, and comparison to EU Member States. Information taken from WISE Water Framework Directive (data viewer)[63]

Pollutant	uPBT	Number of UK groundwater bodies in which the pollutant has led to poor status	Percentage (%) of UK groundwater bodies the pollutant has caused failure to achieve good chemical status	Number of EU Member States* groundwater bodies the pollutant has caused failure to achieve good chemical status	Percentage (%) of EU Member States* groundwater bodies the pollutant has caused failure to achieve good chemical status	Number of EU Member States* that have reported failed to achieve good chemical status due to the pollutant	Percentage (%) of EU Member States* that have reported failed to achieve good chemical status due to the pollutant
Nitrate	No	142	17.97	1,137	7.51	25	89
Other chemical parameters	/	57	7.22	13	0.09	5	18
Iron and its compounds	No	41	5.19	30	0.20	6	21
Total phosphorus	No	17	2.15	5	0.03	3	11
Chloride	No	14	1.77	347	2.29	15	54
Zinc and its compounds	No	11	1.39	28	0.18	4	14
Lead and its compounds	No	11	1.39	76	0.50	8	29

63 https://tableau.discomap.eea.europa.eu/t/Wateronline/views/WISE_SOW_PrioritySubstance/SWB_SWPrioritySubstance_Europe?:embed=y&:showAppBanner=false&:showShareOptions=true&:display_count=no&:showVizHome=no

Pollutant	uPBT	Number of UK groundwater bodies in which the pollutant has led to poor status	Percentage (%) of UK groundwater bodies the pollutant has caused failure to achieve good chemical status	Number of EU Member States* groundwater bodies the pollutant has caused failure to achieve good chemical status	Percentage (%) of EU Member States* groundwater bodies the pollutant has caused failure to achieve good chemical status	Number of EU Member States* that have reported failed to achieve good chemical status due to the pollutant	Percentage (%) of EU Member States* that have reported failed to achieve good chemical status due to the pollutant
Aluminium and its compounds	No	9	1.14	34	0.22	4	14
Sulphate	No	9	1.14	211	1.39	16	57
Nickel	No	8	1.01	88	0.58	10	36

* The EU Member States includes Norway in this table as this is how the information is presented in WISE, Norway is not included in the analysis.

The challenges of directly comparing chemical status between different countries have been noted, as stated by the EEA, monitoring is not comparative between all Member States. Additionally, threshold values can vary widely with different methodologies for calculating thresholds used at Member State discretion. The list of substances for which threshold values are set will also vary depending on whether a risk to groundwater is identified (i.e., a pressure is present and surveillance monitoring detects the presence in groundwater).

Monitoring

Of note in the European Commission's analysis of the UK's 2nd RBMPs, a large proportion (73%) of groundwater bodies were not subject to monitoring, limiting the monitoring data.[64]

Comparison between the 1st and 2nd RBMPs, shows that UK monitoring significantly reduced, with the number of surveillance monitoring sites dropping from 4,080 in the 1st RBMPs to 255 in the 2nd RBMPs. Surveillance monitoring is carried out to support the assessment of risk to groundwater and looks to identify what is present and is carried out at least once in the RBMPs 6-year cycle. Operational monitoring is carried out at a minimum of once a year in the UK and supports trends assessment and status assessment. The groundwater chemical status situation also deteriorated between cycles, with the total number of groundwater bodies failing good status increasing from 190 (26 %) to 242 (31%) of groundwater bodies. The reasons for this were identified as re-delineation of groundwater bodies, splitting, and merging of groundwater bodies, additional pressures and increased understanding of natural groundwater body characteristics and pressures.

Compared to the change for other Member States between cycles, the improvement of groundwater chemical status across the board was minimal. The number of groundwater bodies achieving good chemical status increased from 80% to 81% between cycles.[65] Similar to the UK, drawing comparisons between different cycles was highlighted as challenging for some Member States, due to changes in assessment methodologies, changed threshold values and the re-delineation of groundwater bodies. In general, the confidence in the status results increased between the 1st and 2nd cycles.

The Netherlands reported progress as their groundwater body area failing to achieve good status dropped from 30% of the 1st RBMPs to only 4% of the 2nd RBMP. An explanation for this improvement was not found in the RBMPs or in the supporting background documents but the Netherlands have clarified that this improvement might be due to more data being available for the 2nd RBMP.[66]

Member States that reported a deterioration in groundwater status between cycles include Poland, Luxembourg, and Spain. Poland have highlighted that the increases in area of groundwater body failing good status (from 3.7% to 7.8%) could be due to redelineation of water body boundaries between cycles.

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64 European Commission, 2019. Second River Basin Management Plans – Member State: United Kingdom. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

65 European Commission (2019). European Overview – River Basin Management Plans. Available at : https ://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019 :30:FIN&qid=1551267381862&from=EN

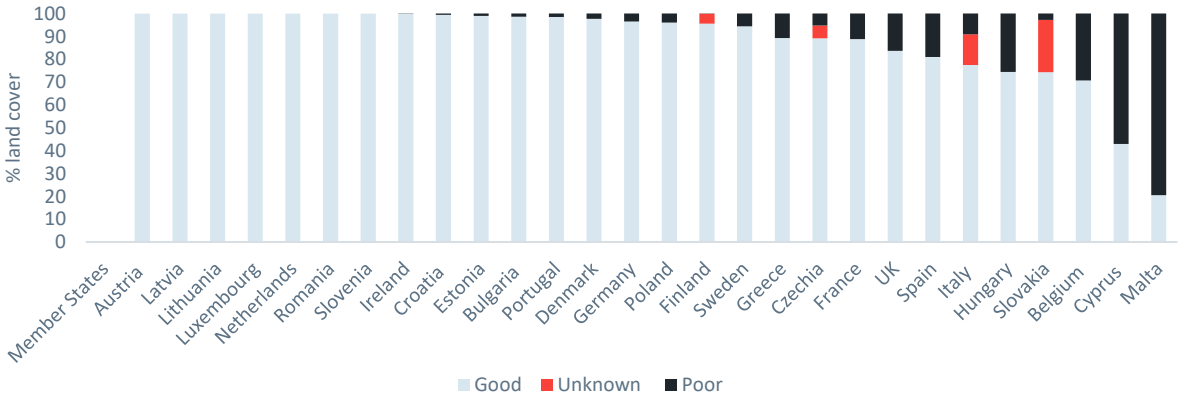
66 European Commission, 2019. Second River Basin Management Plans – Member State: The Netherlands. SWD (2019) 50 final. Available at : https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:50:FIN&qid=1551205988853&from=EN

Groundwater Quantitative Status

The Water Framework Directive requires good quantitative status to be achieved by ensuring sustainable management of groundwater status, for example available groundwater resource is not exceeded by the long-term annual average rate of abstraction.[67] The groundwater quantitative status is an assessment of the amount, quality, and availability of groundwater resources.

Results from the 2nd RBMPs in 2015 have demonstrated that around 92% of groundwater bodies in the EU (12,299 of the 13,367 groundwater bodies) are in good quantitative status, with around 5% (693 groundwater bodies) failing good status (Figure 3-14).

Figure 3-14 - Percentage of land coverage (km2) of the quantitative status of groundwater bodies of EU Member States compared to the UK with data from the 2nd RBMPs



Discussion on groundwater quantitative status

In the 2nd RBMPs, the UK reported that 666 of 788 groundwater bodies (85%) were in good quantitative status, while 121 (15%) failed to achieve good status and one groundwater body was of unknown status. The total number of groundwater bodies failing good quantitative status decreased significantly by 20% from 150 groundwater bodies in the 1st RBMPs to 121 in the 2nd RBMPs (from 18.7% to 16.3% of the total groundwater body area). However, in four of the river basins districts (Anglian, Neagh Bann, North Western and North Eastern) the number of groundwater bodies at poor quantitative status increased.

In the 2nd RBMPs it was highlighted that 93 groundwater bodies failed good quantitative status due to diminution of the status of groundwater associated aquatic ecosystems. Another 59 groundwater bodies failed good status due to failing the water balance test, meaning the long-term annual average rate of groundwater abstraction is exceeding the available groundwater resource and the volume required to support dependant ecosystems. Another eleven groundwater bodies were reported to fail due to saline intrusion caused by abstraction, and eight groundwater bodies failed due to damage to groundwater dependent terrestrial ecosystems due to reductions in inflow.

[67] European waters, 2018. Assessment of status and pressures 2018. EEA Report No 7/2018. Available at: https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive/groundwater-quantitative-status

In the 3rd RBMPs, it was reported that England and Northern Ireland had significantly more groundwater bodies classified as good compared to poor showing improvements since the 2nd RBMPs.

Comparison to other Member States

Across the EU in the 2nd RBMPs, groundwater had wide-spread good quantitative status (89% of the total groundwater area).[68] This was an improvement of 5% since the 1st RBMPs. Seven Member States reported that 100% of their groundwater bodies were in good quantitative status (Austria, Latvia, Lithuania, Netherlands, Romania, Luxembourg and Slovenia).

In contrast, Malta had the highest proportion of groundwater bodies in poor status (78%). As mentioned previously, Malta is a highly population dense island nation with water resources which are very vulnerable to climate change and saline intrusion, as well as the high demands of tourism and agriculture. Hence there are significant pressures on water abstraction in the country.

The main reason for failing good quantitative status in Member States was attributed to the 'water balance / lowering of water table[69]' with approximately 61% of the groundwater body area failing good quantitative status. There were 544 groundwater bodies in the 19 Member States not achieving good quantitative status across all tests for this reason. In calculating a water balance, most Member States identify a proportion of the annual recharge required by groundwater associated aquatic ecosystems (surface water) and dependant terrestrial ecosystems (wetlands) as well as the abstraction for human use. Reasons for changes in water balance or lowering of the water table, leading to long term downward trends, can include over-abstraction of groundwater (e.g., excessive extraction of groundwater for use by agriculture, industry, or public water supply) or insufficient groundwater recharge[70] due to climate change, increased evaporation, or changes in land use (e.g., urbanisation).

Many of the pressures reported for the UK in the 2nd RBMPs were also cited by other Member States. This included diminution of surface water bodies (217 groundwater bodies in Germany, Spain, Finland, France, Italy, UK), damage to groundwater dependant terrestrial ecosystems (100 groundwater bodies in Bulgaria, Germany, France, Hungary, Poland, UK) and saline or other intrusions (104 groundwater bodies in Belgium, Bulgaria, Cyprus, Germany, Spain, Finland, France, Croatia, Italy, Poland, UK).

Groundwater Monitoring

In the UK's 2nd RBMP, 576 of the groundwater bodies (73%) are not subject to monitoring. This has been clarified in the UK's 2nd RBMPs to be due to a risk-based approach to monitoring applied, with monitoring mostly done in areas that are at risk of identified pressures or downgrades. By assessing whether a water body is at risk from a particular pressure, such as abstraction or saline intrusion it is possible to optimise monitoring efforts by prioritising the most "at risk" water bodies, rather than expending resources to sample all of them. Particularly for saline intrusion where the risk to potable supplies is identified monitoring is likely to be on a site-by-site basis by the abstractor such that

68 European waters. Assessment of status and pressures 2018. EEA Report No 7/2018. Available at: https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive/groundwater-quantitative-status

69 The water table is the upper surface of the saturated zone in the ground, and groundwater is often found below this water table.

70 Groundwater recharge is the process by which water from precipitation or surface waters infiltrate the soil and replenishes the water stored underground.

trigger values to cease abstraction are followed. Long term quantitative monitoring is an essential tool in understanding the long trends in pressures and external forces such as climate change.

The pressures on budgets for monitoring mean that these essential data sources for the state of the UK groundwater resource are at risk. Innovation around use of automatic and telemetered groundwater level logging equipment (already used by UK environmental agencies) and extensive investment by the Environment Agency in numerical regional modelling to understand and predict risks have been essential tools in supporting RBMPs reporting and programmes of measures.

The 2nd RBMPs highlighted that in England 16 out of 42 groundwater bodies are monitored for quantitative status (approx. 38% by area). Whilst there was no specific detail on why some groundwater bodies were not monitored, the UK Technical Advisory Group Task 12(a) Guidance on Monitoring Groundwater provides national guidelines that advise representative monitoring points should be reflective of the conceptual model of risk and be representative of groundwater conditions within the monitored groundwater body. In England the groundwater quality monitoring relies heavily of third-party boreholes, wells and springs including water company sites. Water companies may also share their water quality data with the Environment Agency (by agreement). Quantitative monitoring is carried out at Environment Agency owned observation boreholes.

Northern Ireland on the other hand monitors 2 out of the 16 groundwater bodies for quantitative status. Of note is that Northern Ireland does not use groundwater for public water supply, so it was highlighted in the UK's 2nd RBMPs that monitoring relies predominantly on third party boreholes and the cooperation of landowners. Consequently, this network can frequently change.

The UK reported a slight increase in monitoring sites between cycles (183 monitored groundwater bodies in the 1st cycle compared to 212 in the 2nd cycle). Many Member States also reported increases in the monitoring of groundwater for quantitative status (Belgium, Czech Republic, Germany, Denmark, France, Hungary, Italy, Poland, Portugal, Sweden, Slovenia), with five Member States having similar coverage between cycles (Austria, Cyprus, Croatia, Malta, Netherlands). Member States that reduced monitoring efforts included Bulgaria, Estonia, Finland, and Romania; the reason(s) why were not reported.

Confidence in Groundwater Status

Overall confidence in groundwater chemical and quantitative status assessments for the 2nd RBMPs has been reported as good, with two thirds of groundwater bodies reported with high or medium confidence.[71] In particular, knowledge of groundwater quantitative status was noted to increase between cycles, with only 1% of groundwater bodies (across four Member States) reported to be at unknown status. Around 70% of quantitative status assessments were reported with high or medium confidence.

In the UK's 2nd RBMPs, it was noted that quantitative status in groundwater was mainly based on data with low confidence (or no data), which highlighted a significant need for increased monitoring data.[72] This was not the case for Scotland, where the Solway Tweed and Northumbria RBDs reported high confidence for quantitative groundwater status.

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71 European Environment Agency, 2018. European waters -- Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

72 European Commission, 2019. European Overview – River Basin Management Plans. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

All four nations of the UK follow specific guidance set out by UK TAG. Northern Ireland has been monitoring their groundwater regionally since 2000, and had reviewed this process in 2007, in a document under 'Approach to Groundwater Monitoring for Northern Ireland, United Kingdom to meet the requirements of the Water Framework Directive' published by the Environment and Heritage Service in February 2007.[73]

When looking at the 3rd RBMPs, England reports monitoring data for nitrogen due to it being a requirement for groundwater bodies. However, when looking at the number of sampling sites for Total Inorganic Nitrogen (TIN), the number of samples have decreased from 2,643 in 2015 to 1,770 in 2019. This means that it is presumed that the level of monitoring in England has decreased, and that confidence will be reduced.[74]

3.5 Exemptions

The overarching aim of the WFD is to achieve good water status and sustainable water use, while acknowledging exemptions may be necessary for technical, economic and social reasons as well as natural conditions. In the WFD[75], it is stated there may be grounds for exemptions from the requirement to prevent further deterioration or to achieve good status under specific conditions, balancing environmental protection with other societal needs. Article 4 of the WFD defines environmental objectives for sustainable water management and permits exemptions when natural conditions, technical feasibility or disproportionate costs prevent good water status. The exemptions under WFD Article 4 include:

- **Article 4(4)** – allows for an extension of the deadline beyond 2015;
- **Article 4(5)** – allows for less stringent objectives;
- **Article 4(6)** – allows for a temporary deterioration; and
- **Article 4(7)** – allows new modifications/new sustainable human development activities.

Article 4(4) allows for an extension of the deadline on the grounds of disproportionate cost, technical feasibility, or natural conditions so long as no further deterioration to the status occurs. Article 4(5) on the other hand allows for "less stringent environmental objectives" in certain situations, if certain conditions are met. Member States may use Article 4(4) or Article 4(5) if the stipulated conditions are met. However, the justification for setting less stringent objectives requires a more in-depth assessment than for extending the deadline (application of Article 4(4)). The conditions for applying Article 4(5) are specified in Box 1.

73 UKTAG, 2007. UKTAG Task 12(a) Guidance on Monitoring Groundwater. Available at: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Groundwater%20monitoring_Draft_010807.pdf

74 [INTERNAL] WSP, 2023. Nitrate Vulnerable Zones - data review.

75 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. 2020. https://eur-lex.europa.eu/eli/dir/2000/60/oj

Box 1: Article 4(5) – Setting of less stringent objectives

Member States may aim to achieve less stringent environmental objectives than those required under paragraph 1 for specific bodies of water when they are so affected by human activity, as determined in accordance with Article 5(1), or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive, and all the following conditions are met:

the environmental and socioeconomic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs;

Member States ensure:

- for surface water, the highest ecological and chemical status possible is achieved, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution,
- for groundwater, the least possible changes to good groundwater status, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution;

no further deterioration occurs in the status of the affected body of water;

the establishment of less stringent environmental objectives, and the reasons for it, are specifically mentioned in the river basin management plan required under Article 13 and those objectives are reviewed every six years.

Source: WFD (2000)

This section presents the comparison of the use of exemptions from the 2nd RBMPs for the EU Member States and the UK. The focus will be on the UK, and in particular England and Northern Ireland, in comparison to the EU Member States for a critical assessment and to draw out examples of good practice. To note, exemptions have been referenced in UK law as follows:

- England and Wales: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 transposed Article 4(4)-(7) requirements in Regs 16, 17, 18 and 19.[76]
- Northern Ireland: The Water Environment (Water Framework Directive) Regulations (Northern Ireland) (2017).[77]
- Scotland: The Water Environment and Water Services (Scotland) Act 2003.[78]

[76] Legislation.gov.uk, 2017. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. 2017 No. 407. Available at: https://www.legislation.gov.uk/uksi/2017/407/contents/made (Accessed 13th June 2023).

[77] Legislation.gov.uk, 2017. The Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2017. Available at: https://www.legislation.gov.uk/nisr/2017/81/contents/made (Accessed 13th June 2023)

[78] Legislation.gov.uk, 2003. Water Environment and Water Services (Scotland) Act 2003. 2003 asp 3. Available at: https://www.legislation.gov.uk/asp/2003/3/contents (Accessed 13th June 2023).

Use of Exemptions

Article 4(4)

In the UK's 2nd RBMPs, 266 Article 4(4) exemptions were applied for surface waters. The justifications for the use of exemptions were provided in all RBDs. For surface waters the justifications referred to technical feasibility, natural conditions, and disproportionate costs. For groundwater in the UK, 381 exemptions were applied in the 2nd RBMP. The justification of the use of Article 4(4) varied between RBDs, with technical feasibility justification applied to Scotland, Solway Tweed, Northumbria, Humber, Thames, South East and North West RBDs. Disproportionate costs were used for justification in the Anglian, Thames, South East, South West and Severn RBDs and natural conditions in the Northumbria, Thames, South East, Neagh Bann, North Western and North Eastern RBDs.

Comparison between the 1st RBMPs and the 2nd RBMPs for the UK, showed an overall increase in the number of exemptions for surface water bodies and a decrease in exemptions for groundwater bodies.[79] An increase in exemptions for surface water in England was assessed by the European Commission's compliance assessment on the UK's 2nd RBMPs to be due largely to a significantly improved evidence base between cycles, and a more extensive economic appraisal of measures taken at the catchment scale. Consequently, the objectives and corresponding justifications were based upon an improved evidence base and increased understanding.

Exemptions in the 3rd RBMPs for England have been summarised in the table below.

Table 3-4 - Summary of applications of Regulation 16 and Regulation 17 exemptions

Exemption	Surface water (ecological status & potential)	Surface water (chemical status & potential)	Groundwater (quantitative status)	Groundwater (chemical status)
Regulation 16	11	4,648	8	21
Regulation 17	865	0	26	29
2027 – low confidence	2,735	0	25	78

Note: Regulation 16 and Regulation 17 are a UK implementation of Article 4. Regulation 16 corresponds to Article 4(4) which allows for an extension of the deadline and Regulation 17 corresponds to Article 4(5) which allows for less stringent objectives.

[79] European Commission, 2019. Second River Basin Management Plans – Member State: United Kingdom. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

Analysis of the application of exemptions in the 3rd RBMPs has identified that the application of Regulation 16 to extend the deadline to reach chemical status in surface water is high in all RBDs. This has been applied in all or nearly all waterbodies in each RBD. The most used is an extension of the deadline to 2063 with 'Natural conditions / Chemical status recovery time' specified as the reason. [80] The main pressure causing the use of this exemption is chemical pollution. In particular, it has been used due to the presence of persistent, bioaccumulative and toxic (PBT) substances such as PBDEs, PFOS and mercury.

For Northern Ireland there is limited information regarding exemptions in the draft 3rd RBMPs. There is one mention that specifies an exemption has been applied (Lough Neah). In the UK's 2nd RBMP, Article 4(4) exemptions were applied in Northern Ireland.

It was noted in the UK's 2nd RBMPs that exemptions due to technical feasibility under Article 4(4) were defined in all RBMPs. In surface waters, exemptions under Article 4(4) were driven by urban development, transport, industry, agriculture, and unknown factors, while Northern Ireland included flood protection, forestry, fisheries and aquaculture and energy. For groundwater, England identified similar drivers as those in surface waters, while Northern Ireland cited agriculture and industry.

The pressures responsible for exemptions under Article 4(4) in the UK's 2nd RBMPs in surface waters included urbanisation, industry, agriculture, mining, atmospheric deposition, and activities causing changes in hydro morphology. For groundwater the main pressures were point and diffuse pollution from atmospheric deposition, mining, settlements, and agriculture as well as water abstraction for industry and agriculture.

Article 4(4) was applied in all Member States in the 2nd RBMPs, the percentage of exemptions applied to water bodies by justification are detailed in Table 3-4, the breakdown of numbers of waterbodies of these exemptions applied may be found in the Appendix A.

[80] Environment Agency, 2021. Catchment data explorer. Available at: https://environment.data.gov.uk/catchment-planning/v/c3-plan/England/objectives (accessed 5th June 2023).

Table 3-5 - Summary of applications of Article 4(4) exemptions applied in the 2nd RBMPs

Member State	Article 4(4) Surface water: ecological status as a %			Article 4(4) Surface water: chemical status as a %			Article 4(4) Ground water: quantitative status as a %			Article 4(4) Ground water: chemical status as a %			No. of water bodies in each country	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW
Austria	53	47	53	100	100	0	0	0	0	0	0	3	8,127	138
Belgium	23	37	51	97	0	0	0	0	10	4	14	55	554	80
Bulgaria	19	0	22	1	0	1	2	0	0	11	0	22	955	169
Croatia	38	38	0	7	7	0	3	3	3	6	6	3	1,572	33
Cyprus	40	0	0	3	0	0	5	0	71	5	0	29	204	21
Czechia	79	0	0	34	0	0	9	0	1	65	0	11	1,121	174
Denmark	8	18	3	0	0	0	0	1	0	0	0	25	8,765	402
Estonia	34	8	8	2	0	2	0	3	0	0	0	0	752	39
Finland	10	0	15	1	0	49	0	0	0	1	0	1	6,806	3,773
France	51	9	10	15	0	2	5	0	5	11	6	24	11,414	645
Germany	60	17	67	100	0	9	1	0	0	11	4	31	9,808	1,177
Greece	34	0	0	1	0	0	16	0	0	15	0	0	1,669	591
Hungary	41	47	7	7	8	0	1	2	17	0	0	21	1,078	185
Ireland	30	0	0	1	0	0	0	0	0	8	0	0	4,310	513

Member State	Article 4(4) Surface water: ecological status as a %			Article 4(4) Surface water: chemical status as a %			Article 4(4) Ground water: quantitative status as a %			Article 4(4) Ground water: chemical status as a %			No. of water bodies in each country	
Italy	37	7	2	5	0	1	18	1	2	26	2	5	8,581	1,052
Latvia	0	0	10	0	0	6	0	0	0	0	0	0	470	22
Lithuania	48	0	12	1	0	0	0	0	0	0	0	0	1,186	20
Luxembourg	96	2	29	100	0	0	0	0	0	0	0	50	110	6
Malta	0	0	32	47	0	0	0	0	13	13	0	60	19	15
Netherlands	71	62	59	15	8	2	0	0	0	13	0	0	711	23
Poland	63	27	0	4	0	0	1	0	0	5	0	0	5,649	178
Portugal	24	2	21	1	0	0	0	0	3	9	0	0	2,040	151
Romania	29	3	0	2	0	0	0	0	0	10	0	0	3,028	143
Slovakia	24	22	0	2	1	0	3	3	3	0	11	0	1,510	102
Slovenia	35	0	3	99	0	0	0	0	0	0	0	14	154	21
Spain	17	21	2	4	1	1	11	10	1	17	11	12	5,162	762
Sweden	35	35	2	2	0	0	0	0	0	2	0	0	23,186	3,311
UK	19	27	7	1	1	0	3	4	1	2	10	11	9,328	790

TF: Technical feasibility, DP: Disproportionate costs, NC: Natural conditions, SW: Surface waters, GW: Groundwater. Note that waterbodies can have more than one exemption applied (e.g., a water body can have Article 4(4) applied for both ecological and chemical status). The exemption that has been applied to a water body may also be justified by several of the justifications (e.g., an Article 4(4) that has been applied to a water body may have been justified by both technical feasibility and disproportionate costs).

Member States widely implemented Article 4(4) in the 2nd RBMPs, where it was reported approximately half of Europe's water bodies were under an Article 4(4) exemption.[81] Exemptions were predominantly applied to surface waters rather than groundwater that were generally achieving better status.

Justifications for Article 4(4) exemptions

The main reported type and justification for exemptions of surface water bodies to good ecological status across the 2nd RBMPs was technical feasibility. Over 1/3 of Member States applied Article 4(4) exemptions to achieving good ecological status in over 50% of their water bodies (Netherlands, Luxembourg, Hungary, Germany, Czech Republic, Poland, Belgium, Sweden, France, Austria). In comparison, the UK had applied this to just over 40% of its surface water bodies.

Regarding the justifications for technical feasibility for Article 4(4), the European Commission reported that many of the justifications are elaborated on within the RBMPs themselves or in the background documents. Technical feasibility tends to be the most commonly applied exemption since it can be used to address a wide range of situations in which achieving the environmental objectives of the WFD are challenging or not technically possible. This may involve technological limitations, challenges with changing existing or implementing new infrastructure.

For the Scheldt RBD in Belgium, it was reported that technical feasibility related to delays, numerous diffuse sources that are difficult to tackle, or slow response time of the water system.[82] In Austria, the European Commission's analysis reported that there were general explanations to justify technical feasibility, including the number of barriers/installations, uncertainty regarding available funds and uncertainty about financing through local actors/municipalities.[83]

For achieving good chemical status, several Member States have applied exemptions in 100% of their surface water bodies (Austria, Germany, and Luxembourg). In comparison the UK in the 2nd RBMPs, reported 1% of exemptions for surface water chemical status for technical feasibility and disproportionate costs.

For groundwater, technical feasibility was again the predominant justification applied. For good chemical status in groundwater, the main justifications for the use of exemptions were both natural conditions and technical feasibility.

In the UK's 2nd RBMPs for Thames RBD, justifications of technical feasibility were set under Article 4(4) and 4(5). Justifications included unavailable solutions, unknown adverse impacts and technical constraints One example involved the invasive American signal crayfish, which lacked a known management solution.

81 European Commission, 2019. European Overview – River Basin Management Plans. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

82 European Commission, 2019. Second River Basin Management Plans - Member State: Belgium. SWD (2019) 37 final. Available at: eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:37:FIN&qid=1551205988853&from=EN

83 European Commission, 2019. Second River Basin Management Plans - Member State: Austria. SWD (2019) 36 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:36:FIN&qid=1551205988853&from=EN

A general observation is that the justification for Article 4(4) exemptions has improved in the 2nd RBMPs in comparison to the 1st RBMPs, with greater detail and consistency in the reporting of exemptions at the water body level. This was observed in England, due to an increased evidence base between cycles. However, it was noted during the European Commission's analysis that many of the justifications were still generic and greater progress is needed by Member States to further define these.[84]

Article 4(5)

Table 3-5 presents an overview of the percentage of water bodies with Article 4(5) exemptions in the 2nd RBMPs for all Member States (split by justification). In the UK's 2nd RBMPs the number of RBDs that had Article 4(5) applied increased between the 1st and 2nd cycle. Article 4(5) was applied in all RBDs, except the ones in Northern Ireland. The justifications given in the 2nd RBMPs were technical feasibility and disproportionate costs. The application of Article 4(5) in groundwater had also increased. In the 1st cycle exemptions were only applied in Northumbria and the North West, but this expanded to Humber, Anglian, Thames; South East; South West, Severn, Western Wales and Dee in the 2nd. The reasons given were technical feasibility and/or disproportionate costs.

Exemptions in the 3rd RBMPs for England were summarised earlier in Table 3-4 which included application of Regulation 17 (which corresponds to Article 4(5)). When looking at England's 3rd RBMPs, it is noted that the Anglian, Humber and Thames RBDs have applied Article 4(5) for less stringent ecological objectives more frequently than other English RBDs for surface waters. For Northern Ireland, there is limited information on the use of exemptions in the draft 3rd RBMP and a document detailing the use of exemptions is not currently included. There is one mention of where an exemption has been applied in Lough Neah.

84 European Commission (2019). European Overview – River Basin Management Plans. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

Table 3-6 - Percentage of water bodies with Article 4(5) exemptions (less stringent objectives) applied in the 2nd RBMPs

Member State	Article 4(5) Surface water: ecological status as a %			Article 4(5) Surface water: chemical status as a %			Article 4(5) Ground water: quantitative status as a %			Article 4(5) Ground water: chemical status as a %			No. of water bodies	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW
Austria	0	0	0	0	0	0	0	0	0	0	0	0	8,127	138
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	554	80
Bulgaria	3	0	0	1	0	0	2	0	0	8	0	0	955	169
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	1,572	33
Cyprus	0	0	0	0	0	0	5	0	0	5	0	0	204	21
Czechia	17	0	0	24	0	0	1	0	0	37	0	0	1,121	174
Denmark	0	1	0	0	0	0	0	0	0	0	0	0	8,765	402
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	752	39
Finland	0	0	0	0	0	0	0	0	0	0	0	0	6,806	3,773
France	0	0	0	0	0	0	0	0	0	1	0	0	11,414	645
Germany	0	0	0	1	0	0	3	0	0	2	1	0	9,808	1,177
Greece	0	0	0	0	0	0	0	0	0	0	0	0	1,669	591
Hungary	0	0	0	0	0	0	0	2	0	0	0	0	1,078	185
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	4,310	513

Member State	Article 4(5) Surface water: ecological status as a %			Article 4(5) Surface water: chemical status as a %			Article 4(5) Ground water: quantitative status as a %			Article 4(5) Ground water: chemical status as a %			No. of water bodies	
Italy	5	6	0	0	0	0	0	0	0	2	0	0	8,581	1,052
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	470	22
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	1,186	20
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	110	6
Malta	0	5	0	0	0	0	0	0	0	20	0	0	19	15
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	711	23
Poland	1	1	0	0	0	0	7	0	0	3	0	0	5,649	178
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	2,040	151
Romania	0	0	0	0	0	0	0	0	0	0	0	0	3,028	143
Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	1,510	102
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	154	21
Spain	1	2	0	0	0	0	1	2	0	1	4	0	5,162	762
Sweden	0	0	0	100	0	0	0	0	0	0	0	0	23,186	3,311
UK	6	7	0	0	0	0	0	6	0	3	3	0	9,328	790

TF: Technical feasibility, DP: Disproportionate costs, NC: Natural conditions, SW: Surface waters, GW: Groundwater. Note that waterbodies can have more than one exemption applied (e.g., a water body can have Article 4(4) applied for both ecological and chemical status). The exemption that has been applied to a water body may also be justified by several of the justification (e.g., an Article 4(4) that has been applied to a water body may have been justified by both technical feasibility and disproportionate costs).

Justifications for Article 4(5) exemptions

Several Member States reported an increase in the use of Article 4(5) exemptions between the 1st and 2nd RBMPs. In the 1st RBMPs, <5% of all exemptions applied were Article 4(5). The European Commission's analysis of the 2nd RBMPs reported that the justifications for exemptions under Article 4(5) were more detailed and reported more consistently in the 2nd RBMP, although the justifications were still reported as generic in many cases. [85]

The use of Article 4(5) exemptions for ecological status or potential in surface water was high in Czech Republic, Italy, Malta, Spain, Bulgaria and the UK and justifications were mainly due to technical feasibility and disproportionate costs. Specific justifications covered a broad range of activities, including urbanisation, industry, mining, and abstraction. For example, one surface water body in Spain has chemical pollution that has been attributed to industrial activities that are considered not feasible to halt. Disproportionate costs were applied to the Grand Harbour in the Czech Republic's 2nd RBMP, which was justified by affordability, cost-effectiveness analysis, distribution of costs, and social and sectoral impacts.[86] Article 4(5) had been applied in the UK's 2nd RBMPs due to natural barriers to fish migration which has in some instances resulted in classification of less than good status in a water body.[87]

The use of Article 4(5) exemptions for chemical status in surface water was mainly used in Sweden and Czech Republic. Sweden has applied Article 4(5) the most widely (100% of surface water bodies), this exemption has been applied due to wide-spread pollution by mercury. Article 4(5) in Sweden's surface waters have been justified by technical feasibility.

Disproportionate costs

Whilst the use of application of Article 4(5) was reported to increase between the two RBMPs, the justification of disproportionate costs decreased for both surface water ecological and chemical status and for groundwater quantitative and chemical status. The Member States that have used the justification of disproportionate costs for the use of Article 4(5) in the 2nd RBMPs include Austria, Germany, Denmark, Estonia, Spain, France, Italy, Malta, Poland, Romania, Sweden, Slovakia, and the UK.

Notably, the amount of detail and the approach taken by Member States with regards to disproportionate costs varied in the 2nd RBMPs. Justifications based on disproportionate costs were generally lacking detail and were missing in many Member States. Countries where justifications on disproportionate costs were not clear or detailed, included Denmark, Poland, Romania, Slovakia, and Austria.

85 European Commission (2019). European Overview – River Basin Management Plans. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

86 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:48:FIN&qid=1551205988853&from=EN

87 Note is it mentioned here that adaption of the reference conditions could be more appropriate than application of an Article 4(5) exemption.

In contrast, Member States that did provide information for the justification of disproportionate costs used different approaches to assess. For example, Sweden used a balance of costs and benefits, whereas Spain, Italy and Malta used a more mixed approach, considering factors such as affordability and social and sectoral impacts. France and the UK have been highlighted as case studies for good practice with the approach to applying Article 4(5) and justifications under disproportionate costs (Box 1).

In France, the approach to applying exemptions does include taking into account the cost of such measures and whether they are disproportionate, which is assessed by a cost benefit analysis. This is done by a tool which has been developed in France in order to understand the links between environmental measures, their associated benefits, and costs using reference values. In the UK, the cost benefit analysis (CBA) is used in disproportionate cost assessment that utilise benefit unity values derived in the National Water Environment Benefit Survey (NWEBS).[88] This survey established people's Willingness to Pay for improvements in surface water bodies. Use of the NWEBS unit values have been used transparently and consistently in decision-making contexts.

Box 1 – Article 4(5) examples of good practice for disproportionate costs: France and the UK

France – In France, an economic analysis tool has been developed to assess disproportionate costs, utilising a cost-benefit approach. The tool takes the form of an Excel-based spreadsheet that links between environmental measures, their associated benefits, and costs using reference values. Calculations are done through inputting water body information (such as water volume and population data). Market benefits are estimated by considering saved wastewater treatment costs, while non-market benefits are derived from factors like population density and the community's willingness to pay for recreational activities and natural heritage. To account for potential uncertainties, a 20% error margin is applied, assuming cost overestimations and benefit underestimations.

Currently, a group of practitioners and environmental economists is working on updating the tool for the 4th River Basin Management Plans. The main objectives include revising existing benefit values, incorporating new monetized benefits, enhancing the assessment's robustness, and improving user-friendliness.

UK – In the UK, cost benefit analysis is utilised in disproportionate cost assessment. This analysis uses that benefit unit values that were obtained from the National Water Environment Benefit Survey (NWEBS). This survey elicited people's Willingness to Pay for improvements in surface water bodies. NWEBS benefit unit values represent the value to society which arises when the ecological status of the aquatic environment is improved and cover six components which characterise good ecological status:

- Fish;
- Other animals such as invertebrates;
- Plant communities;
- The clarity of water;
- The condition of the river channel and flow of water; and
- The safety of the water for recreational contact.

The NWEBS benefit values encompass various ecosystem services, including recreational services (e.g., angling, water sports, walking, birdwatching), aesthetic services, and non-use values (such as option and existence values). These benefit values are specific to each catchment.

Over the past decade, NWEBS benefit unit values have been widely, consistently, and transparently employed in diverse decision-making contexts aimed at preserving and enhancing the water environment's quality, including in disproportionate cost assessments under Article 4.

[88] Note this survey only covered England and Wales.

Article 4(6)

Article 4(6) allows for a temporary deterioration of in the water body status in RBMPs under certain circumstances, which are exceptional and could not have been reasonably foreseen. Such circumstances for example can include natural causes.

The UK has not applied Article 4(6) in either the 1st or the 2nd RBMP. This is still the case in the 3rd RBMPs in England and in Northern Ireland. The Member States that have applied Article 4(6) have been the Netherlands, Spain, Portugal, and Hungary. Reasoning has included extreme flooding (the Netherlands), prolonged droughts (Spain, Portugal, and the Netherlands) and accidents (Netherlands, Hungary, and Spain). In the 2nd RBMPs, the number of RBDs applying Article 4(6) exemptions in the EU has increased since the 1st cycle, from five to fourteen.

Article 4(7)

Article 4(7) allows for a failure to achieve good groundwater status, good ecological status, or good ecological potential, or to prevent deterioration of surface water or groundwater as a result of new modifications to surface water/alterations to the level of groundwater/new sustainable human development activities, where certain conditions are met. Such activities can include new hydropower plants, flood protection schemes or groundwater abstraction projects.

In the UK's 2nd RBMP, according to WISE, Article 4(7) has been applied in the Scotland RBD for a number of water bodies. There were also some discrepancies in the reporting for some RBDs regarding application of Article 4(7), for example in the North Eastern RBD in Northern Ireland, had reported to WISE that no Article 4(7) exemptions have been applied. This contrasted with the background documents where one development (a hydroelectricity scheme) had been authorised despite the potential result in deterioration.

In the European Commission's assessment of the UK's 2nd RBMPs, it was recommended that further clarification would be provided as to whether the procedures as set out by the WFD and in Article 4(7) have been followed, since no specific information on the assessment of the impact of new modifications on water body status was provided.

Regarding the 3rd RBMPs, two instances of a Regulation 19 (Article 4(7) equivalent) were applied in England and 27 waterbodies were identified as potentially or pending the requirement for a Regulation 19 application in the future. Northern Ireland's draft 3rd RBMP provided limited information on the use of exemptions and no information regarding Article 4(7) exemptions was identified in Scotland and Wales.

The application of Article 4(7) had increased overall in the 2nd RBMPs, with more than a third of Member States reporting them.[89] In the 1st RBMPs it was applied in 12 RBDs but in the 2nd it was applied to approximately 1/5 of the total RBDs (29 out of 147 RBDs). The most common justification was impoundments for drinking water, followed by justifications for floor protection schemes and hydropower plants.

According to the information reported to WISE, Article 4(7) has been applied in the following Member States: Austria (3/3 RBDs), Bulgaria (3/4 RBDs), Germany (2/10 RBDs), Spain (9/25 RBDs), France (2/14 RBDs), the Netherlands (1/4 RBDs), Poland (3/10 RBDs), Portugal (3/10 RBDs), Romania (1/1 RBD) and the UK (2/16 RBDs).

89 European Commission (2019). European Overview – River Basin Management Plans. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:30:FIN&qid=1551267381862&from=EN

Progress between the 1st RBMPs and 2nd RBMPs has been noted by the European Commission.[89] For example, Member States have provided more in-depth information on approaches and methodologies to assess a project's effect on the status of water bodies and provided justifications in more detail.

Limited information on the assessment of the application of Article 4(7) in the 2nd RBMPs was observed for Austria, Romania, and the Netherlands and the European Commission noted that there was no information in the RBMPs or background documents on whether all steps of Article 4(7) were performed, or if the impact of new modifications on water status was assessed.[90]

Spain, Portugal, and Germany provided slightly more detailed information for Article 4(7). In Portugal, Article 4(7) has been applied in the Douro RBD and in the Vouga, Mondego and Lis RBD due to the building of new dams for hydroelectricity production. In conclusion, whilst some Member States have made positive progress in providing detailed justifications to the use of Article 4(7), other Member States, including the UK, are lacking on the specific assessment details for use of this exemption.

Summary of Exemptions

To conclude, the application of exemptions in the 2nd RBMPs differed among EU Member States and the UK, reflecting the specific challenges and conditions each country faced. Exemptions under Article 4(4) were used to a significant extent in all Member States.

DG Environment concluded that the justifications of the use of exemptions of Article 4(4) and Article 4(5) were more detailed and more consistently reported on the water body level in the 2nd RBMPs compared to the 1st RBMPs. However, there was still room for improvement, as justifications often remained generic, and Member States were recommended to improve this aspect of their reporting.

Article 4(5) exemptions were applied more often in the 2nd RBMPs than in the 1st RBMPs in several Member States. Information on justifications based on disproportionate costs was often lacking clarity or missing for many Member States. Some good practice was noted for the UK and France in particular.

The number of RDBs applying Article 4 (6) exemptions in the EU has increased in the 2nd RBMPs in comparison to the 1st, from five to fourteen. The reasoning for use of these exemptions included extreme flooding, prolonged droughts, and accidents.

Similar conclusions were made by the European Commission on the use of Article 4(7); while some Member States, such as Germany, Spain, and the UK, made progress in assessing impacts, further improvements, increased transparency, and comprehensive documentation of all steps required by Article 4(7) are still needed. With an expectation of more projects in the future, it is crucial to increase transparency and accountability, as the application of Article 4(7) may become increasingly common.

3.6 Programme of Measures

Article 11 of the WFD requires each Member State to establish a Programme of Measures (PoMs) to address the issues and pressures identified and to achieve the objectives established under Article 4. The measures are split into two categories: basic and supplementary. The basic measures are the minimum requirements to be complied with and refer to other legislation (e.g.,

[90] European Commission, 2019. Second River Basin Management Plans - Member State: Austria. SWD (2019) 36 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:36:FIN&qid=1551205988853&from=EN

urban waste water legislation and nitrates legislation), For example, basic measures must include 'controls, including a requirement for prior authorisation of artificial recharge or augmentation of groundwater bodies'.[91] Supplementary measures are developed in addition to basic measures where necessary. Member States may adopt supplementary measures to help achieve the objectives if it is decided that the basic measures are not sufficient or to provide additional protection or improvement of waterbodies covered in the WFD.[92] The basic measures are covered under article 11(3)(a), or 11(3) (b-l), and the supplementary measures are covered under 11(4).

Basic and supplementary measures are reported against Key Type Measures (KTM). KTMs are a concept developed in 2012 to simplify reporting. There was a large range in the number of measures that Member States were reporting (10-20 vs thousands) in 2010 so KTMs were introduced to define groups of measures that target the same pressure or purpose. This means that individual measures included in Member States PoMs are grouped into KTMs for reporting. One measure can be part of more than one KTM as it may be multipurpose.[93]

The WFD Reporting Guidance 2016 outlines 25 predefined KTMs that are available for Member States to use when reporting. These are standardised KTMs which highlight the most significant pressures seen in water bodies, for example, KTM1 is the construction or upgrades of wastewater treatment plants.[94] KTMs can also be supplementary which means they are set by the individual Member State to highlight a significant pressure not covered by the 25 predefined KTMs. These KTMs were updated in 2016 and added the most common significant pressures which were not listed in the original KTMs.

Within the timeframe of the RBMPs planning period, each KTM should be fully implemented and made operational to address specific pressures and achieve the environmental objectives.[95]

Overview of Practices Related to PoM in Member States

Table 3-7 was produced to compare the number of basic and supplementary measures being used against KTMs in Member States. Overall, there is a diversity of measures applied between each Member State. This can be linked to either the level of detail in the measures, with some Member States being very detailed within their measures, and some using more general measures. For example:

- Spain has reported the highest number of both basic and supplementary measures, with the majority of their measures coming under KTM 1 (Construction or upgrades of wastewater treatment plants) and KTM 14 (Research, improvement of knowledge base reducing uncertainty);

91 Lexparency, n.d. Article 11 — Programme of measures. (Accessed: 23rd March 2023). Available at: https://lexparency.org/eu/32000L0060/ART_11/

92 Lexparency, n.d. Article 11 — Programme of measures. (Accessed: 23rd March 2023). Available at: https://lexparency.org/eu/32000L0060/ART_11/

93 WFD Reporting Guidance 2016.https://cdr.eionet.europa.eu/help/WFD/WFD_521_2016/Guidance/WFD_ReportingGuidance.pdf

94 WFD Reporting Guidance 2016.https://cdr.eionet.europa.eu/help/WFD/WFD_521_2016/Guidance/WFD_ReportingGuidance.pdf

95 European Commission, 2019. Second River Basin Management Plans - Member State: UK. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

- Italy has reported the second highest number of basic measures, which are both mainly mapped to KTM 1 (Construction or upgrades of wastewater treatment plants) and KTM 14 (Research, improvement of knowledge base reducing uncertainty);
- Czechia has reported the second highest number of supplementary measures, which were mainly mapped to KTM6 (Improving hydro morphological conditions of water bodies other than longitudinal continuity) and KTM 14 (Research, improvement of knowledge base reducing uncertainty);
- Estonia had the least basic measures applied out of all Member States; and
- Slovenia had the least supplementary measures applied out of all Member States.

Table 3-7 - Overview of basic and supplementary measures in Member States

	Number of measures		Number of KTMs applied			
			Basic	Supplementary		
	Basic	Supplementary	predefined	regional or national	predefined	regional or national
Austria	189	87	12	n/a	9	n/a
Belgium	155	20	20	16	19	4
Bulgaria	105	82	24	n/a	24	n/a
Croatia	589	19	22	2	7	1
Cyprus	30	24	4	1	5	0
Czechia	1400	868	12	1	12	10
Denmark	NR	18	n/a	n/a	8	1
Estonia	5	52	3	n/a	12	n/a
Finland	14	59	4	n/a	14	1
France	38	204	15	4	24	7
Germany	31	110	13	n/a	21	2
Greece	780	407	16	1	19	1
Hungary	87	71	18	13	15	13

	Number of measures		Number of KTMs applied			
			Basic	Supplementary		
	Basic	Supplementary	predefined	regional or national	predefined	regional or national
Ireland	63	57	16	1	14	1
Italy	2351	824	21	16	23	10
Latvia	110	107	not detailed	not detailed	not detailed	not detailed
Lithuania	0 (potential error)	179	n/a	n/a	10	1
Luxembourg	158	63	14	2	12	3
Malta	51	54	10	2	8	5
Netherlands	30	71	12	4	15	22
Poland	1410	139	15	9	9	4
Portugal	428	831	15	8	19	9
Romania	22	93	11	2	12	4
Slovakia	22	23	8	n/a	10	n/a
Slovenia	18	11	9	23	6	n/a
Spain	5365	6051	21	10	18	11

	Number of measures		Number of KTMs applied			
			Basic	Supplementary		
	Basic	Supplementary	predefined	regional or national	predefined	regional or national
Sweden	52	45	12	n/a	14	n/a
UK	171	149	22	34	19	3

Overview of the UKs PoM

The European Commission's assessment of the UK's 2nd RBMP[96] found that there was good progress with the identification of pressures and implementation of the measures included in the PoMs. In total, seven out of the fifteen RBDs had implemented the first PoMs set out. The main changes between the 1st and 2nd RBMPs included improvements in the understanding of pressures and impacts, prioritisation of understanding of when to act, and how to prevent a pressure from escalating. In the 2nd RBMPs for the UK the financing of POMs was secured in 12 of the 15 RBDs. No financing of POMs was described for Northern Ireland for the 2nd RBMPs.[97]

In the UKs 2nd RBMPs, the basic and supplementary measures were mapped against KTMs. 9% of basic measures and 15% of supplementary measures were mapped against KTM21 (measures to prevent or control the input of pollution from urban areas, transport and built infrastructure), and 6% of basic measures and 18% of supplementary measures were mapped against KTM14 (research, improvement of knowledge base reducing uncertainty').[98.]

When looking at the 3rd RBMPs for England and Northern Ireland, Northern Ireland's draft 3rd RBMPs state that 90% of the 136 KTMs identified in the 2015 plans have been achieved or are on track to be achieved. 6% of their KTMs are making slow progress but showing positive improvements on water quality, the results of which are not expected to occur until beyond 2021, and 4% of the KTMs have not yet started.[99] The draft 3rd RBMPs also include draft POMs for the 3rd cycle which are not specific to RBDs. The measures are grouped by the following key sectors: agriculture; urban development; drinking water, chemicals and pesticides; abstraction, fisheries & morphology; non-native invasive species, forestry, waste and contaminated land; and other (which includes key targeted measures relating to research, education and protected areas).

For England, the Environment Agency states that it has not been possible to track progress with all the POMs in the 2nd RBMPs. However, progress has been recorded as part of kilometres enhanced reporting which is an indicator for progress established by the Environment Agency in 2016. Overall, 7, 588 actions contributed to kilometres enhanced between January 2016 and March 2022 across England.[100] England's 3rd RBMPs provides an excel file that contains a summary of the PoMs which is made up of national measures and RBD specific measures. The measures that aim to achieve water body status objectives include Water company investment programme in the Water Industry National Environment Programme (WINEP) and the Green economic recovery, water resources sustainability measures, Rural Development Programme for England agriculture, environment schemes, National Highways environment fund, mine water

96 European Commission, 2019. Second River Basin Management Plans - Member State: UK. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

97 European Commission, 2019. Second River Basin Management Plans - Member State: UK. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

98 European Commission, 2019. Second River Basin Management Plans - Member State: UK. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

99 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

100 Environment Agency, 2022. River basin management plans, updated 2022: progress report. Available at: River basin management plans, updated 2022: progress report - GOV.UK (www.gov.uk)

programmes: (coal mine water treatment and metal mine water treatment) and the flood risk management investment programme.[101]

Comparison of Practices Related to Programme of Measures

Types of KTM (basic or supplementary)

Overall, the most commonly mapped measures to KTMs that Member States used were, KTM1 (construction or upgrade of wastewater treatment works) and KTM2 (reduce nutrient pollution from agriculture), which were reported by 26 Member States. The number of RBDs in which these KTMs have been applied vary across each Member State e.g., KTM1 is reported in 100% (14) of France's RBDs, compared to only 50% (5) of Poland's.[102] France and Ireland mapped their measures to the highest number of KTMs (24) including KTM99 (other KTM which is used when a specific pressure is not covered under the 25 predefined KTMs). This type of information allows for the identification of the key measures that are deemed required by Member State to achieve good status of the waterbodies.

Implementation of the PoMs

As part of the mid cycle reporting on the implementation of the PoMs, Member States were asked to report any obstacles encountered to the European Commission. [103] Austria, Cyprus, and Lithuania reported no obstacles, whereas Hungary, Czechia, Poland, and Germany reported the most obstacles. Czechia reported 6 obstacles[104] for 3 of their RBDs, Germany reported 7 obstacles[105] in 10 of their RBDs and Hungary reported 7,106 obstacles. In one of their RBDs Poland reported all 8 obstacles[107] for 10 of their RBDs. The UK's main obstacles observed in the majority of its 15 RBDs are highlighted in the table below.[108] These obstacles are reported throughout a number of Member States, examples of these obstacles are highlighted in **Table 3-8** below.

[101] Environment Agency. Measure data for England. Available at: Measures data for England | Catchment Data Explorer

[102] European Commission, 2021. European Overview - Implementation of planned Programmes of Measures and New Priority Substances. SWD (2021) 970 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0970

[103] TBD

[104] Governance, Delays, Lack of Finance, Lack of mechanism, not cost effective and extreme events.

[105] Delays, Lack of Finance, Lack of mechanism, not cost effective, Extreme events, Lack of measures and other reasons.

[106] Governance, Delays, Lack of Finance, Lack of mechanism, Extreme events, Lack of measures and other reasons.

[107] Governance, Delays, Lack of Finance, Lack of mechanism, not cost effective, Extreme events, Lack of measures and other reasons.

[108] European Commission, 2019. Second River Basin Management Plans - Member State: UK. SWD (2019) 58 final. Available at: https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

Table 3-8 - Overview of obstacles in Member States RBDs

Member State	Number of RBD(s)	Obstacles							
		Governance	Delays	Lack of finance	Lack of mechanism	Lack of measures	Not cost effective	Extreme event	Other
Austria	**3**								
Belgium	**8**		3	3	2				2
Bulgaria	**4**		4		1	1			
Croatia	**2**		2	2	2				
Cyprus	**1**								
Czechia	**3**	3	3	3	3		3	3	
Denmark	**4**		4						4
Estonia	**3**		3	3	3				
Finland	**8**			8	8				
France	**14**	14	14	14	14				14
Germany	**10**		10	4	10	9	7	4	10
Greece	**14**		14						
Hungary	**1**	1	1	1	1	1		1	1
Ireland	**3**	3		3			3		3

Member State	Number of RBD(s)	Obstacles							
		Governance	Delays	Lack of finance	Lack of mechanism	Lack of measures	Not cost effective	Extreme event	Other
Italy	**8**	5	5	8	7	1	2	6	
Latvia	**4**			4				4	
Lithuania	**4**								
Luxembourg	**2**							1	2
Malta	**1**		1						
Netherlands	**4**		4	4			4		4
Poland	**10**	3	3	3	3	4	4	2	5
Portugal	**10**		8	9			8	8	
Romania	**1**		1	1	1		1		1
Slovakia	**2**		2	2					
Slovenia	**2**			2					
Spain	**25**	25	25	25	25				
Sweden	**5**				5				
UK*	**15**		majority		majority		lesser extent		

*As the UK is not included in the implementation of the POMs report, this information is taken from the compliance assessment of the UK's 2nd RBMPs.

Securing finance for the PoMs

One of the key aspects in carrying out the PoMs, is mapping out and ensuring that financing will be available to fully carry out the plans. Without clear financing being available for the PoMs, then questions are raised as to how the Member State will be able to fund its PoMs. A clear financial commitment must therefore be mapped out.

A Member State can set out a financial plan against numerous articles of the Water Framework Directive, including:

- 11(3)(a) which covers the measures required to implement Community legislation (legislation set in 1998 covering ecological status);
- 11(3) (b-l) which covers numerous measures and requirements for achieving good water status (usage etc.);
- 11(4) supplementary measures designed and introduced in addition to basic measures in order to achieve objectives in pursuant to Article 4; and
- 11(5) if failure seems likely for an objective set out under Article 4, Member States must follow a number of processes to show the reasoning for failing and try to prevent failure.[109]

When comparing the UK's 2nd RBMPs to other Member States, the UK had reported that a lack of finance was one of their main obstacles they faced in all but one RBD. However, finance had been secured for the implementation of 12 of the 15 RBDs in the UK.

When comparing this to other Member States with a similar number of RBDs:

- Greece, like the UK had reported that all their RBDs has financing secured, however, a lack of finance was reported as an obstacle for implementation;
- Germany did not hold data in the correct format to be able to report the cost of their basic measures for any cycles, financing of measures was also not secured in any of Germany's RBDs[110];
- France, like the UK, also reported a lack of finance as an obstacle for the implementation of their PoMs, however, finance had been secured for all measures and relevant sectors in the country; and
- A minority of Member States did not provide funding for costs in one or more of their RBDs, meaning that there was no verification for methods of funding for the PoMs in the RBD.

Summary

Overall, Member States are at different stages in terms of implementing their planned measures. Only Finland (8 out of 8 RBDs), Hungary (1 out of 1 RBDs) and Italy (1 out of 8 RBDs) have completed all their planned measures since the adoption of the 2nd RBMPs for their RBDs.[111] The UK reported in their 2nd RBMPs that three RBDs had some of their planned measures completed,

[109] European Commission, (2000). DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. L 327/1. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

[110] Germany state this was down to a computing error and financing has been secured.

[111] European Commission, 2021. European Overview - Implementation of planned Programmes of Measures and New Priority Substances. SWD (2021) 970 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0970

and five RBDs reported that the planned measures had started, the seven other RBDs had reported all their measures as complete. Difficulty arises when comparing Member States PoMs due to the level of progress made and varying underlying scenarios.

3.7 Achievement of Objectives

Environmental objectives should be set by Member States to ensure good status to both surface and groundwater bodies, these objectives should help to maintain good status and prevent deterioration. The objectives may be set on the basis of appropriate, evident and transparent criteria.[112]

It is expected that once a water body is classified under good or high status, it will not deteriorate to a lower classification under the WFD's 'no deterioration requirement'.[113] For this reason, a comparative analysis of the high and good classifications has been used to determine which countries are expected to achieve good status by 2027. The analysis of the 2nd RBMPs also provides information on whether the relevant Member States are expected to achieve good status beyond 2027, which will be covered later on in this section.[114]

Ecological Objectives

Table 3-9 shows a comparison of high ecological status for lakes, rivers, transitional water bodies in each Member State. The table uses a colour scale to show what percentile each country currently is in comparison to the others and based on the status information provided in the 2nd RBMPs. Green represents the upper percentile, amber the median, and red the lower percentile.

Table 3-9 - Percentages of high ecological classification for surface waterbody in each Member State

	Lake		River		Transitional		Coastal
Ireland	36.1	Austria	19.8	Ireland	23.6	Portugal	54.5
Croatia	29.7	Croatia	19.4	UK	9.5	Malta	44.4
Finland	24.3	Finland	16.3	Spain	7.5	Greece	42.7
Bulgaria	16.2	Spain	13.5	Bulgaria	7.1	Ireland	41.4
Austria	16.1	Sweden	12.2	France	3.2	United Kingdom	26.9
Sweden	14.4	Lithuania	9.1	Portugal	1.9	Spain	10.8
UK	9.8	France	8.5	Belgium	0	France	9.5
Spain	7.4	Ireland	7.7	Croatia	0	Sweden	4.4
Lithuania	5.9	Denmark	6.4	Germany	0	Italy	0.4
Denmark	5.8	Bulgaria	4.9	Greece	0	Belgium	0

[112] European Commission, 2000. DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. L 327/1. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

[113] UKTAG (2006) WP 13e) Prevent Deterioration of Status. Available at: https://www.wfduk.org/sites/default/files/Media/Setting%20objectives%20in%20the%20water%20environment/Prevent%20deterioration%20of%20status_Draft_010506.pdf

[114] European Commission, 2022. Implementation Reports. Available at: https://environment.ec.europa.eu/topics/water/water-framework-directive/implementation-reports_en

	Lake		River		Transitional		Coastal
Poland	5.3	Italy	4.9	Italy	0	Bulgaria	0
Estonia	4.5	Slovenia	4.4	Latvia	0	Croatia	0
Portugal	4.3	Cyprus	4	Lithuania	0	Cyprus	0
Italy	2.9	Slovakia	3.6	Malta	0	Denmark	0
France	2.3	Belgium	2.7	Netherlands	0	Estonia	0
Germany	2.3	Portugal	2.7	Poland	0	Finland	0
Latvia	2.3	United Kingdom	2.7	Romania	0	Germany	0
Hungary	1.7	Greece	0.8	Austria	n/a*	Latvia	0
Belgium	0	Estonia	0.6	Cyprus	n/a*	Lithuania	0
Cyprus	0	Latvia	0.5	Czechia	n/a*	Netherlands	0
Czechia	0	Poland	0.5	Denmark	n/a*	Poland	0
Greece	0	Czechia	0.4	Estonia	n/a*	Romania	0
Luxembourg	0	Hungary	0.4	Finland	n/a*	Slovenia	0
Malta	0	Germany	0.1	Hungary	n/a*	Czechia	n/a*
Netherlands	0	Luxembourg	0	Luxembourg	n/a*	Hungary	n/a*
Romania	0	Malta	0	Slovakia	n/a*	Luxembourg	n/a*
Slovakia	0	Netherlands	0	Slovenia	n/a*	Slovakia	n/a*
Slovenia	0	Romania	0	Sweden	n/a*	Austria	n/a*

*Not applicable to the Member State

Ireland has the highest percentage of high ecological classification for lakes at 36.1%, and the highest percentage for transitional waters at 23.6% and Portugal has the highest percentage for coastal waters at 54.5%. Several member states reported that zero water bodies met a higher classification of ecological status in a number of categories. Overall, the UK reports an above average percentage of high ecological status in water bodies for lakes (9.8%), is a high performer for coastal (26.9%) and transitional water bodies (9.5%) and sits in the lower percentile for high ecological status in rivers (2.7%) compared to other Member States.

Table 3-10 shows the same comparison for good ecological status for lakes, rivers, transitional water bodies based also on the data from the 2nd RBMPs. The table used the same colour scale as above.

Table 3-10 - Percentages of good ecological classifications for surface water in each Member State

	Lake		River		Transitional		Coastal
Austria	72.6	Romania	66.6	Croatia	40	Spain	66.5
Romania	72.3	Estonia	62.9	Spain	37.6	Croatia (HR)	65.4
Estonia	59.7	Greece	62.2	United Kingdom	27.4	Slovenia	60

	Lake		River		Transitional		Coastal
Finland	56.4	Slovenia	56.6	Portugal	26.9	United Kingdom	59.9
Lithuania	53.8	Slovakia	52.5	France	26.6	Cyprus	54.5
Portugal	43.5	Cyprus	51.7	Bulgaria	17.9	Italy	54.5
Spain	40.5	Portugal	49.6	Ireland	13.3	France	41.9
Sweden	34.3	Finland	47.8	Italy	5.2	Greece	41.5
Slovenia	33.3	Bulgaria	43	Greece	5	Malta	33.3
Poland	29.1	Spain	41.8	Belgium	0	Portugal	27.3
France	27.1	Lithuania	39.8	Germany	0	Ireland	27
Germany	23.8	Italy	37.7	Latvia	0	Sweden	13.2
Greece	23.7	France	36.3	Lithuania	0	Estonia	12.5
Ireland	22.7	Ireland	34	Malta	0	Finland	12
Latvia	19.7	Poland	30.2	Netherlands	0	Bulgaria	11.8
Bulgaria	18.9	United Kingdom	28.1	Poland	0	Denmark	1.7
Italy	17.3	Austria	26.5	Romania	0	Belgium	0
Croatia	16.2	Belgium	24.9	Austria	n/a	Germany	0
United Kingdom	15.7	Denmark	23.3	Cyprus	n/a	Latvia	0
Denmark	13.3	Croatia	22.2	Czechia	n/a	Lithuania	0
Czechia	11.7	Latvia	20.2	Denmark	n/a	Netherlands	0
Hungary	10.4	Sweden	19.5	Estonia	n/a	Poland	0
Belgium	0	Czechia	19.3	Finland	n/a	Romania	0
Cyprus	0	Hungary	7.4	Hungary	n/a	Austria	n/a
Luxembourg	0	Germany	6.6	Luxembourg	n/a	Czechia	n/a
Malta	0	Luxembourg	2.7	Slovakia	n/a	Hungary	n/a
Netherlands	0	Netherlands	0.8	Slovenia	n/a	Luxembourg	n/a
Slovakia	0	Malta	0	Sweden	n/a	Slovakia	n/a

In the 2nd RBMPs, Austria had the highest classification of good ecological status in lakes at 72.6%, closely followed by Romania with 72.3%. Romania reported the highest classification of good ecological status in rivers at 66.6% and Croatia reported the highest classification in transitional water bodies at 40%. Spain had the highest percentage of good status for coastal water bodies at 66.5%.

The percentage of lakes and rivers that the UK reported at good ecological status were in the middle percentile at 15.7% and 28.1% in comparison to other Member States. The UK reported an above average classification of good ecological status in coastal water bodies at 27.4% and transitional water bodies at 59.9% in comparison to other Member States. Similar to the classifications of high ecological status, several Member States reported 0% or n/a of water bodies achieving a good ecological status across their water bodies. Of the Member States that have not extended their deadline of achieving ecological status to beyond 2027, the Netherlands is the only nation to report a low percentage of their surface water bodies achieving high or good classification (only 0.8%). Based on the information from the 2nd RBMPs summarised above, it is clear that for the majority of Member States, significant progress is needed for their water bodies to improve in order to achieve good ecological status by 2027.

In the 3rd RBMPs, England has 3,591 water bodies that have a target of good or higher ecological status by 2027. Of these, 2,735 are identified as having low confidence that the target will be met. This means there are 856 surface water bodies that England is confident will meet the target of having good or higher status by 2027. If only those 856 water bodies in which there is confidence the objective will be met reach good or higher status by 2027, this would result in only a 2% improvement of water bodies at good or higher ecological status in the 3rd RBMP cycle.

In Northern Ireland's 3rd RBMPs, there is a working target to achieve 70% of water bodies at good or better status for 2027. Currently, 32% of Northern Ireland's 496 surface water bodies are a good or higher ecological status, which means another 38% need to improve to meet the working target. This is below the ambition of the WFD to have all water bodies at good or higher status by 2027 and it is not clear how the working target aligns with the objectives of the WFD regulations.

Chemical Objectives of Surface Water Bodies

This section presents the difference in Member States' reporting of chemical status of their surface water and the status of surface water bodies with and without ubiquitous substances. **Table 3-11** shows a comparison of good classification of chemical status in surface water bodies between Member States.

Table 3-11 - Share of surface water bodies achieving 'good' chemical status – 2nd RBMPs data

	Lake		River		Transitional		Coastal
Croatia	100.0	Malta	100.0	Malta	100.0	Romania	100.0
Malta	100.0	Lithuania	99.4	Romania	100.0	Cyprus	100.0
Portugal	100.0	Romania	97.6	United Kingdom	94.3	Finland	97.4
Romania	100.0	Slovakia	97.5	Portugal	84.6	United Kingdom	96.6
United Kingdom	99.9	United Kingdom	95.0	Croatia	72.0	Greece	93.5
Lithuania	99.7	Croatia	92.0	Greece	60.0	Croatia	84.6
France	84.4	Spain	90.0	Spain	53.2	Spain	73.8
Spain	84.4	Greece	89.0	France	51.1	France	72.6
Greece	71.7	Cyprus	86.2	Italy	32.6	Portugal	71.2

	Lake		River		Transitional		Coastal
Czechia	67.5	Italy	75.2	Lithuania	25.0	Italy	52.2
Italy	48.1	Finland	69.1	Poland	22.2	Estonia	48.7
Netherlands	39	Czechia	68.6	Ireland	15.9	Poland	30.0
Finland	38.5	Poland	68.3	Belgium	0	Bulgaria	17.6
Hungary	37.4	Belgium	66.7	Netherlands	0	Ireland	10.8
Bulgaria	27.0	France	62.0	Bulgaria	0	Denmark	1.7
Poland	18.4	Hungary	46.7	Latvia	0	Malta	0
Cyprus	12.5	Netherlands	41.9	Germany	0	Lithuania	0
Ireland	7.1	Bulgaria	35.4	Sweden	0	Belgium	0
Latvia	3.9	Portugal	21	Slovakia	n/a	Netherlands	0
Estonia	2.2	Latvia	19.7	Cyprus	n/a	Latvia	0
Denmark	0.4	Estonia	10.7	Finland	n/a	Slovenia	0
Austria	0	Ireland	6.1	Czechia	n/a	Germany	0
Belgium	0	Slovenia	0.7	Hungary	n/a	Sweden	0
Germany	0	Denmark	0.1	Estonia	n/a	Slovakia	n/a
Luxembourg	0	Austria	0	Slovenia	n/a	Czechia	n/a
Slovakia	0	Germany	0	Denmark	n/a	Hungary	n/a
Slovenia	0	Luxembourg	0	Austria	n/a	Austria	n/a
Sweden	0	Sweden	0	Luxembourg	n/a	Luxembourg	n/a

Romania, Portugal, Croatia, and Malta classified 100% of their lakes at good chemical status, with Lithuania (99.7%) and the UK (99.9%) following a similar trend. For rivers, Malta reported 100% good chemical classification, with Lithuania just behind at 99.4% for their river chemical classification. Malta also reported 100% of their transitional water bodies as a good chemical classification, alongside Romania. Similarly, Romania reported 100% of their coastal waters as a good chemical status alongside Cyprus. Several Member States reported 0% for one or more of their surface water bodies, with Germany and Sweden reporting 0% for all their surface water bodies having a good chemical status.

Without considering the Member States which have already stated their surface water bodies will not be achieving a good chemical status by 2027, Sweden, Germany, Slovenia, Luxembourg, Denmark, and Austria all require significant progress to achieve good chemical status of surface water by 2027. **Table 3-12** outlines each Member States' surface water bodies chemical status with and without ubiquitous substances.

Table 3-12 -Share of surface water bodies' good chemical status with or without uPBTs

	with or without uPBTs	good chemical status (%)
Austria	With ubiquitous substance	0
	without ubiquitous substance	100
Belgium	With ubiquitous substance	2

	with or without uPBTs	good chemical status (%)
	without ubiquitous substance	74
Bulgaria	With ubiquitous substance	34
	without ubiquitous substance	34
Croatia	With ubiquitous substance	92
	without ubiquitous substance	94
Cyprus	With ubiquitous substance	85
	without ubiquitous substance	85
Czechia	With ubiquitous substance	28
	without ubiquitous substance	72
Denmark	With ubiquitous substance	1
	without ubiquitous substance	1
Estonia	With ubiquitous substance	10
	without ubiquitous substance	11
Finland	With ubiquitous substance	49
	without ubiquitous substance	99
France	With ubiquitous substance	63
	without ubiquitous substance	76
Germany	With ubiquitous substance	0
	without ubiquitous substance	91
Greece	With ubiquitous substance	89
	without ubiquitous substance	90
Hungary	With ubiquitous substance	46
	without ubiquitous substance	47
Ireland	With ubiquitous substance	7
	without ubiquitous substance	8
Italy	With ubiquitous substance	72
	without ubiquitous substance	78
Latvia	With ubiquitous substance	11
	without ubiquitous substance	12
Lithuania	With ubiquitous substance	99
	without ubiquitous substance	99
Luxembourg	With ubiquitous substance	0
	without ubiquitous substance	0
Malta	With ubiquitous substance	53
	without ubiquitous substance	100
Netherlands	With ubiquitous substance	39

	with or without uPBTs	good chemical status (%)
	without ubiquitous substance	42
Poland	With ubiquitous substance	59
	without ubiquitous substance	85
Portugal	With ubiquitous substance	25
	without ubiquitous substance	25
Romania	With ubiquitous substance	98
	without ubiquitous substance	98
Slovakia	With ubiquitous substance	98
	without ubiquitous substance	98
Slovenia	With ubiquitous substance	1
	without ubiquitous substance	99
Spain	With ubiquitous substance	87
	without ubiquitous substance	89
Sweden	With ubiquitous substance	0
	without ubiquitous substance	99
UK	With ubiquitous substance	22
	without ubiquitous substance	96

The difference between the achievement of good chemical status with and without uPBT substances shows the influence uPBT substances have on waterbodies. The UK is heavily influenced by uPBT substances, with a 74% difference in chemical status results with and without the substances. Similarly, Slovenia, Germany, Czechia, and Austria have a significantly higher percentage of good classification without uPBT substances.

Luxembourg is the only nation to report 0% for good classification with and without uPBT substances. Austria reports 0% of good classification with uPBT substances and 100% without. Slovenia likewise reports a change in good classification, from 1% of water bodies classified as good with uPBT substances and 99% without.

Chemical and Quantitative Status of Groundwater Bodies

Table 3-13 shows the comparison of groundwater chemical and quantitative status in the respective Member States.

Table 3-13 -Share of good groundwater chemical and quantitative status classification in Member States

	Status of body	good chemical status (%)
Austria	Groundwater chemical status	98.4
	Groundwater quantitative status	100
Belgium	Groundwater chemical status	36.6
	Groundwater quantitative status	70.7

	Status of body	good chemical status (%)
Bulgaria	Groundwater chemical status	55.3
	Groundwater quantitative status	98.6
Croatia	Groundwater chemical status	98.5
	Groundwater quantitative status	99.5
Cyprus	Groundwater chemical status	88.1
	Groundwater quantitative status	42.9
Czechia	Groundwater chemical status	37.3
	Groundwater quantitative status	89.2
Denmark	Groundwater chemical status	78.4
	Groundwater quantitative status	97.7
Estonia	Groundwater chemical status	95.1
	Groundwater quantitative status	99
Finland	Groundwater chemical status	88.4
	Groundwater quantitative status	95.6
France	Groundwater chemical status	74.6
	Groundwater quantitative status	88.8
Germany	Groundwater chemical status	62.4
	Groundwater quantitative status	96.5
Greece	Groundwater chemical status	89
	Groundwater quantitative status	89.3
Hungary	Groundwater chemical status	82.8
	Groundwater quantitative status	74.5
Ireland	Groundwater chemical status	99.1
	Groundwater quantitative status	99.9
Italy	Groundwater chemical status	57.6
	Groundwater quantitative status	77.5
Latvia	Groundwater chemical status	100
	Groundwater quantitative status	100
Lithuania	Groundwater chemical status	100
	Groundwater quantitative status	100
Luxembourg	Groundwater chemical status	21.1
	Groundwater quantitative status	100
Malta	Groundwater chemical status	3.1
	Groundwater quantitative status	20.5
Netherlands	Groundwater chemical status	96.3
	Groundwater quantitative status	100

	Status of body	good chemical status (%)
Poland	Groundwater chemical status	92.9
	Groundwater quantitative status	96.1
Portugal	Groundwater chemical status	97.3
	Groundwater quantitative status	98.5
Romania	Groundwater chemical status	86.5
	Groundwater quantitative status	100
Slovakia	Groundwater chemical status	60.1
	Groundwater quantitative status	74.4
Slovenia	Groundwater chemical status	94.9
	Groundwater quantitative status	100
Spain	Groundwater chemical status	69.1
	Groundwater quantitative status	81
Sweden	Groundwater chemical status	94.4
	Groundwater quantitative status	99.7
UK	Groundwater chemical status	51.1
	Groundwater quantitative status	83.7

The majority of Member States reported over 50% of their groundwater bodies classified as good chemical status, with only four countries reporting a chemical status below 50%. This includes Malta (3.1%), Luxembourg (21.1%), the Czech Republic (37.3%) and Belgium (36.6%). Several Member States report their groundwater chemical status at over 90%. Latvia and Lithuania, report 100% of their groundwater bodies at good status. In terms of quantitative status, several countries report their groundwater quantitative status at 100%. Only two countries report a quantitative status below 50%, including Malta (20.5%) and Cyprus (42.9%).

A number of Member States need to address an array of pressures in order to achieve good chemical classification by 2027. Overall, agriculture, through pollution from nitrates and pesticides, is the principal pressure causing failure to achieve good status in groundwater.[115]

Achievement of objectives by 2027

The WFD requires Member States to achieve good ecological and chemical status of surface water and quantitative and chemical status of groundwater by 2027, with time extensions applied by Article 4(4). Beyond 2027 this is not possible, except in cases where the natural conditions play such a factor that the current objectives cannot be achieved within this period.

Member States are expected to report in their RBMPs whether they will achieve their good chemical, quantitative or ecological status for groundwater and surface water. There are a wide range of results for Member States achieving good status by 2027.

[115] European Environment Agency, 2018. Assessment of status and pressures 2018. Available at: https://www.eea.europa.eu/publications/state-of-water

In the assessment of the 2nd RBMPs, 10% of rivers in the UK are not expected to achieve good status until beyond 2027.[116] It is also reported that for two RBDs which contain information on their significant pressures, that less than 10% of water bodies are expected to achieve a good status.

In addition,13 Member States[117] have reported that they will not extend the achievement of the objectives beyond 2027. This may be changed within the 3rd RBMPs. 11 Member States[118] have reported that they will not achieve good status in one or more areas of classification by 2027. Italy reports only one groundwater body which will not achieve good chemical status until beyond 2027, whereas Hungary reports that up to 50% of its rivers and lakes will not achieve good ecological status until beyond 2027. Bulgaria indicated that a small percentage of its groundwater bodies will not achieve a good quantitative or chemical status until beyond 2027, a small percentage of its rivers will not achieve a good chemical status until beyond 2027, and a small percentage of its rivers and lakes will not achieve a good ecological status until beyond 2027.

Both of England and Northern Ireland's 3rd RBMPs reported that issues around meeting the good status objectives by 2027 are expected. These issues are linked to uncertainties around the delivery of measures and the waterbodies that will benefit. This shows that there are challenges with implementation which are likely to be due to a gap between the objectives set for the plans and being able to achieve them within the designated timeframe.

Summary

Overall, based on the 2nd RBMPs, it is likely that most Member States will not reach the objective of achieving good status (or good potential) by 2027. This appears to be confirmed in the England with 3rd RBMP data including deadlines well into the future. A main cause of the majority of deadline extensions are due to the identification of new uPBT substances. These uPBT substances are expected to prevent many other Member States from achieving their chemical objectives and at EU level, extensions of deadlines to beyond 2027 are expected to be observed in a number of Member States 3rd RBMPs.

3.8 Economic Analysis

Article 5 of the WFD requires Member States to undertake an economic analysis of water uses according to the specifications of Annex III. This stipulates that the economic analysis of water use should contain enough information in sufficient detail to support the assessment of cost recovery for water services and related obligations (Article 9) as well as judgements on the most cost-effective combination of measures in respect of water uses to be included in the POMs (Article 11).

In the 2nd RBMPs, the Commission found that the economic analysis was updated fully or partly in almost all RBDs.[119] This included England's economic analysis which was reviewed in accordance with the WFD, and new estimates of the costs and benefits were made at local level. The new

[116] European Commission, 2019. Second River Basin Management Plans – Member State: United Kingdom. SWD (2019) 58 final. Available at: eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

[117] Denmark, Estonia, Finland, France, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, and Slovenia.

[118] Bulgaria, Croatia, Czech Republic, Cyprus, Germany, Greece, Hungary, Italy, Ireland, Spain, and the Netherlands

[119] European Commission, 2019. Directorate-General for Environment, *Integrated assessment of the 2nd river basin management plans: EU-wide storyline report*, Available at: https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1

estimates were summarised at length in the RBMPs. In the UK's other RBDs, the economic analysis was reported as updated for some, partially updated for others and for the Western Wales RBD it was not updated. England's analysis in the 2nd RBMPs appears to be the most in depth in comparison to the other UK nations.

Cost recovery of water services

A key component of the economic analysis is making the relevant calculations to consider the cost recovery of water services including financial, environmental and resource costs. Overall, it was not common for there to be a full and detailed explanation of how the cost recovery rates for defined water services were calculated and this was the key difference between higher and lower performers.

As noted above, many Member States updated their economic analysis for the 2nd RBMPs, and as a result more Member States reported to have adopted a wider definition of water services to include more water services. The WFD states that "water services" means services which provide, for households, public institutions or any economic activity: (a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater, (b) waste-water collection and treatment facilities which subsequently discharge into surface water'.[120] Different interpretations of the scope of this definition has led to a range in how narrow or broad Member States definitions of water services are with narrow being the minimum requirement. The important aspect of how Member States define their water services relates to being able to give a comprehensive justification for the selection of water services and to be able to ensure financial, environmental and resource cost recovery for all the water services that are defined.

The Member States that broadened their definitions included Bulgaria, Cyprus, Greece, Hungary, Latvia, and Romania. Latvia provides an example of a Member State that broadened the definition of water services and also provided cost recovery rates for all these services, showing good performance. There are a large number (around 30%) which use a narrow definition of water services that focus on water supply and wastewater collection and treatment services.[121] Our research found that there are variations in terms of how wide or narrow the definition of water services is between MS and also within MS. A narrow definition was used in a number of Member States including Austria, the Czech Republic, Denmark, Finland, Germany, Ireland, and Italy. In the UK, water services were defined and managed differently in each country as a result of different national laws and water utilities. In England and Northern Ireland, water services were described as drinking water abstraction (surface and/or groundwater), treatment and distribution and sewage collection and wastewater treatment (when considered together).

The majority of Member States had limitations with their economic analysis. To provide an overview, Member States who had mostly positives or mostly negatives have been selected for this section. The MS who provided reasonably detailed information on how the economic analysis was carried out included Croatia, Cyprus, France, and the UK. The Member States where the

[120] European Commission, 2000. DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 23 October 2000, establishing a framework for Community action in the field of water policy. L 327/1. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

[121] European Commission, 2019. Directorate-General for Environment, *Integrated assessment of the 2nd river basin management plans : EU-wide storyline report*, Available at: https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1 https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1

explanation of methodologies for cost recovery calculations remained overly limited or unclear included Italy, Austria, Czech Republic, Finland, and Germany.

It was common for the definition of water services or the methodology for calculation of cost recovery to be different between Member States RBDs. For example, in Belgium, water services were defined differently in the Belgian RBDs and not all RBMPs included information on environmental and resource costs. This results in potential discrepancies in calculation methodologies or reporting outputs and does not provide the whole picture. Despite this, the economic analysis was reported as updated for all RBDs except for the North Sea RBD. Another key finding was that a number of Member States reported cost recovery rates of 100% or higher than 100% with limited information on the methodology/approach used to determine this. Examples of cost recovery rates of 100% or higher were found in Austria (for all water services), Poland (for water supply and sewage), Romania (for all water services) and Slovenia (for drinking water supply and communal wastewater collection and treatment).

The European Commission's assessment of 2nd RBMPs for the UK found that cost recovery was explained in general terms but was not transparently presented for all relevant services in all RBDs. Environmental and resource costs were not calculated in the 2nd cycle and only general information on the application of the polluter pays principle was reported. It was reported that only slight progress was made in terms of meeting the Commission's recommendation of ensuring that cost recovery addresses a broad range of water services and is transparently presented for all relevant sectors.[58]

In comparison the draft 3rd RBMPs for Northern Ireland clearly detail the methods used for cost recovery in accordance with Article 9. This information is also found in England's 3rd RBMPs which outlines that the costs of water and sewage services are recovered through customer bills from water company charges and abstraction charges.[122]

Cost Effective Analysis of Measures

A cost-effectiveness analysis is an appraisal technique that provides a ranking of alternative measures on the basis of their costs and effectiveness, where the most cost-effective has the highest ranking. A limited number of Member States had reported a complete qualitative or quantitative cost-effectiveness analysis of measures and/or provided a full explanation of how selections of measures were made. Those who had fulfilled most of these obligations included Austria, Denmark, Finland, Germany, Netherlands, and Romania. Notably Finland and Germany had much improved since the first cycle in which neither Member State had carried out the analysis.

It appears as though it is common across MS to have either a limited/incomplete cost-effective analysis or no cost-effectiveness analysis for the 2nd cycle. For example, in Cyprus, it was unclear how measures were selected in the first cycle and the cost effectiveness assessment has been carried out only for measures which were already selected in the POMs. This meant it had no effect on the selection of measures. Other key uncertainties included a lack of detail on the prioritisation of measures or detail on the methodology used to select measures (Italy, Poland,

[122] Gov.UK, 2023. River basin planning process overview. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/2-river-basin-management-plans

Malta, Croatia, Spain, and Cyprus), a lack of clarity on the funding of measures (Bulgaria and Belgium) and a general lack of sufficient data.

For the 1st cycle the UK used cost-effectiveness analysis as a tool to assess measures for all significant pressures. This has continued for the 2ndcycle POMs where a combination of a qualitative and quantitative cost-effectiveness analysis had been carried out in all 15 RBDs for supporting the selection of measures proposed under the 2015-2021 POMs.

In Northern Ireland's draft 3rd RBMPs, judgements made on the most cost-effective combination of measures are not as clear. Northern Ireland states that the Economic Assessment Report will be updated for the final RBMP. The economic assessment of the POMs in England 3rd RBMPs used cost effectiveness and cost-benefit analysis to determine the most valuable combination of measures to improve the water environment. Comprehensive detail on the methods and data used, a comparison of monetised costs and benefits, the investments needed, an overview of the funds committed for planned 2021 to 2027 activities are provided.[123] The monetised costs and benefits of achieving the environmental objectives in the 3rd RBMP are provided at the RBD level.[124]

Summary

This section assessed the economic analysis of the 2nd RBMPs for all EU Member States and 3rd RBMPs from England and Northern Ireland where possible. The key parts of the economic analysis focused on were cost recovery of water services and cost-effectiveness of POMs.

Overall, more Member States have adopted a wider definition of water services as a result of updating the economic analysis in the 2nd RBMPs. Around 30% of Member States use a narrow definition that focuses on water supply and wastewater collection and treatment services, including England and Northern Ireland. Irrespective of how broad or narrow these definitions were, the Member States that were able to provide a comprehensive justification for the selection of water services and ensure financial, environmental and resource cost recovery for all of their defined water services were those that were found to be high performers.

The majority of Member States had limitations with either how they carried out the assessment of cost recovery of water services or with the level of detail provided about the methodology used. The 2nd RBMPs for the UK was no different in that cost recovery was explained in general terms but it was not transparently presented in all RBDs. It appears that progress has been made in England and Northern Irelands 3rd RBMPs, as both clearly detail the methods used for cost recovery analysis.

A limited number of Member States had reported a complete cost-effectiveness analysis of measures and/or provided a full explanation of how selections of measures were made. The UK appeared to have been a high performer in this area in the 2nd RBMPs, which has continued in England's 3rd RBMPs. The information is not as clear in the 3rd RBMPs for Northern Ireland. As

123 Environment Agency, 2022. Investment requirements for England's River basin management plans. Available at: https://www.gov.uk/government/publications/investment-requirements-for-englands-river-basin-management-plans/investment-requirements-for-englands-river-basin-management-plans#about-this-report (Accessed 13th June 2023).

124 Environment Agency, 2022. Appendix D: Costs and benefits by river basin district. Available at: https://www.gov.uk/government/publications/investment-requirements-for-englands-river-basin-management-plans/appendix-d-costs-and-benefits-by-river-basin-district (Accessed 13th June 2023).

mentioned above, this information may already be included but not reported on or it may still be to come for Northern Ireland's final 3rd RBMPs.

3.9 Governance

Public Consultation

This section describes the approach taken by Member States in terms of public consultation using information available from their 2nd RBMPs. According to Article 14 of the WFD the draft RBMPs and other key documents such as the timetable, work programme and overview of significant water management issues, should be available for public consultation for a minimum of six months. Additionally, a comprehensive draft RBMP should be consulted on. Comprehensive means all main chapters should be available for consultation, including a complete or nearly complete POMs and the presentation of all objectives and exemptions.

There are a range of differences and similarities between the different approaches each Member State took in terms of public consultation. This section has drawn out examples of good performance, poor performance and any points of interest.

Almost all countries reported in their 2nd RBMPs that the required documents were available for the minimum six months. The exceptions were Malta which did not report whether the documents were available for the required period of time and the Canary Islands in Spain. The Canary Island's RBMPs were submitted via a legally endorsed emergency procedure and as such the public consultation was decreased to three months.[125]

Most Member States did not publish their RBMPs by the required deadline of December 2015 including the UK. The Member States that published their RBMPs on time include Finland, France and three out of the eight RBMPs for Italy. Several Member States did not mention when they published their RBMPs, so we were unable to determine if they met the deadline.

There was a range of information available on how comprehensive each Member State draft RBMPs were. Some examples that appeared less comprehensive included Italy and Belgium. In Italy reporting was not consistent across RBDs. The characterisation of groundwater bodies was not complete for some RBDs, and a number of significant pressures were not assessed for surface waters and groundwater. For Belgium, the European Commission's assessment of the 2nd RBMPs found that key information was not made available in a consolidated way across RBDs. Member States who appeared to have more comprehensive draft RBMPs included Greece, Latvia, Lithuania, Luxembourg, Poland, Romania, Slovakia, and Spain. The UK reported RBMPs for 15 out of 16 RBDs. This excluded Gibraltar which was reported to the European Commission but not uploaded to WISE due to technology errors.

Notably the governance aspects were reported as an obstacle in a number of Member States for achieving the objectives of the WFD. This included Germany, Hungary, and Italy. In Germany progress in implementation and compliance with the WFD since the 1st RBMPs was reported as "some measures completed", but governance was listed as an obstacle for WFD implementation and compliance for one out ten RBDs. In Hungary, the governance aspects were reported as an

[125] European Commission, 2019. Directorate-General for Environment, *Integrated assessment of the 2nd river basin management plans : EU-wide storyline report*, Available at: https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1 https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1

obstacle in seven out of eight RBDs. Italy reported governance as an issue in seven out of eight RBDs in the 2nd RBMPs. In this context 'governance' is referring to aspects such as coordination between competent authorities in, international cooperation, or public consultation and the active involvement of stakeholders.[126]

In the 3rd RBMPs, England and Northern Ireland carried out a 6-month consultation and the key documents were made available as required. Northern Ireland also reported that detailed status updates on each RBD were provided, however, the 3rd RBMP for Northern Ireland remains in draft status and some information, such as a full breakdown of objectives data, is not yet available.

Summary

All Member States, apart from Malta and the Canary Islands, reported that the RBMP documents were available for the minimum six months for public consultation as required under the WFD. In the 3rd RBMPs, England and Northern Ireland's documents were also available for the minimum 6 months, however, Northern Irelands 3rd RBMPs remains in draft.

Very few Member States published their RBMPs by the December 2015 deadline, the UK included. As seen by the lack of currently available 3rd RBMPs this trend is largely continuing for the 3rd cycle. This potentially reflects the challenge of reporting under the WFD and the amount of information that is required to complete RBMPs alongside the technical challenges that can be faced reporting to WISE.

The level of comprehensiveness of the draft 2nd RBMPs consulted on varied between Member States. In some cases, there was limited reporting on the level of detail included in the drafts making it difficult to draw conclusions.

Engagement of Stakeholders

Article 14 of the WFD outlines that Member States shall encourage the active involvement of all interested parties, in the implementation of the WFD, in particular in the production, review and updating of the RBMPs.

This includes:

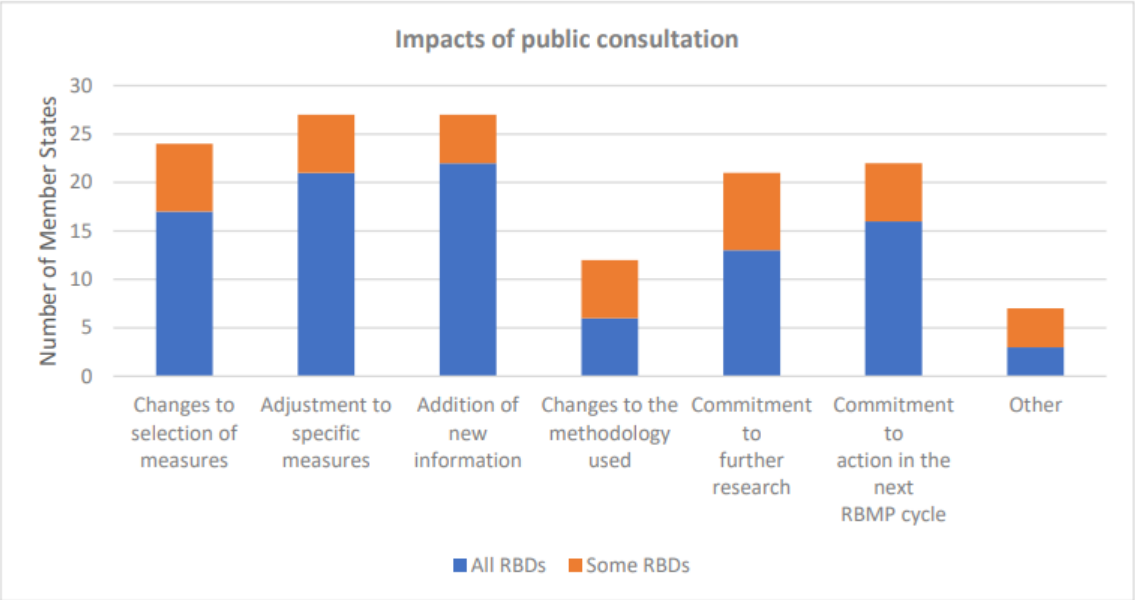
- Using mechanisms (establishment of advisory groups, involvement in drafting, digitalisation, and others) for active involvement of stakeholders;
- Indicating types of stakeholders actively involved (Industry, farmers, NGOs, and others); and
- Considering issues raised by stakeholders (addition of new information, changes to information).

All Member States reported using a range of mechanisms for the active involvement of stakeholders and indicated the types of stakeholders involved. All 25 Member States assessed by the European Commission reported that the consultation of the draft RBMPs impacted the final RBMPs as shown in Figure 3-7. Around one third of Member States also showed evidence of considering issues raised by stakeholders by making changes to the methodology and other types of changes such as better coordination of finance and policies and the addition of new river water

[126] European Commission, 2019. FITNESS CHECK of the Water Framework Directive, Groundwater Directive, Environmental Quality Standards Directive and Floods Directive. SWD (2019) 439 final. Available at: https://commission.europa.eu/system/files/2020-04/swd_2019_0439_en.pdf

bodies.[127] Denmark, Netherlands, Slovakia, and Spain were exceptions as they did not mention whether any changes were made.

Figure 3-15 - Impacts of consultation on the final RBMPs



Source: WISE electronic reports

Member States that were found by the European Commission to have made considerable progress and/or taken on board the recommendations included the Czech Republic and Bulgaria. For the Czech Republic this included the more active involvement of stakeholders in the preparation of the 2nd RBMPs through advisory groups and in drafting.[128] For Bulgaria this included improving coordination with Greece and the development and application of common approaches and methodologies across all four RBDs.[129]

The only country that reported a decrease in the engagement of stakeholders was Cyprus. The WISE reporting suggested that public consultation was less broad in terms of the engagement of stakeholders in comparison to the first cycle. However, Cyprus noted that for the 2nd cycle, only the main stakeholders that participated in the meetings or provided feedback for the preparation of the 2nd RBMPs were reported.[130]

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127 European Commission, 2019. Directorate-General for Environment, *Integrated assessment of the 2nd river basin management plans : EU-wide storyline report*, Available at: https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1 https://op.europa.eu/en/publication-detail/-/publication/65babd28-1bc7-11ea-8c1f-01aa75ed71a1

128 European Commission, 2019. Second River Basin Management Plans - Member State: Czechia. SWD (2019) 35, Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:35:FIN&qid=1551205988853&from=EN

129 European Commission, 2019. Second River Basin Management Plans - Member State: Bulgaria. SWD (2019) 39. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:39:FIN&qid=1551205988853&from=EN

130 European Commission, 2019. Second River Basin Management Plans - Member State: Czechia. SWD (2019) 35, Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:35:FIN&qid=1551205988853&from=EN

For the 3rd RBMPs, England outlines the mechanisms used to actively engage stakeholders which included sessions with catchment partnerships and key stakeholders. England provided a very thorough summary of responses to the consultation and outlined a number of changes made in response to the feedback gained.

For Northern Ireland, there is limited information on the consultation page about the active involvement of stakeholders in the consultation process, but a list of stakeholders involved can be found in the POMs section. There is no mention of any changes that have resulted from the consultation, however the 3rd RBMPs are still in draft form.

Summary

Overall, examples of mechanisms to actively involve stakeholders in the consultation process as well as an indication of the types of stakeholders involved were provided in the majority of Member States. Evidence of consideration of issues/feedback from the consultation process being acknowledged and responded to was often shown through additions of or changes of information in the RBMPs. The level of detail provided on the public consultation process varied by country.

In comparison, the 3rd RBMPs for England provided very detailed information about the consultation process and the changes made in response to the feedback received. This shows signs of a transparent process. The final 3rd RBMPs for Northern Ireland are not yet available, therefore the extent of the changes to be made following the stakeholder consultation is not yet known.

4 Selection of EU Member States for Task 2C

This report informs the selection of EU Member States for Task 2C focusing on an assessment of lessons and practices from selected EU jurisdictions.

Based on comments received from the OEP, we proposed a focus on Ireland, Germany, Denmark, and the Netherlands. We note this makes the selection Western Europe focused as we chose countries with similar climates, demographics, and land use to the UK to allow for more relevant comparisons.

A revised view on potential EU Member States and the justifications are provided below:

- **Ireland:** achievement of change:
  - Ireland was selected as presenting best practice for achieving change, in particular with regards to increasing local participation and strengthening the interface between science and policy. In response to criticism from the 1st RBMPs, Ireland established new structures and processes for the 2nd RBMPs:
    - Ireland has also been selected as an example of good practice for strengthening the science-policy interface by effective use of innovative catchment programmes. The Republic of Ireland established the Agricultural Catchments Programme in 2008, the objectives of which include: to measure the effectiveness of the Good Agricultural Practice, evaluate the efficacy of the nitrates derogation, and to provide a scientific basis for policy reviews. Since 2008, this programme has involved the voluntary engagement of over 300 farmers across six catchments. Additionally, Ireland has a similar agricultural landcover to the UK (about 68% to the UKs 71%) which means agriculture is a main pressure for both making it a good comparator.
- **The Netherlands:** best practice for governance:
  - The WFD provides a framework for the integrated management of water policy. A robust framework and appropriate and effective governance structures are essential pre-requisites for successful integrated river basin management. The Netherlands was selected as presenting a best practice for governance. The WFD provides a framework for the integrated management of water policy. A robust framework and appropriate and effective governance structures are essential pre-requisites for successful integrated river basin management. The Netherlands has been selected as a case study due to the transparent coordination between authorities leading to detailed and accessible information being reported:
    - The Netherlands has also demonstrated good practice in the integration with the Marine Strategy Framework Directive (MSFD) and Floods Directive Flood Risk Management Plans (FRMPs).

- **Germany:** best practice approach to chemical status:
  - Germany was selected as presenting a best practice approach to chemical status. Whilst Germany classified all the water bodies as failing good chemical status, the approach to establishing chemical status was considered a good case study for good practice. Germany used the revised environmental quality standards (EQS), with increased monitoring between the 1st and 2nd RBMPs, and over 80% of the water bodies were classified with high confidence.
- **Denmark:** synergies with other policies:
  - Strengthening operational synergies between the WFD and other policies is necessary for the successful delivery of WFD objectives. A coherent, focused, and grounded policy framework is vital to make significant progress in improving the water environment in the face of multisectoral pressure. In Denmark, there is a tax on emissions of nutrients (N and P) from wastewater treatment plants. The tax provides an incentive for sewage companies to increase the level of N and P removal above the requirement in the Urban Waste Water Treatment Directive (UWWTD).

Appendix A

DETAILED DATA FOR TASK 2A

Table A-1 - Number and breakdown of type of surface waters in each EU Member State and in the UK

	Rivers/lakes	Transitional	Coastal	Total
Sweden	22514	0	653	23186
France	11141	94	179	11414
Germany	9728	5	75	9808
UK	8574	190	561	9328
Denmark	8632	0	119	8765
Italy	7840	172	561	8581
Austria	8127	0	0	8127
Finland	6530	0	276	6806
Poland	5630	9	10	5649
Spain	4761	186	260	5162
Ireland	4004	195	111	4310
Romania	3021	2	4	3028
Portugal	1922	52	66	2040
Greece	1383	40	246	1669
Croatia	1521	25	26	1572
Slovakia	1510	0	0	1510
Lithuania	1179	4	2	1186
Czechia	1121	0	0	1121
Hungary	1078	0	0	1078
Bulgaria	910	28	17	955
Estonia	734	0	16	752
Netherlands	697	5	9	711
Belgium	545	6	2	554
Latvia	462	3	5	470
Cyprus	182	0	22	204
Slovenia	149	0	5	154

	Rivers/lakes	Transitional	Coastal	Total
Luxembourg	110	0	0	110
Malta	5	5	9	19

Table A-2 - Number of groundwater bodies in each EU Member State and in the UK

	Number of groundwater bodies
Finland	3773
Sweden	3311
Germany	1177
Italy	1052
UK	790
Spain	762
France	645
Greece	591
Ireland	513
Denmark	402
Hungary	185
Poland	178
Czechia	174
Bulgaria	169
Portugal	151
Romania	143
Austria	138
Slovakia	102
Belgium	80
Estonia	39
Croatia	33
Netherlands	23
Latvia	22

	Number of groundwater bodies
Cyprus	21
Slovenia	21
Lithuania	20
Malta	15
Luxembourg	6

Table A-3 - Top 15 priority substances causing failure to achieve good chemical status in over 100 water bodies (out of a total of 111 062 surface water bodies) from the 2nd RBMPs

Priority substances	uPBT substance	Type/use of chemical	Number of water bodies not achieving good chemical status	Number of Member States with water bodies not achieving good chemical status for the listed substance
Mercury	Yes	Metal	45973	24
Brominated diphenylethers	Yes	Flame retardant	23331	8
Benzo (g, h, i) perylene+ indeno(1,2,3-cd) pyrene	Yes	PAH	3091	15
Benzo(a)pyrene	Yes	PAH	1630	12
Fluoranthene	No	PAH	1390	14
Cadmium	No	Metal	1014	20
TBT	Yes	Biocide	663	15
Nickel	No	Metal	654	20
Lead	No	Metal	462	19
Benzo(b)fluoranthene + benzo(k)fluoranthene	Yes	PAH	460	10
Isoproturon	No	Pesticide	199	8
4-Nonylphenol	No	Surfactant	188	10
Anthracene	No	PAH	123	11
Hexachlorocyclohexane	No	Pesticide	120	11
DEHP	No	Plasticiser	102	11

Note: This table includes the UK. This table has been adapted from https://www.eea.europa.eu/publications/state-of-water.

Table A-4 - Top 15 priority substances causing failure to achieve good chemical status in over 100 water bodies (out of a total of 111 062 surface water bodies) from the 2nd RBMPs

Pollutant	Type/use of chemical	Number of water bodies not achieving good chemical status	Number of Member States with water bodies not achieving good chemical status for the listed substance
Nitrate		1137	25
Chloride		347	15
Pesticides		341	10
Ammonium		265	15
Sulphate		211	16
Electrical conductivity		142	11
Arsenic and its compounds		130	12
Tetrachloroethylene		123	9
Nickel and its compounds		88	10
Trichloromethane		88	2
Lead and its compounds		76	8
Cadmium and its compounds		75	4
Desethylene		69	5
Trichloroethylene		63	6
Atachlor ESA		63	1

Note: This table includes the UK. This table has been adapted from https://www.eea.europa.eu/publications/state-of-water.

Table A-5 - The number of water bodies with Article 4(4) exemptions applied in the 2nd RBMPs

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
Austria	18	18	0	12	12	0	0	0	0	0	0	0	8127	138	60	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	554	80	0	0
Bulgaria	32	0	0	8	0	0	4	0	0	14	0	0	955	169	40	18
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	1572	33	0	0
Cyprus	0	0	0	0	0	0	1	0	0	1	0	0	204	21	0	2
Czechia	185	0	0	270	0	0	1	0	0	64	0	0	1121	174	455	65
Denmark	1	103	0	0	0	0	0	0	0	0	0	0	8765	402	104	0
Estonia	0	1	0	0	0	0	0	0	0	0	0	0	752	39	1	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	6806	3773	0	0
France	49	20	0	5	0	0	0	0	0	4	0	0	11414	645	74	4
Germany	22	18	0	64	1	0	34	0	0	27	10	0	9808	1,177	105	71
Greece	0	0	0	0	0	0	0	0	0	0	0	0	1669	591	0	0
Hungary	0	0	0	0	0	0	0	4	0	0	0	0	1078	185	0	4

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
Ireland	5	0	0	0	0	0	0	0	0	2	0	0	4310	513	5	2
Italy	422	488	0	19	1	0	0	0	0	22	4	0	8581	1052	930	26
Latvia	2	0	0	0	0	0	0	0	0	0	0	0	470	22	2	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	1186	20	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	110	6	0	0
Malta	0	1	0	0	0	0	0	0	0	3	0	0	19	15	1	3
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	711	23	0	0
Poland	48	33	0	0	0	0	12	0	0	5	0	0	5649	178	81	17
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	2040	151	0	0
Romania	14	4	0	0	0	0	0	0	0	0	0	0	3028	143	18	0
Slovakia	1	1	0	0	0	0	0	0	0	0	0	0	1510	102	2	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	154	21	0	0
Spain	61	91	0	4	0	0	4	12	0	11	33	0	5162	762	156	60
Sweden	20	101	0	23167	1	0	0	0	0	0	1	0	23186	3311	23289	1

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
UK	546	622	0	14	2	0	1	48	0	25	23	0	9328	790	1184	97

TF: Technical feasibility, DP: Disproportionate costs, NC: Natural conditions, SW: Surface waters, GW: Groundwater

Table A-6 - The number of water bodies with Article 4(5) exemptions applied in the 2nd RBMPs

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
Austria	18	18	0	12	12	0	0	0	0	0	0	0	8127	138	60	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	554	80	0	0
Bulgaria	32	0	0	8	0	0	4	0	0	14	0	0	955	169	40	18
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	1572	33	0	0
Cyprus	0	0	0	0	0	0	1	0	0	1	0	0	204	21	0	2
Czechia	185	0	0	270	0	0	1	0	0	64	0	0	1121	174	455	65
Denmark	1	103	0	0	0	0	0	0	0	0	0	0	8765	402	104	0
Estonia	0	1	0	0	0	0	0	0	0	0	0	0	752	39	1	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	6806	3,773	0	0
France	49	20	0	5	0	0	0	0	0	4	0	0	11414	645	74	4

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
Germany	22	18	0	64	1	0	34	0	0	27	10	0	9808	1,177	105	71
Greece	0	0	0	0	0	0	0	0	0	0	0	0	1669	591	0	0
Hungary	0	0	0	0	0	0	0	4	0	0	0	0	1078	185	0	4
Ireland	5	0	0	0	0	0	0	0	0	2	0	0	4310	513	5	2
Italy	422	488	0	19	1	0	0	0	0	22	4	0	8581	1,052	930	26
Latvia	2	0	0	0	0	0	0	0	0	0	0	0	470	22	2	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	1186	20	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	110	6	0	0
Malta	0	1	0	0	0	0	0	0	0	3	0	0	19	15	1	3
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	711	23	0	0
Poland	48	33	0	0	0	0	12	0	0	5	0	0	5649	178	81	17
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	2040	151	0	0
Romania	14	4	0	0	0	0	0	0	0	0	0	0	3028	143	18	0
Slovakia	1	1	0	0	0	0	0	0	0	0	0	0	1510	102	2	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	154	21	0	0
Spain	61	91	0	4	0	0	4	12	0	11	33	0	5162	762	156	60

Member State	Article 4(5) Surface water: ecological status			Article 4(5) Surface water: chemical status			Article 4(5) Ground water: quantitative status			Article 4(5) Ground water: chemical status			No. of water bodies		Total number of Article 4(5) exemptions	
Justifications:	TF	DC	NC	TF	DC	NC	TF	DC	NC	TF	DC	NC	SW	GW	SW	GW
Sweden	20	101	0	23,167	1	0	0	0	0	0	1	0	23186	3,311	23,289	1
UK	546	622	0	14	2	0	1	48	0	25	23	0	9328	790	1,184	97

TF: Technical feasibility, DP: Disproportionate costs, NC: Natural conditions, SW: Surface waters, GW: Groundwater

2

Task 2B - Comparison Against Approaches and Performance in Scotland and Wales

1 Introduction

1.1 Objectives of Task 2B

The aim of this task was to identify, if any, significant differences between the approaches adopted to implement Water Framework Directive (WFD) legislation in Scotland and Wales, compared to the approaches in England and Northern Ireland. These differences have been evaluated to understand whether learning from different approaches could improve the overall compliance, or rate of improvement of water bodies in England and Northern Ireland.

1.2 Approach Undertaken

A series of indicators were defined to assess the approaches and data from Scotland, Wales, England and Northern Ireland's 3rd River Basin Management Plans (RBMPs). The indicators enable us to perform a quantitative and qualitative comparison of the RBMPs for England and Northern Ireland with those from Scotland and Wales.

The indicators cover several aspects, including:

- General context (e.g., landscapes, population sizes, land use);
- Ecological status and changes since the 2nd RBMPs;
- Chemical status and changes since the 2nd RBMPs;
- Significant pressures;
- Environmental objectives and use of exemptions;
- Water pricing and cost recovery; and
- Governance.

The information upon which our analysis is based was extracted from:

- England: The RBMP progress report for England[131] (and linked RBMPs for each River Basin District (RBD)[132]);
- Northern Ireland: The draft RBMP for Northern Ireland, containing the North Western, Neagh Bann and North Eastern RBDs 2021-2027;[133]

131 Environment Agency, 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report.

132 Environment Agency, 2022. River basin management plans, updated 2022. Available at: https://www.gov.uk/guidance/river-basin-management-plans-updated-2022

133 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023)

- Wales: The Western Wales RBMP 2021- 2027 summary, the Dee RBMP 2021- 2027 summary[134] and the transboundary Severn RBMP 2021-2027;[135] and
- Scotland: The RBMP for Scotland[136] and the transboundary Solway Tweed RBMP.[137]

Each of these RBMPs have additional links and data portals that provide further information. The way this information is presented and can be accessed differs for each nation. To account for this, where possible, information throughout this document is referenced to the location where it was found which is often not the standalone RBMP document but a linked information source (e.g. appendices, classification data tables[138] or map explorer portals).[139]

Of note, England and Wales, Northern Ireland and Scotland have transposed the WFD into their regulations which differ between nations for some sections. For ease of reading the relevant WFD articles have been used in the economic analysis (section 3.6) and governance sections (section 3.7).

134 Natural Resource Wales, 2021. Dee and Western Wales river basin management plans summary 2021-2027. Available at: https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans/river-basin-management-plans-2021-2027/?lang=en (accessed 13th June 2023).

135 Natural Resource Wales, 2021. Severn River Basin Management Plan 2021-2027. Available at: https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans/Severn-river-basin-management-plan-2021-2027/?lang=en

136 Scottish Environment Protection Agency, 2021. The River Basin Management Plan for Scotland 2021 – 2027. Available at: https://www.sepa.org.uk/media/594088/211222-final-rbmp3-scotland.pdf (accessed 13th June 2023).

137 Scottish Environment Protection Agency, 2021. The River Basin Management Plan for the Solway Tweed River Basin District2021 update. Available at: https://www.sepa.org.uk/media/594087/211221-final-rbmp3-solway-tweed.pdf (accessed 13th June 2023).

138 Environment Agency, 2021. Explore catchment data. Available at: https://environment.data.gov.uk/catchment-planning/ (Accessed: 13th June 2023).

139 Scottish Environment Protection Agency, 2021. Welcome to the 2021 update to the Water Environment Hub. Available at: https://informatics.sepa.org.uk/RBMP3/ (accessed 13th June 2023).

2 Key Findings

The purpose of this task is to identify, if any, significant differences between the approaches adopted to implement WFD legislation in Scotland and Wales, compared to the approaches in England and Northern Ireland. These differences have been evaluated to understand if the learning / approaches could improve the overall compliance, or rate of improvement of water bodies in England and Northern Ireland.

It is important to note that there are limitations in the comparison due to variation between the four United Kingdom (UK) nations in terms of how information was reported, and the level of detail available. This means that information was not always directly comparable, or in some instances comparisons could not be done due to incomplete information. This was particularly apparent where RBMPs were still in draft form (i.e., Northern Ireland) and where documents were 'summary' or 'update' RBMPs (i.e., Wales and the Solway Tweed).

The key findings for each indicator are summarised below:

- The **significant pressures** outlined in each nation highlight pressures that contribute to an impact which may result in not meeting the WFD objectives of not having at least good status. The findings show that there are differences in the pressures faced by Scotland and the other three nations. A lack of pressure from pollution from towns, cities, transport and wastewater along with a lower population density and less agricultural areas could provide an explanation as to why Scotland is achieving more combined high and good status as a percentage of all of their water bodies in comparison to the other three nations.
- For current **ecological status**, England, Wales and Northern Ireland reported the majority of their surface water bodies as moderate and Scotland reports the majority as good ecological status. Scotland has the highest combined percentage for water bodies classified as high or good status (53.7%) followed by Wales (45.6%), Northern Ireland (31.1%) and England (16.1%).
- In terms of improvement in **ecological status** since the 2nd RBMPs, Western Wales 3rd RBMP reports an improvement of 2% in water bodies that achieved good or better overall ecological status (this did not meet the predicted improvement of 4%) and the Dee RBMP reports an improvement of 11% (exceeding the target by 3%). England and Scotland's results showed very little overall change, with a decrease in ecological status and Northern Ireland has reported no change in their ecological status in comparison to the 2nd RBMPs.
- New ecological status standards in England and Northern Ireland such as standards for nitrogen in lakes, could lead to more strict standards, which could in turn lead to an increase in failures of surface water bodies.
- For **chemical status**, all four nations classified the majority of surface water bodies at good chemical status when ubiquitous Persistent, Bioaccumulative and toxic (uPBTs) are excluded from results, with over 90% of surface water bodies at good status for all nations.
- When the **chemical status** results account for the addition of new substances (such as uPBTs) and improved analytical techniques and methods in comparison to previous cycles the results are significantly different. The approach to the representing uPBTs in results differs between nations. Wales is still investigating the approach to take, Scotland is only reporting classifications of monitored water bodies and England and Northern Ireland are extrapolating their results. The

widespread chemical status failure in England and Northern Ireland when uPBT failures are extrapolated provide a realistic assessment of the chemical status of water bodies. It illustrates that the uPBTs are ubiquitous and result in a blanket failure of chemical status in water bodies and if uPBTs were accounted for in all nations it is expected that widespread chemical status failure would result.

- This shows that the classification method can be just as important as the results published in understanding the information a country is reporting, especially for chemical status. For example, Scotland appears to have comparatively better surface water chemical status than the other nations. However, the difference in classification results is likely to be influenced, at least in part, by the different approach to considering uPBTs and the decision to only report on classifications of monitored water bodies (rather than extrapolation as in England and Northern Ireland).
- Wales and England reported a decrease in good **chemical status** of groundwater bodies since 2015. Scotland was the only nation that reported an increase in good chemical status of groundwater bodies. The explanations differed between nations, Wales reported that more research needs to be done to determine the reason for possible deterioration of chemical status of their two groundwater bodies. England reported that the main reason for possible deterioration is due to an 'increase in pressure' from the environment. No reason for change could be identified in Northern Ireland's 3rd RBMP.
- Overall, between the 2nd and 3rd RBMPs, England, Northern Ireland and Scotland have all reported improvements to their groundwater **quantitative status**. England had the lowest percentage of groundwater bodies at good quantitative status (73.4%), compared to Scotland (94.8%), Northern Ireland (94.8%) and Wales (100%). Wales has consistently reported 100% of their water bodies at good quantitative status in both cycles. Scotland had the smallest improvement in quantitative status between cycles, with a 2% increase.
- England and to a lesser extent Wales continue to rely significantly on **exemptions** in the 3rd RBMPs. The main reasons for exemptions being applied tend to be as result of uPBTs, such as mercury preventing the timely improvement in the status of water bodies (referred to as 'natural conditions' in the WFD Regulations. Disproportionate costs and technical infeasibility are other common reasons highlighted. There was limited information available for exemptions in Northern Ireland and Scotland.
- Overall, the **economic analysis** for England and Wales appeared to provide the most detail in comparison to Scotland and Northern Ireland. England in particular shows long term consistency as each cycle builds on the extensive economic assessment that was undertaken in preparation for the 1st RBMP. More information for Northern Ireland may be provided when the final RBMP is published.
- In terms of provision of information and **public consultation**, there were no major differences found between England and Wales. The RBMPs that Scotland and Northern Ireland consulted on were missing key documents such as information on the use of exemptions. England was the only country who provided full details of the considerations and changes made in response to the consultation.
- Overall, there was clear information provided for the **active involvement of stakeholders** and the mechanisms used in Wales, Scotland and England. This information was limited in Northern Ireland due to the RBMPs remaining in draft form.

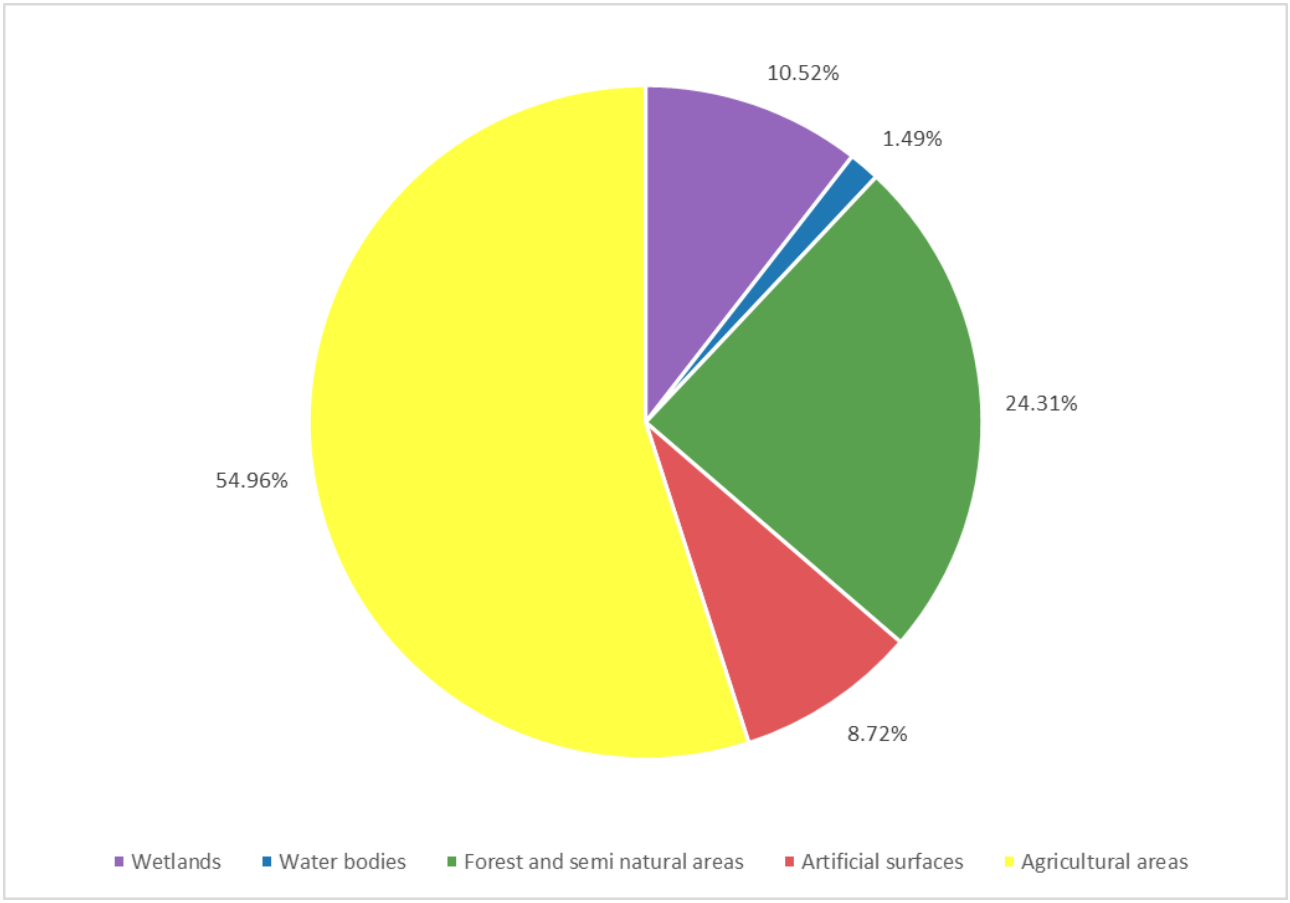
3 Comparative Analysis of Performance

This section presents the comparative analysis of performance in Wales, Scotland, England and Northern Ireland.

3.1 Contextual Information

Landcover for Wales, Scotland, England and Northern Ireland

Figure 3-1 - Land Cover in the UK[140]

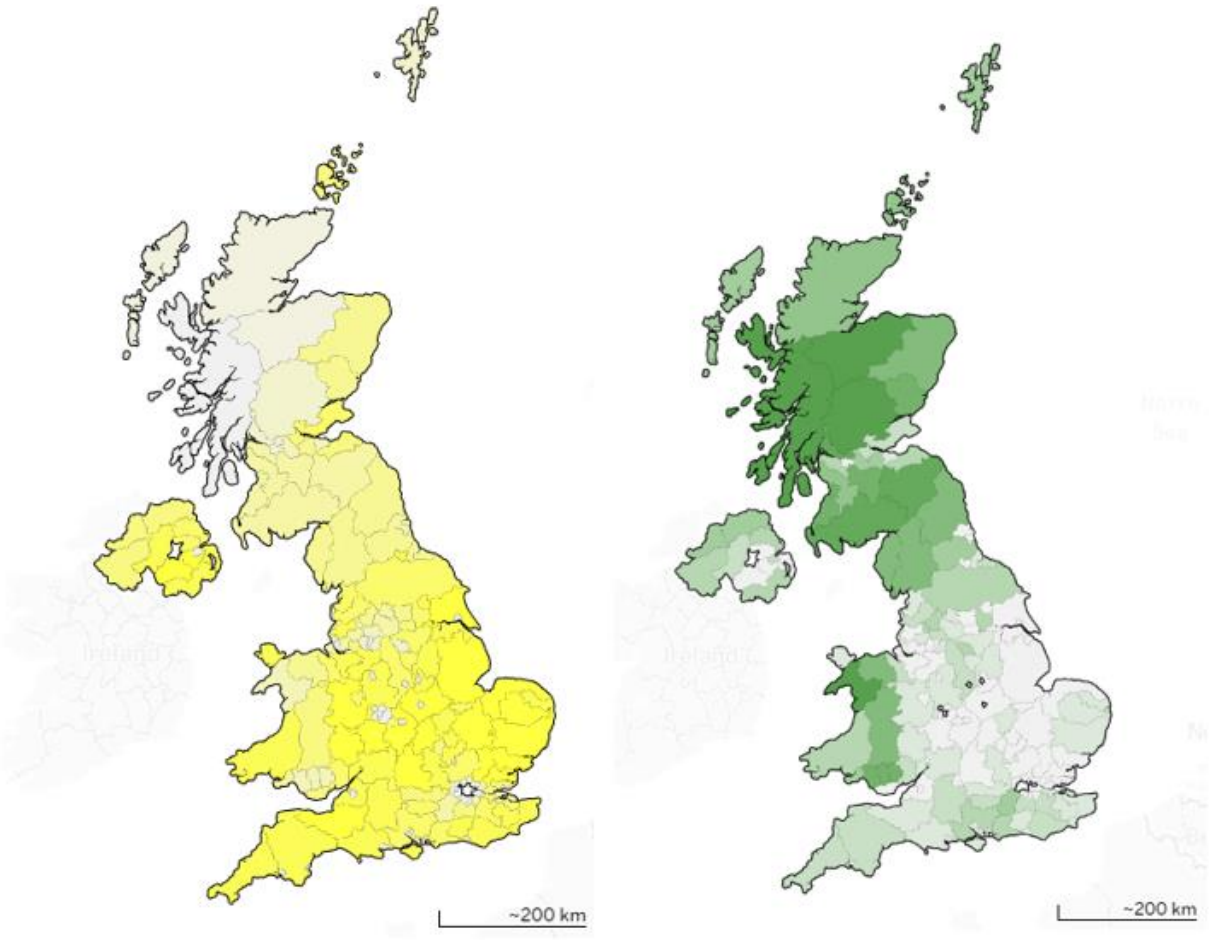


Source: Copernicus Land Monitoring Service (2018). Land cover and land cover changes in European countries in 2000-2018. Available at: https://land.copernicus.eu/dashboards/clc-clcc-2000-2018

[140] The data and maps are sourced from the Copernicus Land Monitoring service website which is based off CORINE land cover data. The CORINE series is a European programme that provides a consistent classification system of long-term land cover in Europe.

The overall land cover in the UK is illustrated in **Figure 3-1**. The main land cover, the agricultural areas of the UK, are made up of 50% permanent pasture, 49% non-irrigated arable land and 1% other. As can be seen by Figure 3-2 below by the darker yellow colour, the majority of agricultural areas are found in England, Wales and Northern Ireland. The forest and semi natural areas of the UK are mostly made up of moors and heathland (31%), natural grasslands (24%) and coniferous forest (19%). As illustrated in **Figure 3-2** by the darker green, most of these areas are found in Scotland.

Figure 3-2 - Agricultural (left) and forest and semi natural areas (right) in the UK based on CORINE land cover data



Source: Copernicus Land Monitoring Service (2018). Land cover and land cover changes in European countries in 2000-2018. Available at: https://land.copernicus.eu/dashboards/clc-clcc-2000-2018

Population

The population and population density of Wales, Scotland, England and Northern Ireland are shown in Table 3-1 below.

Table 3-1 - Population and population density of the UK

	Population (million)	Population Density (people/km^2)

Wales[141]	3.1	150
Scotland[142]	5.5	70
England[143]	56.5	434
Northern Ireland[144]	1.9	141

As Table 3-1 demonstrates, England is both the most populated and the most densely populated nation. Scotland is the least densely populated but has the second largest population. The population density is further illustrated in Figure 3-2.

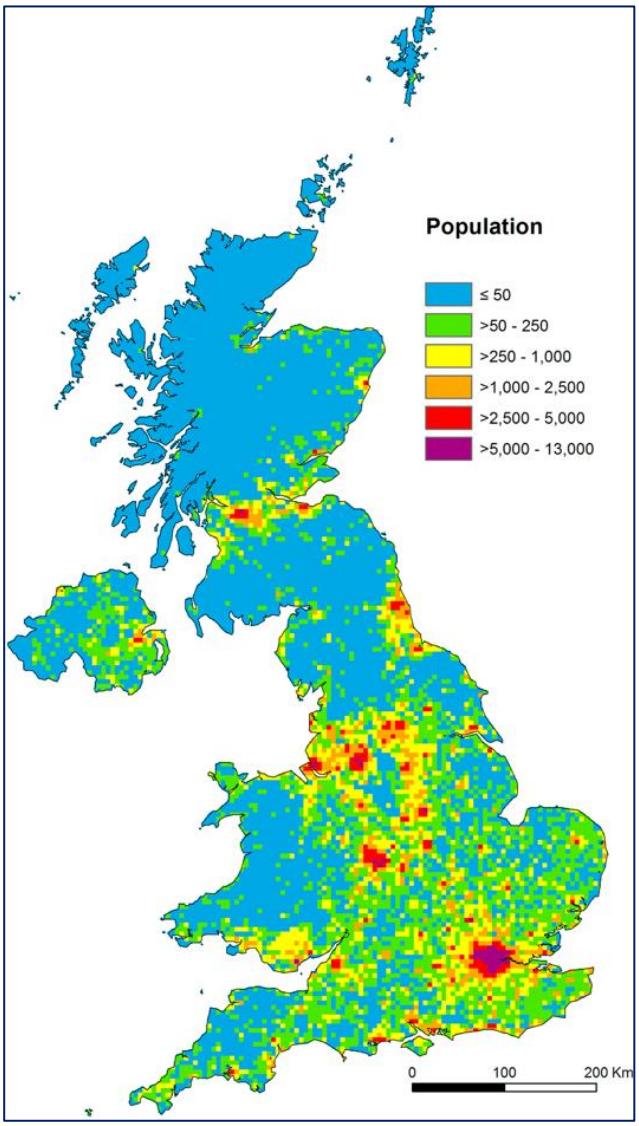
141 Office for National Statistics, 2022. Population estimates for the UK, England, Wales, Scotland and Northern Ireland: mid-2021. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2021#population-of-england-and-wales (Accessed 12th June 2023).

142 Office for National Statistics, 2022. Population estimates for the UK, England, Wales, Scotland and Northern Ireland: mid-2021. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2021#population-of-england-and-wales (Accessed 12th June 2023).

143 Office for National Statistics, 2022. Population estimates for the UK, England, Wales, Scotland and Northern Ireland: mid-2021. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2021#population-of-england-and-wales (Accessed 12th June 2023).

144 Office for National Statistics, 2022. Population estimates for the UK, England, Wales, Scotland and Northern Ireland: mid-2021. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2021#population-of-england-and-wales (Accessed 12th June 2023).

Figure 3-3 - Population density of the UK



Source: Vieno, M., Heal, R., Williams, M., Carnell, E., 2016. The sensitivities of emissions reductions for the mitigation of UK PM2.5. atmospheric chemistry and physics, 16(1), 265-276.

RBDs and Number of Water Bodies for Wales, Scotland, England and Northern Ireland

The RBDs for Wales, Scotland, England and Northern Ireland are shown in **Figure 3-4**. Some of these RBDs are transboundary. This includes the Dee and the Severn which cover England and Wales. The Solway Tweed and a small portion of Northumbria cover Scotland and England. The Neagh Bann and North Western cross both Northern Ireland and Ireland.

It is important to note that when this report discusses the findings for each nation, this relates to all water bodies in that nation which includes the water bodies in their respective parts of transboundary RBDs. Where differences within and between RBDs have been found, this has been stated.

Figure 3-4 - Map of the RBDs in Wales, Scotland, England and Northern Ireland

Source: River Basin Districts. Available at: https://fwrinformationcentre.co.uk/html/humber-river-basin-district.html (note - RBD titles added to original map).

Table 3-2 - Overall number of water bodies in Wales, Scotland, England and Northern Ireland

Type of water bodies	Wales	Scotland	England	Northern Ireland
Rivers[145]	736	2,410	3,928	450
Lakes	114	334	564	21
Coastal	23	457	61	25
Transitional	32	48	105	
Groundwater	25	403	271	75
Total no. water bodies	930	3,652	4,929	571

Note: For Northern Ireland, transitional and coastal waters are presented as one category (as per the RBMP).

Significant Pressures

Wales

In the Western Wales RBD,[146] the most significant pressures were pollution from rural areas; physical modifications; pollution from towns, cities and transport; pollution from wastewater and changes to the natural flow and levels of water. In the Dee RBD, [147] the most significant pressures were physical modifications; pollution from rural areas; pollution from towns, cities and transport; pollution from wastewater and changes to the natural flow and levels of water. These pressures are all listed in descending order for both RBDs.

Scotland

The main pressures on surface water in Scotland include rural diffuse pollution, man-made barriers to fish migration, physical modifications and water use by the hydropower sector. The main pressures on groundwater include discharges from industries such as mining and quarrying, rural diffuse pollution and irrigation.[148]

England

The main pressures in England's water environment include physical modifications; pollution from agriculture and rural areas; pollution from towns, cities and transport and pollution from water industry wastewater.[149] Assessment of abstraction pressures has also been tightened with the raised level of ambition to meet environmental river flows set out in the Environment Agency's National

[145] The WFD Regulations (Schedule 1) define a surface water body as a 'discrete and significant element' of surface water such as a lake or reservoir or entire (or part) stream, river or canal, estuary or stretch of coastal water.

[146] Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

[147] Welsh government, 2022. Dee River Basin Management Plan 2021 –2027 Summary (Accessed 11th March 2023). Available at: https://cdn.cyfoethnaturiol.cymru/media/695219/dee-rbmp-2021_2027-summary.pdf

[148] Scottish Environment Protection Agency, n.d. Welcome to the 2021 update to the Water Environment Hub. Available at: https://informatics.sepa.org.uk/RBMP3/ (Accessed 13th June 2023).

[149] Gov.UK, 2023. River basin planning process overview. Available at: https://www.gov.uk/government/publications/river-basin-planning-process-overview/river-basin-planning-process-overview (accessed 13th June 2023).

Framework[150] (although the proportionality of the cost and carbon implications of delivering the large scale abstraction reductions needed has not yet been considered).

Northern Ireland

The main pressures in Northern Ireland's water environment include issues surrounding nutrients from agricultural land use activities and sewage related impacts. Other relevant pressures include pollution from chemicals and pesticides; abstraction, fisheries and morphology; non-native invasive species, forestry and waste and contaminated land.[151]

Summary

The significant pressures outlined in each nation highlight pressures that contribute to an impact which may result in not meeting the WFD objectives of not having at least good status. The findings show that Scotland is less affected by pressures such as pollution from towns, cities, transport or wastewater in comparison to England and Wales. Northern Ireland also faces pressure from sewage related impacts. This suggests that England and Wales face pressure from densely populated cities which can be linked to the fact that they are the two most densely populated nations, whilst Scotland is the least densely populated as shown in Table 3-1. Agricultural or rural diffuse pollution is listed as a significant pressure in all four nations, however as shown in **Figure 3-2** , the majority of agricultural areas are found in England, Wales and Northern Ireland. Less pressure from pollution from towns, cities, transport and wastewater along with a lower population density and less agricultural areas could provide an explanation as to why Scotland is achieving more combined high and good status in comparison to the other three nations.

Main Changes Made in 3rd RBMPs Compared to the 2nd RBMPs

Wales

In the 3rd RBMP, changes have been made to the classification status alongside updates to the characterisation of some water bodies.

Changes to classification information include minor amendments to the waterbody network, classification tools changes based on advice from technical experts and the UK Technical Advisory Group[152] (UKTAG) and revised environmental standards. These changes were not considered to be major but are expected to give a better overview of the water environment.[153]

150 Meeting our future water needs: a national framework for water resources (March 2020). https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

151 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

152 The UKTAG is a group of experts drawn from environment and conservation agencies that was set up to support the implementation of the WFD.

153 Note that as these changes make comparison to the 2nd RBMP more complex, the current condition is presented using the 2nd cycle information to allow for progress reporting on progress on objectives. The new network, environmental standards and classification tools will be used to set the baseline for the 3rd cycle.

Updates to water bodies include changes to delineation,[154] correction of incorrect naming, revisions to some of the 2nd cycle heavily modified waterbody (HMWB) designations and new designations. These changes make a difference to the number of water bodies reported for ecological status in the 3rd cycle.[155]

The types of chemicals and how they have been assessed have also changed since previous cycles. The 3rd cycle is the first time that uPBTs are fully reported in Wales' RBMPs. Wales reports that due to the nature of sampling for uPBTs (through the tissue of shellfish and fish), the numbers of water bodies sampled are limited in comparison to water samples. Natural Resource Wales are looking into other techniques to be able to overcome this practical and ethical challenge and determine the impact that uPBTs have. Natural Resource Wales state that the approach to chemicals classification in England is likely to provide the most accurate representation of uPBTs on a national scale.[156]

Scotland

Scotland's 3rd RBMP includes a summary of updates made which focused on updates to the characterisation, monitoring and classification of water bodies.

These include changes to the boundaries of a number of surface water bodies – some, for example, have been merged and others have been split into more than one body. This has resulted in the overall number of surface water bodies increasing (i.e. 3,247 to 3,249).[157] Additionally, as a result of reviewing the designation of HMWBs in the 2nd RBMP, 13 have been de-designated and an additional 407 have been designated as HMWBs.[158]

Scotland also provided an update on their monitoring approach for uPBTs under the Environmental Quality Standards Directive. Scotland's biota monitoring network, similar to Wales, is small (the freshwater network makes up around 3% of surface waters) and due to the practicalities, such as the resources needed and ethical reasons (e.g. the killing of vertebrate animals (fish) for sampling), Scotland has opted to report classifications for uPBTs only in the locations they are monitored. The Scottish Environmental Protection Agency stated that they considered other options and decided that extrapolating data, as the Environment Agency and the Northern Ireland Environment Agency does, or using a default classification for unmonitored water bodies would give results that were too inaccurate.[159]

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154 Water bodies should be delineated at a size that allows the identification and quantification of significant pressures and the classification of status. This is outlined in CIS Guidance Document No. 2: Identification of Water Bodies.

155 Natural Resource Wales, 2020. Consultation on updating the Western Wales River Basin Management Plan for the 3rd cycle (2021-2027). Available at: https://ymgynghori.cyfoethnaturiol.cymru/evidence-policy-and-permitting-tystiolaeth-polisi-a-thrwyddedu/western-wales-rbmp/user_uploads/draft-western-wales-urbmp-consultation-2020-1.pdf (Accessed 13th June 2023).

156 Welsh government, 2022. Western Wales and Dee River Basin Management Plan 2021 –2027 Summary (Accessed 11th March 2023). Available at: https://cdn.cyfoethnaturiol.cymru/media/695219/dee-rbmp-2021_2027-summary.pdf

157 Scottish Environment Protection Agency, 2021. Appendix 2: Characterisation, monitoring and classification. Available at: https://informatics.sepa.org.uk/RBMP3/Appendices/Appendix%202%202021%20final%20links.pdf (Accessed 13th June 2023).

158 Scottish Environment Protection Agency, 2021. Appendix 3: Heavily modified and artificial water bodies. Available at: https://informatics.sepa.org.uk/RBMP3/Appendices/Appendix%203%202021%20final%20links.pdf (Accessed 13th June 2023).

159 Scottish Environment Protection Agency, 2021. Appendix 7: An inventory of emissions for priority substances for Scotland. Available at: Appendix 7 Inventory of emissions of priority substances.pdf (sepa.org.uk)

England

Since the 2nd RBMPs there have been some small changes to waterbody networks, artificial and HMWB designations, and water quality standards such as a new nitrogen standard for lakes used for the first time in 2019.[160]

There have also been a number of changes to how the chemical status of surface water bodies is assessed in England. This includes the addition of new substances and improved analytical techniques and methods which have resulted in considerable changes in chemical status in comparison to previous cycles. Biota environmental quality standards (concentrations in aquatic animals) are now used to assess uPBTs. This gives a more accurate picture as these substances can be underestimated by monitoring water quality alone. The considerable changes are mainly due to 3 groups of substances (polybrominated diphenyl ethers, mercury and perfluorooctane-sulfonate) and there are only small changes in chemical status for other chemicals.[161] As outlined in Wales and Scotland, the biota monitoring network is small due to the ethical and practical challenges of widespread chemical assessments of biota. To be able to represent the results from the sites where biota are monitored, the Environment Agency extrapolates the data to represent a more extensive geographical area for classification.[162] As presented in section 3.3 the addition of these substances, as well as the extrapolation of data, is leading to widespread failure to achieve good chemical status.

The Environment Agency's National Framework[163] assessment of water resources and the Catchment Based Approach recommendations for protecting headwater spring flows included in the Chalk Streams Strategy[164] have significantly raised expectations that large scale reductions in abstractions to deliver environmental flow targets are essential (even though flow remains a supporting element for ecological status classification). The cost and carbon implications of the major re-organisation of water supply systems required are now being presented in water company plans for the OFWAT Pricing Review, alongside the huge investment also needed to reduce Combined Sewer Overflow discharges during storms. However, exemptions in line with WFD disproportionate cost tests do not appear to have been considered appropriately at a national level (in England or the other nations), and the wisdom of significantly cutting back access to groundwater storage in England in the face of anticipated future droughts and climate change is unclear. The cost estimates used for fixing environmental low flow deficits assumes that these would be equivalent to abstraction reductions. For many groundwater abstractions this is not true - abstraction reductions typically have to be much larger than the flow recovery required. The Chalk Streams Strategy has also resulted in environmental compliance goal posts being significantly tightened (abstraction sensitivity bands set to high or CSMG for protected SSSI rivers), and compliance assessment points have been moved further upstream to protect headwater springs. There appears to have been no

160 Environment Agency, 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report#changes-in-evidence-since-2015

161 Environment Agency, 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report#changes-in-evidence-since-2015

162 Environment Agency, 2022. River basin planning process overview. Available at: River basin planning process overview - 3. Defining and describing the water environment - Guidance - GOV.UK (www.gov.uk)

163 Meeting our future water needs: a national framework for water resources (March 2020). https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

164 https://catchmentbasedapproach.org/learn/chalk-stream-strategy-3/

regulatory impact assessment of the huge cost, carbon or sustainability implications of these changes.

Northern Ireland

Northern Ireland's draft 3rd RBMP outlines a number of changes since the 2nd RBMP. These changes include new and revised ecological status standards for freshwater as a result of UKTAG recommendations i.e. standards for nitrogen in lakes, the list of aquatic non-native species, and flows in rivers.

In the final RBMPs, the chemical status assessment will be updated to include new priority substances which means uPBTs will be assessed for the first time (apart from in lakes where new priority substances were considered for the 2020 update of lakes' classification).[165] The 3rd RBMP provides chemical status of surface water bodies in three subgroups which include; chemical classification excluding both uPBTs and cypermethrin, chemical classification excluding uPBTs and chemical classification including uPBTs extrapolated to all surface water bodies. When uPBTs are included, all surface water bodies reportedly fail. Northern Ireland Environment Agency states that the monitoring of uPBTs in biota occurred during the 2nd cycle planning period at selected monitoring locations. These locations were chosen through a risk-based approach.[166] Similar to England's approach, Northern Ireland concluded that uPBTs would result in more failures if there was more monitoring and therefore extrapolated the results across all Northern Ireland water bodies.[167]

As well as this, a number of small water bodies along the coast that were less than 10 km^2 were assessed in the 3rd Plans, having been listed previously as unassessed in the 2nd Plans.[168] These have been assessed through grouping with nearby, monitored, water bodies with a similar set of pressures.

Summary

All four nations report small changes to waterbody networks such as corrections of incorrect naming and new designations which are expected to make changes to the number of water bodies reported between cycles.

The most influential change is likely to be in chemical status due to the addition of new substances (such as uPBTs) and improved analytical techniques and methods in comparison to previous cycles. The timeframe for when this may impact each nation's results may differ dependant on the approach they have taken. As outlined above, Wales is still investigating the approach to take, Scotland is only

165 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023).

166 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023).

167 Northern Ireland Environment Agency, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf

168 Countries have discretion on how they address small water bodies.

reporting classifications of monitored water bodies and England and Northern Ireland are extrapolating results. The widespread chemical status failure in England and Northern Ireland when uPBT failures are extrapolated provide a realistic assessment of the chemical status of water bodies. It illustrates that the uPBTs are ubiquitous and result in a blanket failure of chemical status in water bodies.

The change in how Northern Ireland reports on overall surface water status (separating ecological and chemical status for the first time) is likely to be another significant change from previous cycles, and as noted above should improve visibility of reasons for waterbody classifications.

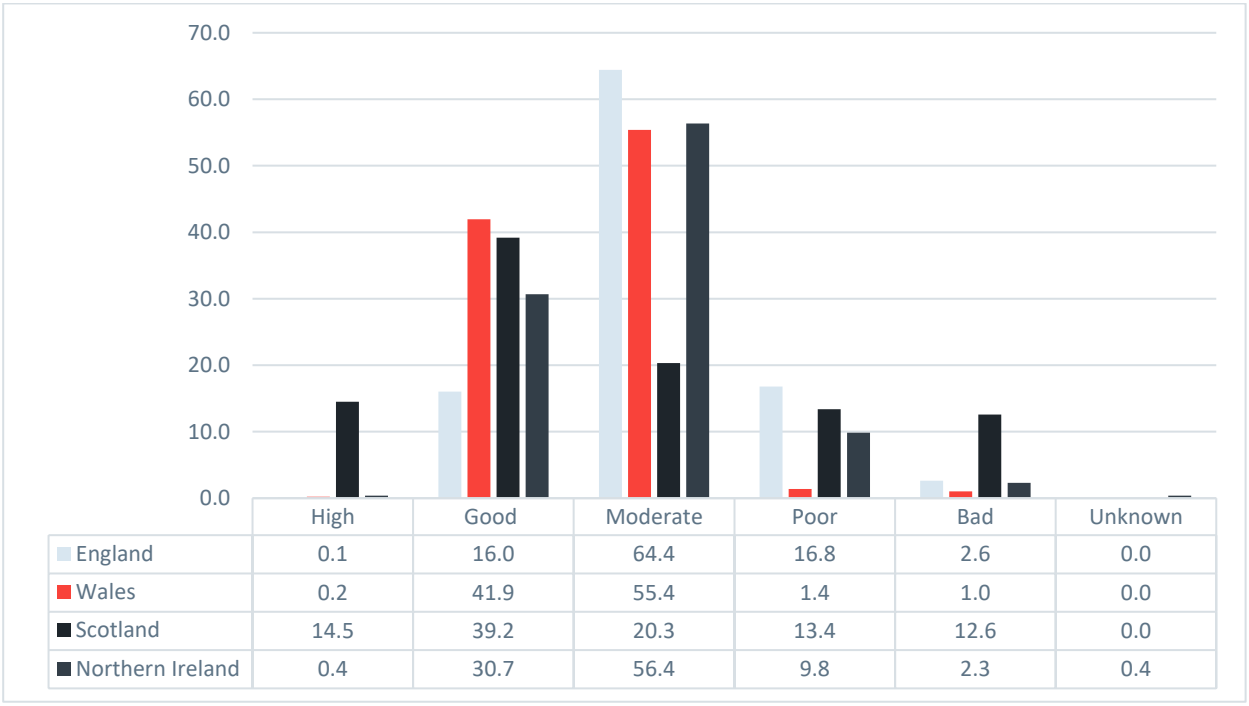
3.2 Current Ecological Status of Surface Waters

The current ecological status of rivers, lakes, transitional and coastal waters for each nation are outlined below based on the published 3rd RBMPs. For England, the data found in the online RBMPs did not match the classification data found in the excel file which was submitted alongside the 3rd RBMP (which gave a breakdown of classification by type). The differences between these datasets can be seen in Appendix B. The Excel data was used for this section as the breakdown of classification by water body type provided more detailed and useful information to compare to the other nations.

Current Overall Ecological Status

Figure 3-5 shows the current classification of ecological status for all rivers, lakes, transitional and coastal water bodies as percentages for each nation. The figure shows that England, Wales and Northern Ireland reported the majority of their surface water bodies as moderate and Scotland reports the majority as good ecological status. England reported the highest percentage of water bodies in the poor category, closely followed by and Scotland and Northern Ireland. Scotland reported the highest percentage of water bodies at bad status and the highest combined percentage of water bodies classed at a high or good status.

Figure 3-5 - Overall ecological classifications in all water bodies (percentages)



	High	Good	Moderate	Poor	Bad	Unknown
England	0.1	16.0	64.4	16.8	2.6	0.0
Wales	0.2	41.9	55.4	1.4	1.0	0.0
Scotland	14.5	39.2	20.3	13.4	12.6	0.0
Northern Ireland	0.4	30.7	56.4	9.8	2.3	0.4

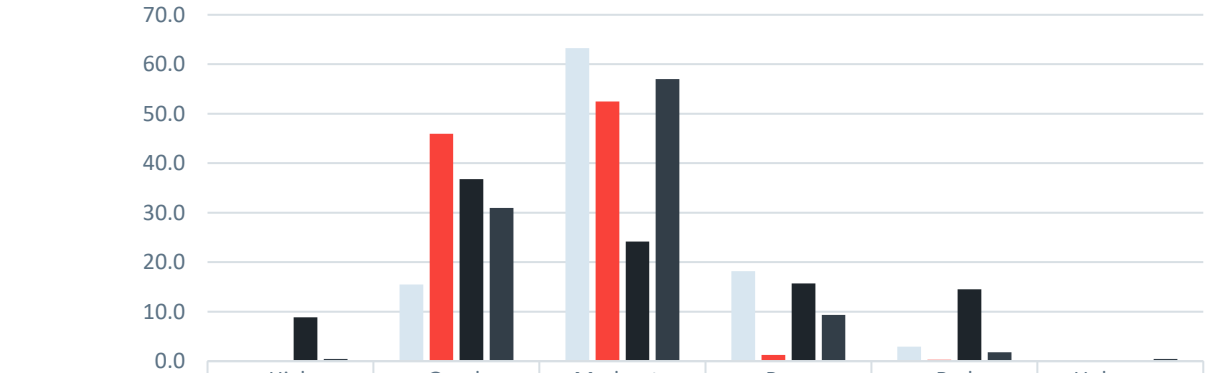
Rivers

Figure 3-6 shows the ecological status of rivers in the 3rd RBMPs for all four nations as percentages. The figure shows that for high and good classification, when combing the percentages, both Wales (46.0%) Scotland (44.9%) have the highest combined percentages, followed by Northern Ireland (31.4%), and then England (15.6%). England has a significantly smaller percentage of water bodies classified as either high or good.

In terms of moderate status, England (63.3%), Northern Ireland (57.0%) and Wales (52.5%) all have fairly similar percentages of classification, whilst Scotland has a much lower percentage (15.7%).

When looking at the combined poor and bad status, Scotland has the highest combined percentage (30.2%), followed by England (21.1%), Northern Ireland (11.2%) and Wales (1.6%).

Figure 3-6 - Ecological status classifications in rivers (percentages)



	High	Good	Moderate	Poor	Bad	Unknown
England	0.1	15.5	63.3	18.2	2.9	0.0
Wales	0.0	46.0	52.5	1.3	0.3	0.0
Scotland	8.8	36.8	24.1	15.7	14.5	0.0
Northern Ireland	0.4	31.0	57.0	9.4	1.8	0.4

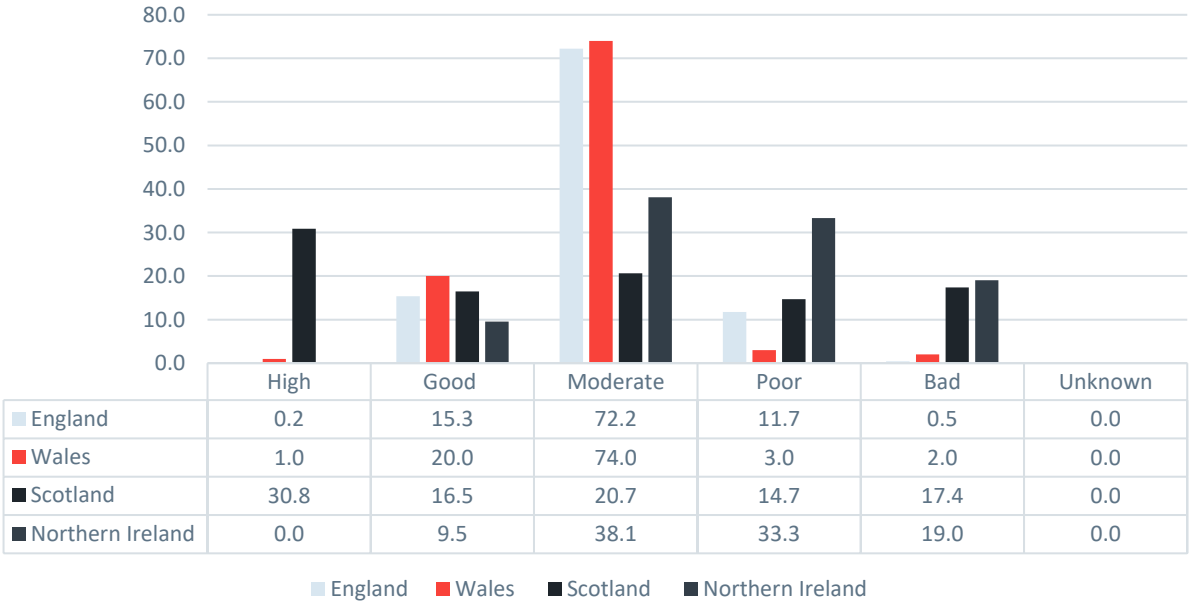
Lakes

Figure 3-7 shows the ecological status for lakes in the 3rd RBMPs for all four nations as percentages. The figure shows that for high and good classification, when combing the percentages, Scotland (47.3%) has the highest combined percentages, followed by Wales (21.0%), England (15.5%) and Northern Ireland (9.5%).

In terms of moderate status, Wales (72.2%) and England (63.3%) have fairly similar percentages of moderate classification, followed by Northern Ireland (38.1%) and Scotland (20.7%).

When looking at the combined poor and bad status, Northern Ireland has the highest combined percentage (52.3%), followed by Scotland (32.1%), England at (12.2%) and Wales at (5.0%).

Figure 3-7 - Ecological status classifications in lakes (percentages)



	High	Good	Moderate	Poor	Bad	Unknown
England	0.2	15.3	72.2	11.7	0.5	0.0
Wales	1.0	20.0	74.0	3.0	2.0	0.0
Scotland	30.8	16.5	20.7	14.7	17.4	0.0
Northern Ireland	0.0	9.5	38.1	33.3	19.0	0.0

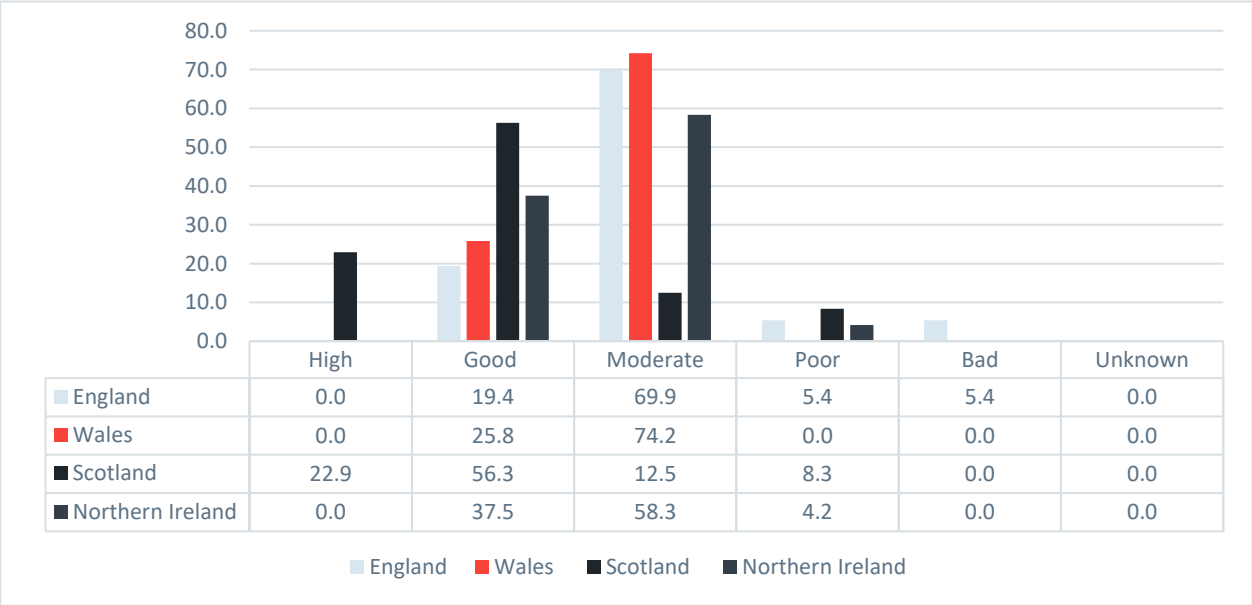
Transitional waters

Figure 3-8 shows the ecological status for transitional waters in the 3rd RBMPs for all four nations. The figure shows that for high and good classification, when combing the percentages, Scotland (79.2%) significantly has the highest combined percentages, followed by Northern Ireland (37.5%), Wales (25.8%) and England (19.4%).

In terms of moderate status, Wales (74.2%) and England (69.9%) have fairly similar percentages of moderate classification, followed by Northern Ireland (58.3%) and Scotland which has a significantly lower percentage classified at moderate (12.5%).

When looking at the combined poor and bad status, England has the highest combined percentage (10.8%), followed by Scotland (8.3%), Northern Ireland (4.2%) and Wales (0%).

Figure 3-8 - Ecological classifications in transitional water bodies[169] (percentages)



	High	Good	Moderate	Poor	Bad	Unknown
England	0.0	19.4	69.9	5.4	5.4	0.0
Wales	0.0	25.8	74.2	0.0	0.0	0.0
Scotland	22.9	56.3	12.5	8.3	0.0	0.0
Northern Ireland	0.0	37.5	58.3	4.2	0.0	0.0

Coastal

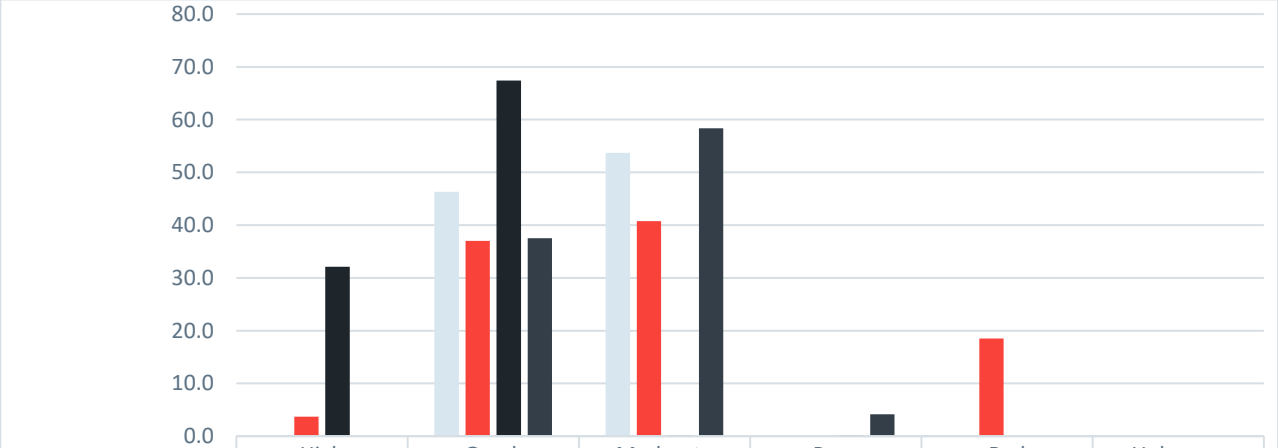
Figure 3-9 shows the ecological status for coastal water bodies in the 3rd RBMPs for all four nations. The figure shows that, when combing the percentages, Scotland has the highest combined percentage for high and good ecological classification of transitional water bodies (99.6%), followed by England (46.3%), Wales (40.7%) and Northern Ireland (37.5%).

In terms of moderate status, Northern Ireland (58.3%) and England (53.7%) have fairly similar percentages of moderate classification, followed by Wales (40.7%) and Scotland which has a significantly lower percentage classified at moderate (0.2%).

When looking at the combined poor and bad status, Wales has the highest combined percentage (18.5%), followed by Northern Ireland (4.2%), Scotland (0.2%) and England (0%).

169 Northern Ireland combine their transitional and coastal water bodies for classification of ecological status.

Figure 3-9 - Ecological classifications in coastal water bodies (percentages) [170]



	High	Good	Moderate	Poor	Bad	Unknown
England	0.0	46.3	53.7	0.0	0.0	0.0
Wales	3.7	37.0	40.7	0.0	18.5	0.0
Scotland	32.1	67.4	0.2	0.2	0.0	0.0
Northern Ireland	0.0	37.5	58.3	4.2	0.0	0.0

Changes to Ecological Status

Summary

In the 3rd RBMPs, the majority of water bodies in all four nations were classed as moderate (England, Northern Ireland and Wales) or good ecological status (Scotland). Scotland has the highest combined percentage for water bodies classified as high or good status (53.7%) followed by Wales (45.6%), Northern Ireland (31.1%) and England (16.1%).

The improvement in the number of surface water bodies achieving good or better status in the 3rd RBMPs in comparison to the 2nd RBMPs, varies between the four nations. The Western Wales 3rd RBMP reports an improvement of 2% (this did not meet the predicted improvement of 4%) and the Dee RBMP reports an improvement of 11% (exceeding the target by 3%). England and Scotland's results showed very little overall change, with a decrease in ecological status likely due to increased monitoring. Northern Ireland has reported no change in their ecological status in comparison to the 2nd RBMPs.

Below, the changes to ecological status of surface water bodies between the 2nd and 3rd RBMPs have been outlined for each nation.

Scotland

The 2015 ecological status data sourced from the Scottish Environmental Protection Agency's classification portal[171] was compared with the most recent data reported in the 3rd RBMP. The data showed that there has been an increase in the number of rivers classified at high status from 193 to 213 and an increase in the number classified as bad from 130 to 350. Overall, there has been a

[170] Northern Ireland combined their transitional and coastal water bodies for classification of ecological status.

[171] Scottish Environment Protection Agency, 2020. Water Classification Hub. Available at: https://www.sepa.org.uk/data-visualisation/water-classification-hub (Accessed on the 4th May 2023).

small percentage decrease in the number of water bodies classified at good or better status since 2015 (56.4% in 2015 compared to 53.4% in the 3rd RBMP). This is an overall decrease of 2.7%.

The Scottish Environmental Protection Agency reported that a lack of access to data due to a cyber-attack has meant they have been unable to fully determine the difference between classification changes.[172] Despite this, the Scottish Environmental Protection Agency also reports that since 2015 they have collected more information on water bodies, identified new pressures and advanced the assessment methods and standards used. These improvements in evidence and understanding of the water environment are likely to provide an explanation for the decreases in high ecological status. The Scottish Environmental Protection Agency state that further assessment is needed to confirm if deterioration has occurred or if it is as a result of other changes. This assessment is not currently possible due to lack of access to data. The Scottish Environmental Protection Agency intends to update the necessary data during the 3rd cycle when access to the data systems is restored.[173]

Wales

In the Western Wales 2nd RBMP it was predicted that the water bodies in Wales that achieved good or better ecological status would increase from 40% to 44% by 2021. However, only 42% of water bodies are achieving good or better ecological status in the 3rd RBMPs.[174]

In the Dee RBD, it was predicted that the ecological status of water bodies at good or better would increase from 27% in 2015 to 35% by 2021. This target was exceeded and 38% of water bodies are at good or higher in the 3rd RBMPs.

In the Severn RBD 2nd RBMP, it was predicted that the water bodies meeting good or better overall status would rise from 31% in 2015 to 39% in 2021. However, in 2021 there were only 35% which achieved good overall status. Natural Resource Wales states that many of the measures that were implemented with the objective of achieving good status by 2021 may not be reflected in the classification as the ecology and water quality have not yet had time to recover.[175]

172 Scottish Environmental Protection Agency (2021). Appendix 6: Progress towards achieving objectives for 2021. Available at: Appendix 6 2021 final links.pdf (sepa.org.uk). (Accessed 13 May 2023)

173 Scottish Environmental Protection Agency (2021). Appendix 6: Progress towards achieving objectives for 2021. Available at: Appendix 6 2021 final links.pdf (sepa.org.uk). (Accessed 13 May 2023)

174 Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

175 Natural Resource Wales, 2022. Welsh part of the Severn River Basin Management Plan (2021-2027) Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695983/severn-rbmp-2021_2027-summary.pdf (Accessed 13th June 2023).

England

The proportion of surface waters at good ecological status or potential in England in 2019 (16%) was similar to that in 2015 (17%). Although the overall results have shown little change, there is some movement between status classes for individual water bodies. In England, 151 water bodies improved from moderate or worse ecological status in 2015, to good or better ecological status in 2019. In contrast, 171 water bodies dropped from good or better ecological status in 2015, to moderate or worse ecological status in 2019. [176,177]

At a national level there has been no significant change in the status of individual quality elements. For example, the majority of sampled rivers are still at good or high status for invertebrates, ammonia and dissolved oxygen, but under half are at good or high status for fish, macrophytes or phosphate.[178]

Northern Ireland

There were no changes reported to the ecological status of water bodies since the 2nd RBMPs. As a result of the stagnation in the overall percentage of water bodies at good or better, Northern Ireland Environment Agency has reported that the initial objective of good status in all water bodies (100%) by 2027 is highly unlikely to be achieved. The draft 3rd Cycle River Basin Management Plan reports that in 2015 Northern Ireland Environment Agency's objective was to have 70% of all Northern Ireland's water bodies at good status in 2021, but this objective has only been partially achieved with 31% at good or higher ecological status.[179] Northern Ireland Environment Agency state that they are committed to the 70% at good or better goal and plan to use it as the working target for 2027.

3.3 Current Chemical Status for Surface Waters

Overall

Overall chemical status

The chemical status of surface water bodies is classified using various pollutants that are scored on a 'good' or 'failing to achieve good' basis. As per the ecological status, the overall chemical status is based on the worst class of these (i.e., the one out all out principle). All information used for the ecological status was taken from the relevant sources highlighted in Section 1.3, and their accompanying data portals.

176 Environment Agency, 2021. Trends in pressures on biodiversity: surface water status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025323/21_Surface_water_status.pdf

177 Environment Agency, 2021. River Basin planning: progress report. Available at: River basin planning: progress report - GOV.UK (www.gov.uk)

178 Environment Agency. 2022. River basin management plans, updated 2022: progress report. Available at: https://www.gov.uk/government/publications/river-basin-management-plans-updated-2022-progress-report/river-basin-management-plans-updated-2022-progress-report

179 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

Table 3-3 shows the chemical classification of each nation's surface water bodies without uPBTs. These results show that with uPBTs excluded the majority of surface water bodies are classified at good chemical status for all nations with Scotland having 99.8% of surface water bodies at good status. The next section provides more detail around classification results when uPBTs are included in results.

Table 3-3 - Surface water chemical status classification excluding uPBTs

	Good	Failing to achieve good
England[180]	4,368 (93.9%)	282 (6.1%)*
Wales[181] [182]	727 (90.3%)	78 (9.7%)
Scotland[183]	3,241 (99.8%)	8 (0.2%)
Northern Ireland[184]	461 (92.9%)	35 (7.1%)

*These numbers show results for England and Northern Ireland without uPBT substances, as with uPBT substances 100% of England and Northern Irelands' water bodies fail their chemical classification. This gives a fairer comparison to the other nations as uPBTs are not yet included in their results.

Ubiquitous persistent, bio accumulative, toxic substances (uPBTs) in four nations

uPBTs, as suggested by their name are extremely persistent in the environment, which means that they bioaccumulate in and are toxic to biota. Achieving environmental quality standard targets for these groups is very challenging, and they are a common cause of failure to achieving good chemical status.[185] There are three main groups of global pollutants that have caused significant change in chemical classification, including Polybrominated Diphenol Ethers (PBDEs) and mercury, and perfluoro octane sulfonate (PFOS)[186].

180 Environment Agency, 2021. Classifications data for England. Available at: https://environment.data.gov.uk/catchment-planning/England/classifications (Accessed 16th March 2023).

181 Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

182 Welsh government, 2022. Dee River Basin Management Plan 2021 –2027 Summary Available at: https://cdn.cyfoethnaturiol.cymru/media/695219/dee-rbmp-2021_2027-summary.pdf (Accessed 11th March 2023).

183 Scottish Environment Protection Agency, (2020). Water Classification Hub. Available at: https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (Accessed 16th March 2023).

184 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

185 WISE, n.d. Surface water chemical status. Available at: https://water.europa.eu/freshwater/europe-freshwater/water-framework-directive/surface-water-chemical-status-pressures#:~:text=The%20Directive%20also%20identifies%20a%20smaller%20group%20of,ethers%20%28pBDE%29%2C%20tributyltin%20and%20certain%20polyaromatic%20hydrocarbons%20%28PAHs%29. (Accessed 16th March 2023).

186 Environment Agency, 2022. River basin planning overview process. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/3-defining-and-describing-the-water-environment (Accessed 15th March 2023).

To be able to represent the results from the small number of sites where biota is monitored, the Environment Agency extrapolates the data to represent a more extensive geographical area for classification.[187] The addition of these substances is leading to widespread failure to achieve good chemical status.

Western Wales, the Severn and the Dee RBD 3rd RBMPs state that uPBTs are being reported in full for the first time. However, in all three Welsh RBDs, the summary states that the number of water bodies assessed for uPBTs is limited due to the recommended method of assessment (getting samples from the tissue of fish and shellfish) and that Natural Resource Wales is investigating other methods to assess the risk that uPBTs pose. It also states that England's approach to chemical classification best represents the national picture on uPBT substances. This indicates that the classification outputs for Wales are unlikely to fully represent the assessment of uPBTs.

Northern Ireland's 3rd RBMP reported that 93% of water bodies are classified as good chemical status excluding uPBT substances and cypermethrin.[188] When uPBT substances and cypermethrin are included, all water bodies fail. Northern Ireland Environment Agency states that the monitoring of uPBTs in biota occurs at selected monitoring locations chosen through a risk-based approach.[189] Northern Ireland concluded that uPBTs would results in more failures if there was more monitoring and therefore extrapolated the results across all Northern Ireland water bodies.[190]

Scotland's has a small biota monitoring network and due to the practicalities and ethical reasons that inhibit biota sampling, Scotland reports classifications for uPBTs only in the locations they are monitored. The Scottish Environmental Protection Agency stated that they decided that extrapolating data, as the Environment Agency and the Northern Ireland Environment Agency does, or using a default classification for unmonitored water bodies would give results that were too inaccurate.[191] When combining Scotland and the Solway Tweed 3rd RBMPs, eight of the 3,249 surface water bodies fail for priority substances. In 2015, five of the 3,243 water bodies failed.[192] The increase in failures in the 3rd cycle could be due to the addition of new priority substances or increased surveillance of water bodies.[193]

187 Environment Agency, 2022. River basin planning process overview. Available at: River basin planning process overview - 3. Defining and describing the water environment - Guidance - GOV.UK (www.gov.uk)

188 A substance previously used as an insecticide.

189 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023).

190 Northern Ireland Environment Agency, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf

191 Scottish Environment Protection Agency, 2021. Appendix 7: An inventory of emissions for priority substances for Scotland. Available at: Appendix 7 Inventory of emissions of priority substances.pdf (sepa.org.uk)

192 The change in number of water bodies between cycles is likely to be due to factors outlined in section 3.1 (such as updates to the water body network).

193 Scottish Environment Protection Agency, 2020. Water Classification Hub. Available at: https://www.sepa.org.uk/data-visualisation/water-classification-hub (Accessed on the 4th May 2023).

In the 2nd RBMPs, 96% of surface water bodies in the UK were achieving good chemical status.[194] This has decreased due to better monitoring of uPBTs across the UK (0% of uPBTs were monitored in the 2nd cycle in England).[195] For the most recent classification of chemical status for England's 3rd RBMPs, assessments of uPBTs were included. The Environment Agency had highlighted that their approach to chemical status has undergone a change in 2019 to achieve a more advanced classification and introduced four new uPBTs[196] and a higher level of accuracy. This resulted in no surface water bodies meeting good chemical status. If the assessments for uPBTs are excluded, then only 6.2% of surface water bodies fail the chemical tests and 93.8% have good chemical status.[197]

The issue of uPBTs shows that understanding the assessment methodology can be just as important as the reported results when making fair performance comparisons between countries. In the case of uPBTs, it is an improved and extended assessment methodology that is changing results and resulting in widespread failure rather than a deterioration in the chemical status of water bodies.

Surface water chemical status

When status assessment results are reported, the confidence in the status assessment can be reported at low, medium or high confidence. As defined in the CIS reporting Guidance No 35[198], low means there is no monitoring data, a medium confidence means there is limited, or insufficiently robust monitoring data and high confidence means there is both good monitoring data and a good understanding of the system.[199] In the 2nd RBMP, 96% of surface water bodies in the UK were reported to have a good chemical status, but 83% of these results were with low confidence.[200]

For the 3rd RBMPs, England is the first to fully include uPBTs in the assessment methods and consequently all surface water bodies fail to achieve good chemical status. Northern Ireland's most recent classification (2021) does not yet include uPBTs, but NORTHERN IRELAND ENVIRONMENT AGENCY has indicated that when they are included all water bodies fail as seen in England.[201] Scotland reports 99.8% of water bodies at good chemical status without uPBTs but does not provide results with uPBTs included. Wales reports a limited assessment of uPBTs that does not

194 European Environment Agency, 2018. Assessment of status and pressures 2018. Available at: https://tableau.discomap.eea.europa.eu/t/Wateronline/views/WISE_SOW_SWB_SWPrioritySubstanceWithoutUPBT/Country?:embed=y&:showAppBanner=false&:showShareOptions=true&:display_count=no&:showVizHome=no

195 State of the water environment indicator B3: supporting evidence - GOV.UK (www.gov.uk) (Accessed 15th March 2023).

196 Environment Agency, 2022. How to use Catchment Data Explorer. Available at: https://environment.data.gov.uk/catchment-planning/help/usage#chemical-status (Accessed 10th May 2023).

197 Environment Agency, 2023. State of the water environment indicator B3: supporting evidence. Available at: https://www.gov.uk/government/publications/state-of-the-water-environment-indicator-b3-supporting-evidence/state-of-the-water-environment-indicator-b3-supporting-evidence#surface-waters-ecological-and-chemical-classification

198 Wise, 2016. WFD Reporting Guidance 2016. Available at: https://circabc.europa.eu/sd/a/5b969dc0-6863-4f75-b5d8-8561cec91693/GuidanceNo35-WFDReportingGuidance.pdf

199 European Environment Agency, 2018. European waters Assessment of status and pressures 2018. No 7/2018. Available at: https://www.eea.europa.eu/publications/state-of-water (accessed 15th May 2023).

200 European Commission, 2019. COMMISSION STAFF WORKING DOCUMENT, Second River Basin Management Plans – Member State: United Kingdom. SWD(2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN (accessed 13th June 2023).

201 Department of Agriculture, Environment and Rural Affairs, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf (accessed 15th May 2023).

appear to have had a substantial impact on results. When the assessments of uPBTs are fully included for all four nations widespread failure of chemical status is expected.

As the data and knowledge improves the confidence levels would be expected to improve further in the 3rd RBMPs. As a result of limited information on the confidence of status assessments in the 3rd RBMPs we are unable to determine if confidence levels have improved or not.

Achievement of Objectives

The 3rd RBMP results (classified in 2019) show that 758 (16%) of surface water bodies in England are classed as good or higher ecological status. If the 3rd RBMPs deliver their PoMs, it is estimated that up to 3,591 surface water bodies (77%) will achieve good or higher ecological status or potential by 2027. However, 3,591 (76%) of the "by 2027" objectives are flagged as low confidence.[202] It is predicted in the RBMPs that 3,647 (78%) of England's 4,651 assessed surface water bodies will achieve good or higher chemical status by 2063. This has been due to the inclusion of uPBT substances such as PBDEs, PFOS and mercury.

Wales does not give a breakdown between chemical and ecological status when mentioning their achievement of objectives.[203] Overall, the Western Wales RBMP states that 495 (87%) of their water bodies have an objective of good status by 2027. However they are only confident that 248 (44%) of water bodies are set to achieve or remain at good status or potential by 2027. This is due to the reason for failures not being confidently identified, or the measures not being in place by 2027.[204] Note this data is for all water bodies in Western Wales as the available information does not give specific surface water body information. Similarly, the Dee RBMP states that 76 (92%) water bodies have an objective of good status by 2027, but they are only confident that 37 (43%) will achieve or remain at good. The Severn RBMP reports that 235 water bodies (83%) will have an objective of good status by 2027, but they are only confident that 98 will achieve or remain at good status by 2027.[205]

In Scotland, 80.3% of surface water bodies are expected to achieve good status by 2027.[206] For the Solway Tweed RBD overall, 172 of the 302 water bodies that are not achieving a good ecological status are expected to achieve a good ecological status by 2027 (a 57% improvement).

As the 3rd Cycle RBMP for Northern Ireland is in draft, a full breakdown of objectives data is not currently available. NORTHERN IRELAND ENVIRONMENT AGENCY, prior to the 2nd RBMP, had an objective of 100% of water bodies at good status by 2027, in 2015 this 'working' objective[207] was updated to have all 70% of all water bodies at good status by 2021. NORTHERN IRELAND ENVIRONMENT AGENCY have reported they are aiming to reach 70% good or better status by 2027. In the most recent (2021) data, only 31% of surface water bodies are at good ecological status.

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202 Low confidence is defined as where the measures needed to achieve good status by 2027 are uncertain about when they will take place, also, how effective the proposed measures will be.

203 For a comparison, the overall status was used for Wales

204 Natural Resource Wales, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

205 For a comparison, the overall status was used for Northern Ireland

206 Scottish Environment Protection Agency, 2020. Objectives. Available at: https://informatics.sepa.org.uk/RBMP3/ (Accessed 3rd May 2023).

207 The working objective is not classified as an objective itself, but is classified alongside the objectives

In terms of chemical status of surface water, once monitoring for all uPBT substances are carried out in each nation, it is likely that the majority of surface water bodies will not reach good chemical status until beyond 2027.

3.4 Chemical and Quantitative Status of Groundwater Bodies

For groundwater bodies that do not have monitoring in place, 'grouping' can be used to give the groundwater bodies a classification. This allows the generalisation of classification status to groundwater bodies which have similar characteristics. If a groundwater body is **not at risk** according to the characterisation process, then it can be 'grouped'. These groundwater bodies do not need to be adjacent to each other, and a monitoring point is not required in each of the component's bodies, provided there is sufficient overall monitoring in the group as a whole to meet the criteria. If a groundwater body is **at risk,** then it can be grouped but only with groundwater bodies with which it has similar pathway susceptibilities, pressures and confidence in the risk assessments.[208]

Groundwater Chemical Status

The chemical status of groundwater bodies is classified using a series of tests related to the chemical condition of the groundwater body itself (including saline or mine water intrusion) and its receptors (drinking water, associated aquatic ecosystems, dependant terrestrial ecosystems), scored on a 'good' or 'poor' basis. The lowest score is used to classify the overall chemical status of the body.[209]

As shown in Table 3-4, England is the only nation to have more groundwater bodies in poor chemical status than good. Wales has an almost even split of good and poor classification, with Northern Ireland and Scotland having significantly more groundwater bodies classified as good than poor. The main parameters causing the failures in England are nitrates, orthophosphates, copper and chloride.[210]

Summary - Changes to Groundwater Chemical Status Between Cycles

Table 3-4 - Groundwater chemical status (2nd and 3rd cycle)

Groundwater - chemical status			
	Cycle	**Poor**	**Good**
England	2nd	47% (127)	53% (144)
	3rd	55% (149)	45% (122)
% Change		+8%	-8%

208 UKTAG, 2007. UKTAG Task 12(a) Guidance on Monitoring Groundwater. Available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Groundwater%20monitoring_Draft_010807.pdf (accessed 13th June 2023).

209 UKTAG Paper 11b(i) Groundwater Chemical Classification for the purposes of the Water Framework Directive and the Groundwater Directive. Available at http://wfduk.org/resources/paper-11bi-groundwater-chemical-classification-april-2019

210 Environment Agency, 2023. State of the water environment indicator B3: supporting evidence. Available at: https://www.gov.uk/government/publications/state-of-the-water-environment-indicator-b3-supporting-evidence/state-of-the-water-environment-indicator-b3-supporting-evidence (accessed: 13th June 2023).

Groundwater - chemical status			
Wales	2nd	38% (15)	62% (24)
	3rd	44% (17)	56% (22)
% Change		+6%	-6%
Scotland	2nd	17.9% (72)	82.1% (331)
	3rd	11.4% (46)	88.6% (357)
% Change		-6.5%	+6.5%
Northern Ireland	2nd	32% (24)	68% (51)
	3rd	29% (22)	71% (53)
% Change		-3%	+3%

Summary of change to chemical status of groundwater bodies since 2015

Overall, Wales and England reported a decrease in good chemical status of groundwater bodies since 2015. Scotland and Northern Ireland reported an increase in good chemical status of groundwater bodies. Wales reported that more research needs to be done to work out the possible deterioration of chemical status of their two groundwater bodies. England reports that the main reason for deterioration is down to an 'increase in pressure' from the environment. No reason for change could be identified in Northern Ireland's 3rd RBMPs.

Groundwater Quantitative Status

The quantitative status of groundwater reflects the impact of human activity (abstraction primarily) on the capacity of the groundwater body to provide support (in terms of flow and also chemistry) to associated aquatic ecosystems, dependant terrestrial ecosystems as well as for human uses.[211] As for chemical status, this is classified based on a series of tests which identify if the body achieves its environmental objectives and is at good status or alternatively is at poor status. The worst score determines the overall quantitative status of the groundwater body.

For the quantitative status of groundwater bodies, all four nations had significantly more groundwater bodies at good rather than poor status, as shown in **Table 3-5**. For the Solway Tweed RBMP, 94% of groundwater bodies achieved good quantitative status.[212]

2nd Cycle Overview of the UK

In the 2nd cycle for the UK, 85% of monitored groundwater bodies were classified at good quantitative status, 15% were failing good status and one groundwater body was at unknown status. It is important to note that of all groundwater bodies in the UK, 73% were not monitored and whilst a quantitative status has been determined for all groundwater bodies, the status was determined

[211] UKTAG Paper 11b(ii) : Groundwater Quantitative Classification for the purposes of the Water Framework Directive. Available at http://wfduk.org/resources%20/paper-11bii-groundwater-quantitative-classification-march-2012

[212] Scottish Environment Protection Agency, 2021. The River Basin Management Plan for the Solway Tweed River Basin District 2021 update. Available at: https://www.sepa.org.uk/media/594087/211221-final-rbmp3-solway-tweed.pdf (Accessed 13th June 2023).

through groundwater body grouping alongside expert judgment. The UK provided further information that clarified that risk-based monitoring is used. This means that the majority of monitoring is carried out in areas at risk of pressures/downgrades. Groundwater bodies are grouped together if it is identified that they are impacted by similar pressures and only a selection of these groundwater bodies are monitored but the classification is applied across the whole group.[213]

Summary - Changes to Groundwater Quantitative Status Between Cycles

Table 3-5 - Groundwater quantitative status (2nd and 3rd cycle)

Groundwater - quantitative status			
	Cycle	**Poor**	**Good**
England	2nd	31% (84)	69% (187)
	3rd	27% (72)	73% (199)
% Change		-4%	+4%
Wales	2nd	0	100% (39)
	3rd	0	100% (39)
% Change		0%	0%
Scotland	2nd	7% (28)	93% (375)
	3rd	5% (21)	95% (382)
% Change		-2%	+2%
Northern Ireland	2nd	11|% (8)	89% (67)
	3rd	5% (4)	95% (71)
% Change		-8%	+8%

Summary of change to quantitative status of groundwater bodies since 2015

Overall, between the 2nd and 3rd RBMPs, England, Northern Ireland and Scotland have reported improvements to their quantitative status. Wales has consistently reported 100% of their water bodies at good quantitative status in both cycles.

[213] European Commission, 2019. COMMISSION STAFF WORKING DOCUMENT, Second River Basin Management Plans – Member State: United Kingdom. SWD(2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN (accessed 13th June 2023).

Achievement of Objectives

Currently 199 of England's groundwater bodies (73%) are classed as good quantitative status. If the RBMPs deliver their PoMs, it is predicted that 244 groundwater bodies (90%) will achieve good quantitative status by 2027. Twenty-five (78%) of the "by 2027" objectives for quantitative status are low confidence. It is predicted that 245 (90%) of England's groundwater bodies will achieve good quantitative status by 2040.

Currently 122 of England's groundwater bodies (45%) are classed as good chemical status. If the RBMPs deliver their PoMs, it is predicted that 221 groundwater bodies (82%) will achieve good or higher chemical status by 2027. All of the 78 "by 2027" objectives for chemical status are flagged as low confidence. It is predicted that 242 (89%) of England's groundwater bodies will achieve good chemical status by 2060. No information regarding the level of confidence past 2027 could be found.

In Scotland, 373 groundwater bodies (92.5%) are expected to achieve good overall chemical status by 2027.[214] 403 groundwater bodies (100%) are expected to achieve good beyond 2027.

As noted in an earlier section, Western Wales RBMP states that they are confident that 248 (44%) of water bodies are set to achieve or remain at good status or potential by 2027 in comparison to the objective of 495 (87%).[215] the Dee RBMP states 76 (92%) water bodies have an objective of good status by 2027, but they are only confident that 37 (43%) will achieve or remain at good. The Severn reports that 235 water bodies (83%) will have an objective of good status by 2027, but they are only confident that 98 water bodies will achieve or remain at good status by 2027.[216]

In Northern Ireland there are 75 groundwater bodies, 71 (95%) classed as good quantitative status (2021) and 53 (71%) classed as good chemical status in 2021. There are 51 (68%) groundwater bodies classed as good overall status in 2021. Northern Ireland is aiming to achieve 70% of all water bodies at good status or better by 2027. Despite this, the Draft 3rd Cycle River Basin Management Plan for Northern Ireland's draft RBMP includes 2020 classifications which will be their current status, but they do not include their 2027 objectives which limits the assessment of level of environmental improvement by 2027 and ability to compare to the other nations.[217]

Overall, only England and Scotland provide groundwater specific information for the achievement of objectives. The information reported shows that both nations are expecting high levels of good chemical status by 2027 with England predicting that 90% of groundwater bodies will achieve good or higher quantitative status and 82% will achieve good or higher chemical status. Scotland predicts that 92.5% of water bodies will achieve good or higher status but does not differentiate between quantitative and chemical status.

214 Scottish Environment Protection Agency, 2020. Objectives. Available at: https://informatics.sepa.org.uk/RBMP3/ (Accessed 3rd May 2023).

215 Welsh government, (2022). Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

216 For a comparison, the overall status was used for Wales

217 TBD

3.5 Exemptions

The Water Environment Regulations (2017) allow under certain conditions four exemptions to be applied under which the achievement of the environmental objectives can be delayed or amended. They are derived from Article 4 of the WFD and include the provisions in Article 4(4) - extension of deadline beyond 2015, Article 4(5) – less stringent objectives, Article 4(6) - temporary deterioration and Article 4(7) - new modifications / new sustainable human development activities. Article 4(4) exemptions may be justified by: disproportionate cost, technical feasibility or natural conditions, and Article 4(5) by disproportionate cost or technical feasibility. These have been referenced in UK law as follows:

- England and Wales: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 transposed Article 4(4)-(7) requirements in Regs 16, 17, 18 and 19;
- Northern Ireland: The Water Environment (Water Framework Directive) Regulations (Northern Ireland) (2017)[218]; and
- Scotland: The Water Environment and Water Services (Scotland) Act 2003[219].

Exemptions in the 3rd RBMPs

An overview of the use of exemptions identified in the 3rd RBMPs is presented in the sections below.

England

A summary of the application of Regulation 16 and Regulation 17 in the 3rd RBMPs for England is provided in Table 3-6.

Table 3-6 - Applications of Regulation 16 and Regulation 17 exemptions

Exemption	Surface water (ecological status & potential)	Surface water (chemical status & potential)	Groundwater (quantitative status)	Groundwater (chemical status)
Regulation 16 (extended deadline) exemptions	113	4,648	8	21
Percentage of Regulation 16 (extended deadline) exemptions	2.4%	99.8%	3%	7.75%
Regulation 17 (setting of less stringent) exemptions	865	0	26	29
Percentage of Regulation 17 (setting of less stringent) exemptions	18.6%	0%	9.6%	10.7%

218 Legislation.gov.uk, 2017. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. 2017 No. 407. Available at: https://www.legislation.gov.uk/uksi/2017/407/contents/made (Accessed 13th June 2023).

219 Legislation.gov.uk, 2003. Water Environment and Water Services (Scotland) Act 2003. 2003 asp 3. Available at: https://www.legislation.gov.uk/asp/2003/3/contents (Accessed 13th June 2023).

Source: England_objectives data[220] which lists 4,658 surface water bodies and 271 groundwater bodies

Regulation 16 (extended deadline) exemptions have been used extensively in surface water to extend the deadline to achieve good chemical and potential chemical status (99.8%). The most reported timeframe and reason is an extension to 2063 with 'Natural conditions / Chemical status recovery time' specified as the reason. The main pressure causing the use of this exemption is chemical pollution, especially due to the uPBT substances discussed previously (PBDEs, PFOS and mercury).

A Regulation 16 extension has also been used to extend the deadline to achieve good quantitative status for 3% of groundwater bodies and good chemical status for 8% of groundwater bodies. Technical feasibility, disproportionate costs and natural conditions linked to the time lag for groundwater recovery from pollution and over abstraction are all reported as reasons for applying this exemption.

Regulation 17 (setting of less stringent objectives) was applied in 18.6% of surface water bodies for ecological status and potential. This exemption is used to reduce the objective status or potential of a waterbody to lower than 'good'. Disproportionate costs have been cited as a reason in 95% of cases and technical feasibility has been cited as a reason in 35% of cases.[221]

It has also been used to set less stringent objectives for quantitative status for 9.6% of groundwater bodies and chemical status in 10.7% of groundwater bodies. Disproportionate costs and technical feasibility are cited as the reasons.

Northern Ireland

For Northern Ireland, there is limited information on the use of exemptions in the draft 3rd RBMP and a document detailing the use of exemptions is not currently included. There is one mention of where an exemption has been applied in Lough Neah. The draft 3rd RBMP states 'We will also take into account extended deadlines due to natural conditions' which hint to use of exemptions. Considering extensive use of exemptions in the 2nd RBMP, it is expected that exemptions would be relied upon also in the 3rd RBMPs. It is unclear why the draft RBMPs do not include that information which is an important component of the RBMP and should be available for public scrutiny prior to finalisation of the plans.

In the 2nd RBMP[222], Regulation 16 exemptions were applied in 69% of surface water bodies for ecological status, 6 % of surface water bodies for chemical status, 11% of groundwater bodies quantitative status and in 61% of ground water bodies for chemical status. There were no Regulation 17 exemptions applied and there was one Regulation 19 (new modification or sustainable development activity) exemption applied the North Western RBD for a hydroelectric power scheme on a river water body.

220 Objectives table for England at https://environment.data.gov.uk/catchment-planning. Accessed February 2023.

221 Environment Agency, 2023. River basin planning process overview. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/4-updating-objectives (Accessed 13th June 2023).

222 TBD

Wales

The Western Wales 3rd RBMP states that Regulation 16 has been applied for 28 water bodies because of acidification or for chemicals which require a longer time for the impacts of the programme of measures to take effect and for good status to be achieved. These water bodies have a delayed objective of good by 2033 or 2039. Regulation 17 has been applied for 43 water bodies due to being disproportionately costly or technically infeasible to improve to good status over the 3rd cycle. No deterioration remains an objective for these 43 water bodies.[223]

In the Dee RBMPs[224], four water bodies have an extended timescale to meet good status by 2033 for reasons of acidification or mercury (noted as a uPBT). In all four measures have been adopted but it is expected that the recovery will not be achieved by 2027. A disproportionate cost assessment was carried out over 18 water bodies and seven water bodies have a less than good status/potential objective on the basis of them being disproportionately costly, or technically infeasible to improve to good status over the 3rd cycle. However, the RBMPs note that all seven water bodies will have national and local measures taken to improve the water quality. [225]

Scotland

For Scotland, the 3rd RBMP[226] mentions the application of exemptions related to hydromorphology and the removal of 35 impassable man-made barriers where it is proposed to set less stringent objectives based on an assessment of disproportionate costs. The RBMP does not include further information on this but indicates that some uncertainties remain with regard to large scale removal of barriers and that disproportionate costs might be identified during the implementation of the RBMPs.

For Solway Tweed RBD, there is no mention of less stringent objectives, disproportionate costs or technically infeasible measures associated with the use of exemptions.

Summary

The comparison of the four approaches to exemptions in the 3rd cycle is challenging due to the lack of details on the application of exemptions particularly in Scotland and Northern Ireland. The reliance on exemptions in England, and to a lesser extent Wales, continue to be significant, in particular for chemical pressures and the presence of uPBTs.[227,228] This was seen in the Dee RBMP in which, similar to England, one of the main reasons for exemptions to be used is as result of uPBTs, such as mercury. Disproportionate costs and technical infeasibility are other common reasons highlighted.

223 Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

224 Welsh government, 2022, Dee River Basin Management Plan 2021 –2027 Summary Available at: https://cdn.cyfoethnaturiol.cymru/media/695219/dee-rbmp-2021_2027-summary.pdf (Accessed 11th March 2023).

225 Dee RBMP 2021-2027 Summary (cyfoethnaturiol.cymru)

226 211222-final-rbmp3-scotland.pdf (sepa.org.uk)

227 TBD

228 TBD

3.6 Economic Analysis

As noted in section 1.3, England and Wales, Northern Ireland and Scotland have transposed the WFD into their own regulations which differ between nations. For example, the economic analysis refers to Regulation 7 in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 but Section 5 in The Water Environment (Controlled Activities) (Scotland) Regulations 2011. For ease of reading the relevant WFD articles have been used in the following economic analysis and governance sections.

The WFD requires Member States to undertake an economic analysis of water use in each RBD according to the specifications of Annex III. This stipulates that the economic analysis of water use should contain enough information in sufficient detail to support the assessment of cost recovery for water services and related obligations (Article 9) as well as the judgements on the most cost-effective combination of measures in respect of water uses to be included in the Programme of Measures (Article 11).

England

In the UK's 2nd RBMP, for the RBDs in England, water services were described as drinking water abstraction (surface and/or groundwater), treatment and distribution and sewage collection and wastewater treatment (when considered together).[229]

The costs of water and sewage services are recovered through customer bills based on the charges of water companies. The price limits for what water companies can charge is set by Ofwat, the economic regulator for the water industry in England and Wales. Water company businesses outline how much each company needs to charge customers to be able to provide water and sewage services and also comply with statutory obligations. In terms of water abstraction, charges apply when abstractors have an abstraction licence that covers the cost of sustainable water resources management.[230] Water industry funded measures form the majority of expected investment in realising the environmental objectives.

The 3rd RBMP builds on the extensive economic assessment that was undertaken in preparation for England's 1st RBMP. Some parts of the 1st RBMP were found to be already sufficient and were not updated. This includes information on the different sectors' use of water and the socio-economic characteristics of all England's RBDs. The Environment Agency states that these reports were reviewed but not updated for the 3rd RBMPs as the socio-economic characteristics have not changed significantly.[231] Other parts were updated, including improved information on the scale and

229 European Commission, 2019. COMMISSION STAFF WORKING DOCUMENT, Second River Basin Management Plans – Member State: United Kingdom. SWD(2019) 58 final. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN (accessed 13th June 2023).

230 Gov.UK, 2023. River basin planning process overview. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/2-river-basin-management-plans (Accessed 13th June 2023).

231 Gov.UK, 2023. River basin planning process overview. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/4-updating-objectives (Accessed 13th June 2023).

costs of the measures needed to reduce the negative impacts of agriculture, through more sophisticated modelling, and the water industry, through more in-depth analysis and evidence.[232]

The economic assessment of the Programmes of Measures for the 3rd RBMP uses cost effectiveness and cost-benefit analysis to determine the most valuable combination of measures to reduce harm and improve the water environment. Detailed information on methods and data used, the investments needed, a comparison of monetised costs and benefits, an overview of the funds committed for planned 2021 to 2027 activities are provided.[233] The monetised costs and benefits of achieving the environmental objectives in the 3rd RBMP are also provided at the RBD level.[234]

However, review of the reported investment requirements considered for measures related to abstraction reduction to meet river flow targets, and the associated need to develop alternative reservoir sources and transfers, suggests these significantly underestimate the scale of the challenge posed by the Environment Agency's National Framework Ambition, Natural England's Protected Habitats objectives and Catchment Based Approach recommendations in the Chalk Streams Strategy. These are currently driving plans for huge reductions in groundwater and river baseflow abstraction which have not been appropriately evaluated in terms of costs, benefits and carbon at a national level, and may be unwise in terms of supply and environmental resilience through anticipated droughts and ongoing climate change.

Northern Ireland

In the 2nd RBMP for the UK, Northern Ireland defines water services as drinking water abstraction (surface and/or groundwater), treatment and distribution and sewage collection and wastewater treatment. No charges were applied to users for water in the 2nd RBMP.

The draft 3rd RBMP outlines Northern Ireland's recovery of costs of water services. Northern Ireland Water (NI Water) is a government-owned company that is the sole provider of public drinking water and sewage services. NI Water directly links the revenue obtained with the costs incurred by allocating its total revenue requirement to each of its eight customer groups (non-domestic measured water and sewerage, non-domestic unmeasured water and sewerage, domestic unmeasured water and sewerage, trade effluent and road drainage) on the basis of the volume of water they consume and sewage they discharge. Based on this allocation, NI Water sets tariffs to recover the costs. Most of the costs (≥75 %) for non-domestic customers are directly recovered through a Scheme of Charges set out by NI Water. The remaining costs as well as those for

232 Environment Agency, 2022. Investment requirements for England's river basin management plans. Available at: https://www.gov.uk/government/publications/investment-requirements-for-englands-river-basin-management-plans/investment-requirements-for-englands-river-basin-management-plans#about-this-report (Accessed 13th June 2023).

233 Environment Agency, 2022. Investment requirements for England's river basin management plans. Available at: https://www.gov.uk/government/publications/investment-requirements-for-englands-river-basin-management-plans/investment-requirements-for-englands-river-basin-management-plans#about-this-report (Accessed 13th June 2023).

234 Environment Agency, 2022. Appendix D: Costs and benefits by river basin district. Available at: https://www.gov.uk/government/publications/investment-requirements-for-englands-river-basin-management-plans/appendix-d-costs-and-benefits-by-river-basin-district (Accessed 13th June 2023).

domestic customers are funded by the Northern Ireland Executive. The Economic Assessment Report will be updated for Northern Ireland's final RBMP.[235]

The draft 3rd cycle plan also outlines the regulation of private abstractions and private sewage services. The plan notes that the NORTHERN IRELAND ENVIRONMENT AGENCY charging policy ensures that the NORTHERN IRELAND ENVIRONMENT AGENCY fully recovers the cost of regulating all abstraction activities and wastewater discharges.

Judgements on the most cost-effective combination of measures do not appear to be included in the Programme of Measures in the draft 3rd RBMP.

Scotland

In the 2nd RBMP for the UK, Scotland defines water services as water supply and wastewater services, infrastructure for flood protection, infrastructure for navigation, irrigation water abstraction, treatment and distribution, and self-abstraction.

Appendix 9 of the draft 3rd RBMP for Scotland outlines the practical steps and measures taken to apply the principle of recovery of the costs of water services in accordance with Article 9 of the Water Framework Directive. Scottish Water, the water and sewage services provider, is a publicly owned body and a responsible authority. The financial costs of providing water supply and sewerage services are fully recovered by Scottish Water through customer charges. This includes the collection of chargeable revenue from households as well as non-household customers, including businesses and agriculture.[236] An independent economic regulator, the Water Industry Commission for Scotland determines the financial resources required and the charges that Scottish Water can set. The 3rd RBMP mentions that the intent of the water pricing policies is to ensure that the environmental objectives can be met in a proportionate and cost-effective manner. More information on the cost effectiveness analysis of measures was not found.

The Scottish Environmental Protection Agency has also put in place a charging scheme with the intent of recovering the regulatory costs associated with General Binding Rules. This charging scheme reflects polluter pays principles; and applies to activities considered to pose a very low level of risk.

Wales

The Overview Annex for Wales[237] provides information on the background and decision-making processes followed to develop the 3rd RBMPs for Wales (including the Dee, the Severn and Western Wales). This document outlines the economic analysis of water use. It states that water supply and sewerage services in Wales are wholly privatised. Therefore, over the long term, the financial costs

235 Department of Environmental, Agricultural and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 11th March 2023).

236 Scottish Environment Protection Agency, 2021. Appendix 9: Cost Recovery. Available at: https://informatics.sepa.org.uk/RBMP3/Appendices/Appendix%209%20Cost%20recovery.pdf (Accessed 13th June 2023).

237 Natural Resource Wales, 2022. River Basin Management Plan Overview Annex Wales December 2022. Available at: https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf (Accessed 13th June 2023).

of water and sewerage services are recovered in full, from service users. The 3rd RBMP states that this includes the internalised environmental and resource costs.

The economic analysis, included a local assessment of the most cost-effective programmes of measures to prevent deterioration, achieve Protected Area objectives and achieve good status where technically feasible. This analysis has drawn on the database of costs of measures, maintained and developed since the first plans were published and supplemented where appropriate by local and stakeholder information.[238]

The three draft 3rd RBMPs for Wales include a section that outlines the economic appraisal and objectives for water bodies not achieving good status. For example, all three draft RBMPs state that the remediation of physical impacts has been difficult to cost, and it is hoped that an improved estimate will be made during the implementation of the 3rd RBMPs. They also outline the economic appraisal for managing pollution from sewage and wastewater, resolving agricultural pressures, managing pollution from mines, towns, cities and transport including the impacts of acidification and improving fish passage and habitats. It also notes that an economic appraisal in some areas such as changes to the natural flow and water levels and managing INNS have not been possible.[239] Additionally, the RBMPs outlines a disproportionate cost assessment has been carried out for 179 water bodies. [240]

Summary

Table 3-7 - Economic Analysis Comparison

	Definition of Water Services	Recovery of Costs	Cost Effectiveness Analysis	Cost/Benefit Appraisal
England	Defined in the 2nd RBMP	Privatised and fully recovered (Ofwat)	Yes	Yes – disproportionate costs considered.
Northern Ireland	Defined in the 2nd RBMP	Fully recovered. Privatised and ≥75 % recovered (NI Water). The remaining costs are funded by the Northern Ireland Executive.	No	Not found.
Scotland	Defined in the 2nd RBMP	Privatised and fully recovered (Scottish Water)	No	Not found.

238 Natural Resource Wales, 2022. River Basin Management Plan Overview Annex Wales December 2022. Available at: https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf (Accessed 13th June 2023).

239 Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

240 Welsh government, 2022. Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

	Definition of Water Services	Recovery of Costs	Cost Effectiveness Analysis	Cost/Benefit Appraisal
Wales	Not found	Privatised and fully recovered	Yes	Yes – calculated disproportionate costs for 163 water bodies.

As shown in Table 3-7, the definitions of water services for England, Scotland and Northern Ireland were sourced from the 2nd RBMPs. A definition for Wales was not found.

The 3rd RBMPs for Northern Ireland, Scotland, England and Wales clearly detail the methods used for cost recovery in accordance with Article 9.

Judgements in relation to the most cost-effective combination of measures (Article 11) are not as clear in the 3rd RBMPs. Neither Scotland's nor Northern Irelands 3rd RBMP outline the cost-effective analysis but Northern Ireland's draft RBMP does state that the Economic Assessment Report will be updated for the final RBMP.

England undertook catchment economic appraisals to assess the costs, benefits and potential negative impacts of implementing measures to improve the water environment and considers disproportionate costs, although abstraction reduction requirements to meet current environmental river flow aspirations appear to have been significantly underestimated. Wales' 3rd RBMP also states that a local assessment of the most cost-effective programmes of measures to prevent deterioration, achieve Protected Area objectives and achieve good status where technically feasible was completed. Wales also outlines the calculations for disproportionate costs. Overall, the economic analysis for England and Wales appear to provide the most detail. England in particular shows long term consistency as each cycle builds on the extensive economic assessment that was undertaken in preparation for the 1st RBMP.

3.7 Governance

Public Consultation

Article 14 of the WFD (transposed into regulations for England and Wales, Northern Ireland and Scotland) outlines the requirements for public information and consultation. The draft RBMPs and other key documents such as the timetable, work programme and overview of significant water management issues, should be available for public consultation for the minimum six months.

Additionally, a comprehensive draft RBMP should be consulted on. This means all main chapters should be available for consultation, including a complete or nearly complete programme of measures and the presentation of all objectives and exemptions.

Wales: Dee and Western Wales RBMPs

There were two statutory consultations leading up to the 3rd RBMPs which were the Working Together Consultation (June 2018 to December 2018) and the Challenges and Choices Consultation (June 2019 to December 2019). The timetable for consultation and reporting as part of the development and update of the RBMPs was outlined in accordance with the WFD regulations. The consultation on the draft Western Wales and Dee RBMPs occurred between December 2020 and June 2021.

Information was made available to stakeholders and the general public through the Natural Resource Wales website, Water Watch Wales and through other methods such as presentations and social media. The consultation documents for the Dee and Western Wales were published on the Natural Resource Wales website and the Severn on the Environment Agency's website; hard copies were also available on request. [241]

Scotland

The Scottish Environmental Protection Agency ran a consultation from June 2018 to December 2018 about the steps to take to engage stakeholders in the preparation of the 3rd RBMP for Scotland. This consultation set out proposals on the timetable and work programme to produce the updated RBMPs and explained how people can get involved in river basin planning.

The consultations on the draft 3rd RBMP for Scotland and the Solway Tweed River Basin District were then carried out from December 2020 to June 2021. There is limited information on exemptions in either Scotland's or the 3rd RBMP for the Solway Tweed RBD.

England

England carried out a 6-month public consultation on the draft river basin management plans (22 October – 22 April 2022). The draft RBMP included all of the England only RBDs and the Severn cross-border RBD. The Dee was consulted on by Natural Resource Wales and the Solway Tweed by the Scottish Environmental Protection Agency.

Northern Ireland

Consultation on the Draft 3rd Cycle River Basin Management Plan 2021 to 2027 opened 9 April 2021 and closed 10 October 2021. The draft plan covered the North-Western, Neagh Bann and North Eastern River Basin Districts (RBD) and included detailed status updates on each RBD. The 3rd RBMP remains at draft status and as of yet and includes limited information on the objectives (there is no dataset of objectives and working targets at the waterbody level), programme of measures (there is a summary of the programme of measures, but this is not provided at the RBD level) or exemptions (this is also not provided at the waterbody level) which means all of the information was not available for consultation.

Summary

It appears that for all nations the consultation ran for the minimum six months, and the consultation information was made available in numerous ways. In terms of providing the key documents, these were available for England and Wales but not for Northern Ireland and Scotland.

Northern Ireland did note that publication of the draft 3rd RBMP for consultation was delayed due to key staff being re-deployed in the response to the Covid-19 pandemic. As noted above the draft plan contains limited information on the objectives, exemptions and programme of measures.

[241] Natural Resource Wales, 2022. River Basin Management Plan Overview Annex Wales December 2022. Available at: https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf (Accessed 13th June 2023).

Overall, there appear to be no major difference in how England and Wales upheld the requirements of Regulation 29 for public information and consultation. Scotland and Northern Ireland on the other hand were missing information in their draft 3rd RBMPs such as information on the use of exemptions which means it is possible, they did not meet the requirements of Regulation 29 as not all key documents were available for public consultation.

Engagement of Stakeholders

Article 14 of the WFD provides the requirements for public information and consultation which include that Member States shall encourage the active involvement of all interested parties, in the implementation of the Directive, in particular in the production, review and updating of the RBMPs.

This includes:

- Using mechanisms (establishment of advisory groups, involvement in drafting, digitalisation and others) for active involvement of stakeholders;
- Indicating types of stakeholders actively involved (industry, farmers, NGOs and others); and
- Considering issues raised by stakeholders (addition of new information, changes to information).

Wales

To help encourage the active participation of stakeholders, Wales has established the Welsh Government Water Forum and the Wales Water Management Forum. These forums provide a focus for communication and consultation on a range of water related issues as well as a place for membership organisations to share evidence and explore opportunities for working together.

Engagement and involvement in the process at a local level were integrated into the Area Statement engagement process which was central to the selection of Opportunity Catchments. Ten Opportunity Catchments were selected as they represented the best range of opportunities for addressing the WFD objectives and will be priority work areas for Natural Resource Wales and partners.[242] The engagement included holding workshops, trying different methods of communication with stakeholders and carrying out stakeholder mapping. Representative groups such as environmental non-governmental organisations, farming unions, angling associations and large industry were included.[243]

The 3rd RBMPs in Wales have all stated that the plan has been influenced by the feedback received from the consultations held over the past four years.[244]

Scotland

During December 2020 to December 2021 consultations for the draft 3rd RBMP for Scotland and the Solway Tweed River Basin District there were numerous opportunities for active involvement of stakeholders in the RBMP planning. This included mechanisms such as through advisory groups,

242 Natural Resource Wales. Area Statements and opportunity catchments. Available at: Natural Resources Wales / Area Statements and opportunity catchments (accessed 18 July 2023).

243 Natural Resource Wales, 2022. River Basin Management Plan Overview Annex Wales December 2022. Available at: https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf (Accessed 13th June 2023).

244 Welsh government, (2022). Western Wales River Basin Management Plan 2021 – 2027 Summary. Available at: https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf

sector specific activities, workshops and twice yearly keeping in touch e-mails to all contacts on the mailing list.[245] The summary of responses to the consultation were published and are available on the Scottish Environmental Protection Agency website. The summary states that the Scottish Environmental Protection Agency will consider the comments and suggestions in the development of the 3rd plans and that any specific waterbody queries have been highlighted and cross checked. The 3rd RBMPs for Scotland and the Solway Tweed do not comment on what changes have been made as a result of the consultations.

England

The consultation for England's 3rd RBMP was run on a citizen space website and paper copies were available on request. The Environment Agency contacted over 3,000 people and organisations, placed statutory notices in newspapers and sent email reminders to get responses. They also held meetings and sessions with catchment partnerships and key stakeholders.

As a result of the responses to the consultation the Environment Agency stated that it made a number of changes to the draft RBMP. The main changes the Environment Agency reported to have made included the improvement of the structure of the plans, improvements of the Catchment Data Explorer and online maps, corrections to some water body status objectives and the addition of new information such as catchment partnership pages that include links to their location.[246]

Northern Ireland

The consultation page for Northern Ireland notes that the publication of the draft 3rd RBMP was late due to key staff being deployed to manage the COVID-19 pandemic. There was no information found on the use of mechanisms to involve stakeholders or the type of stakeholders. [247] As the final plan has not yet been published no information on if changes were made in response to the consultation is currently available. It was noted that the feedback received on the Significant Water Management Issues consultation has helped shape and influence the draft 3rd RBMP.[248]

The draft 3rd RBMP states that the delivery and implementation of the PoMs includes regular engagement with stakeholders. The key stakeholders are listed as NI Water, Department for Infrastructure (DfI) Water and Drainage Policy Division, DfI Rivers and DfI Roads, AFBI, Loughs Agency, local councils, Rivers Trusts, Ulster Farmers Union, Ulster Angling Federation; the private sector; the community and voluntary sector; and the general public, working together with the Department of Agriculture, Environment and Rural Affairs. The plan also notes that active engagement between delivery partners and stakeholders is key for the successful delivery of measures through partnerships and catchment projects.

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245 Scottish Environmental Protection Agency. 2021. Appendix 10: Consultation and engagement. Available at: https://informatics.sepa.org.uk/RBMP3/Appendices/Appendix10%202021%20final%20links.pdf

246 Available at: Draft river basin management plans consultation: improvements to plans - GOV.UK (www.gov.uk)

247 Department of Agricultural, Environment and Rural Affairs, 2021. Consultation on the Draft 3rd Cycle River Basin Management Plan 2021 to 2027. Available at: https://www.daera-ni.gov.uk/consultations/consultation-draft-3rd-cycle-river-basin-management-plan-2021-2027 (Accessed 13th June 2023).

248 Department of Agriculture, Environment and Rural Affairs, 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF (Accessed 13th June 2023).

Summary

Wales encouraged the active involvement through a range of mechanisms and indicated the types of stakeholders involved. All three of their 3rd RBMPs state that changes were made as a result of the consultations, however specifics were not provided.

Scotland outlined the mechanisms used for the active involvement of stakeholders in the RBMP planning. Additionally, the Scottish Environmental Protection Agency states that it will consider the responses from the consultation, however at this stage the 3rd RBMP does not comment on or outline any changes made as a result.

England outlines the mechanisms used to actively engage stakeholders. England also provides a very thorough summary of responses to the consultation as well as describing several changes that were made in response to the feedback gained.

There is limited information on the consultation page for Northern Ireland on the active involvement of stakeholders in the consultation process.

Overall, there was clear information provided for the active involvement of stakeholders and the mechanisms used in Wales, Scotland and England, this information was limited in Northern Ireland.

In terms of considering issues raised by stakeholders England was the only country who provided full details of the considerations and changes made as a result.

Appendix B

DATA FOUND VS ACTUAL DATA FOR ENGLAND

Table B-1 - Data found vs actual data for England

Online (environment.data.gov.uk/catchment-planning/England/classifications)				
Water body categories	**Natural**	**Artificial**	**Heavily modified**	**Total**
River, canals and surface water transfers	2,546	264	1,118	3,928
Lake	99	141	324	564
Coastal	34	2	25	61
Transitional	25	9	71	105
Groundwater	271	0	0	271
Classifications data (downloadable Excel file from environment.data.gov.uk/catchment-planning/England/classifications. Numbers were obtained by filtering for 3rd cycle and for each waterbody type.				
Water body categories	**Natural**	**Artificial**	**Heavily modified**	**Total**
River, canals and surface water transfers	1,968	257	898	3,123
Lake	76	121	246	443
Coastal	30	2	22	54
Transitional	20	8	65	93
Groundwater	271	0	0	271

3

Task 2C - Comparative Approaches to River Basin Management in Jurisdictions Outside England and Northern Ireland

1 Introduction

1.1 Objectives of Task 2C

The aim of the task was to identify and assess practices from selected EU jurisdictions that could be relevant and transferable for England and Northern Ireland.

The objectives of Task 2C were as follows:

- To identify examples of key successes and lessons learnt from implementation of water management practices;
- To undertake a comparative analysis of different approaches taken to implement key aspects of the WFD including:

  An assessment of the benefits and limitations of the approaches taken;

  To what extent the approaches have resulted in delivering positive environmental outcomes; and

  The extent to which the approaches operate in accordance with principles of good governance and whether the approaches work for the parties involved in the process.
- To consolidate the lessons and practices learnt from the selected EU jurisdictions and discuss the extent to which they can have real, practical applicability to England and Northern Ireland.

1.2 Approach Undertaken

The task was delivered following three succinct steps as follows:

- Selection of EU Member States to include in the analysis were based on a series of criteria. A focus on countries with similarities to England and Northern Ireland were prioritised;
- Assessment of best practices of water-based management of individual Member States was undertaken using various literature sources. This included peer-reviewed journals, government websites and reports, and the European Commission's analysis on river basin management plans; and
- Assessment of the applicability of practices for water management in England and Northern Ireland. This involved evaluating the existing approach and identifying any limitations in current practices. By drawing insights of best practice from case studies from other Member States, these could be used to strengthen water management practices in England and Northern Ireland.

1.3 Gaps and Limitations

There were some challenges encountered when carrying out the analysis of Task 2C. In particular the delays experienced in the reporting of updated data in WISE to reflect the 3rd RBMPs have affected the analysis. This data would be required to assess quantitatively progress reported in the 3rd RBMPs and inform a more diverse selection of practices. This means we had to rely on the information from the 2nd RBMPs which is not the most up to date. We have referenced information from England and Northern Ireland's 3rd RBMPs where appropriate to provide a comparator with the current state of progress/performance in implementation of the WFD.

1.4 Key Messages

By looking at other countries approaches to implementing key aspects of the Water Framework Directive (WFD) some key successes and potential lessons for England and Northern Ireland were identified.

The best practices highlighted in this report include:

- Strengthening the mechanisms for local participation in water management processes. This can increase community and stakeholder engagement, and ensure effective information flow and representation (Ireland);
- Establish robust innovative policy programmes (e.g. the Agricultural Catchments Programme) that strengthen the science-policy interface. This creates a strong knowledge and evidence base, and enable informed decision making to support the implementation of the WFD (Ireland);
- The strengthening and coordination of internal governance mechanisms related to water management is critical for implementation of the WFD. For example, effective coordination between different authorities increases trust and allows for clear and transparent reporting of information, ensuring details are both accessible and usable (Netherlands);
- The importance of robust monitoring programmes for the assessment of water bodies, which allow for an increase in confidence of status classification (Germany);
- The setting of more stringent standards early, embraces a precautionary approach and can further identify potential risks (e.g. pollutant levels that may have otherwise been considered safe but could still lead to environmental damage over time). Setting stricter standards prioritises a higher level of protection for both ecosystems and human health (Germany); and
- The importance of the recognition of regional / local differences when implementing policy (Denmark); and
- The use of policies that should be scientifically justified, flexible, and site-specific to ensure their effectiveness. (Denmark).

Effective governance and internal communication are critical for implementation of the WFD for several reasons. This includes increased transparency and trust, increased awareness and education and to allow inclusive decision making. The Netherlands demonstrate good practice in this area associated with coordination between different authorities that has led to accessible and detailed information being provided and reported.

2 Selection of EU Member States

2.1 Introduction

Based on the findings from Task 2A[249] a series of countries were selected to be the focus of Task 2C including Ireland, Germany, Denmark, and the Netherlands. Our selection deliberately focused on countries with similar features to the UK (i.e., climate, land use, population density), consequently the selection includes only Western European countries. This focus does not suggest there is lack of valuable insight that other Member States could offer.

2.2 Selected Countries

A brief overview of the EU Member States selected for discussion along with the justifications are provided below.

Ireland

Ireland was selected as presenting best practice for achieving change, in particular with regard to increasing local participation. In response to the findings from the 1st RBMPs, Ireland established new structures and processes for the 2nd RBMPs.

Ireland has also been selected as an example of good practice for strengthening the science-policy interface by effective use of innovative catchment programmes. The Republic of Ireland established the Agricultural Catchments Programme in 2008, the objectives of which include: to measure the effectiveness of the Good Agricultural Practice, evaluate the efficacy of the nitrates derogation, and to provide a scientific basis for policy reviews. Since 2008, this programme has involved the voluntary engagement of over 300 farmers across six catchments.[250]

The Netherlands

The Netherlands have been selected as a case study due to the transparent coordination between authorities leading to detailed and accessible information being reported. Governance in the Netherlands takes place at multiple levels (national, provincial, regional and municipal), with distinct roles and responsibilities for each administrative body related to water quality policy. The Netherland's approach of separate plans for each RBMP might seem complex, but it becomes apparent that there is an overarching coordination mechanism in place. This is evident through the Water Steering Group, chaired by the Ministry of Infrastructure and Water Management, which facilitates coordination between authorities and assigns clear roles to each representative. Such division of tasks ensures that responsibilities are carried out at the appropriate level.

The Netherlands have also demonstrated good practice in the integration of the WFD with the Marine Strategy Framework Directive (MSFD) and the Floods Directive's Flood Risk Management Plans (FRMPs).

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249 The aim of Task 2A was to compare the progress and performance in achieving the WFD outcomes in England and Northern Ireland against progress from all EU Member States (27 countries). These differences were evaluated to understand if the learning / approaches could improve the overall compliance, or rate of improvement of water bodies in England and Northern Ireland.

250 Agricultural Catchments Programme – Catchments, Teagasc, https://www.teagasc.ie/environment/water-quality/agricultural-catchments/catchments/

Germany

Germany was selected as presenting a best practice approach to the classification for chemical status. Whilst Germany's water bodies are all failing to achieve good chemical status, the approach to establishing chemical status was considered to demonstrate good practice. Germany used the revised environmental quality standards (EQS), with increased monitoring between the 1st and 2nd RBMPs, and over 80% of the water bodies were classified with high confidence.

Denmark

Denmark was selected as offering an example of best practice related to synergy of water policies with other policies (e.g. agricultural policies). A coherent, focused and grounded policy framework is vital to make significant progress in improving the water environment in the face of multisectoral pressure. Due to long-standing agricultural pressures on the environment, Denmark has had a long history of developing comprehensive environmental action plans to tackle excess levels of nitrogen and phosphorus. This has included a series of agricultural policy actions (e.g. livestock stocking densities or controls on slurry spreading) to tackle diffuse pollution. Innovative policies have also been utilised to tackle point sources of pollution too, for example Denmark implemented a tax on emissions of nutrients (nitrogen and phosphorus) from wastewater treatment plants. The tax provides an incentive for sewage companies to increase the level of nitrogen and phosphorus removal above the requirement in the Urban Waste Water Treatment Directive (UWWTD).

3 Assessment of Lessons and Practices - Country Profiles

3.1 Ireland

Contextual Information

The island of Ireland is located in the North West of Europe, and West of Great Britain. The terrain consists of mostly level to rolling plain with some hills and low mountains.[251]

The island of Ireland has a significant proportion of its population living in rural areas, with the Republic of Ireland (herein this will be referred to as Ireland) estimating 31.4%[252] and Northern Ireland estimating 36%[253], in comparison to 17.1% of the total population in England.[254] Furthermore, 99% of Ireland is covered by predominantly rural and intermediate regions, more than double that of the EU Member State average.[255] Agriculture is an important industry in the Ireland, accounting for 4.3% of the country's economy (total gross value added) and 67% of the total land-use area in Ireland[256] (75% in Northern Ireland[257]). Whilst many other Western European countries are now characterised by large, industrialised farms, most farms in both Ireland and Northern Ireland are still classified as small and family run.[258]

The key pressures across the island of Ireland are nutrient impacts on the water quality of surface and transitional waters from urban wastewater and agriculture, and hydromorphology impacts on surface waters due to physical modification and silt.

251 Ireland Geography, country profile. https://www.countryreports.org/country/Ireland/geography.htm

252 Urban and Rural Life in Ireland, 2019, Central Statistics Office. https://www.cso.ie/en/releasesandpublications/ep/p-urli/urbanandrurallifeinireland2019/introduction/

253 Key Rural Issues, Northern Ireland 2022, DAERA. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Key%20Rural%20Issues%202022.pdf (population estimates based on NISRA's 2020 mid-year estimates)

254 Office Statistics, Rural population and migration, updated October 2021. https://www.gov.uk/government/statistics/rural-population-and-migration/rural-population-and-migration#:~:text=twitter.com%2FDefraStats-,1.,cent)%20lived%20in%20urban%20areas.

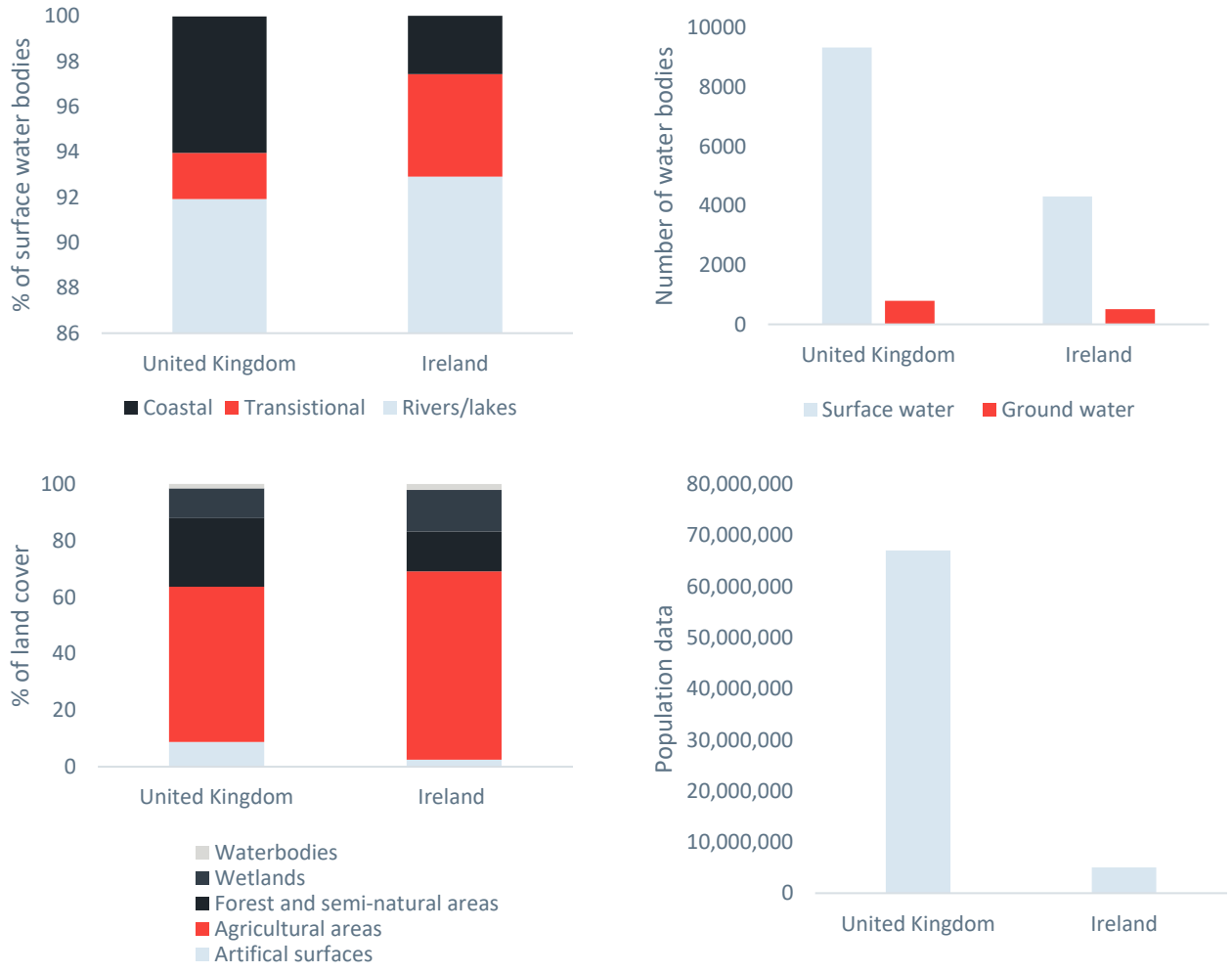
255 EU agricultural policy focus, European Commission. https://ireland.representation.ec.europa.eu/strategy-and-priorities/key-eu-policies-ireland/agriculture-and-rural-development_en#irish-agriculture-facts-and-figures

256 https://www.mdpi.com/2073-4441/14/4/528#B9-water-14-00528

257 Department of Agriculture Environment and Rural Affairs (DAERA). Statistical Review of Northern Ireland Agriculture, 2017; NI DAERA: Belfast, UK, 2018.

258 Central Statistics Office, Farm Structure Survey 2016. https://www.cso.ie/en/releasesandpublications/ep/p-fss/farmstructuresurvey2016/

Figure 3-1 - Country comparison between the Republic of Ireland and the UK (including Northern Ireland) including % of surface water bodies, number of surface water bodies[259], percentage of land cover[260] and population size[261]



Increased Local Involvement

Ireland has been selected as a good example for achievement of change between RBMPs through improved local involvement, public awareness and participation. This increased engagement and local participation has been attributed to a change in water governance structure between RBMP cycles. Ireland has also been selected as an example of good practice for strengthening the science-policy interface through effective use of innovative catchment programmes.

259 Surface and groundwater bodies information, European Environment Agency. https://www.eea.europa.eu/data-and-maps/dashboards/wise-wfd

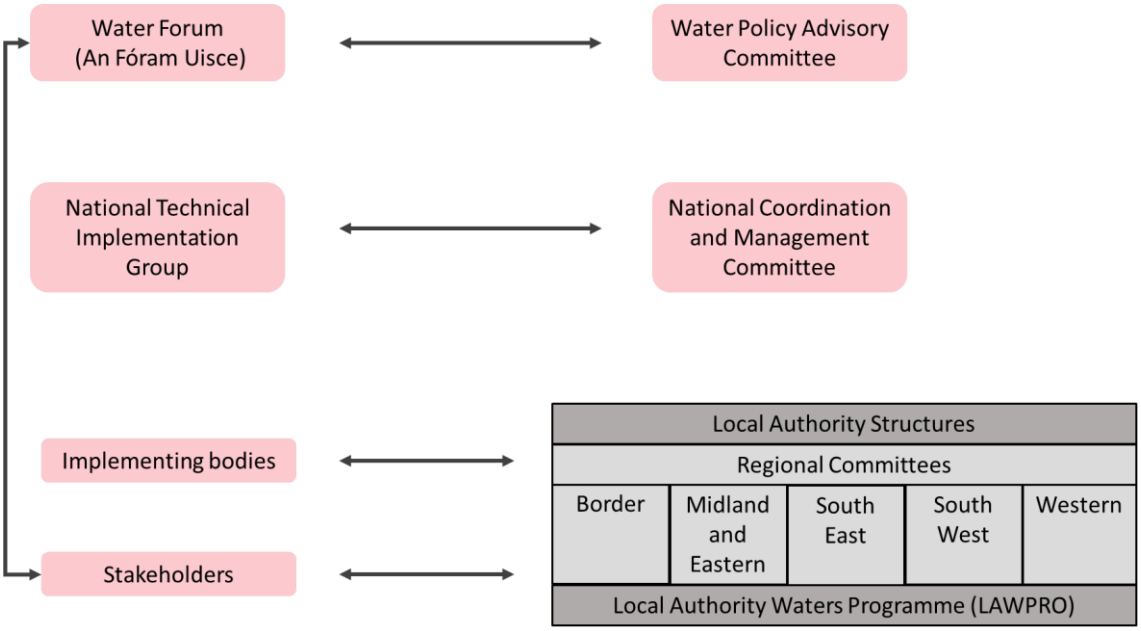
260 % of land cover, European Environment Agency. https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics

261 2022 population data for Member States: Eurostat (https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en). For the UK, 2021 from the Office for National Statistics (https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland)

In the assessment of the 1st cycle RBMPs, the European Commission reported that Ireland had no single body with ultimate responsibility, and that there were fragmented institutional structures, poor intra- and inter-institutional relationships and limited capacity.[262] These factors were considered by the European Commission to undermine the ability to both develop and implement the plans and restrict opportunities for engaging with stakeholders.

In response to the comments made by the European Commission on the governance system put in place for the 1st RBMPs, Ireland established new structures and processes for water governance in the 2018-2021 cycle. This included the development of a new three-tier structure (**Figure 3-2**) which is credited by the Environmental Protection Agency (EPA) to have significantly improved governance arrangements between the two cycles, and to have improved public awareness and participation.

Figure 3-2 - Water governance arrangements under the 2nd RBMP, taken from Boyle et al.[262]



The roles and responsibilities of the different bodies in Figure 3-2 are detailed in Appendix C (Table C-1). The new governance structure has been credited by Antwi et al. 2021 to not only have enhanced central steering, but has also provided opportunities to involve new levels of engagement with local communities, and enhanced collaboration across a range of public bodies.[263] The EPA has credited this increased engagement at the local level to have catalysed new local initiatives that are reported to have resulted in better practice.[265]

[262] Using an Experimental Governance Lens to Examine Governance of the River Basin Management Plan for Ireland 2018–2021. Boyle, R. O'Riordan, J. O'Leary, F. and Shannon, L. Environmental Protection Agency Report. 2021. https://www.epa.ie/publications/research/water/research-373-using-an-experimental-governance-lens-to-examine-governance-of-the-river-basin-management-plan-for-ireland-20182021.php

[263] Antwi, S.H., Linnane, S., Getty, D. and Rolston, A., 2021. River basin management planning in the Republic of Ireland: Past, present and the future. Water, 13(15), p.2074.

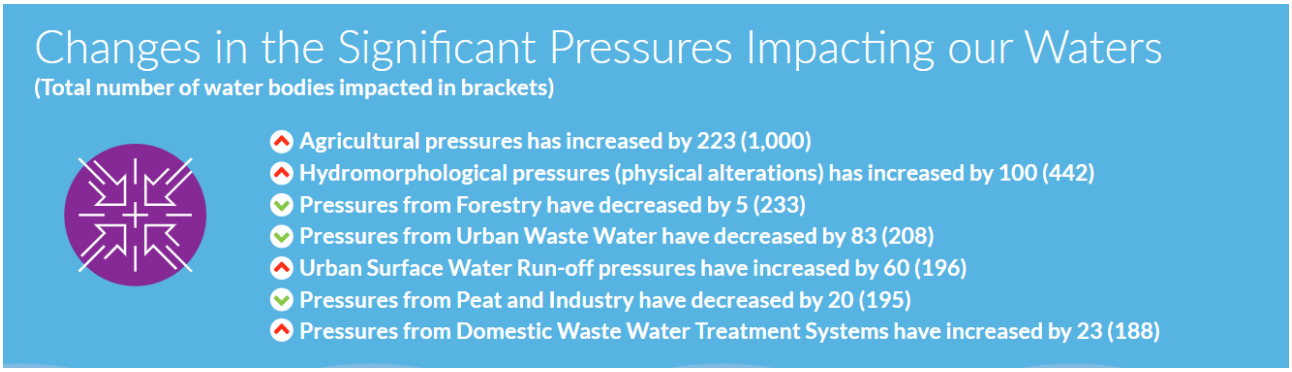
The new structure included the establishment of the Local Authority Waters Programme (LAWPRO) in 2018.[264] LAWPRO has been reported by the EPA to have increased capacity and expertise at the local level.[265] A key element of LAWPRO's stakeholders' engagement role is working with the agricultural sector with the **Agricultural Sustainability Support and Advisory Programme (ASSAP)**. This programme's aims are to promote sustainable agricultural practices in 190 target areas by providing free advice to improve water quality. The EPA report that not only has LAWPRO's involvement in this programme facilitated knowledge sharing, but it has also helped to build capacity and expertise within ASSAP, through regular meetings and joint training.[262]

The three-tier governance structure put in place to support the implementation of the RBMP has been considered in the EPA's assessment to be appropriate, and no radical changes to the governance structure for the 3rd RBMPs is expected.[265]

Innovative Catchment Programmes to Strengthen the Science-Policy Interface

Ireland is an agriculturally intensive country and nutrient pollution poses a particular problem to the water environment. The EPA in Ireland's draft 3rd RBMP have identified that there has been an increase in agricultural pressures (Figure 3-3). Furthermore, diffuse and land-based emissions from the agricultural sector are the primary source of an upward trend in excess levels of nutrients.[266] This trend is noted in particular areas of increased agricultural intensification and higher stocking rates.

Figure 3-3 - Part of an infographic taken from Ireland's draft RBMP 2022-2027[267] describing the change in pressures impacting water bodies since the last cycle



264 Local Authority Waters Programme: https://lawaters.ie/

265 Using an Experimental Governance Lens to Examine Governance of the River Basin Management Plan for Ireland 2018–2021. Boyle, R. O'Riordan, J. O'Leary, F. and Shannon, L. Environmental Protection Agency Report. 2021. https://www.epa.ie/publications/research/water/research-373-using-an-experimental-governance-lens-to-examine-governance-of-the-river-basin-management-plan-for-ireland-20182021.php

266 Draft River Basin Management Plan for Ireland 2022-2027 https://www.gov.ie/pdf/?file=https://assets.gov.ie/199144/7f9320da-ff2e-4a7d-b238-2e179e3bd98a.pdf#page=null

267 Ireland's draft river basin management plan 2022-2027 – The right measure, in the right place. RBMP water infographic with logo - 9b4f7b0d-d5ca-4c7c-b198-e7493717b831.pdf (www.gov.ie)

The **Agricultural Catchments Programme (ACP)** was established by the Republic of Ireland in 2008 in response to various pressures from agriculture. [268] It has been reported here as an example of an innovative programme in strengthening the interface between science and policy. The programme has been used to evaluate the impact of Ireland's Nitrates Action Programme (NAP) and the Nitrates Derogation which are implemented under the Nitrates Directive.[269]

The key objectives of the ACP include measuring the effectiveness of the Good Agricultural Practice programme, evaluating the efficacy of the nitrates derogation, and providing a scientific basis for policy reviews. Since first being established in 2008, the programme has worked with over 300 farmers across six catchments located across the country.[268]

This programme is funded by the Department of Agriculture, Food and the Marine (DAFM) and has been delivered by Teagasc[270] since its inception and is renewed on a four-year basis. The programme takes a whole catchment approach and facilitates an understanding of how nutrients are lost from agricultural sources, and how they can be mobilised and transferred, and how and where they may negatively impact water quality.

The ACP is currently in its 4th phase, running from 2020-2023.[268] Due to its long running nature, the programme is said to have amassed a unique range of environmental data covering soils, groundwater, surface water, weather, ecology, farm practice, farm attitudes, topography and economic returns.

Results from phase 2 (the most recent report published on their website)[271] have found that there is improved water protection against nutrients in the studied catchments, for example, declining soil phosphorus trends in 80% of catchments.[272] Each of the key findings from the phase have a "policy relevance" link, and how this informed change. For example, the low use of Nutrient Management Plans (NMP) was investigated in phase 2. This was done via a survey of both ACP and non-ACP farmers, where it was identified that over half of those interviewed did not have one, due to difficulties in using them in their current format.[273] Following stakeholder engagement, Teagasc developed a new online NMP plan to enable a more flexible and easy-to-use plan.

The current phase (4th phase) has been updated to reflect the increasing need to improve water quality, and to determine attitudes and awareness of farmers to water pollution issues and to emphasise national focal points for agricultural technology and education.[274] A series of key findings to date from the ACP may be found in the Appendix C (Table C-2).

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268 Agricultural Catchments, Teagasc. https://www.teagasc.ie/environment/water-quality/agricultural-catchments/

269 Nitrates Directive: Council Directive 91/676/EEC

270 Teagasc is the state agency providing research, advisory and education in agriculture, horticulture, food and rural development in Ireland.

271 Reports – Agricultural Catchments programme, Teagasc [accessed on 08/06/2022] https://www.teagasc.ie/environment/water-quality/agricultural-catchments/publications/reports/

272 Executive Summary (Phase 2 of the Agricultural Catchments Programme (2012-2015)) Teagasc. https://www.teagasc.ie/media/website/environment/climate-change/water-quality/acp/EXSUM_Dec1.pdf

273 Executive Summary (Phase 2 of the Agricultural Catchments Programme (2012-2015)) Teagasc. https://www.teagasc.ie/media/website/environment/climate-change/water-quality/acp/EXSUM_Dec1.pdf

274 Programme objectives, Agricultural Catchments Programme, Teagasc. https://www.teagasc.ie/environment/water-quality/agricultural-catchments/research/acp-current-objectives/

Ireland's establishment of the ACP has some key elements that the UK could learn from, including a strong grounding in a science-based approach; collaboration with farmers, researchers, and advisors; the selection of representative catchments; continuous monitoring and evaluation; together with knowledge dissemination and information sharing.

Furthermore, early commitment and action to tackle issues are also key. Whilst Ireland continues to have problems with agricultural pressures on water quality, the ACP has allowed for continuous data collection and increased knowledge on agricultural practices and impacts. Fundamental to achieving change is having an understanding of the root issues.

Applicability to England and Northern Ireland

Changes in governance structure to increase local participation

Ireland's transition to a three-tier governance structure in the 2nd RBMPs has reportedly achieved notable success. This revamped governance structure appears to have not only enhanced the central steering mechanism and clearly defined roles for all parties, but also includes a framework for involving new layers of local community engagement. It has also promoted improved collaboration across various public bodies.

Similarly, England also implemented changes to its water governance structure during the 2nd RBMP cycle, with a catchment-based approach to water management.[275,276] In England and Wales, this shift was underscored by the establishment of Catchment Partnerships.[277] Encouraged by national governments, these groups were formed with the intention of organising activities according to local needs.[278] However, it has been noted that WFD implementation in England and Wales is "top-down",[279] with the main role in the development of the RBMPs and the programmes of measures (PoM) which is primarily led by the Environment Agency.[280]

Furthermore, a comparative assessment of different governance structures and stakeholder participation for RBMPs by Pellegrini et al. revealed that both England and Wales were evaluated as having low performance in terms of representation and information flow.[281] This was even after the shift to the catchment-based approach in the 2nd RBMPs. This has been attributed to the voluntary nature of the Catchment Partnerships. For instance, the Thames catchment is managed by a non-

275 Catchment Based Approach: Improving the Quality of Our Water Environment. A Policy Framework to Encourage the Wider Adoption of an Integrated Catchment Based Approach to Improving the Quality of Our Water Environment; DEFRA, UK, 2013. https://www.gov.uk/government/publications/catchment-based-approach-improving-the-quality-of-our-water-environment

276 Pellegrini, E., Bortolini, L. and Defrancesco, E., 2019. Coordination and Participation Boards under the European Water Framework Directive: Different approaches used in some EU countries. Water, 11(4), p.833.

277 About the catchment based approach: https://catchmentbasedapproach.org/about/

278 Fritsch, O., 2019. Participatory water governance and organisational change: Implementing the Water Framework Directive in England and Wales. Water, 11(5), p.996. https://www.mdpi.com/2073-4441/11/5/996

279 Rollason, E., Bracken, L.J., Hardy, R.J. and Large, A.R.G., 2018. Evaluating the success of public participation in integrated catchment management. Journal of Environmental Management, 228, pp.267-278.

280 Pellegrini, E., Bortolini, L. and Defrancesco, E., 2019. Coordination and Participation Boards under the European Water Framework Directive: Different approaches used in some EU countries. Water, 11(4), p.833.

281 Pellegrini, E., Bortolini, L. and Defrancesco, E., 2019. Coordination and Participation Boards under the European Water Framework Directive: Different approaches used in some EU countries. Water, 11(4), p.833.

profit charity, and because their activities are volunteer based, there might be limitations in representation.[282]

Another analysis on implementation of the WFD and tackling agricultural pollution in England suggested that participatory approaches largely depended on existing consultation procedures.[283] These were highlighted as neither sufficiently extensive nor intensive to build a genuine partnership based on trust among the regulator, the farming sector, and environmental non-government organisations (NGOs). A move was made to establish a UK-wide dedicated governance structure through the formation of a technical and expert group, known as UKTAG[284], chaired by the Environment Agency and comprising representatives from all environment and conservation agencies, including Natural England. However, this organisation primarily serves to provide technical advice, rather than supporting wider participation and consultation as the ACP does.

For Northern Ireland, the Water Catchment Partnership (WCP) was established in 2013 to address water quality issues in Northern Ireland. This programme involves representatives from Northern Ireland Water, the Ulster Farmers Union, the Northern Ireland Environment Agency and the Department of Agriculture, Environment and Rural Affairs (DAERA).[285] However, the WCP has a specific focus on pesticide pollution, and there does not appear to be other goals related to water quality issues.

DAERA recently published the Future Agricultural Policy Decisions for Northern Ireland[286] which summarises how farming will be funded and responses from the consultation period on the proposal. This included the Farming with Nature Package, that was proposed by DAERA to support farmers across all land types to make improvements to the environment and sustainability. One of the key principles has been highlighted as collaborative participation, and where possible participants in schemes will be incentivised to work collaboratively with other farmers with assistance from facilitators and advisors. DAERA have reported that the Farming with Nature Package will be developed with stakeholders and in line with the principles that were highlighted in the consultation documents.[287]

282 Euler, J. and Heldt, S., 2018. From information to participation and self-organization: Visions for European river basin management. Science of the Total Environment, 621, pp.905-914.

283 De Vito, L., Fairbrother, M. and Russel, D., 2020. Implementing the Water Framework Directive and tackling diffuse pollution from agriculture: Lessons from England and Scotland. Water, 12(1), p.244.

284 Water Framework Directive UK Tag - http://www.wfduk.org/

285 About your water – who's involved in the Water Catchment Partnership, Northern Ireland Water. Available at: https://www.niwater.com/the-water-catchment-partnership/#:~:text=The%20Water%20Catchment%20Partnership%20%28WCP%29%20was%20established%20in,Water%20Ulster%20Farmers%20Union%20Northern%20Ireland%20Environment%20Agency

286 Future Agricultural Policy Decisions for Northern Ireland, DAERA, 2023. Available at: https://www.daera-ni.gov.uk/publications/future-agricultural-policy-decisions-northern-ireland

287 Future Agricultural Policy for Northern Ireland, DAERA, 2022. Available at: https://www.daera-ni.gov.uk/news/future-agricultural-policy-northern-ireland

There could therefore be an opportunity for the UK's devolved nations governments to address policy disconnects between various agricultural programmes and the WFD, and to give more power to catchment-based programmes to influence water management processes.[288,289] Thereby strengthening local involvement and implanting a more "bottom-up" approach to water management.

Catchment programmes

Like Ireland, the UK also experiences significant agricultural pressures. This has led to the adoption of programmes such as the Catchment Sensitive Farming, the Countryside Stewardship and Environmental Stewardship schemes, and the First Milk Nutrient Offsetting Project.

These programmes do differ notably from Ireland's Agricultural Catchments Programme (ACP). For instance, the Catchment Sensitive Farming programme[290], established in England in 2006, mainly offers advice and support to farmers. Unlike the ACP, it does not engage in extensive data collection, instead relying on existing data to inform its advisory services.

In comparison, a key strength and uniqueness of the ACP has been in the long-term and high frequency monitoring of the programme. Ireland's decision to launch the ACP in 2008 showed an early dedication to not only tackle diffuse agricultural pollution sources but also to deepen understanding of how nutrients are lost from agricultural sources, and their fate and impact in the environment. This programme has published over 100 scientific peer-reviewed papers to date.[291]

This proactive stance has resulted in an in-depth understanding of the effects of farming practices on Ireland's water bodies (table in Appendix C of the results), which is critical for achieving effective change and targeting measures more effectively.

3.2 The Netherlands

Contextual Information

The Netherlands is a country in North Western Europe, characterised by low-lying and flat terrain, with numerous rivers and lakes.[292] It is a densely populated country, with an estimated 17,590,672 million inhabitants in 2022.[293] About 66% of the land in the Netherlands is used for agricultural purposes, consisting of approximately 51,000 farms (with an average farm size of 32 hectares).[294]

288 De Vito, L., Fairbrother, M. and Russel, D., 2020. Implementing the Water Framework Directive and tackling diffuse pollution from agriculture: Lessons from England and Scotland. Water, 12(1), p.244.

289 Graversgaard, M., Hedelin, B., Smith, L., Gertz, F., Højberg, A.L., Langford, J., Martinez, G., Mostert, E., Ptak, E., Peterson, H. and Stelljes, N., 2018. Opportunities and barriers for water co-governance—A critical analysis of seven cases of diffuse water pollution from agriculture in Europe, Australia and North America. Sustainability, 10(5), p.1634.

290 Catchment Sensitive Farming: advice for farmers and land managers. https://www.gov.uk/guidance/catchment-sensitive-farming-reduce-agricultural-water-pollution

291 Agricultural Catchment Programmes – Publications, Teagasc. https://www.teagasc.ie/environment/water-quality/agricultural-catchments/publications/

292 Netherlands, country profile. https://www.countryreports.org/country/Netherlands/geography.htm

293 2022 population data for Member States: Eurostat. https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en

294 At a glance – the Netherlands' CAP strategic plan. European Commission. https://agriculture.ec.europa.eu/system/files/2023-04/csp-at-a-glance-netherlands_en.pdf

The Netherlands includes four RBDs: the Rhine, the Meuse, the Scheldt and the Ems. All four are international river basins. The high densities of both population and economic activities (such as agriculture) have led to significant environmental pressures. Environmental issues in the Netherlands have a strong international dimension (due to the international nature of its RBDs) and it has high vulnerability to climate change and sea level rise.[295]

Figure 3-4 - Country comparison with the Netherlands and the UK including % of surface water bodies, number of surface water bodies[296], percentage of land cover[297] and population size[298]

295 Environmental Performance Review of the Netherlands – Executive Summary. The OECD Environmental Programme. https://www.oecd.org/environment/country-reviews/2958654.pdf

296 Surface and groundwater bodies information, European Environment Agency: https://www.eea.europa.eu/data-and-maps/dashboards/wise-wfd

297 % of land cover, European Environment Agency: https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics

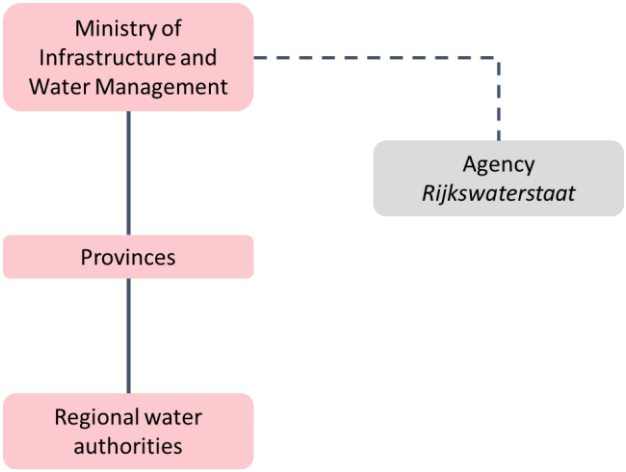
298 2022 population data for Member States: Eurostat (https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en). For the UK, 2021 from the Office for National Statistics (https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland)

Governance (Internal Communication) and Synergies of Policy/PoMs

Effective governance and internal communication are critical for implementation of the WFD for several reasons. This includes increased transparency and trust, increased awareness and education and to allow inclusive decision making. The Netherlands demonstrate good practice in this area associated with coordination between different authorities that has led to accessible and detailed information being provided and reported.

Governance takes place at the national, provincial, regional and municipality level in the Netherlands and each of these authorities have different roles and responsibilities. The Netherlands is a decentralised unitary state and there are four kinds of administrative bodies responsible for water quality policy (Figure 3-5).[299]

Figure 3-5 - Administrative structure of the Netherlands with regard to water quality, adapted from Squintani et al.[300]



The Netherlands reported separate plans for the 2nd RBMP that included the National Water Plan 2016-2021; the Plans of the Regional Water Authorities 2016-2021, the Water Management and Development Plan for the Dutch Main Water System, and regional water plans for each province. The Netherlands 3rd RBMP reported the following separate plans: the National Water Programme 2022-2027; the Plans of the Regional Water Authorities 2022-2027 and regional water plans for each province.

The different authorities and resultant separate plans present a seemingly complex system, however as explained in the 2nd RBMP, there is a clear purpose as well as an overarching coordination mechanism. Following the 1st RBMPs, the European Commission requested that the Netherlands provide transparent information to allow for an understanding of the coordination mechanisms between the different authorities. As a result, in the 2nd RBMPs further information was provided that explained the different responsibilities of each authority in terms of WFD implementation which occurs at their respective levels. Overarching coordination between the authorities and their

299 Squintani, L., Plambeck, E. and Van Rijswick, M., 2017. Strengths and weaknesses of the Dutch implementation of the water framework directive. Journal for European Environmental & Planning Law, 14(3-4), pp.269-293.

300 Squintani, L., Plambeck, E. and Van Rijswick, M., 2017. Strengths and weaknesses of the Dutch implementation of the water framework directive. Journal for European Environmental & Planning Law, 14(3-4), pp.269-293.

respective responsibilities occurs through the Water Steering Group which is chaired by the Ministry of Infrastructure and Water Management. The group includes representatives from the different authorities with clear roles allocated to each. Furthermore, the consultation covered the draft RBMPs of the national, provincial and water board plans as well as detailed factsheets for each waterbody. For example, it outlines that there are 21 regional water authorities in the Netherlands which each have the responsibility to monitor and assess the status of surface water, pressure and impact analysis, enforcement of regulations, public participation, implementation of measures and coordination of implementation.

This shows a clear example of division of tasks to ensure they are carried out at the appropriate level (e.g. regional or local), provision of detailed and accessible information and coordination between different authorities through the Water Steering Group.[301] As a country in which 55% of the land is flood prone or below sea level, the Netherlands is seen to have developed a strong economy and water industry and governance has been reported to play a key role in this success. An OECD report outlines that this success is as a result of advanced 'natural infrastructure' that has been developed through a system of water governance combining the functions of the different authorities and engaging stakeholders in a way that focuses on consensus-based decision making.[302]

Relevance to England and Northern Ireland

Due to the close geographic proximity of the Netherlands to the UK, both have similar temperate climates. Furthermore, the Netherlands and the UK display a similar percentage of agricultural land coverage, 60% and 55% respectively (Figure 3-4). A difference between the two is that whilst the Netherlands is mostly flat, the UK has a more diverse topography.[303,304]

In the 2nd RBMPs, the Netherlands improved the transparency of the coordination mechanisms between the different authorities and reported detailed and accessible information at the different levels (such as fact sheets on each water body). This is relevant for both England and Northern Ireland. For example, one of the key findings of England's RBMPs in the parallel OEP project[305] is about the accessibility of information. For Northern Ireland, the 3rd RBMPs are still in draft form and water body specific information is currently lacking, for example a full breakdown of objectives data is not currently available.[306]

For example, some of the information contained in England's RBMPs is aggregated at a high level. This includes the 2022 progress report, a section of the RBMPs which provides a summary of what has occurred since the last update in 2015 and is the same for all RBDs rather than being RBD specific.[307] This makes it difficult to understand trends and progress at the RBD level. The Netherlands example shows that having clear and transparent coordination of authorities has led to

301 European Commission assessment report, the Netherlands, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:50:FIN&qid=1551205988853&from=EN

302 Water governance in the Netherlands – fit for the future? OECD studies on water, 2014. https://read.oecd-ilibrary.org/governance/water-governance-in-the-netherlands_9789264102637-en#page1

303 Netherlands geography, country profile. https://www.countryreports.org/country/Netherlands/geography.htm

304 United Kingdom geography, country profile. https://www.countryreports.org/country/UnitedKingdom/geography.htm

305 The review of the 3rd RBMPs for England and Northern Ireland.

306 Northern Ireland Environment Agency 2021. Draft 3rd cycle River Basin Management Plan: For the North Western, Neagh Bann and North Eastern River Basin Districts (2021 – 2027). Available at: https://www.daerani.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

307 River basin management plans, updated 2022: progress report - GOV.UK (www.gov.uk)

improved reporting and accessibility of information. This in turn leads to a greater understanding of progress at a detailed level.

Synergies of Polices/PoMS

The European Commission's assessment of the Netherlands 2nd RBMPs noted that co-ordination of the preparation of all RBMPs and PoM with the Marine Strategy Framework Directive (MSFD) had taken place in all four RBDs.[308] Joint consultation was also held between the MSFD and the RBMPs. The assessment also noted that while Floods' Directive Flood Risk Management Plans (FRMPs) the processes had been coordinated with:

- Joint consultations of RBMPs and FRMPs;
- Consideration of objectives and requirements of the Floods Directive in the 2nd RBMPs PoMs;
- Win-win measures in terms of achieving the objectives of the WFD and Floods Directive;
- The design of new and existing structural measures (e.g. flood defences) adapted to take account of the WFD environmental objectives;
- Financial commitments for the implementation of the PoM in flood protection areas; and
- The application of WFD Article 9(4) to impoundment for flood protection.[309]

The synergies with other legislation, in particular floods legislation, are particularly important due to the Netherlands' geographic position and its exposure to risks of flooding. It is worth noting that the Netherlands' approach to flood defences are generally considered as being advanced.[310] For example, the Meuse River flows through France, Belgium and Netherlands, and reached record high water levels in 2021.The Netherlands' approach to water management and prior efforts to reduce flood risk were deemed to reduce the impacts of the flood in comparison to the other countries.[311]

Applicability to England and Northern Ireland

Regarding the MSFD, it was highlighted in the 2nd RBMPs that a joint consultation had been carried out on the RBMPs and the Marine Strategy for England and Wales, and that the preparation of the RBMP and PoMs have been coordinated with the MSFD. However, for the Scotland RBD, coordination with the MSFD was reported to not have taken place and for the Solway Tweed RBD and the three Northern Ireland RBDs (Neagh Bann, North Western and North Eastern) some coordination only happened during the preparation stages of the RBMP and PoMs (i.e. no joint consultation).

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308 European Commission assessment report, Netherlands, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:50:FIN&qid=1551205988853&from=EN

309 Article 9(4) provides an exception to the principle of cost recovery for water services under certain conditions. Impoundment for flood protection refers to the development of structures to hold back water (e.g. reservoirs) to prevent flooding from nearby areas

310 Squintani, L., Plambeck, E., & van Rijswick, M. (2017). Strengths and Weaknesses of the Dutch Implementation of the Water Framework Directive, *Journal for European Environmental & Planning Law*, *14*(3-4), 269-293. doi**: https://doi.org/10.1163/18760104-01403002**

311 CNBC, 2021. What the Dutch can teach the world about flood preparedness. Available at: https://www.cnbc.com/2021/07/30/europe-floods-what-the-dutch-can-teach-the-world-about-preparedness.html#:~:text=Parts%20of%20Switzerland%2C%20France%2C%20Luxembourg%20and%20the%20Netherlands,Netherlands%20was%20not%20the%20same%20as%20seen%20elsewhere [Accessed 25/06/2023].

The UK Marine Strategy is a framework for delivering marine policy at the UK level. Part 3 of this strategy is focused on the PoMs to achieve or maintain good ecological status. Defra published a summary of responses from a consultation process regarding the "Marine Strategy Part Three: UK programme of measures".[312] The summary of responses highlighted issues raised on the clarity of links between the MFSD and the WFD, with some respondents calling for greater clarity and guidance on the links between the MFSD and WFD including:

- The need to provide guidance to marine users on the implications of the MSFD PoMs where the WFD and MSFD overlap in coastal waters; and
- The need to provide clarity on the links between MSFD measures and those in the WFD RBMPs.

An updated version of the UK Marine Strategy part 3 was out for consultation in 2021, the analysis of this feedback was due to be published in 2022.[313] This however has not been the case and no recent update on when results from this consultation are expected have been specified.

In England's 3rd RBMPs cycle there are stronger links between the implementation of the MSFD and WFD, but in Northern Ireland these are less apparent. The UK, similar to the Netherlands, had not combined the Flood Risk Management Plans with the RBMPs into one single integrated plan. Joint consultations were carried out on the RBMPs and FRMP in 10 of the 15 RBDs (those in England and Wales). It was stated that for those 10 of the 15 RBDs, that a clear financial commitment has been secured for the implementation of the PoM in the flood protection sector. Implementing related legislation more closely could help the UK developing more synergistic PoMs and support identification and implementation of win-win measures.

3.3 Germany

Contextual Information

Germany is a country in western Europe with a temperate climate and has diverse landscapes, including flat lowlands to mountains.[314] It includes a number of major rivers and lakes, including transboundary rivers (such as the Rhine, Danube, Elbe, Meuse, Ems and Oder[315]) which span multiple countries in Europe. As such this requires Germany's participation in international water management commissions such as the Rhine[316], Danube[317], and Oder[318].

312 Marine Strategy Part Three: UK programme of measures – summary of responses. 2015. Defra. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/486624/marine-strategy-part3-consult-sum-resp.pdf

313 Closed consultation: Marine strategy part three: programme of measures. Defra. Last updated 4 August 2022. Available at https://www.gov.uk/government/consultations/marine-strategy-part-three-programme-of-measures [Accessed 20/06/2023]

314 Germany geography, country profile. https://www.countryreports.org/country/Germany/geography.htm

315 Transboundary water cooperation into practice: example of the German experience. Sub-regional workshop. 2017. https://unece.org/fileadmin/DAM/env/documents/2017/WAT/12Dec_20-21_TunisWS/3.2_Germany_Jekel_German_experience_cooperation.pdf

316 Central Commission for the Navigation of the Rhine. https://www.ccr-zkr.org/

317 Danube Commission. https://www.danubecommission.org/dc/en/

318 International Commission for the Protection of the Odra River against Pollution. http://www.mkoo.pl/index.php?mid=1&lang=EN

Germany has one of the highest populations in Europe - estimated at 83,237,124 million inhabitants in 2022.[319]

Germany is also one of the leading industrialised countries when it comes to production, recording the highest value of sold commodities (the equivalent of 27% of the EU total).[320] German production includes a strong agricultural presence, with 56% of the total land cover dedicated to agricultural land (Figure 3-4).

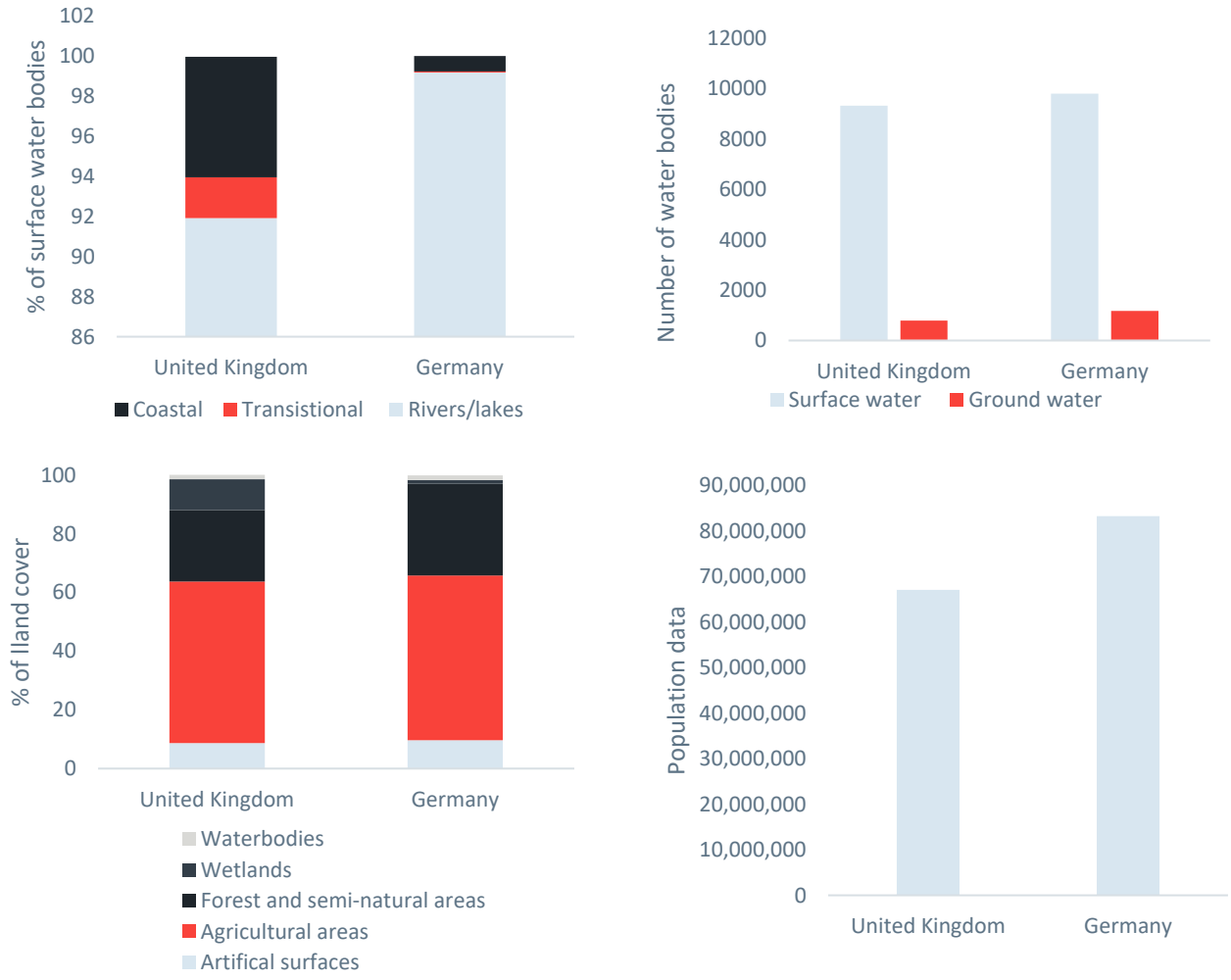
The key pressures therefore on Germany's water environment include industrial and agricultural emissions, but also wastewater and hydromorphological pressures.[321] Furthermore, for transboundary waters, in the majority of cases Germany lies at the lower end of the reach, receiving waters from neighbouring countries, again highlighting the importance of co-operation and monitoring of waters to determine chemical pressures and where interventions may be necessary.

319 2022 population data for Member States: Eurostat https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en

320 Eurostat 2022. Industrial production statistics. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Industrial_production_statistics#Industrial_production_by_country

321 European Commission assessment report, Germany, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:41:FIN&qid=1551205988853&from=EN

Figure 3-6 - Country comparison with Germany and the UK including % of surface water bodies, number of surface water bodies[322], percentage of land cover[323] and population size[324]



Approach to Assessing Chemical Status

Environmental quality standards

Germany has been identified as an example of good practice regarding its **approach to assessing chemical status**, more specifically the use of revised stricter environmental quality standards (EQS) and the increase in monitoring between the 1st and 2nd RBMPs (which increased confidence in status classification and risk characterisation across the river basin districts).

322 Surface and groundwater bodies information: https://www.eea.europa.eu/data-and-maps/dashboards/wise-wfd

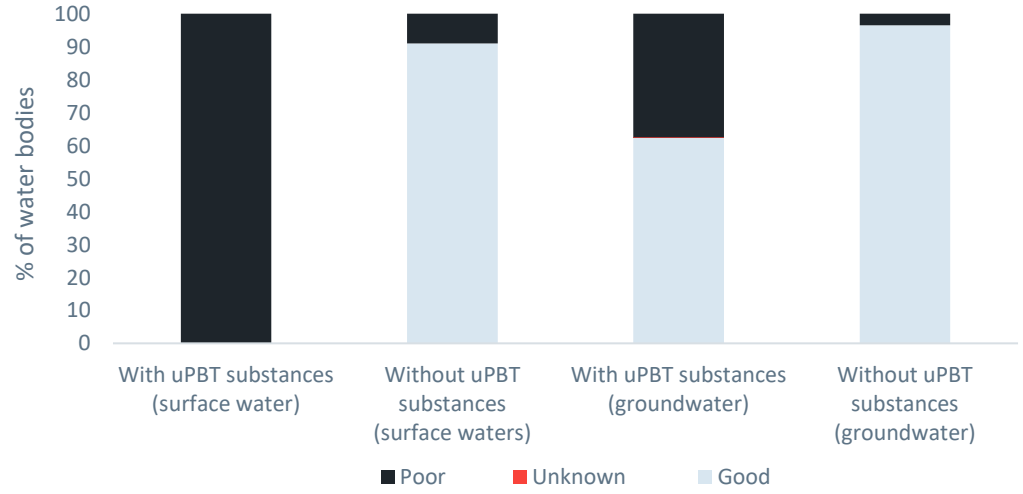
323 % of land cover: https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics

324 2022 population data for Member States: Eurostat (https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en). For the UK, 2021 from the Office for National Statistics (https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland)

Based on the 45 priority substances (33 from the original 2008 EQSD and a further 12 added in 2013), it has been recognised across Europe as a whole that a small number of substances cause the high majority of poor chemical status. In particular this can relate to what are termed ubiquitous persistent, bio accumulative, and toxic (uPBT) substances where options for programs of measures are particularly limited. For greater clarity in the potential risks and measures many Member States are now reporting data twice (full data-set, and data minus uPBT substances). This helps provide further clarity on the priority substances responsible for poor chemical status[325].

Germany has followed this approach of reporting the full data-set and the data of minus uPBT substances. In this case, the failures associated with uPBTs is largely attributed to mercury. However, excluding uPBTs Germany reports 91% of its water bodies with good chemical status (**Figure 3-7**).

Figure 3-7 - The percentage of water bodies in Germany with good, poor or unknown chemical status. Results show both the inclusion and exclusion of uPBTs in both surface and groundwater



According to the WFD 2016 reporting guidance, Member States should have reported chemical status for 2015 using the EQS laid out in the Directive 2008/105/EC. However, some Member States reported it using the stricter standards in the 2013 Priority Substances Directive.[326]

Germany was one of the Member States that used the revised EQS in the assessment of the 2nd RBMPs which are stricter that the 2008 Directive.[327] Only a small number of Member States used the revised EQS (Box 1). The majority of Member States in the 2nd RBMPs, including the UK, used the older EQS.

325 Note that exceeding the EQS thresholds denotes a potential chemical risk for water bodies. It does not define an impact, scale of the impact, or how the impact manifests. This is why the use of chemical and ecological status is important. Presenting data with and without uPBTs helps present the nature of the risk in different ways.

326 Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:226:0001:0017:en:PDF

327 More stringent environmental quality standards were set for seven substances anthracene, brominated diphenylether, fluoranthene, lead and its compounds, naphthalene, nickel and its compounds, polyaromatic hydrocarbons (PAH)

Box 1: Other Member States that used the revised EQS in the 2nd RBMPs

- The Netherlands

In the Netherlands 2nd RBMP a major contributor to the significant difference between the proportion of good status water bodies since the 1st RBMP was attributed to the application of the revised EQS. By applying the new standards, deterioration was observed for 11% of water bodies due to fluoranthene, and for 5% of water bodies associated with nickel.

- Sweden

Sweden has used the environmental quality standards from the revised Environmental Quality Standards Directive (EQS Directive) (2013/39/EU) as the basis for the assessment of chemical status for 33 Priority Substances in the 2nd RBMP. For the remaining eight Priority Substances, Sweden reported that alternative and/or additional standards have been applied.

Monitoring

Germany reported an increase in monitoring efforts between the 1st and 2nd RBMPs, with a net increase in the number of sites and water bodies for both operational and surveillance monitoring[328] between the two cycles. For operational monitoring of surface water bodies there was an increase of 5,038 sites and 3,270 water bodies covered by increased river monitoring. For surveillance monitoring, the number of sites has increased by 195 and the number of water bodies has increased by 57 since the 1st cycle.

Due to a combination of increased monitoring, expert judgement and grouping, the confidence in chemical status for Germany's results is high, with 80% of water bodies being classified with high confidence with regards to chemical status, 28% with medium confidence and only 2% with low confidence.[329]

Germany has also taken an approach of extrapolation of monitoring results, as mercury was found in all monitoring samples exceeding the EQS. This has led to an extrapolated result of 'failing to achieve good' to all surface water bodies.

Applicability to England and Northern Ireland

Germany is one of the most densely populated and urbanised nations in Europe, and similarly to the UK it display diverse geographic landscapes.[330] Other similarities with the UK include a similar number of surface water bodies (Germany: 9808, UK: 9328), with Germany having more groundwater bodies (1177) than the UK (790) (Figure 3-6). The two also have a similar breakdown of land cover, with agriculture making up 56% and 55% of Germany and the UK respectively. Germany has slightly more forest cover than the UK (31% versus 24%).

Regarding the approach to assessing chemical status, Germany and the UK have taken different routes (Table 3-1).

328 Two types of water quality monitoring are used in the context of the WFD 1) Surveillance monitoring, this involves regular monitoring of water quality to assess status and trends of water bodies 2) Operational monitoring, this tends to be focused on monitoring specific water quality parameters that can inform water treatment processes are operating correctly.

329 Confidence has been defined in the CIS reporting Guidance No 35 as low (no monitoring); medium (limited or insufficiently robust monitoring data); and high (good monitoring data and understanding of the system). http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm

330 Germany geography, country profile. https://www.countryreports.org/country/Germany/geography.htm

Table 3-1 - Comparison in approaches to chemical status reporting between the UK and Germany from the 2nd RBMPs, table adapted from the EEA[331]

Country	With uPBTs	Without uPBTs	Approach taken	Other countries taking a similar approach
Germany	Wide-spread failure to achieve good chemical status (100%)	Few failures to achieve good chemical status	Extrapolation of monitoring results	Austria, Belgium, Finland, Luxembourg, Malta, Slovenia, Sweden
UK	Widespread good chemical status	Widespread good chemical status	Extrapolation not widely applied: status shows confirmed status only	Croatia, Cyprus, France, Italy, Poland, Romania, Slovakia, Spain

Germany used an approach of extrapolating results from monitored water bodies to unmonitored water bodies. Due to the levels of mercury in the monitored water bodies, this resulted in wide-spread failure in chemical status. The UK as a whole however did not report extrapolated results in the 2nd RBMPs.[332] For England, Scotland and Wales, a risk assessment was undertaken to establish any potential risks to water bodies. Water bodies that did not have any identified risks were classified with good chemical status, but with low confidence (Northern Ireland instead classified unmonitored water bodies as unknown status). This risk assessment is one based on the potential pressures and would be used to identify if there are any predicted risks from Priority Substances.[333] If there are no predicted risk, the water body would be assigned as "good" status but with low confidence.

It is mentioned in the UK's 2nd RBMPs that these risk assessments may have included investigatory monitoring and modelling to assess the potential risks to a water body. Risk assessments on water bodies should have been done to any water bodies that were not a part of the monitoring programme in the 2nd RBMPs.

Regarding the 3rd RBMPs, the Environment Agency have said that their approach to chemical status for England and Wales has changed since 2015, and that a more advanced approach is used.[334] This has led to a wide-spread failure regarding chemical status in the 3rd RBMPs. It is mentioned that with uPBTs in biota, the Environment Agency has extrapolated the data to represent a more extensive geographical area for classification.[334] It is not clear on this site whether the same approach is undertaken with water samples.

331 European waters - Assessment of status and pressures 2018. EEA Report No 7/2018. https://www.eea.europa.eu/publications/state-of-water

332 European Commission assessment report, United Kingdom, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

333 European Commission assessment report, United Kingdom, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:58:FIN&qid=1551205988853&from=EN

334 River basin planning process overview – Defining and describing the water environment. Environment Agency. Last updated 30 March 2023. Available at: https://www.gov.uk/guidance/river-basin-planning-process-overview/3-defining-and-describing-the-water-environment

Northern Ireland's 3rd RBMP reported that 93% of water bodies are classified as good chemical status excluding uPBT substances and cypermethrin.[335,336] When uPBT substances and cypermethrin are included, all water bodies fail. Northern Ireland Environment Agency states that the monitoring of uPBTs occurs in both the water column and in biota. It is mentioned that biota samples are only collected at selected surface water monitoring stations. As uPBT substances have been detected at all monitored stations and resulted in failures, this has been extrapolated to all surface water bodies across Northern Ireland.[337]

Furthermore, there were differences in the extent of monitoring done in each country. In the 2nd RBMPs, the proportion of sites used for monitoring of chemical status differed significantly for the UK and Germany. For the UK only 16%, 2%, 3% and 8% of the total monitoring sites are used for the monitoring of chemical status in lakes, rivers, transitional and coastal waters respectively. This is in comparison to Germany where 65%, 43%, 20% and 64% of the total monitoring sites are used for the monitoring of chemical status in lakes, rivers, transitional and coastal waters respectively (Figure 3-8).

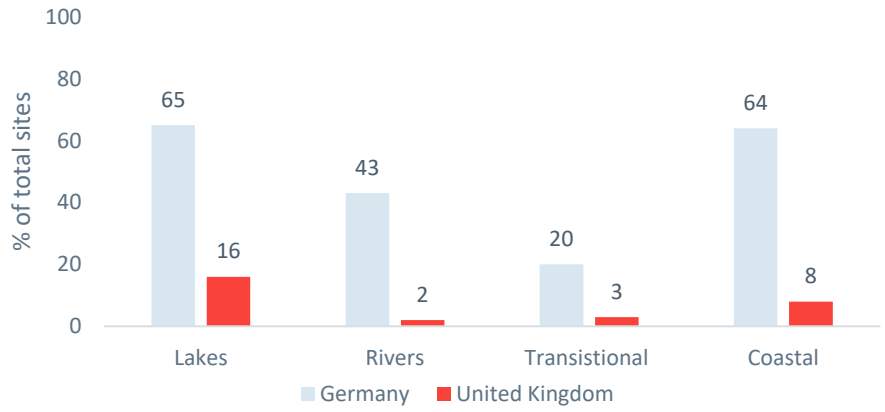
Germany in general also monitored a higher proportion of water bodies for chemical status in the 2nd RBMPs than the UK (Figure 3-8).

335 Northern Ireland Environment Agency, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf

336 A substance previously used as an insecticide.

337 Northern Ireland Environment Agency, 2021. Water Framework Directive Statistics Report. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%20Report%202021.pdf

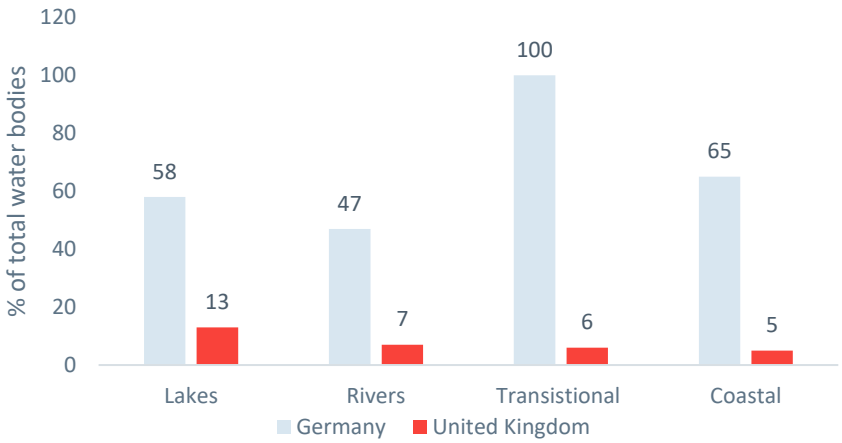
Figure 3-8 - Proportion of monitoring sites in percentages (%) used for chemical status in the UK and Germany



Country	Number of monitoring sites used for chemical status (number in brackets is the total number of monitoring sites irrespective of purpose in each category)			
	Lakes	Rivers	Transitional	Coastal
Germany	615 (946)	6652 (15470)	11 (56)	101 (158)
UK	135 (845)	450 (22484)	24 (811)	65 (813)

Note: The table below shows the absolute number of monitoring sites (the number in brackets represents the total number of monitoring sites irrespective of their purpose).

Figure 3-9 - Proportion of total water bodies in each category which are monitored for chemical status in the UK and Germany



Country	Total number of water bodies monitored for chemical status (number in brackets is the total number of water bodies in each category)			
	Lakes	Rivers	Transitional	Coastal
Germany	423 (730)	4,229 (8998)	5 (5)	49 (75)
United Kingdom	139 (1068)	525 (7506)	11 (190)	28 (561)

Note: The table below shows the absolute number of water bodies monitored for chemical status (the number in brackets represents the total number of water bodies in each category). No distinction is made between sites used for surveillance and/or operational monitoring

As a likely result of these monitoring differences, the UK had much lower classification confidence in comparison to Germany. The UK's 2nd RBMP reported that 85% of water bodies chemical classification had low confidence (in comparison to Germany's 80% high confidence) across its surface water bodies. Regarding the UK's 3rd RBMP, there is currently limited information on the confidence of status assessments in this cycle, so it could not be determined in this study if confidence levels have improved or not.

Whilst Germany reported wide-spread failure of chemical status in its 2nd RBMP, there is demonstration of good practice in the approach and methodology to assessing this status. In particular with regards to the standards used and the monitoring approach. Germany has significantly improved on its monitoring and confidence in chemical status since the 1st RBMP. Furthermore, is has also applied the more stringent revised EQS standards for the assessment of the 2nd RBMPs.

Key takeaways for the UK could be to increase monitoring efforts, which in turn could help increase confidence in chemical status results. Regarding use of EQS, both England[338] and Northern Ireland[339] have reportedly used the revised EQS in the 3rd RBMPs.

3.4 Denmark

Contextual Information

Denmark is a country in Northern Europe with a temperate climate. It covers an area of 43,100 km^2 and consists of flat, arable land and sandy coastlines. Denmark is located between the North Sea and the Baltic Sea.

Denmark has a large intensive agricultural sector, with over 60% of land in Denmark dedicated to agricultural activities. Denmark is the only country in the Nordic-Baltic region that is a net exporter of agricultural products. The estimated population of Denmark is 5,873,420 million inhabitants in 2022, but the food production is reportedly high enough to feed 15 million people[340] (producing almost 3x the amount of food it needs for self-sufficiency).

Due to the intensive agricultural activities in Denmark, diffuse pollution from agriculture is a significant contributor to nutrient pollution in the environment (e.g. 98% of coastal water bodies and 30% of lake water bodies are affected by agricultural pollution).[341]

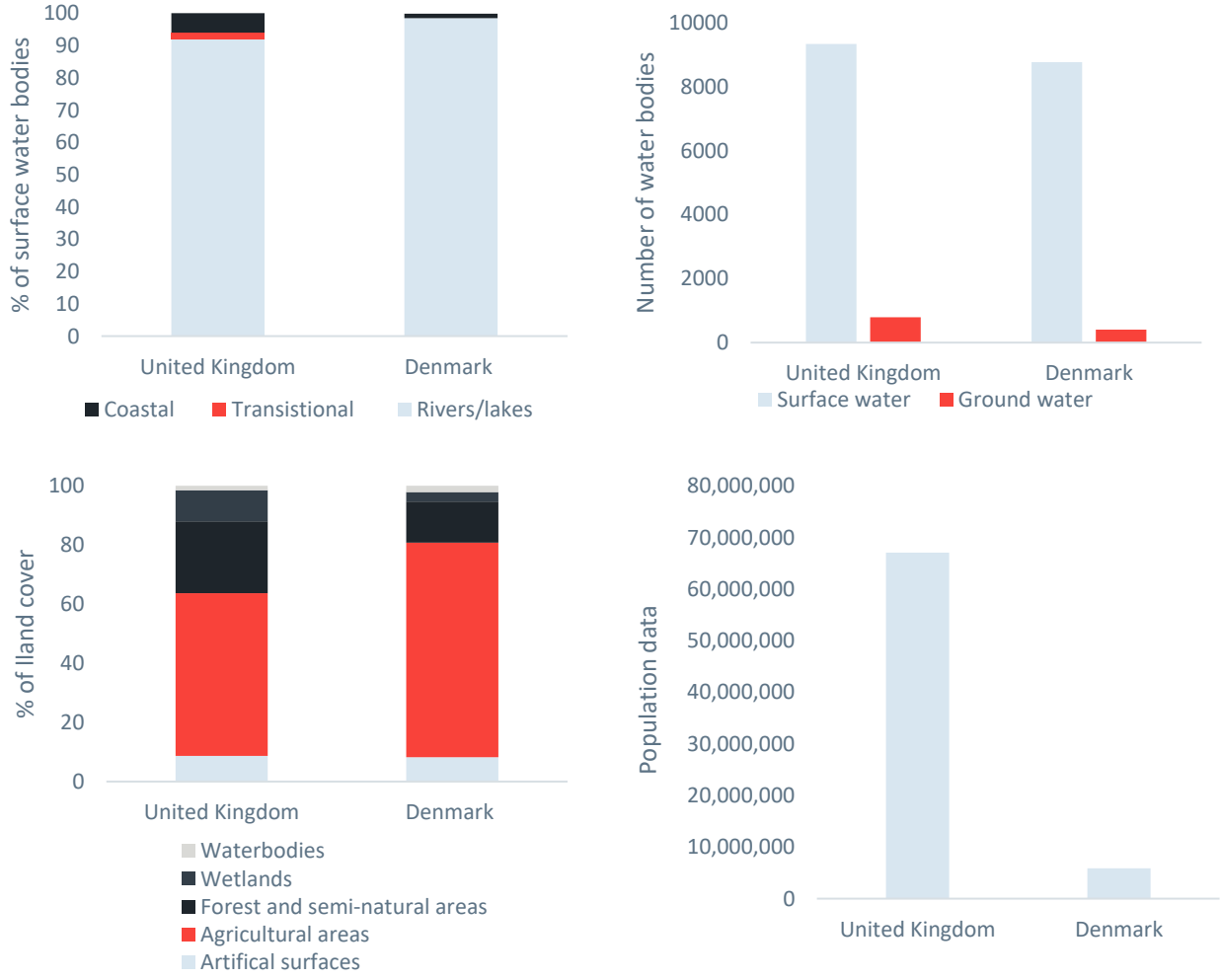
338 Environment Agency, 2022. Groundwater chemical status assessment (classification) and trend assessment – method statement. Available at: Groundwater_chemical_status_assessment_and_trend_assessment_2022.odt (live.com).

339 Northern Ireland Environment Agency. Draft 3rd cycle River Basin Management Plan. Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Draft%203rd%20cycle%20River%20Basin%20Management%20Plan%20for%20Northern%20Ireland%202021-2027_0.PDF

340 file:///C:/Users/natalie.sims/Downloads/207147-lf-facts-and-figures-2019-samlet-opslag-web-final.pdf

341 European Commission (2019), The EU Environmental Implementation Review 2019 Country Report: Denmark, https://ec.europa.eu/environment/eir/pdf/report_dk_en.pdf.

Figure 3-10 - Country comparison with Denmark and the UK including % of surface water bodies, number of surface water bodies[342], percentage of land cover[343] and population size[344]



342 Surface and groundwater bodies information, European Environment Agency: https://www.eea.europa.eu/data-and-maps/dashboards/wise-wfd

343 % of land cover, European Environment Agency: https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics

344 2022 population data for Member States: Eurostat (https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en). For the UK, 2021 from the Office for National Statistics (https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland)

Addressing Nutrient Pollution

Denmark is an agriculturally intensive country and suffers from high levels of nutrient pollution and issues with eutrophication due to excess nitrogen and phosphorous in the water environment. This has been attributed largely to the following agricultural practices; intensive livestock breeding leading to high amounts of manure, high mineral fertiliser uses, and tillage erosion that may lead to high phosphorus loss.[345]

Chemical pollution of groundwater in Denmark is particularly problematic. It has previously been estimated that on average, 81% of groundwater is affected by an excess of nutrients. A key aspect of Denmark's water supply is that almost all domestic use and drinking water is abstracted from groundwater.[346] It has been noted that nitrate pollution of groundwater due to agriculture has led to the closure of many minor water wells based on shallow aquifers.

Key to achieving the successful delivery of the WFD objectives is strengthening operational synergies between the WFD and other policies. A coherent, focused and grounded policy framework is vital to make significant progress in improving the water environment in the face of multisectoral pressure. Denmark has demonstrated good examples of synergies with other policies.

Wastewater emission tax

In Denmark there is a tax on the emissions of nitrogen and phosphorus from wastewater treatment plants. This is according to article 2.a of the Act on Waste water price.[347] This provides an incentive for Danish treatment plants to reduce the levels of nutrients in their wastewater streams beyond the levels of removal required by the Urban Waste Water Treatment Directive (UWWTD).

It is noted there are significant costs associated with efforts to reduce nutrient pollution. For example, the marginal costs of reducing nitrogen and phosphorus discharges from wastewater treatment plants ranges from €2.83 to €7.1 per kilogram of nitrogen and €4.84 to €8.04 per kilogram of phosphorus.[348] Nitrogen loads from point source to streams contributed 20-25% of the combined total N loads in the 1990s, but improved wastewater treatment had reduced this point source load to 10% of the total load by 2018.[349,350]

345 Resource efficiency in practice – Closing mineral cycles : final report, European Commission, 2016, https://data.europa.eu/doi/10.2779/710012. https://op.europa.eu/en/publication-detail/-/publication/c4e6e51f-18cc-11e6-ba9a-01aa75ed71a1

346 Water supply in Denmark, Danish Ministry of the Environment. https://eng.ecoinnovation.dk/media/mst/8051461/Vandforsyning_artikel.pdf

347 Bekendtgørelse nr. 633 af 07/06/2010 af lov om betalingsregler for spildevandsforsyningsselskaber https://www.retsinformation.dk/forms/r0710.aspx?id=131457

348 Resource efficiency in practice – Closing mineral cycles : final report, European Commission, 2016, https://data.europa.eu/doi/10.2779/710012. https://op.europa.eu/en/publication-detail/-/publication/c4e6e51f-18cc-11e6-ba9a-01aa75ed71a1

349 Dalgaard, T., Hansen, B., Hasler, B., Hertel, O., Hutchings, N.J., Jacobsen, B.H., Jensen, L.S., Kronvang, B., Olesen, J.E., Schjørring, J.K. and Kristensen, I.S., 2014. Policies for agricultural nitrogen management—trends, challenges and prospects for improved efficiency in Denmark. Environmental Research Letters, 9(11), p.115002.

350 Riemann, B., Carstensen, J., Dahl, K., Fossing, H., Hansen, J.W., Jakobsen, H.H., Josefson, A.B., Krause-Jensen, D., Markager, S., Stæhr, P.A. and Timmermann, K., 2016. Recovery of Danish coastal ecosystems after reductions in nutrient loading: a holistic ecosystem approach. Estuaries and Coasts, 39, pp.82-97.

DANVA[351] in their 'Water in Figures' 2022 report note that approximately 90% of nitrogen and phosphorus are removed at Denmark's wastewater treatment plants.[352] Here, it was further highlighted that treatment plants in Denmark generally treat wastewater significantly better than the discharge requirements set by the authorities. For example, treatment plants discharge less than half of the phosphorus and less than 70% of the nitrogen they are permitted to release in their discharge permits.

Approach to implementing the WFD: Tackling diffuse agricultural pollution

Analysis of the routes to implementing the WFD in the literature has highlighted that soft or voluntary measures to address issues of agricultural pollution in the environment are unlikely to fulfil the ambitious targets of the WFD.[353] Denmark, however, arguably took a more ambitious approach initially compared to other Member States, by adopting national mandatory measures and specific reduction targets in order to tackle issues of agricultural pollution.[354]

Due to the long-standing agricultural pressures on the environment, Denmark has had a history of developing detailed and comprehensive environmental action plans to tackle excess levels of nitrogen and phosphorus (Table 0-3).[355] For example, the combined total N load from point and diffuse sources to surface and coastal waters have decreased by almost 50% during the period 1990–2018.[356]

Denmark is considered to have a fairly centralised water governance approach[357], and until 2016, many of the measures were implemented nation-wide, with uniform application throughout the country.[358] However, whilst this approach has had the benefits of uniform data and application of measures across the country, it failed to recognise that all catchments have a unique combination of drivers related to climate, land use, farm practices, and catchment-specific bio geophysical properties. Therefore, the effect of measures varied across different catchments.[359]

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351 The Danish Water and Waste Water Association – an industry association for drinking water companies and wastewater companies in Denmark

352 Water in figures, 2022 Denmark, DANVA. https://www.danva.dk/media/8746/5307102_water-in-figures-2022_web.pdf

353 Jacobsen, B.H., Anker, H.T. and Baaner, L., 2017. Implementing the water framework directive in Denmark–lessons on agricultural measures from a legal and regulatory perspective. Land Use Policy, 67, pp.98-106.

354 Wiering, M., Liefferink, D., Boezeman, D., Kaufmann, M., Crabbé, A. and Kurstjens, N., 2020. The wicked problem the water framework directive cannot solve. The governance approach in dealing with pollution of nutrients in surface water in The Netherlands, Flanders, Lower Saxony, Denmark and Ireland. Water, 12(5), p.1240.

355 Nutrient surplus as a tool for evaluating environmental action plans in Denmark, F. P. Vinther and C. D. Børgesen, OECD https://www.oecd.org/greengrowth/sustainable-agriculture/44806936.pdf#:~:text=From%201985%20until%20today%2C%20several%20national%20Action%20Plans,of%20manure%20utilization %2C%20and%20organic%20farming%20production%20systems.

356 Dalgaard, T., Hansen, B., Hasler, B., Hertel, O., Hutchings, N.J., Jacobsen, B.H., Jensen, L.S., Kronvang, B., Olesen, J.E., Schjørring, J.K. and Kristensen, I.S., 2014. Policies for agricultural nitrogen management—trends, challenges and prospects for improved efficiency in Denmark. Environmental Research Letters, 9(11), p.115002.

357 Rowbottom, J., Graversgaard, M., Wright, I., Dudman, K., Klages, S., Heidecke, C., Surdyk, N., Gourcy, L., Leitão, I.A., Ferreira, A.D. and Wuijts, S., 2022. Water governance diversity across Europe: Does legacy generate sticking points in implementing multi-level governance?. Journal of environmental management, 319, p.115598.

358 Petersen, R.J., Blicher-Mathiesen, G., Rolighed, J., Andersen, H.E. and Kronvang, B., 2021. Three decades of regulation of agricultural nitrogen losses: Experiences from the Danish Agricultural Monitoring Program. Science of the Total Environment, 787, p.147619.

359 Petersen, R.J., Blicher-Mathiesen, G., Rolighed, J., Andersen, H.E. and Kronvang, B., 2021. Three decades of regulation of agricultural nitrogen losses: Experiences from the Danish Agricultural Monitoring Program. Science of the Total Environment, 787, p.147619.

Whilst Denmark's more stringent approach has contributed to successes in reducing nutrient pollution, it has also had several downsides. This has predominantly been theorised to be due to a disconnection of national policy making with locally policy implementation, in particular with the 1st cycle of RBMPs.[360,361] The 1st RBMPs for Denmark reportedly had a very low level of public participation, resulting in a potential lack of local expertise and knowledge.[362,363,364] There was notable resistance to the 1st RBMPs from farmers and environmental NGOs which led to lengthy delays in Denmark adopting the 1st RBMPs.[365]

Furthermore, a lack of knowledge on both effectiveness and cost effectiveness at the local level also contributed to resistance to the mandatory approaches. For example, reduced dredging[366] and vegetation management in water courses was a core measure in the Green Growth Agenda.[367] Concerns were raised however that there were only very rough estimates on the areas which might be affected by flooding, and there was a lack of models that could predict the impact of reduced vegetation management in detail.[360]

Jacobsen et al. theorised that application of mandatory measures without knowledge on the effectiveness (particularly at the local scale) can undermine policies.[360] For example, this resistance has influenced the content of the RBMPs. In Denmark's 2nd RBMP it is mentioned that the Danish government and a supporting party in parliament signed an agreement on a Food and Agriculture package in 2015.[368] This led to a change to the RBMPs proposals under consultation. For example the agreement included an abolition of mandatory nine-metre buffer zones, the cancellation of the planned additional 60,000 hectare catch crops, adjustment of restrictive fertiliser standards to the level of economical optimum and adjustment of no-tillage regulation.

Instead, the new package suggests that several of these earlier implied measures previously enforced by regulation, should be addressed through voluntary measures with economic support.[360] This agreement has represented a shift in how Denmark regulates farming, moving from a blanket rule to a more targeted and focused approach.

There is likely a balance between increasing decision-making abilities at the local level and allowing for more voluntary measures without leading to a regional imbalance in measures, and a lack of

360 Jacobsen, B.H., Anker, H.T. and Baaner, L., 2017. Implementing the water framework directive in Denmark–lessons on agricultural measures from a legal and regulatory perspective. Land Use Policy, 67, pp.98-106.

361 Graversgaard, M., Jacobsen, B.H., Kjeldsen, C. and Dalgaard, T., 2017. Stakeholder engagement and knowledge co-creation in water planning: Can public participation increase cost-effectiveness?. Water, 9(3), p.191.

362 Jacobsen, B.H., Anker, H.T. and Baaner, L., 2017. Implementing the water framework directive in Denmark–lessons on agricultural measures from a legal and regulatory perspective. Land Use Policy, 67, pp.98-106.

363 Jager, N.W., Challies, E., Kochskämper, E., Newig, J., Benson, D., Blackstock, K., Collins, K., Ernst, A., Evers, M., Feichtinger, J. and Fritsch, O., 2016. Transforming European water governance? Participation and river basin management under the EU Water Framework Directive in 13 member states. Water, 8(4), p.156.

364 Graversgaard, M., Jacobsen, B.H., Kjeldsen, C. and Dalgaard, T., 2017. Stakeholder engagement and knowledge co-creation in water planning: Can public participation increase cost-effectiveness?. Water, 9(3), p.191.

365 Wiering, M., Liefferink, D., Boezeman, D., Kaufmann, M., Crabbé, A. and Kurstjens, N., 2020. The wicked problem the water framework directive cannot solve. The governance approach in dealing with pollution of nutrients in surface water in The Netherlands, Flanders, Lower Saxony, Denmark and Ireland. Water, 12(5), p.1240.

366 Dredging is the process of removing the accumulation of silt material, that has been washed into water bodies. Negative environmental effects include damaging fish spawning grounds and reducing the stability of river banks https://environmentagency.blog.gov.uk/2021/12/23/floods-and-dredging/

367 Regeringen, 2009. Grøn Vækst [Green Growth]. Regeringen. April 2009.

368 European Commission assessment report, Denmark, 2nd RBMPs, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=SWD:2019:38:FIN&qid=1551205988853&from=EN

progress to achieving environmental objectives.[360] It should be noted that allowing for more decision-making capabilities at the local level would not necessarily be relying on soft or voluntary measures, but instead applying an integrated approach at the local level with measures that can be flexible.

Relevance to England and Northern Ireland

Denmark and the UK display some similarities, with a similar number of surface water bodies (UK: 9328, Denmark: 8765) (Figure 3-10). Denmark is almost entirely surrounded by the sea, and so like the UK displays a moderate, maritime climate. The landscape differs from the UK however, as it is mostly characterised by low and flat to gently rolling terrain.[369] Denmark is agriculturally more intensive than the UK, with 73% of Denmark's land dedicated to agricultural activities versus the UK's 55%.

Both Denmark and the UK face similar environmental challenges and pressures, as they both have a significant agricultural sector that results in nutrient pollution issues. Furthermore, Denmark's centralised approach to implementation is similar to the UK's approach. Therefore, Denmark's experiences tackling these issues could provide key insights for England and Northern Ireland when it comes to implementing the respective RBMPs.

Denmark had an ambitious approach to achieving WFD implementation initially, by setting specific reduction targets and nation-wide mandatory measures. However, it experienced to a lack of public participation and resistance to measures (due to a lack of understanding of the impacts at the local level) in the second planning cycle following the adoption of the 1st RBM. This led to a change of policy approach for the 2nd RBMPs, with a mix of mandatory and voluntary measures.

Ensuring strong science reasoning and justification behind policies and measures is crucial. A factor contributing to the resistance to Denmark's policies was insufficient understanding of effectiveness and cost-effectiveness at the local level. Developing and building a knowledge base of an area is important as this can allow the effectiveness of measures to be fully understood.

Along with an understanding of the local area, the importance of local participation is essential, with mechanisms for incorporating local expertise and knowledge into policy-making needing to be established. This could have a number of beneficial impacts, including raising awareness, reducing resistance to policies, as well as ensuring measures applied to certain sites will be effective.

Furthermore, Denmark's policy examples could serve as practical templates for UK policy measures that could be adopted. For example, these could be policy mechanisms to provide economic incentives for reduction of nutrient pollutant (e.g. tax on nutrient emissions in wastewater).

Denmark's experiences in tackling agricultural nutrient pollution offer valuable insights for England and Northern Ireland in implementing the RBMPs. The inclusion of mandatory measures, coupled with a balance of voluntary actions, is crucial. Policies should be scientifically justified, flexible, and site-specific to ensure their effectiveness. Incorporating local knowledge and expertise into policy-making has also been highlighted as essential.

[369] Denmark geography, country profiles. https://www.countryreports.org/country/Denmark/geography.htm

4 Conclusions

In conclusion, there are clear insights and opportunities for the UK's devolved nation (including Northern Ireland) to learn from Member States' strategies and practices related to river basin management. This report focused on countries located in Western Europe, due to the similarities these nations share with the UK in terms of climate, demographic structure, and land-use patterns. The identified successes and lessons highlight important strategies that can enhance water management processes. These include:

- Strengthening the mechanisms for local participation in water management processes. This can increase community and stakeholder engagement, and ensure effective information flow and representation (Ireland);
- Establish robust innovative policy programmes (e.g. the Agricultural Catchments Programme) that strengthen the science-policy interface. This creates a strong knowledge and evidence base, and enable informed decision making to support the implementation of the WFD (Ireland);
- The strengthening and coordination of internal governance mechanisms related to water management is critical for implementation of the WFD. For example, effective coordination between different authorities increases trust and allows for clear and transparent reporting of information, ensuring details are both accessible and usable (Netherlands);
- The importance of robust monitoring programmes for the assessment of water bodies, which allow for an increase in confidence of status classification (Germany);
- The setting of more stringent standards early, embraces a precautionary approach and can further identify potential risks (e.g. pollutant levels that may have otherwise been considered safe but could still lead to environmental damage over time). Setting stricter standards prioritises a higher level of protection for both ecosystems and human health (Germany);
- The importance of the recognition of regional / local differences when implementing policy (Denmark); and
- The use of policies that should be scientifically justified, flexible, and site-specific to ensure their effectiveness. (Denmark).

Appendix C

Additional tables

Table C-1 - The roles and responsibilities of the different bodies in Ireland

Body	Role and responsibility
The Water Forum (An Fóram Uisce)	The Water Forum was established in June 2018, pursuant to the Water Services Act 2017. The aim of the Water Forum is to facilitate stakeholder engagement in water quality issues, and as a statutory body it is representative of stakeholders with an interest in the quality of Ireland's water bodies. The Water Forum has 26 members currently, including representatives from a wide range of organisations with direct connections to issues relating to water quality and public water consumers.
The Water Policy Advisory Committee (WPAC)	The WPCA was established under the EU (Water Policy) Regulations 2014, in preparation and implementation of the WFD. Its function is to provide advise to the Minister for Housing, Local Government and Heritage in the: ▪ Preparation of RBMPs; ▪ Environmental objectives of the WFD; ▪ The POMs required to achieve these objectives; and ▪ Other related matters concerning the protection and management of the aquatic environment and water resources. The WPAC is made up of representatives from a range of government departments and agencies.
National Technical Implementation Group (NTIG)	The NTIGs role is to: ▪ Oversee the technical implementation of the RBMP at the national level; ▪ To provide a forum to ensure that actions among all relevant state actors are co-ordinated and address any operational barriers to the implementation that may arise; and ▪ To review progress and provides updates to the NCMC on the implementation and effectiveness of measures. The NTIG is also intended to be a forum for information exchange and to promote the consistency of regional.
National Coordination and Management Committee (NCMC)	The roles of the NCMC include the following: ▪ Ensure that the POMs are managed over the period of implementation; ▪ Embed the partnership approach taken in developing the draft RBMP and to provide the interface between science, policy and programme delivery; ▪ To agree and overseeing the overall work programmes; and ▪ Report to the WPAC on the progress of the work programmes. The NCMC should address potential obstacles to implementation and, when required, to advise the WPAC on

Body	Role and responsibility
	future policy needs, acting in a project management capacity in this regard. The NCMC is responsible for overseeing the preparation of future RBMPs and POMs on behalf of the WPAC.
Implementing bodies	
Local Authorities	Individual local authorities are critical to the "on-the-ground implementation" of the RBMP and tracking of the progress and effectiveness of implemented measures. They will have a key role in the support of national policy development and implementation, which is facilitated through their participation to the WPAC and NCMC.
Regional Committees	The five regional committees have the responsibility for the co-ordinated delivery of measures at regional and local levels. They also must ensuring a consistency of approach across the regions (and, in the case of the Border committee, also with Northern Ireland). The five regional committees are chaired by local authority chief executives, with participation and technical advice from the EPA. Each committee produces a regional integrated catchment management programme for the period of the RBMP. These programmes will also set out: ▪ The measures to be implemented in each area; ▪ Who is responsible in actioning these measures; ▪ What resources are assigned; ▪ The expected timelines for implementation; and ▪ Details on how communities and other stakeholders will be included and engaged with.
Local Authority Water Programme (LAWPRO)	LAWPRO is a shared service operated on behalf of the local authorities. LAWPRO has three key aims: ▪ To co-ordinate efforts by local authorities, public bodies and other stakeholders to achieve the environmental objectives of the WFD; ▪ To support local communities that wish to get involved in the care of their local waters and engage with river basin planning; ▪ To build a better understanding of the issues affecting water quality at a local level and recommend improvement measures. The programme comprises two teams: the Communities team and the Catchments team. Both teams operate out of 13 different local authority centres nationwide.

Table C-2 - Key findings from Ireland's Agricultural Catchments Programme (https://www.teagasc.ie/environment/water-quality/agricultural-catchments/research/acp-key-findings/)

	Key findings from the Agricultural Catchments Programme to date
1	Declining Soil Test Phosphorus Trends across catchments
2	Low use of Nutrient Management Plans by farmers
3	Improved nitrogen and phosphorus use efficiency on farms
4	Soil type and geology override soil P level as a predictor of P loss risk
5	P loss to groundwater through the soil can be important in some settings
6	Point sources have a disproportionately large summer influence
7	Closed period is effective but extension is not warranted
8	Sediment losses are low and from roadways, stream banks and beds
9	Importance of Critical Source Areas for targeting mitigation
10	Identified the main influencers on farmers' nutrient management practices
11	Climate and weather are important pressures on nutrient losses and the response differs depending on catchment typology
12	Groundwater Nitrate below 11.3 mg/L in all 6 catchments
13	Hydrogeological and agronomic factors controlled groundwater hydrochemical signatures
14	Groundwater nitrous oxide was found to be a net source of greenhouse gas emission
15	Dairy expansion can increase loss of N to the environment due to increased N loading
16	A new conceptual model of P loss and retention with new categories of risk assessment for a karst catchment is created
17	Improving river ecological quality requires improved management of sediment inputs and a reduction in point sources
18	E. coli transfers are correlated with P transfers in some catchments
19	There is a need for improved support to knowledge transfer for better farm and soil specific nutrient management planning strategies
20	Improving river ecology requires a reduction in point sources

Table C-3 - Details of the Danish agricultural nitrogen policy packages elements.[370,371]

Policy	Elements
NPO (nitrogen, phosphorus and organic matter) Action Plan	Max. 2 livestock unit/ha stocking density Autumn ban on slurry spreading Manure storage measures
The First Action Plan for the Aquatic Environment	Minimum 9 months slurry storage capacity Mandatory fertiliser and crop rotation plans Minimum winter crop cover
Action Plan for a Sustainable Agriculture	Nitrogen quota introduced (at economic optimum23) Extended ban on slurry spreading Statutory norms on plant-available nitrogen in manure
The Second Action Plan for the Aquatic Environment	Nitrogen quota 10% below economic optimum Max. 1.7 livestock unit/ha stocking density Subsidies to artificial wetlands and afforestation Minimum catch crop planting
Ammonia Action Plan	Animal housing and manure storage subsidies Ban on broadcast spreading of slurry Increased minimum catch crop planting
The Third Action Plan for the Aquatic Environment	Closely related to WFD and HD Further increase in minimum catch crop planting Stricter statutory norms on plant-available nitrogen in manure Tax on mineral phosphorous in livestock feed Further wetland areas and afforestation
Green Growth Action Plan	Nitrogen quota 15% below economic optimum Promotion of optimised feed practice Further buffer zones
Agriculture and Environment Package	Nitrogen quota at economic optimum Subsidies for end-of-pipe nitrate leaching solutions

370 A case study of agricultural nitrogen management policy in Denmark, Eroy, V. and Huthchings, N.J. Scotland's centre of expertise connecting climate change research and policy. 2017. https://www.climatexchange.org.uk/media/2080/eu_case_studies_denmark_-_agricultural_nitrogen_management.pdf#:~:text=Denmark%2C%20as%20a%20major%20agricultural%20producer%2C%20has%20been,spreading%20technologies%20and%20buffer%20zones%20and%20artificial%20wetlands

371 Dalgaard, T., Hansen, B., Hasler, B., Hertel, O., Hutchings, N.J., Jacobsen, B.H., Jensen, L.S., Kronvang, B., Olesen, J.E., Schjørring, J.K. and Kristensen, I.S., 2014. Policies for agricultural nitrogen management—trends, challenges and prospects for improved efficiency in Denmark. Environmental Research Letters, 9(11), p.115002.

4

Task 2D - Assessment of Lessons and Practices From Selected Non-EU Jurisdictions

1 Introduction

1.1 Objectives of Task 2D

The task looks beyond EU Member States to explore different water management approaches taken by other countries. Using a literature review and thematic analysis of non-EU jurisdictions this study identifies lessons and best practices that could be adopted and applied to the water management sectors in England and Northern Ireland, as the UK looks to revise environmental legislation following the country's exit from the European Union. Thematic analysis is used to draw out key areas and topics focusing on the assessment of integrated water resource management practices from non-EU jurisdictions.

1.2 Approach Undertaken

A broad literature review was undertaken to identify non-EU jurisdictions of interest. In a first step, seven jurisdictions were shortlisted as possible candidates for an assessment of lessons and practices regarding the management of the water environment. The longlist of countries (and river basins where appropriate) were as follows:

- New Zealand (Canterbury);
- USA (California);
- Australia (Murray-Darling Basin);
- Switzerland;
- Norway;
- South Africa; and
- Israel.

Further research was conducted on each of these countries and the following three case studies selected:

- Nutrient pollution management in New Zealand;
- Water resources management in California; and
- Water governance in South Africa.

The selection of case studies was made to ensure diversity of themes and focus. For each country/river basin not selected for a more detailed case study, interesting aspects of water management that could be selected for the lessons learned/best practice are outlined in Appendix D.

2 Case Studies

2.1 Introduction

The aim of the case studies is to review in depth a small number of non-EU jurisdictions that have adopted integrated water management practices, to identify examples of best practices for different aspects of the water management sector. Special attention has been given to cases which are deemed most pertinent to England and Northern Ireland in terms of environmental legislation following the UK's exit from the EU.

Water management themes and lessons learnt from New Zealand, California and South Africa are presented below. For each jurisdiction the main theme is described, followed by an overview of the legislative approach to the countries' water management. Lessons and best practice around the chosen theme(s) are discussed and an assessment made of the applicability for England and Northern Ireland. Distinction is made for each case study as to whether elements of best practice are being/have been delivered within the current regulatory framework, or whether reform has been identified, or is being enacted, to overcome specific issues.

2.2 New Zealand (Canterbury)

Overview

New Zealand is seen by many as wild, clean and green. However, a 2020 government report found nearly 60% of the country's rivers carried pollution above acceptable levels, with 95 to 99% of rivers in pastoral, urban and non-native forested areas affected by elevated levels of nutrients (nitrogen and phosphorus), chemicals, pathogens and/or sediment. Two-thirds of all rivers were found to be un-swimmable, and three-quarters of New Zealand's native freshwater fish species were considered threatened with extinction.[372]

Poor water quality is attributed largely to diffuse water pollution from agriculture and to farming intensification. Nationally, the area of irrigated agricultural land almost doubled between 2002 and 2017. There was a major shift from sheep and beef to dairy farming, referred to as the 'dairy gold rush' in the 1990s and 2000s due to an increase in the global demand for dairy products. The number of dairy cattle increased nationally by 82% from 3.4 to 6.3 million between 1990-2019, and in Canterbury by 973% from 113,000 to 1.2 million over the same period.[373] Related to this has been increased use of irrigation, fertiliser and pesticides.

As a result of declining water quality, the Essential Freshwater package was introduced in 2020 by the Ministry for the Environment.[374] The package is a new set of standards and regulations designed to achieve freshwater improvements within a generation.

Other water-related issues in New Zealand include population growth in urban areas and ageing water and sewerage assets and infrastructure, which are contributing to poor water quality.

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372 Ministry for the Environment, 2020. Our Freshwater 2020. Available at: https://environment.govt.nz/publications/our-freshwater-2020/ [Accessed 26/01/2023].

373 Stats NZ. 2021. Livestock numbers. Available at https://www.stats.govt.nz/indicators/livestock-numbers. [Accessed 15/03/2023.

374 Ministry for the Environment, 2020. Essential Freshwater: Overview factsheet. Available at: Essential Freshwater: Overview factsheet | Ministry for the Environment [Assessed 14/03/2023].

Themes of Focus

The main water management theme identified for New Zealand (with a particular focus on the Canterbury region) is around **water quality and diffuse nutrient pollution management**.

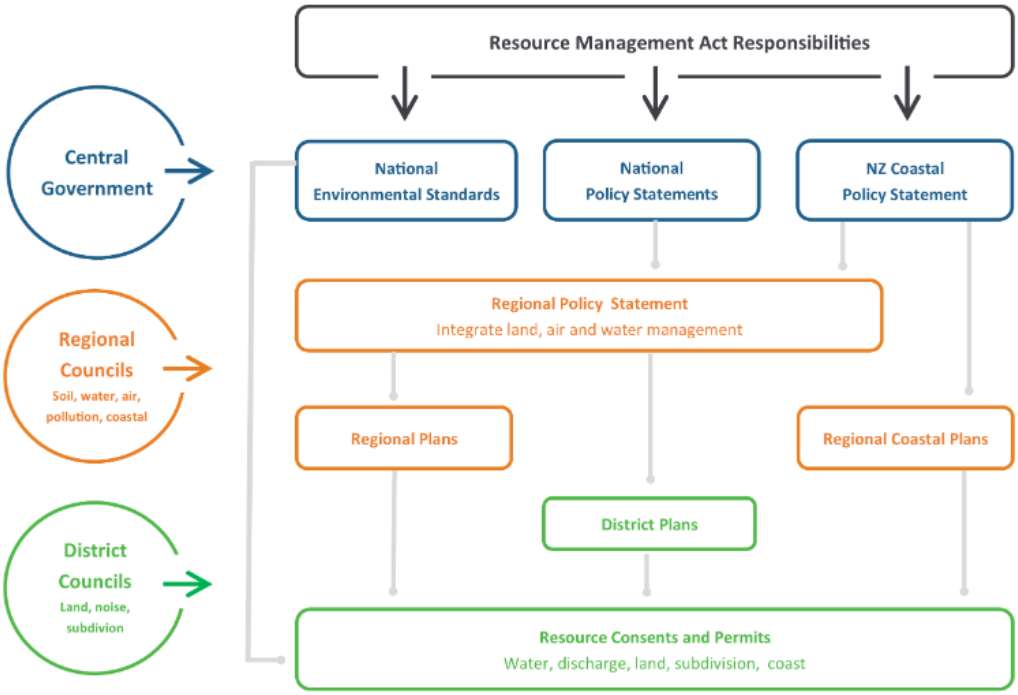
Aspects of this overarching theme covered in this section include:

- Water quality and diffuse water pollution from agriculture;
- Water quality targets and standards;
- Data, guidance and enforcement;
- Freshwater farm plans and catchment context; and
- Absence of agricultural subsidies.

Freshwater Legislation and Regulation

Since 1991, freshwater has been regulated by the Resource Management Act (RMA).[375] Under the RMA, central government establishes national standards and objectives for freshwater use, while local government set rules through regional policy statements and plans. An overview of the different responsibilities is provided in Figure 2-1.

Figure 2-1 - Central Government, Regional and District Council Resource Management Responsibilities



Source: New Zealand Planning Institute. Guide for Internationals. Available at: Guide for Internationals: New Zealand Planning Institute. [Accessed 29/06/2023].

375 Parliamentary Council Office. Resource Management Act 1991. Available at: Resource Management Act 1991 No 69 (as at 17 December 2022), Public Act Contents – New Zealand Legislation [Assessed 15/03/2023].

The main set of standards for water quality in New Zealand is provided through the 2020 Essential Freshwater package. This is part of a new national direction to protect and improve rivers, streams, lakes and wetlands in response to declining water quality. As part of the package, local government is required to give effect to the National Policy Statement for Freshwater Management, National Environmental Standards for Freshwater, Stock exclusion regulations and Water measurement and reporting regulations.[376]

As of 2011, the National Policy Statement for Freshwater Management (NPS-FM) required regional councils to set water quality and quantity limits and adopt plans to achieve the NPS-FM "bottom lines".[377] Ecosystem health and human health for recreation are compulsory national values under the NPS-FM and the bottom lines are the nationally set minimum acceptable states for these two values.[378] More recently, threatened species and mahinga kai[379] have been added as additional compulsory values.

The NPS-FM shares some similarities with the regime of the Water Framework Directive (WFD) Regulations and the Bathing Water Regulations in England in that the objective of the NPS-FM is to ensure that resources are managed in a way that prioritises firstly the health and well-being of water bodies and freshwater ecosystems, secondly the health needs of people and thirdly the ability of people and communities to provide for their social, economic and cultural well-being. This includes ensuring that sites are suitable for the activities that take place in them during 'the bathing season' through monitoring of substances such as *E.coil* and notification of the public if unacceptable levels are found.[380] These NPS-FM objectives could therefore be comparatively viewed as a joined up approach to the WFD and Bathing Water Regulations.

Additionally, a new Freshwater Planning Process has been introduced that must be followed by regional councils and unitary authorities when updating freshwater plans (due in 2024).[381] They are enforced at a local government level through monitoring, compliance and enforcement and local government must achieve the "bottom lines" set by the NPS-FM as noted above. Additionally, there are freshwater commissioners who ensure each council's plan meets the NPS-FM standards.[382]

376 Ministry for the Environment, 2020. National Policy Statement for Freshwater Management. Available at: National policy statement for freshwater management | Ministry for the Environment [Accessed 26/01/2023].

377 Ministry for the Environment, 2020. National Policy Statement for Freshwater Management. Available at: National policy statement for freshwater management | Ministry for the Environment [Accessed 26/01/2023].

378 Buddle Finlay. 2015. New Zealand introduces bottom lines for freshwater management. Available at: New Zealand introduces bottom lines for freshwater management | Buddle Findlay [Assessed 15/03/2023].

379 Mahinga kai promotes Māori measures of freshwater health. Mahinga kai is about the value of natural resources that sustain life and refers to numerous species and inter-relationships rather than something specific. It includes things such as natural habitats, practices for harvesting food and places where food or resources are gathered.

380 Ministry for the Environment, 2020. National Policy Statement for Freshwater Management. Available at: National policy statement for freshwater management | Ministry for the Environment [Accessed 26/01/2023].

381 Ministry for the Environment, 2020. A new freshwater planning process. Available at: https://environment.govt.nz/assets/Publications/Files/a-new-freshwater-planning-process-factsheet.pdf [Accessed 02/02/2023].

382 Ministry for the Environment. 2020. Essential Freshwater: A new Freshwater Planning Process factsheet. Available at: Essential Freshwater: A new Freshwater Planning Process factsheet | Ministry for the Environment [Accessed on 29/02/ 2023]

Prior to the 1980s, New Zealand agriculture was heavily protected via subsidies and price and income support. However, as a result of budget cuts and financial uncertainty, the government removed all agricultural subsidies in 1984. It is believed that because of the loss of subsides New Zealand farmers have become more innovative and were able to become more efficient and productive.[383]

Assessment of Lessons and Practices

The lessons and practices identified around the theme of water quality and nutrient pollution management in New Zealand are described below with an assessment made of their applicability to England and Northern Ireland's water sectors.

Canterbury Case Study

The region of Canterbury in the South Island of New Zealand (Figure 2-2) contains 70% of country's irrigated land, 65% of the nation's hydroelectricity storage capacity, an extensive groundwater system, highly prized coastal lagoons, lowland waterways valued for cultural and recreational use, and world-renowned braided river systems.[384] From 2000, concerns grew around irrigation expansion, agricultural intensification, and first-come-first-served water allocation, alongside the lowering of groundwater levels and freshwater quantity and quality set against rapid population growth in some areas of Canterbury.

Figure 2-2 - Canterbury Region

Source: Google maps. Available from: Canterbury – Google Maps.[Assessed on 15/03/2023]

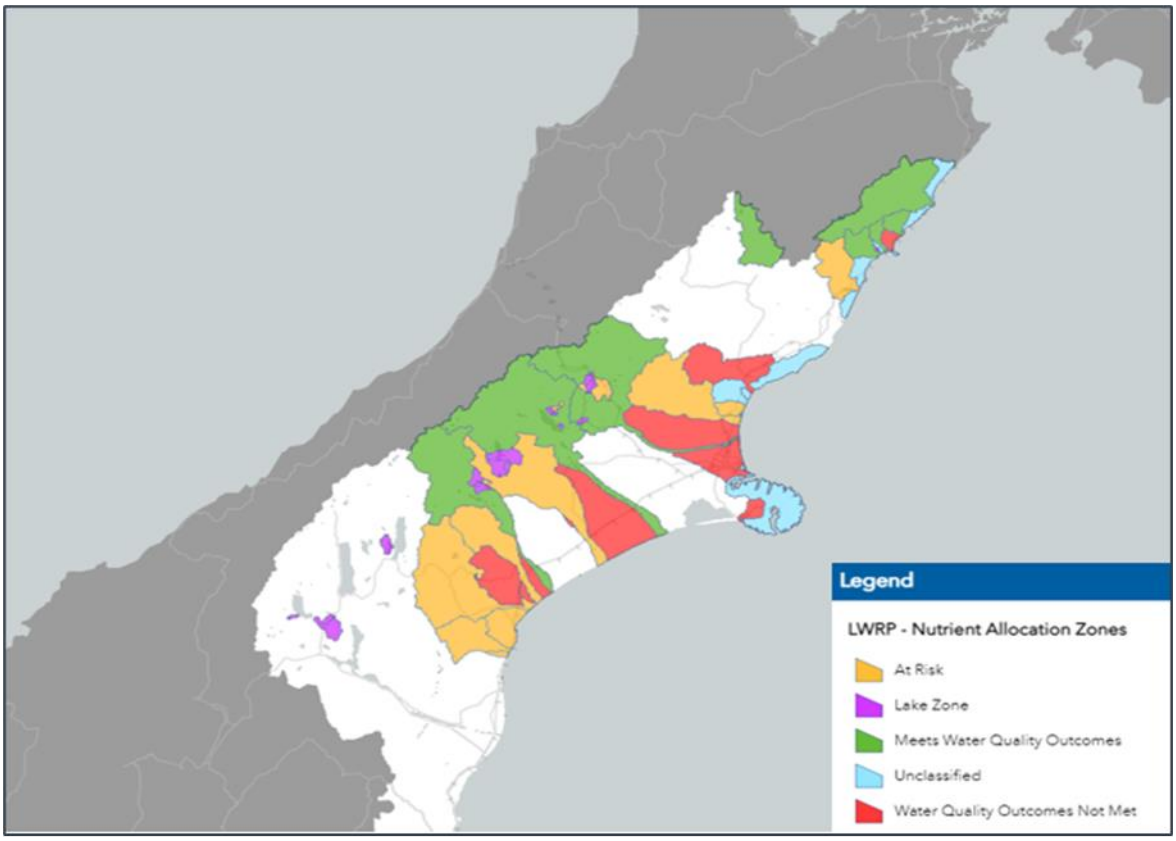
383 Farmers Weekly. 2011. Subsidy withdrawal: Efficiency rules in New Zealand. Available at: Subsidy withdrawal: Efficiency rules in New Zealand – Farmers Weekly (fwi.co.uk). [Assessed on 15/03/2023]

384 OECD. 2017. The Canterbury Water Management Strategy, New Zealand. Available at: https://www.oecd.org/stories/ocean/the-canterbury-water-management-strategy-new-zealand-307e7d5e/ [Accessed on: 02/02/2023]

In terms of water quality, there is an excess of nutrients (nitrogen and phosphorus) from fertiliser runoff, sediment loss, faecal effluent from cattle, reduced flows due to over-extraction by irrigators, and from wastewater and stormwater infrastructure, including septic tanks. The Canterbury Nutrient Allocation Zones map in **Figure 2-3** shows catchments at risk and those failing to meet nutrient targets; most of these are coastal catchments at the bottom of the river systems and/or the location of urban centres.

Polluted runoff is causing algal blooms in many watercourses and occurrences of pathogens like Campylobacter, which can make people ill when they drink or swim in polluted water. In 2022, 8% of groundwater wells monitored by Environment Canterbury (Ecan) exceeded the drinking water standard for nitrate, and 68% of wells were classed as 'worsening contamination'.[384] Ecan are a regional authority for the Canterbury region and are a part of New Zealand local government. They have enforcement powers under the RMA and can take action on non-compliance and issue infringement notices.

Figure 2-3 - Canterbury Nutrient Allocation Zones



Source: Canterbury Maps. Available at: **Canterbury Maps Viewer**. [Assessed on 15/03.2023]

Canterbury Water Management Strategy

The Canterbury Water Management Strategy (CWMS) was launched in 2009 as a devolved, collaborative, community-led approach to environmentally sustainable water management. This strategy sets out the priorities for the Canterbury Regional Policy Statement which is required under the Essential Freshwater Package (which sets national direction).

Reducing nitrogen loss is an important part of the CWMS due to increasing nitrate levels in Canterbury which can be traced back to farming on the plains more than 150 years ago.[385] In response, Ecan brought in strict rules and regulations around nutrient levels in rivers, including a nitrogen loss limit for farms. The nitrogen losses for each farm are determined from a baseline of several years' farming operations most often calculated using Overseer, a nutrient modelling tool, and are usually set to reduce over time depending what zone the farm is located in. For example, dairy farms in the Selwyn Waihora zone leaching more than 15kg of nitrogen per hectare/year must reduce their nitrogen losses by 30% below their nitrogen baseline.[386] The regulator, Ecan, is also responsible for carrying out compliance monitoring.

As mentioned above, reducing diffuse nutrient loss is an important part of the CWMS. This has been at times a contentious issue within the region.[387] Firstly, due to shortcomings of Overseer, a nutrient modelling tool used to estimate nutrient outputs and secondly, due to the setting of nutrient baselines using Overseer, i.e., higher baselines were fixed for farms/areas that were already polluters meaning 'cleaner' farms were penalised. This led to social unrest between neighbouring farms and further reduced trust in public action related to this issue. In summary, an over reliance on one nutrient management modelling tool which was found to have shortcomings during a scientific review has meant that there is now difficulty in enforcing planning and consenting frameworks.[388]

The Ministry for the Environment is currently undertaking a new programme of work in progress to increase confidence in nutrient-management decisions and focus more on risk-based approaches rather than a reliance on a number produced by a tool.

Water Quality Data and Nutrient Management

The 2020 government freshwater report found a lack of data/information specifically about exactly where, when, and what activities and management practices (like tilling soil, stock density, fertiliser use, and managing stock effluent and access to waterways) have contributed to or reduced water pollution in farming areas.[372] It highlighted having no national-scale database or map of farm management practices as one cause of the information gap. Knowledge gaps were also identified for the sources and pathways of pollutants, the impacts of water pollution on ecosystem health, human health, and on wastewater and stormwater networks and pollutants of emerging concern (e.g., per- and polyfluoroalkyl substances (PFAS)).

River health was a key issue in the 2020 election. The government promised "material improvements" and set up a Science and Technical Advisory Group to provide independent scientific advice on its freshwater reforms. One of the key tasks was to determine a nitrate 'bottom line'.[389] As a result, as part of the 2020 Essential Freshwater package, the NPS-FM introduced a new limit of nitrate limit of 2.4 mg/L, bringing New Zealand below the EU limit of 11.3 mg/l (EU Nitrates Directive)

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385 Environment Canterbury Regional Council. 2023. Reducing nitrogen loss. Available at: Reducing nitrogen loss | Environment Canterbury (ecan.govt.nz). [Accessed on 15/03/2023].

386 Environment Canterbury Regional Council. 2023. Selwyn Waihora. Available at: Selwyn Waihora | Environment Canterbury (ecan.govt.nz). [Accessed on 15/03/2023].

387 Newsroom. 2017. Dairy farmers challenge tougher nutrient loss plan. Available at: Dairy farmers challenge tougher nutrient loss plan (newsroom.co.nz) [Accessed on 15/03/2023].

388 Ministry for the Environment, 2020. Essential Freshwater: A new Freshwater Planning Process factsheet. Available at: https://environment.govt.nz/publications/government-response-to-the-findings-of-the-overseer-peer-review-report/ [Accessed 02/02/2023].

389 'Bottom line' refers to toxicity to aquatic species, as defined by the National Objectives Framework (NOF) bands related to ecosystem health (http://www.mfe.govt.nz/).

and below China's limit of 4.5 mg/l (China National Drinking Water Hygiene Standard). This means that regional councils, such as ECan, cannot let the nitrate levels in rivers rise above 2.4 mg/L.[390] Farmer lobby groups pushed back indicating that such a standard was incompatible with dairy farming and concerns about the economic costs were raised.[391] This is an issue that created a lot of media attention and the Environment Minister David Parker committed to revisiting the issue in 12 months' time,[392] however in a more recent statement he said the review would not be necessary as the industry needed "stability".[393]

Water is of high value to New Zealanders as can be seen due to its importance in the 2020 general election as well as financially, in terms of revenue from the tourism industry which made up 5.1% of GDP in 2022 (a decrease of from 9.5% in 2019 pre covid).[394] While there are legislative instruments (e.g. the CWMS and the more recent 2020 policy reforms) in place to improve the water quality, data is showing that it is still declining, largely due to diffuse pollution. Due to the nature of issues such as diffuse pollution it takes time to see results due to factors such as the time lag between action and outcome. Therefore, it is expected that some time will be necessary to see if material improvements in water quality occur due to implementation of recent policy reform.

Water Quality and the Effectiveness of the CWMS

The most recent 2021 CWMS progress report looks back on the previous year's goals and indicates if they have been met.[395] In regard to the 2021 report, the Environment Canterbury Director of Science notes that the region has made great strides in some areas, such as riparian planting, river mouth protection and setting nutrient discharge limits, but is not meeting the goals set in some other target areas. It is noted that reporting explicitly on whether goals have been met was difficult, as in many cases there is no mechanism in place for measuring progress.[396]

The CWMS has been described by some groups such as the Federation of Freshwater Anglers and Greenpeace as a failure due to environmental harm caused by poorly considered irrigation schemes and a lack of evidence of improvement in water quality. Greenpeace alleged that Ecan are too invested in the CWMS and are downplaying the impacts of dairy intensification and related nitrate pollution.[397]

The impasse between government, scientists and farmers over the management of rivers has led Ngāi Tahu, the tribal group whose territory takes up most of the South Island, to take legal action

390 Stuff. 2021. Environmental groups team up to call for stricter water nitrate limit. Available at: Environmental groups team up to call for stricter water nitrate limit | Stuff.co.nz. Available at: [Accessed on 15/03/2023].

391 Radio New Zealand. 2021. MPI opposed nitrogen bottom line over economic concerns. Available at: MPI opposed nitrogen bottom line over economic concerns | RNZ News [Accessed on 15/03/2023].

392 The Farmer. 2022. Concern over New Zealand's dairy industry. Available at: New Zealand's dairy industry causes concern due to water contamination (thefarmermagazine.com.au) [Accessed on: 29/02/2023]

393 Radio New Zealand. 2021. MPI opposed nitrogen bottom line over economic concerns. Available at: MPI opposed nitrogen bottom line over economic concerns | RNZ News [Accessed on 15/03/2023].

394 StatsNZ. 2022. Tourism satellite account: Year ended March 2022. Available at: Tourism satellite account: Year ended March 2022 (stats.govt.nz). [Accessed on 15/03/2023].

395 Environment Canterbury Regional Council. 2021. Measuring CWMS progress. Available at: Measuring CWMS progress | Environment Canterbury (ecan.govt.nz). [Accessed 15/03/2023].

396 Environment Canterbury Regional Council. 2021. Report shines light on progress towards water management goals. Available at: Report shines light on progress towards water management goals | Environment Canterbury (ecan.govt.nz) [Accessed 15/03/2023].

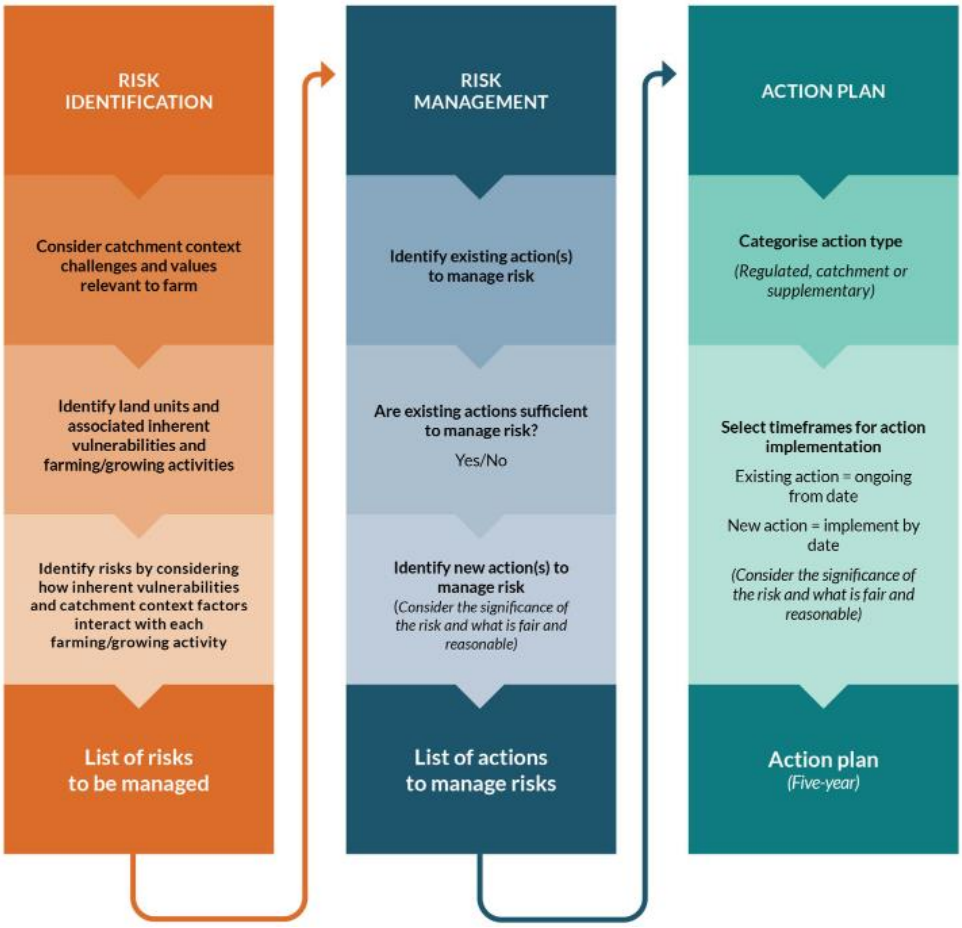
397 Scoop. 2022. The Canterbury Water Management Strategy – A Recipe For Disaster. Available at: The Canterbury Water Management Strategy – A Recipe For Disaster | Scoop News. [Accessed 15/03/2023].

against the government for fiscal and regulatory authority over freshwater in its area. The outcome of this hearing is due in 2023.[398]

Freshwater Farm Plans and Catchment Context

Freshwater Farm Plans are a new legal instrument being established under Part 9A of the RMA. These regulations have not been implemented yet (rollout is occurring from mid-2023) so it is too early to comment on their effectiveness in improving farm practices. However, they show the direction that New Zealand legislation is heading to manage challenging problems such as diffuse pollution.

Figure 2-4 - The development process of a freshwater farm plan



Source: Ministry for the Environment. Freshwater farm plans. Available at: Freshwater farm plans | Ministry for the Environment. [Accessed 29/06/2023]

The aim of these plans is to improve farming practice across the whole of New Zealand. The plan requirements are designed to be more flexible than previous regulations taking into account that 'one size does not fit all' when it comes to on-farm solutions.[399]

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398 ABC News. 2021. New Zealand's troubled waters. Available at: Behind New Zealand's clean, green image is a dirty truth – ABC News. [Accessed 15/03/2023].

399 Ministry for the Environment, 2023. Freshwater farm Plans. Available at: https://environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/freshwater-farm-plans/ [Accessed 02/02/2023].

The bespoke plans will identify practical on-farm actions to improve local waterways, tailored to a particular farm's physical environment and what is priority in the catchment as shown in Figure 2-4.[400] This will be linked to specific freshwater objectives and include catchment values, ecosystem and community outcomes. They will be mandatory and must be certified and audited but offer a departure from stringent rules and regulations. Instead, they will take a catchment-based approach using a risk-based methodology to mitigate impacts on freshwater. This will help ensure that mitigation actions have real impact and are effective and practical. They are being designed to complement existing regulatory requirements including those for nitrogen caps, stock exclusion, intensive winter grazing, etc.

Three Waters Reform

An official inquiry into the water management in New Zealand was carried out in response to a campylobacter contamination in the town Havelock North in 2016 which caused the death of four people. As a result of the inquiry, on 27 October 2021, the New Zealand government unveiled plans for the Three Waters reform programme ('Three Waters' are drinking water, wastewater, and stormwater) that would see the mandatory transfer of the management of the three waters from local councils to ten new publicly owned regional water entities (Water Services Entities, WSEs), which will assume control of water utilities in July 2026. Councils will maintain ownership of assets and there will be an economic regulator and likely a consumer group. This potential reform is a contentious issue in New Zealand.

While it is worthwhile being aware of this planned reform, it will not be covered here in any further detail as it is not directly relevant to diffuse water pollution from agriculture.

Applicability for England and Northern Ireland's Water Sectors

The issues described above are potentially pertinent to a post UK's exit from the EU, therefore the following lessons can be learnt from the New Zealand case study:

- Water quality limits/targets need to be determined based on high quality data/information otherwise they can lead to inappropriate actions;
- Water quality limits/targets need to be enforced in a way that is transparent and fair, and without an over reliance on one nutrient management tool otherwise mistrust in the system can manifest;
- While farm-specific management plans are recommended, a catchment and risk-based approach should also be taken to account for larger scale environmental and hydrological processes

Summary

Diffuse water pollution from agriculture is the main cause of water quality degradation (principally nutrient enrichment) in New Zealand. This issue is particularly evident in Canterbury, where large scale dairy conversions occurred in the 1990s and 2000s due to the profitability of dairy farming at the time. A lot of the land use change occurred on flat, free draining soil alongside an increase of irrigation which resulted in declining water quality in the region. There are numerous lessons to be

[400] Ministry for the Environment, 2023. Freshwater farm Plans. Available at: https://environment.govt.nz/acts-and-regulations/freshwater-implementation-guidance/freshwater-farm-plans/ [Accessed 02/02/2023].

learnt including more consideration of the future impact of land use decisions, such as large-scale dairy conversions.

There are lessons to be gained from the CWMS experience that can be applied to the UK, which include avoiding an over reliance on one nutrient management tool and using the catchment context alongside a risk-based approach to inform decision making in the future. With new national direction being set through the 2020 Essential Freshwater package and a focus on managing water at the catchment scale, there may also be further lessons on how to prevent future deterioration and improve water quality within a generation.

Additionally, New Zealand's approach to freshwater management and the fact that environmental and human health goals are integrated in the NPS-FM, rather than separated as in England, have the potential to lead to more successful outcomes. It allows for a more joined up approach as when local government set objectives and limits for freshwater resources in their region it must be done for both ecosystem health and human health. This approach means that there is more alignment of overall goals. The monitoring and assessment is undertaken to understand the water environment in terms of both its ecosystem and human health value, rather than considering these separately. Despite this, there are a lot of factors that can influence the success or failure of an approach. Continued review of the approach will be needed to identify future successes and failures.

2.3 California

Overview

The state of California covers roughly 430,000km^2 making it the third largest, and most populated state in the USA. The state is one of the most geographically diverse states in the country with a mixture of deserts, forests and mountain ranges.

The Californian Department for Water Resources manages the water supply to roughly 38 million residents and supplies over 35,000km^2 of agricultural land with irrigation.[401] The state has the highest urban density of any US state of roughly 96.62 residents per square kilometre[402] California has a history of extended drought periods, and some areas still do not have access to clean drinking water supplies. The issue of water supply is not wholly due to a lack of rain but also owing to the high-water usage (~350 litres per capita per day[403] compared to ~150 litres per capita per day in the UK)[404] and historical distribution issues due to a lack of infrastructure pre-1980.

In recent years agriculture has moved from farming traditional arable crops to farming fruit and nut trees and vineyards, which rely more heavily on irrigation systems. Coastal vines require 500 – 1,000m^3 of water per year whereas inland vines require 1,000 – 2,000m^3,[405] while nut trees require more than double this amount at 5,000 – 6,000m^3 of water per year. These commodity crops place a

401 Thompson E. 2009 American Farmland Trust. Available at: https://www.cdfa.ca.gov/agvision/docs/agricultural_loss_and_conservation.pdf

402 United States Census Bureau. 2022. Measuring Americas people, places and economy. Available at: https://www.census.gov/quickfacts/fact/map/CA/PST045222

403 Karlamangla S. 2022. Why water use varies so widely across California. Available at: https://www.nytimes.com/2022/06/14/us/water-conservation-california.html

404 Appleby M. 2020. How much water does the UK use? Available at: https://grantham.sheffield.ac.uk/how-much-water-does-the-uk-use/

405 Duggan T, 2021. California vineyards can still make great wine even with limited water supply and droughts. Available at: https://www.sfchronicle.com/climate/article/California-vineyards-can-still-make-great-wine-16494930.php#:~:text=The%20amount%20of%20water%20California,vineyards%20use%201%20acre%2Dfoot

higher demand on water resources but have a higher productivity in the State, producing an economic turnover of roughly USD$ 50billion. [406]

A large proportion of the state's precipitation falls as snow in the northern counties of the state that percolates into surface and ground water reserves during the spring and summer months.[407] Groundwater reserves have been identified as one of the most crucial stores of water for extended drought periods. Reserves currently supply 40% of the water within the state and roughly 85% of residents rely on groundwater supplies for all or part of their water.[408]

Water use by domestic residents has continued to increase over recent years with reports stating that over-watering of residential areas has seen streams of wasted water flowing down local roads. This issue has also been related to inappropriate irrigation of agricultural land.[409] This is particularly prevalent in the southern towns and cities where residents are not abiding the advice from local government to reduce water usage to mitigate against drought conditions. Recently, 2022 saw an extended drought period with winter floods that further highlighted the water management issues in the state.[410]

The oil and gas industry in California uses 11 million m^3 of water during its abstraction and processing[411] and pollutes the environment. Roughly 10% of the water supply in California is for urban usage, which includes industry. Of this total, 5% is used by industry, however, quantities of water were not found during the literature review conducted. The Pacific Institute states that more research is needed on the industrial water usage with the last state-wide industry survey having been conducted in 1995.[412]

Themes of Focus

The main water management theme identified for California is **water resource management** in terms of quantitative aspects.

Aspects of this overarching theme covered in this section include:

- Drought and climate change resilience;
- Water use efficiency – domestic and industrial/agricultural measures;
- Demand management and influencing human behaviour; and
- Simple water use targets for all users and strict legal enforcement.

406 California Agricultural Production Statistics. 2020. Available at: https://www.cdfa.ca.gov/statistics/

407 No Author. 2020. California Water 101. Available at: https://www.watereducation.org/photo-gallery/california-water-101#:~:text=California%20depends%20on%20two%20sources,These%20are%20called%20aquifers.

408 Hanak, E and Chappelle C, and Harter T., 2017. Groundwater in California. Available at: https://www.ppic.org/publication/groundwater-in-california/

409 Ramirez, R., 2022. California is in a water crisis, yet usage is way up. Officials are focused on the wrong problem, advocates say. Available at: https://edition.cnn.com/2022/05/15/us/california-water-usage-increase-drought-climate/index.html

410 Kuebler M. 2023. Flooded California looks for new ways to deal with drought. Available at: https://www.dw.com/en/can-california-turn-flooding-into-a-solution-to-endless-drought/a-64483215

411 Food and Water Watch. 2022. Available at: https://www.foodandwaterwatch.org/2022/02/24/california-water/

412 Cooley, Heather. 2020. Urban and Agricultural Water Use in California, 1960-2015. Oakland, Calif.: Pacific Institute. https://pacinst.org/wp-content/uploads/2020/06/PI_Water_Use_Trends_June_2020.pdf

Freshwater Legislation and Regulation

California began legislation to protect its surface water in 1914, however, it has only recently implemented groundwater management legislation. California first started managing water in 1913 through the Water Commission Act, which introduced todays permitting process and created the State agency that would evolve into today's State Water Board.[413] The first groundwater legislation began a year later in 1914.

California operates under a dual-use legislative policy that recognises Riparian and Appropriative rights.[414] Riparian rights entitles landowners to a share of the water flowing past or through their property without the requirement for permit or licenses. Appropriative rights allow for surface water to be diverted at one point and used beneficially in another location, in contrast to the Riparian rights. The California State Constitution also requires all water use to be both reasonable and beneficial under Article 10 Section 2.[415]

The Sustainable Groundwater Management Act of 2014 consists of three legislative bills (Senate Bill 1168 (Pavely), Assembly Bill 1739 (Dickinson) and Senate Bill 1319 (Pavely))[416]. The legislation implements a framework for long-term sustainable groundwater management across the state and highlights medium and high priority groundwater basins that are overseen by the Groundwater Sustainability Agencies that implement sustainability plans.

In 2022, California experienced extended drought periods requiring further emergency legislation to be implemented. The Central Valley project (CVP) had been conceived in 1933 as a state funded project to manage flooding, store water and produce electricity. The project set about building dams and pipe networks across the state to store and transport water to areas with low water supply. The CVP supplies water to the agricultural heart of the state and had to drastically reduce the allocations to farmers in 2022 to just 5% of their yearly water allowance.[417]

However, other users such as industry or potable water supply were given a 25% allocation, angering farmers who had to fallow land.[418] The Second Water Conservation Emergency Regulation (June 2022) implemented a series of measures such as, no watering of non-essential grass including decorative grasses in residential, commercial, industrial and institutional sites, avoid overwatering of trees and urban water suppliers should implement all Level 2 demand reduction actions to conserve water in the state. Level 2 demand restrictions included the closure of non-

413 California Water Boards. 2018. History of the Water Boards. Available at: https://www.waterboards.ca.gov/about_us/water_boards_structure/history_water_rights.html

414 Water Education Foundation. 2020. Water Rights in California. Available at: https://www.watereducation.org/aquapedia/water-rights-california#:~:text=Additionally%2C%20the%20California%20Constitution%20requires,enhancement%20of%20fish%20and%20wildlife

415 Wilson C. 2011. The reasonable use doctrine and Agricultural water use efficiency. State Water Resources Control Board. Available at: https://www.waterboards.ca.gov/board_info/agendas/2011/jan/011911_12_reasonableusedoctrine_v010611.pdf

416 University of California. 2023. Sustainable Groundwater Management Act. Available at: https://groundwater.ucanr.edu/SGMA/

417 Newburger E. 2023. California water officials raise State Water Project Allocations after storms. Available at: https://www.cnbc.com/2023/02/22/california-officials-raise-state-water-project-allocation-after-storms.html#:~:text=The%20State%20Water%20Project%20collects,agriculture%20in%20the%20Central%20Valley

418 Canon G. 2022. 'We can't make it rain': California farmers left out to dry as US government allots no water. Available at: 'We can't make it rain': California farmers left out to dry as US government allots no water | California drought | The Guardian

recirculating car wash systems, restaurants were not allowed to serve water to patrons unless asked, hotels and motels had to offer guests an opt out option for laundry services and outdoor irrigation by residential and business customers was limited to 1-3 days per week.[419] This regulation could be extended, and the board could change any of the measures without consultation if more drastic measures are needed.[420]

Assessment of Lessons and Practices

The lessons and practices identified around the theme of water resources management in California are described below with an assessment made of their applicability to England and Northern Ireland's water sectors.

Drought and Climate Change Resistance

California is regularly subject to extended drought periods that exacerbate the state's already depleted water resources. The north has the largest water resources and the State Water Project in the 1960s set up a large infrastructure investment to transport water from north to south.[421] This project consisted of 34 reservoirs, 701 miles of aqueducts, 5 power plants and 24 pumping stations with the key feature being the 444 mile long California Aqueduct (**Figure 2-5**). Not only did the project provide a reliable source of water to the state, but it also allowed the creation of recreation facilities on reservoirs, enabled clean energy creation through hydropower and set up a water quality monitoring programme. A total of 40 monitoring stations were created to measure for chemical, biological and physical parameters.

The State Water Project does have relevance to the UKs future water planning. The transport of water is one of the areas that the UK could implement to alleviate the drier regions of the country during low water conditions. However, due to the nature of the water management in the UK being split by several private companies the implementation of large-scale transportation system may be more of a commercial challenge. This transfer system would be run similarly to that of the electricity grid, where supply can be switched to meet demand.

419 California Water Services. 2023. Water Use Restrictions. Available at: https://drought.calwater.com/restrictions#:~:text=In%20Stage%202%2C%20earlier%20restrictions,water%20to%20customers%20unless%20requested.

420 No Author. 2022. Statewide emergency water conservation regulations (2022). Available at: https://drought.ca.gov/state-drought-response/statewide-emergency-water-conservation-regulations/

421 California's state water project, 2021. California's State Water Project | Coachella Valley Water District - Official Website. Available at: https://cvwd.org/170/Californias-State-Water-Project

Figure 2-5 - California Aqueduct[422]

The state has always relied on a valuable snowpack that holds a lot of water during the winter and is released during the summer to top up reserves. The snowpack is reported to be 38% lower than the normal yearly median dating back to 1970, due to temperature rise. However, considerable snowfall in early 2023 has led to the snowpack being 190% of the normal level which gives the state a glimmer of hope that water restriction measures will be considerably less than the previous years.[423] This equates to roughly 40million m^3 of water for the state to recharge dwindling reservoirs and groundwater storage.

Water Use Efficiency

The California State Department for Water is responsible for implementing water efficiency programmes across the state. The state has two main plans. The first is the Urban Water Management Plans (UWMPs), first implemented by the California State Department for Water in 1983. The UWMPs were prepared by water suppliers across the state and updated every five years to ensure that adequate water supplies are available to meet current and future demands. The UWMPs focus on several key areas: supply and demand; supply reliability; drought risk assessment; water use efficiency; water shortage contingency and outreach and engagement with the community.[424]

422 California's state water project, 2021. California's State Water Project | Coachella Valley Water District - Official Website. Available at: https://cvwd.org/170/Californias-State-Water-Project

423 Smith, H. 2023. California's snowpack is approaching an all-time record, with more on the way. Available at: https://www.latimes.com/california/story/2023-03-03/california-snowpack-is-approaching-an-all-time-record

424 Western Municipal Water District., 2020. Urban Water Management Plan and Drought Plan. Available at: https://www.wmwd.com/DocumentCenter/View/5736/Western-ES-2022?bidId=

Secondly, the Water Shortage Contingency Plan is a dynamic legislation that can be applied at any time when water levels are low. This includes a large-scale monitoring programme to better understand water levels and demand. The legislation also applies penalties to those who are not following water reduction targets also implemented by the plan and applies to residents, agriculture and industry.[425]

The California Water Service manages the utility network and billing of water in California and recommended new standards for water use in the state in 2021. The UWMP also puts into place several measures to conserve water during drought periods, such as only lawn watering before 8am and after 6pm, washing of hard surfaces is prohibited, water use for dust suppression is prohibited, filling of ornamental ponds prohibited and offering guests the option to opt out of laundry services at hotels.[426]

A number of these measures could be applied to UK drought conditions. Hose pipe bans are currently used in the UK during periods of drought; however, further measures could be applied such as implementing low flow showerheads and toilets on a widespread basis. New Californian standards were implemented in 2018 to decrease the flow from new showerheads by 30% saving more than 2.4 billion gallons of water a year[427]. This could be a method for the UK to implement on a wider scale especially within drought sensitive areas of the country. Low flow showerheads can save around 30 litres of water per shower and is a cheap option to implement.[428]

Agricultural water usage in California equates to roughly 80% of the total water supply. Through better efficiency measures in irrigation and farming practices it is estimated that water usage could be reduced by 20%.[429] This includes changes to crop production to use more productive varieties that are less water intensive, improved irrigation scheduling to coincide with weather patterns and enhancing soil moisture measures.[50] Figure 2-6 outlines the reduction and irrigation improvements to reduce water consumption. Drip irrigation methods have seen a water efficiency improvement of nearly 40% saving nearly 2 million litres of water.[430]

425 2020 Water Shortage Contingency Plan. Available at: https://www.yourscvwater.com/your-water/plans-and-reports/water-shortage-contingency-plan

426 Xiao H, 2018. Water Issues in California. Kleinman Center for Energy Policy. Available at: https://kleinmanenergy.upenn.edu/research/publications/water-issues-in-california/

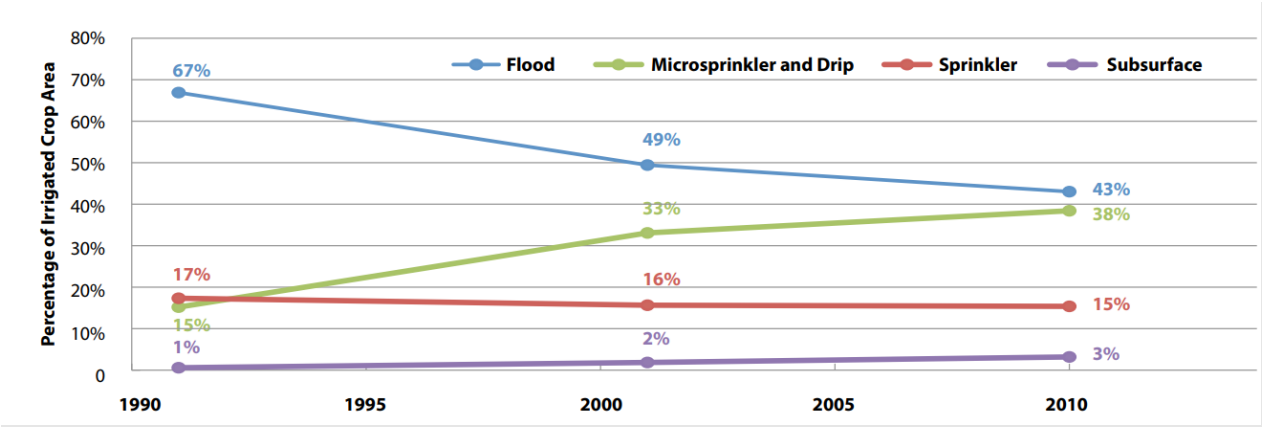
427 Appliance Standards Awareness Project. No date. Showerheads. Available at: https://appliance-standards.org/product/showerheads#:~:text=In%20California%2C%20following%20the%20Governor's,flow%20rate%20of%201.8%20gpm.

428 Commercial Washrooms. 2020. How much water does a low flow shower head save? Available at: https://www.commercialwashroomsltd.co.uk/blog/knowledgebase-faqs/how-much-water-does-a-low-flow-shower-head-save.html#:~:text=Flow%20restrictors%20vary%2C%20but%20you,litres%20of%20water%20per%20shower.

429 Cooley, H. 2014. Agricultural Water Conservation and Efficiency Potential in California. Available at: https://www.nrdc.org/sites/default/files/ca-water-supply-solutions-ag-efficiency-IB.pdf

430 California Department for Food and Agriculture. 2022. Drip-irrigation study sees 37 percent reduction in water use and five percent increase in yield. Available at: https://plantingseedsblog.cdfa.ca.gov/wordpress/?p=24557#:~:text=Drip%2Dirrigation%20study%20sees%2037,Seeds%20BlogCDFA's%20Planting%20Seeds%20Blog

Figure 2-6 - Irrigation methods for irrigated crops grown in California in 1991, 2001, and 2010[50]



California has been recycling and reusing wastewater for several years and currently recycles the equivalent usage of almost 2.6 million households.[431] There is no direct 'toilet to tap flow' (treated water going straight to the consumers tap) as most of the recycled water is used for irrigating landscapes, golf courses and agricultural land and refills underground stores that provide drinking water. California Governor Gavin Newsom called for an increase in recycling by 9% by 2030 to boost the water supply by 22 billion m^3 by 2040. Although issues may arise from this as residents have been encouraged to improve the efficiency of their household appliances and 'let the yellow mellow' which in turn concentrates the waste stream leading to potentially higher treatment costs. [432]

Managing Demand and Changing Public Perception

The San Francisco Bay and South Coast regions demand the most and import water from other parts of the state. Notwithstanding the 2022 drought, recent years saw water use falling due to the implementation of water restriction measures. Between 1995 and 2015 water use had fallen by 270 litres per day per person which shows that the implementation of water saving measures is having an effect.

The State Water Project is investing billions of dollars to create a larger water supply for generations to come. This includes:

- A Plan to increase water storage by 493,392 m^3 of water allowing for greater capacity to gather water from storm events;
- Increasing water recycling and reuse by at least 986,784,000 m^3 by 2030; and
- Freeing up 616,740,000 m^3 through increased efficiency, which will help account for water predicted to be lost by climate change; and

Creation of new water supplies by stormwater capture and desalinisation of sea water.

431 Becker, R. 2022. How can California boost its water supply. Available at: https://calmatters.org/explainers/california-water-solutions/

432 Office of Gavin Newsom. 2022. California's water supply strategy. California State Government. Available at: https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Water-Resilience/CA-Water-Supply-Strategy.pdf

Residents are being asked to reduce water usage to allow the state to be more resilient to future drought periods. This includes several outdoor and indoor measures such as watering gardens during dawn and dusk saving up to 95 litres per person, planting native species in gardens that are more drought resilient, checking pipes and taps for leaks, taking shorter showers and installing more efficient appliances.[433] These measures are low cost and do not require specialist training to implement and therefore can be quickly rolled out. Although water restrictions have been put in place, water usage in urban areas remains high, and the reduction still has not met the targets the authorities were looking for.

Voluntary Water Use Targets

In January 2020, a recommendation of 250 litres per person per day for indoor water usage was set until 2025, which will be further reduced to 225 litres per person per day after 2025 until 2030.[434] From October 2021, new outdoor water use standards were implemented to limit the amount of potable water used for gardening/landscaping, pools and other outdoor uses. Limits for industrial or agricultural use were not found in the literature review.

The voluntary targets set by the state government in 2022 are often exceeded. Being voluntary this target is rarely met with the LA Times reporting that the reduction in water use was ~2% and well off the target set by Governor Newsom.[435]

San Joaquin Delta

The San Joaquin River basin covers 25,556 square kilometres, roughly 3 times the size of the River Thames Basin. The Department for Water Resources has identified 39 groundwater bodies in the watershed area. The valley floor is separated into 15 groundwater basins managed by local Groundwater Sustainability Agencies. A large proportion of the San Joaquin River below Millerton Lake Reservoir has been highly managed and diverted into the Friant-Kern Canal, except for during periods of wetter weather or major snow melt. Flow from the western side of the basin is predominantly dominated by agricultural runoff.

This region of California is a critical link in the state's water supply system. The valley area has several water pressures including groundwater overuse, drinking water contamination and decline in the ecological status of the waterbodies. Water supplies especially in the southern half of the region are dwindling and water is often imported from other areas. Agriculture is the main abstractor in the region and during drought periods farmers all but exhaust the groundwater supplies. The water supply is also at risk in this area from the associated geohazards, especially earthquakes, as the basin is adjacent to the active San Andreas fault that is located on the Western border of the basin.[436]

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433 No Author., 2022. Watersense. United States Environmental Protection Agency. Available at: https://www.epa.gov/watersense/showerheads

434 California Water Service. 2022. Water-Use Restrictions. Available at: https://drought.calwater.com/restrictions

435 Smith H. 2022. California is finally reducing water use, but it's not enough amid severe droughts. LA Times. Available at: https://www.latimes.com/california/story/2022-07-08/california-reducing-water-amid-drought#:~:text=Water%20conservation%20falling%20short,increased%20water%20use%20by%203.6%25.

436 California's state water project, 2021. California's State Water Project | Coachella Valley Water District - Official Website. Available at: https://cvwd.org/170/Californias-State-Water-Project [Accessed: 07/02/2023]

The Sustainable Groundwater Management Act (SGMA)[437] was introduced into law in 2014 to force local water users to implement sustainable groundwater management approaches. The plan aims to achieve wholly sustainable groundwater supply by 2040. The purpose of this act is to protect and conserve groundwater resources as climate change and drought increase water scarcity, by effectively turning reserves into 'bank accounts' that can be withdrawn from but must be rebalanced.[438] Many farms in the Central Valley rely heavily on groundwater abstraction for their water supply. Estimates suggest that up to 1 million acres of farmland could become redundant due to drastic cutbacks in water abstraction. However, the plan offers farmers other land uses such as solar energy or rewilding of land to increase biodiversity.[58]

Applicability for England and Northern Ireland's Water Sectors

Climate change is predicted to have an impact on water resources in the UK. The UK is already experiencing warmer, drier summers as seen in 2022 where there were record temperatures and extended drought measures were put into action across the country. With current climate change estimates predicting that the UK will experience warmer and drier summers, water reduction measures are going to be needed in the coming years. Dry winter and springs in the past couple of years has led to an increase in reported droughts in the UK, which California has been experiencing for a number of years. Implementation of water reduction schemes has been successful; however, voluntary schemes have failed to achieve the same effectiveness. The California Governor passed a new state law in 2022[439] that aims to make it cheaper for residents to replace their lawns with drought resistant plants and landscaping practices. The measure allows residents to claim rebates from state income tax. This is a measure that could be applied to the UK to reduce the need for watering of residential gardens, which will help to save water during extended drought periods.

Examples of other approaches taken in California around water resource management that could be applied in England and Northern Ireland include:

- Sustainable groundwater management is a key focus as the UK abstracts a large proportion from groundwater supplies;
- Stricter penalties on those that do not follow the limits set by legislative authorities; and
- Voluntary water reduction targets have been relatively ineffective. Stricter more punitive measures should be implemented to really cut down water usage.

437 https://water.ca.gov/programs/groundwater-management/sgma-groundwater-management

438 Charles, D. 2021. New protections for California's aquifers are reshaping the state's Central Valley. Available At: https://www.npr.org/2021/10/07/1037369959/new-protections-for-californias-aquifers-are-reshaping-the-states-central-valley

439 Newsom G. 2022. California Is Making It Cheaper to Replace Your Lawn to Save Water and Save Money. Office of Governor Gavin Newsom. California State Government. Available at: https://www.gov.ca.gov/2022/09/28/california-is-making-it-cheaper-to-replace-your-lawn-to-save-water-and-save-money/

Summary

Throughout California water resource and supply is the main issue confronting local and state-wide governance. The balance of supply and demand is a challenge that extends across the region and wider into neighbouring states. To overcome this, the State has implemented several management plans and legal targets to achieve a sustainable water supply. However, demand is still high and voluntary water reduction targets have not been met. Tighter controls have been implemented to reduce water usage, especially in the agricultural Central Valley. The urbanised Southern Cities of the state have also seen controls to change public perception and reduce the impact on the water resources in the State.

2.4 South Africa

Overview

The first non-racial democratic government of 1994 carried out drastic water sector reforms to improve legislation and more equitable access to water supply and sanitation. There has been a focus on improving water efficiency by investing in infrastructure, using a range of water resources, and changing attitudes and behaviours to help to ensure a more stable and resilient water supply. Despite improvements, the country still faces a wide range of water quality and quantity challenges that impact on both surface and groundwater and if not addressed urgently have the potential to significantly limit the country's socio-economic growth.

Themes of Focus

The main water management theme identified for South Africa is around **water governance**.

Aspects of this overarching theme covered in this section include:

- Water management legislative framework;
- Demand management and influencing human behaviour;
- Water quantity – investment in and maintenance of water infrastructure; and
- Water quality – improvements through national legislation.

Freshwater Legislation and Regulation

The National Water Act (NWA) and the Water Services Act (WSA) introduced by the government in 1994 have been key complementary implementation instruments for transforming the management of the water resource sector. They were designed to constitute the main legislative framework for water services and water resource management in post-apartheid South Africa.[440] The Acts provide a framework for sustainable water resource management and improvement of service delivery. South Africa is often commended for the standard of legislation regulating water consumption and the focus on sustainability, and many parts of the plan have been adopted by other nations. However, a lack of implementation and good governance of these laws present a major challenge.[441]

[440] B. Maphela & F. Cloete (2020) Johannesburg's implementation of the National Water Act, 1998 in Soweto, South Africa, Development Southern Africa, 37:4, 535-552, DOI: 10.1080/0376835X.2019.1647834

[441] Agiorbit. 2021. Water supply, legislation and consumption trends in SA. Available at: https://agriorbit.com/water-supply-legislation-and-consumption-trends-in-sa/. [Accessed: 01/03/2023]

The National Water Resource Strategy (NWRS) is the legal instrument for implementing the NWA and the primary mechanism to manage water toward achieving the national Government's development objectives. The focus of the NWRS is to enable equitable and sustainable access to water and sanitation services in support of socio-economic growth and development for the well-being of current and future generations.[442] It provides an integrated catchment management approach to managing water resources. The first and second editions of the NWRS were published in 2004 and 2013 and the third iteration is currently being developed (the 2021 draft version is published).

Assessment of Lessons and Practices

The lessons and practices identified around the theme of water governance in South Africa are described below with an assessment made of their applicability to England and Northern Ireland's water sectors.

Water Quality - Improvements Through National Legislation

Within the NWRS, there are four overarching categories of water consumption/use: domestic, industrial, agricultural, and recreational purposes. The Water Resource Classification System sets a 'class' through a 7-step procedure (shown in **Figure 2-7**), which defines objectives for every significant water resource (watercourse, surface water body, estuary or aquifer). This system recognises that some water resources need a high level of protection and others may be useful for economic and developmental growth needs, according to their ecological importance. Water resources must be able to maintain their use. There are three classes, ranging from minimally used to heavily used, and objectives describe the desired condition of these resources and the extent to which they can be utilised.[443]

[442] National Water Act: National Water Resources Strategy: Comments invited (www.gov.za)

[443] Department of Water Affairs and Forestry. 2007. Development of the Water Resource Classification System (WRCS). Available from: WRCS COVERS.indd (dws.gov.za).[Accessed on: 01/03/2023]

Figure 2-7 - The steps in the South African Water Resource Classification Process[444]

The classification of water resources as a result of this process produces the determination of the quality and quantity of water necessary for ecosystems and economic activities reliant on a specific water resource. In addition, the NWA specifies that Resource Quality Objectives will be established for different water resources; this process is currently underway countrywide. These are aimed at specifying appropriate numeric and narrative objectives which should be met for different water resources, and can include indicators of water quality, as well as the biological and physical characteristics of the resource.[445] The purpose is to establish clear goals for water resources and give effect to the classification determined in previous steps.

To address water quality issues two types of measures are used. Resource-directed measures are informed by the classification system and set goals for resources, which allow different levels of protection for different water resources. Source-directed controls set measures to protect water resources (e.g., land-use controls providing licences for water use and waste disposal). Resource-directed measures also make provision for the "reserve" which is defined as the quantity and quality

444 Brown, Cate & King, Jackie. (2020). Guidelines for the Assessment of Environmental Flows in the Western Indian Ocean Region - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/The-steps-in-the-South-African-Water-Resource-Classification-Process-Dollar-et-al_fig4_344811557 [accessed 16 Mar, 2023]

445 Department of Water and Sanitation. 2022. Draft National Water Resource Strategy. Available at: NWRS-3 - Draft 2.6.pdf (dws.gov.za) [Assessed: 24/02/2023]

of water required to maintain a healthy aquatic ecosystem, whilst meeting the basic human requirements such as clean drinking water.

South Africa uses standard modelling tools for managing water resources across the country (for example models to estimate likely water supply volumes). Using a standard and long-term approach to modelling across catchment boundaries is seen as a strength of the South African approach according to a study for the Water Research Commission.[446] A difference in approaches between States and organisations across catchment boundaries has been found to often lead to problems in other countries, such as Australia. If the same approach is used across catchments for a long period of time this allows for continuity and consistency of results.

As a result of the improved legislation and initiatives that began with the 1994 Government, South Africa has made significant improvements to water resource management. This includes the finalisation of a National Water Monitoring Strategy, commendable progress in the surface water resource classification process, rehabilitation of all delineated buffer zones and water courses, and addressing the sanitation backlog with 84% of households now having access to sanitation.[29]

However, challenges remain for water quality. The 2022 National State of Water Report shows groundwater quality data in 2022 declined significantly back to pre-2019 levels and there is a severe challenge of microbial contamination in rivers and dams. More than half of sites sampled presented a high risk to health if water from the source was used to irrigate crops that were eaten raw.

Water Management Legislative Framework

South Africa is recognised for its high standard of legislation regulating water consumption and the focus on sustainability resource classification process.[447] This means there may be some learnings such as how the NWRS is set out and the methods of classification, resource quality objectives and types of measures.

The NWRS appears to be very granular in its structure as there are a lot of different sections each with their own guiding principles and strategic objectives and actions. As there are still major challenges with water quality and water supply, it is difficult to make judgements on the success or failure of the water resource framework. Despite these challenges, there have been vast improvements in water supply and sanitation which provide potential learnings for the UK.

Demand Management and Influencing Human Behaviour

A strategic objective of the NWRS is to change the behaviour of water users and water and sanitation institutions to ensure the sustainable and equitable use and delivery of water and sanitation services. National plans state that South African households need to consume less water to avoid the projected 17% water deficit by 2030.[448]

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446 WRP Consulting Engineers. A COMPARISON OF THE SOUTH AFRICAN APPROACH TO WATER RESOURCES MANAGEMENT AND PLANNING WITH FOUR INTERNATIONAL COUNTRIES. Available at: KV 341-15.pdf (wrc.org.za). [Assessed: 30/06/2023]

447 Water Research Commission. 2018. Review of South Africa's Water Policy and Legislation. Available at: https://www.wrc.org.za/wp-content/uploads/mdocs/2417-171.pdf. [Accessed: 15/03/2023]

448 ESI Africa. 2021, national Water and Sanitation Master Plan. Available at: National Water and Sanitation Master Plan - ESI-Africa.com [Assessed: 24/02/2023]

The objective is focused on raising the importance and the need for a change of attitude and behaviour in terms of how water is treated and conserved by all South Africans through the media, publication of information and education and awareness programmes. Additionally, the National Water and Sanitation Master Plan notes the use of user tariffs and "user-pays" principles for sanitation services and use of water in excess of the Free Basic Water supply. These principles rely on the sale of water as a commodity to the users as the main income source to manage the water industry. However, access to freshwater is not evenly spread across the nation and calls for a fairer system from some have been noticed, with the poorest in society being offered assistance.[449] Punitive charges for those who do not comply with regulation and publicising successful prosecutions of high impact users is intended to influence and drive behaviours.[450]

The ORIO program is a Dutch Enterprise Agency (RVO)[451] led and partially funded scheme that aims to provide water services to informal settlements. The programme currently runs ancient pipe improvements to reduce water losses, off grid water solutions to remote villages and a number of sanitation programmes. Currently there is a 35% Dutch investment with the other 65% provided by the municipalities. This currently amounts to a total budget of around EUR €200million.

Improving Water Efficiency

South Africa is working on increasing water supply by focusing on integrated resource management and using a mix of methods. Increasing water transfer, desalination and more reservoirs, changing human behaviours and getting people to use less water and resilience to flooding have been identified as important ways forward in the UK.[452] A successful example of getting people in South Africa to use less water occurred in 2018 when South Africa was experiencing a severe water shortage due to drought. The Cape Town local government announced that they were within 90 days of running out of water and reaching a 'Day Zero' scenario.[453] On Day Zero all water sources would be shut down by the government and residents would need to get water from designated collection points. Day Zero was avoided through strict water saving restrictions, increased tariffs and limits on household consumption to 50 litres per day.[454]

Pollution incidents and pipe leakage are issues that the UK and South Africa both face. Achieving South Africa's projected reductions in water demand will require active programmes to reduce water leakage in distribution networks and increase the domestic and commercial efficiency of water use. Exploration of such programmes may provide learnings for the UK.

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449 Enqvist, J., van Oyen, W. Sustainable water tariffs and inequality in post-drought Cape Town: exploring perceptions of fairness. Sustain Sci (2022). https://doi.org/10.1007/s11625-022-01217-9

450 Department of Water and Sanitation. 2018. National Water and Sanitation Plan. Available at: Edit04122019_NWSMP Volume 2 Version 4.2_Edit041219(22-30).indd (dws.gov.za) [Accessed: 09/03/2023]

451 Kingdom of Netherlands. 2022. Water Management. Available at: https://www.netherlandsandyou.nl/your-country-and-the-netherlands/south-africa/about-us/water

452 Environment Agency. 2019. What future for water? Three challenges for the industry. Available at: What future for water? Three challenges for the industry - GOV.UK (www.gov.uk) [Accessed on 28/02/2023]

453 Edmond, C. 2019. Cape Town almost ran out of water. Here's how it averted the crisis. Available at: https://www.weforum.org/agenda/2019/08/cape-town-was-90-days-away-from-running-out-of-water-heres-how-it-averted-the-crisis/#:~:text=The%20city%20was%20just%2090,off%20%E2%80%93%20never%20came%20to%20pass.

454 Njueh W. 2019. CLASP Supports Policies to Improve Water Efficiency in South Africa. Available at: https://www.clasp.ngo/updates/clasp-supports-policies-to-improve-water-efficiency-in-south-africa/

Water Quantity – Investment in and Maintenance of Water Infrastructure

There are areas of South Africa that have either too little or too much water and moving and treating it is complex, with population growth exacerbating the issue.[455] Pollution incidents such as raw sewage escaping into a watercourse and pipe leakage are placing pressure on water supply. An estimated 37% of the water in South Africa's municipal systems is non-revenue water. This means it is "lost" through leaks (often due to old infrastructure and infrequent maintenance), theft, or metering inaccuracies before it reaches customers. This water is worth more than 7 billion South African rand per annum[456] (equivalent to £315 million).

The National Development Plan sets out the priorities for water demand management and is projecting an average reduction in water demand of 15% below the 2012 baseline in urban areas by 2030.[457] Achieving these reductions will require active programmes to reduce water leakage in distribution networks and increase the domestic and commercial efficiency of water use. This includes increasing funding for improving and maintaining water infrastructure as well as focusing on integrated water resource management. For example, South Africa is working on optimising dam storage and transfer systems, using a mix of water resources, and exploring various options to balance water availability with the country's requirements.[29] There are numerous provincial projects to improve water distribution networks and upgrade wastewater treatment works throughout the country.

The Southeast of England is expected to see increased water supply issues as population growth and climate change have an impact on the amount of water in the region. A water shortfall of 300 million litres is predicted by 2030 if no action is taken.[458] Lessons could be learnt from South African measures to conserve water.

The National State of Water report shows that some positive progress in managing water resources has been made in South Africa. For example, dam storage levels are the highest they have been for the past 5 years with over 85% spilling or at optimal levels in September 2022. The national groundwater level status has also shown an upward recovery trend and was just below 60% (normal) at the end of the recent reporting period. Despite improvements, only 64% of households have access to a reliable water supply service.[29]

Applicability for England and Northern Ireland's Water Sectors

Despite different socio-economic circumstances there are some aspects of the South African context that could be applied to the UK in terms of regulatory frameworks and improving water efficiency. These include:

- The way that NWRS is set out and the methods of classification, resource quality objectives and types of measures used could be of use as comparator to the UK as they appear to be very detailed;

455 Environment Agency. 2019. What future for water? Three challenges for the industry. Available at: What future for water? Three challenges for the industry - GOV.UK (www.gov.uk) [Accessed on 28/02/2023]

456 World Bank Group. 2022 South Africa. Available from: South Africa - 2030 Water Resources Group (2030wrg.org) [Accessed on: 28/02/2023]

457 Department of Water and Sanitation. 2022. Draft National Water Resource Strategy. Available at: Draft National Water Resource Strategy (dws.gov.za) [Assessed: 24/02/2023]

458 Green, D. 2022. South East England 'could face water supply crisis' without action. Available at: https://www.theargus.co.uk/news/23125890.south-east-england-could-face-water-supply-crisis-without-action/

- A high standard of legislation is important, however, there must also be a strong focus on implementation and good governance in order to create change on the ground;
- Investment and maintenance of water infrastructure is very important to ensure a reliable water supply and to reduce leakage and pollution incidents; and
- It is important to have a focus on behavioural change as a means of demand management and water use efficiency.

Summary

South Africa has made a great deal of positive progress in terms of improving water quality, supply and sanitation since 1994. Key to this have been improved legal frameworks, investing in infrastructure and focusing on behavioural change to engender water use efficiency. Despite different socio-economic circumstances, several lessons and best practices have been identified that could be applicable to water management in England and Northern Ireland.

3 Key Messages

3.1 Introduction

The literature review for the scoping phase of the study, and the subsequent case studies have enabled the identification of a series of key messages, which are detailed below. The key messages summarise the lessons learnt from non-EU jurisdictions on how they manage the water sector and water environment, with examples of successes and failures. The learnings are presented under themed headings with evidence provided from relevant case studies where appropriate. There is a mixture of examples of where good practice has led to substantive positive outcomes, where there has been good legislation but in practice has not delivered expected outcomes, and examples of poor legislation/governance that have led to negative outcomes but where reform has been planned and/or put in place.

3.2 Clear Regulation to Influence Public Perceptions

Having transposed the Water Framework Directive (WFD) into UK law prior to exit from the EU, clear regulation is still in place to protect water in the UK. However, more could be done to change public perception on water use and protection especially as the UK is not meeting the vast majority of the WFD targets set.

- Transparent, easy-to-understand regulation is critical to good water management when considering matters such as water usage and water infrastructure management. This seems to work better than bureaucratic, market-based interventions, such as those found in the Murray-Darling Basin Plan, Australia, where water markets and water trade has been misused, partly due to lack of transparency and guidance, or voluntary measures, which have failed to deliver improvements in water use efficiency in California.
- Regulation should be transparent and well implemented. Where there is ambiguity and/or uncertainty it can lead to exploitation of the system with negative effects on other water users and the environment. This has been seen in the Murray-Darling Basin where water markets have been leveraged by professional traders for a minority of people.

3.3 Choosing the Best Regulatory Approach

The UK follows a catchment-based management approach as described within the WFD. This aims to deliver positive and sustained outcomes for the water environment by promoting a better understanding of the environment at a local level and to encourage local collaboration and more transparent decision-making when both planning and delivering activities to improve the water environment.

- When considering diffuse agricultural pollution, New Zealand is adopting a more flexible approach to be able to respond to the challenges and values of local systems in a way that works for different farm systems. Interventions at farm level are necessary, but a knowledge of the catchment is also needed to determine the wider context and how much change is needed at the farm scale. This approach is being adopted in New Zealand in 2023 in the form of Freshwater Farm Plans and a new national direction being set through the 2020 Essential Freshwater package.

- Interventions that are easy to communicate to a wider audience (e.g., nature-based solutions to mitigate flood risk; introducing drought-resistant planting; improving management and design of new dams and reservoirs; consolidated legislation that is clear and easy to understand) tend to work better than complicated interventions. Large scale projects have been seen in California to improve water supply across the state. However, these are expensive and can be slow to implement due to construction time frames/planning red tape. Farmers in California are also implementing more drought resistant planting regimes, and residents are being asked to remove turf and replace with native plant species that are drought resistant, one of the measures in the Sustainable Groundwater Management Plan 2014.

3.4 Importance of Monitoring and Information

The WFD monitoring programme provides information on the status of surface and groundwater and can be used to track progress toward the achievement of environmental objectives as well as assess change in the quality of the aquatic environment over time. This means having a robust and comprehensive monitoring system is crucial to determine if progress is being made and where focus is needed. Although the frameworks are different in other parts of the world, looking at the successes and failures of monitoring systems can provide learnings for the UK as it is universally a critical part of being able to improve our freshwater environments.

- Data and information on agricultural activities and farm management practices are vital for identifying sources and pathways of pollutants such as nutrients and fine sediment so that appropriate actions can be determined. This is evidenced in New Zealand where a lack of a national-scale database has contributed to an information gap on what management practices may have contributed to, or reduced, declining water quality.
- Models are valuable tools to assist with nutrient management and meeting water quality and greenhouse gas objectives, however, the way that models are used is equally important. This can be seen in New Zealand where a nutrient model (Overseer) originally designed as a decision support tool, was being used to model nutrient loss from farms and the results were then used to assist with planning and consenting functions. A 2020 scientific review found a lack of confidence in the model's results. The learning here is the need to have high confidence in tools being used in a regulatory context and not relying on one model. Transparency is also vital for users and regulators to have confidence in models used in regulation.

3.5 Diversification of Water Sources

Although the UK is thought to be plentiful in freshwater, there are areas where surface and ground water resources are under pressure to meet demand, particularly the south east of England, with compounding pressures from climate change. Lessons can be learnt from other parts of the world where water scarcity is a more significant issue.

- Over reliance on a single water source is not helpful and alternative water sources could be considered in certain contexts (e.g., treated wastewater for agricultural uses; use of desalinated seawater). California is investing US $8 billion (equivalent to £6.6 billion) into upgrading its water storage facilities as well as building new storage reservoirs and desalinisation plants to increase the capacity of the water supply to keep up with demand;

- Israel, one of the most water stressed countries in the world, invested in the construction of a national bulk water conveyance system to allow water to be distributed to citizens (via regional providers) across the entire country from various sources and can be varied depending on demand;
- Aquifer recharge is used in Israel and California to bolster groundwater resources – aquifers are recharged using treated wastewater during low-demand months and through the capture of occasional flash floods and runoff events; and
- South Africa is challenged with an inconsistent supply of water across the country and difficult climatic conditions. To address these challenges, South Africa caried out a range of water reforms and is working to increase and make its water supply more efficient by focusing on integrated resource management and using a mix of water resources. We can see progress through improved access to a water supply and sanitation.

3.6 Transboundary Cooperation

Within the UK transboundary cooperation is ensured in transboundary basins (e.g. England/ Wales, England/ Scotland) and also between Northern Ireland and Ireland.

- Switzerland is sometimes known as the 'water tower of Europe' as water from Switzerland reaches all northern, southern, western and eastern parts of Europe.[459] Thus, the country has a unique challenge in managing transboundary cooperation. Surrounding countries may rely on the water resources in in Switzerland to boost their own water supply. The Genevese Aquifer Management Plan between France and Switzerland implements a cooperation and monitoring system to manage the water supply between the two nations. The plan has so far been a success, ensuring that the supply of water is continued in the region and beyond.
- The Murray-Darling Basin in Australia covers four states and a territory. The Murray-Darling Basin Plan was established to manage the basin as a connected system to ensure water is divided fairly between users and between humans and the environment. A lack of governance and lack of transparency around the legislation has meant that some states have failed to meet their Water Resource Plan requirements, and ultimately the target volume of water to be released to the environment will not be met by the end date of 2024. As a result of poor management, certain end users and parts of the environment are not able to access the water they are entitled to under the legislation.

[459] Hydrological Atlas of Switzerland. 2004. The Hydrological significance of the European Alps. Available at: https://web.archive.org/web/20150120064413/http://www.hades.unibe.ch/en/products/druckausgabe/wasserhaushalt/tafel6_04. [Accessed: 15/03/2023}.

3.7 Water Use Efficiency and Infrastructure

The UK has an old water infrastructure that needs to be managed efficiently to protect the future water supply. Currently around a fifth of treated water running through pipes is lost to leakage,[460] and water companies in England spend £100 million every year clearing blockages from sewers. [461]

- Demand management through public support and awareness of water-related issues (e.g., scarcity, water quality, environmental degradation) helps to support good water resource management:
  - California is working on changing public perception of water use and improving efficiency; however, voluntary targets are being exceeded and more penalties, such as the financial penalty of $500 per person for those who waste water, could be needed to help conserve water;
  - South Africa's National Water Resource Strategy has placed significant emphasis on raising the importance and the need for behaviour change in terms of how water is treated and conserved by all South Africans by employing a mix of education and awareness campaigns and punitive charges for non-compliance; and
  - The Israel Water Authority used a similar approach but used the setting performance targets for improved efficiency.
- Investing in maintaining and improving water infrastructure is important to reduce 'non-revenue' water and therefore increase the reliability and resilience of the water supply. South Africa has managed to improve and diversify their use of water resources, however as noted in the report a lack of investment and maintenance of infrastructure remains an issue that could limit the socio-economic growth of the country.

3.8 Climate Change Resilience

The impacts of climate change on water resources and water quality are already being seen in the UK. Increased occurrences of high intensity storm events are creating more flooding events while prolonged dry periods with extreme high temperatures have the potential to cause drought conditions. The best way to manage this dichotomy of droughts and floods is to increase the resilience of the water environment and to make better use of the potable water resource.

- California is already experiencing extended drought periods that are stretching water supplies in the state. Infrastructure investment is being implemented to improve water storage facilities and new legislation to protect ground water abstraction has been implemented to conserve important ground water reserves that are crucial to the state during drought periods;

460 Ofwat. 2022. Leakage in the water industry. Available at: https://www.ofwat.gov.uk/leakage-in-the-water-industry/#:~:text=Currently%20around%20a%20fifth%20of,to%20significantly%20improve%20on%20this. [Accessed: 15/03/2023].

461 WaterUK. 2022. Dealing with sewage. Available at: https://www.water.org.uk/advice-for-customers/dealing-with-sewage/. [Accessed 15/03/2023].

- The impacts of climate change were not explicitly accounted for in Australia's Murray-Darling Basin Plan. The basin is now experiencing increased extreme droughts and flood events, which are exacerbating water quality problems in many areas. As predictions of rainfall and flows under climate change scenarios were not included in the setting of targets, those targets are becoming increasingly less fit for purpose. The learning from this is to use the best available science to set legislative targets but allow flexibility to make updates when and where necessary;
- The South African National Development Plan has set out a 15% reduction in water demand compared with 2012 levels to be achieved by 2030. It also aims to improve dam and reservoir storage facilities. The plans put in place will help to alleviate any potential water shortages as climate change has an impact on future water supply; and
- In Israel, the Israel Water Authority relies on its Hydrological Services Unit to collect, analyse, and model water data, which factors in the effects of global warming. To increase the resilience of natural systems the Authority, along with several other stakeholders, produced a Master Plan for the Supply of Water to Nature.

Appendix D

BEST PRACTICE / LESSONS LEARNT FROM AUSTRALIA, SWITZERLAND, NORWAY AND ISRAEL

Appendix D.1

Australia (Murray-Darling Basin)

Summary of lessons learnt and relevant to the UK's water sector post the exit from the EU

The key aspects of the approach taken in the Murray-Darling Basin that are relevant to the water sector in England and Northern Ireland and could be adopted as best practices include:

- Water markets and water trade can be misused, partly due to lack of transparency and guidance;
- Lack of Federal Government enforcement means that some States have not met Water for the Environment (Water Recovery) targets;
- Misuse of funding for private infrastructure improvements – lack of guidance/enforcement led to construction of private dams and prevention of water reaching downstream watercourses;
- Climate change – extreme droughts and flooding exacerbating water quality problems. Climate change effects not accounted for in the Murray-Darling Basin Plan; and
- New approach – individual basin governments can apply for adaptive management; water quality that meets the needs of our intended use.

Table D-1 - Australia (Murray-Darling Basin)

Water management theme	Details	Commentary
Overview of Australian water management (relevant to the Murray-Darling Basin)	▪ The Federal Government provides coordination and guidance but is not directly responsible for day-to-day management of water. ▪ The Department of Agriculture, Water and the Environment is responsible for water policies. ▪ State and territory authorities are principally responsible for everyday operations. ▪ National Water Initiative (NWI) – a blueprint for water reform across Australia (since 2004), focused on efficiency. ▪ National Water Commission (NWC) – established to oversee implementation of NWI and report progress to Federal Government. ▪ Water Act (2007) – to help implement the NWI; established the Murray-Darling Basin Plan (MDBP) in 2012.	

Water management theme	Details	Commentary
Transboundary water management - Murray-Darling Basin Plan (MDBP)	▪ The Murray-Darling Basin (MDB) covers 4 states and a territory. There are many different types of ecosystems throughout the MDB, ranging from semi-arid desert to wetland. Agricultural production in the MDB consumes ~60% of agricultural water used and generates ~40% of all income from the agricultural sector in Australia. These businesses undertake a variety of irrigated farm enterprises, including vegetable crops, tree and vine crops, pastures for grazing, hay, rice, cotton, cereals and oilseed crops [https://www.agriculture.gov.au/abares/research-topics/surveys/irrigation]. ▪ Over the years, the combination of natural droughts and increasing human use of the waterways for agriculture, manufacturing and communities has led to a decline in the health of the Basin [https://www.mdba.gov.au/basin-plan/plan-murray-darling-basin]. ▪ Led by the Murray-Darling Basin Authority (MDBA, federal agency) - the Murray-Darling Basin Plan (MDBP, A$13 billion) was established to manage the basin as a connected system, it covers: • Dividing water fairly and sustainably by calculating water availability and allocating water to entitlement holders; • Ensuring water gets where it needs to go so that human and environmental needs are met through river operations; • Evaluating and maintaining water quality; • Making sure the water market is fair by developing, complying with, and enforcing water trading rules; and • Making sure the river system is as healthy as possible by allocating water for the environment [https://www.mdba.gov.au/water-management/allocations-states-mdba/guide-water-management].	▪ The MDBP promised to deliver 3,200 billion litres of water to the environment each year through water buy backs and investing in water efficiency projects. This was later reduced; however, the target will not be met by the end date of 2024 [https://www.dcceew.gov.au/water/policy/mdb/policy/wesa-review]. ▪ In such a hot, dry country, the growing of rice and cotton (both water-intensive) has been questioned. However, both products are of relative high value. There are also concerns about the increasing number of water-intensive almond trees in some areas [https://www.theguardian.com/environment/ng-interactive/2018/apr/05/murray-darling-when-the-river-runs-dry]. ▪ Individual basin states were required to produce Water Resource Plans under the RBMP by December 2019, but many are late or non-existent, most notably, New South Wales failed to complete its WRP and is threatening to withdraw from Basin Plan. Consequently, a central element of the Basin Plan is yet to commence in NSW despite the Plan being signed into law over 8 years ago. There is a reported lack of transparency around the reasons that submitted WRPs have been (or will be) withdrawn, and a call for them to be made public [https://www.edo.org.au/2021/04/23/nsws-overdue-water-resource-plans-hampered-by-further-delays/].

Water management theme	Details	Commentary
	As well as the MDBA, water management is the responsibility of the following: ▪ Individual State and Territory Governments; ▪ The Commonwealth Environmental Water Office was created to manage water for the environment; ▪ The Australian Government Department of Climate Change, Energy, the Environment and Water is responsible for buying water from entitlement holders and investing in more efficient irrigation ('Recovering Water'); and ▪ The Inspector-General of Water Compliance is responsible for oversight of water management in the Basin and inquiry powers to investigate the implementation of the various Acts, Plans and Agreements [https://www.mdba.gov.au/water-management/allocations-states-mdba/guide-water-management].	
Water markets and trade	▪ Widespread drought in 1982 and 1983 created the need for water trading. Resulting water markets meant that water can be traded between water users, within set limits. 90% of Australia's water trading takes place in the MDB [https://iopscience.iop.org/article/10.1088/1748-9326/aca343], with an annual average value of more than $1.8 billion [https://www.accc.gov.au/publications/guide-to-the-murray-darling-basin-water-markets-inquiry-final-report]. ▪ Water users (principally agricultural sector) can buy or sell water rights, on a permanent or temporary basis. States retain ownership of water; individual water users can hold a water right that gives them legal entitlement to an annual allocation of water based on how much water is in storage across the system at a particular time.	▪ In a 2021 inquiry into MDB water markets, the Australian Competition and Consumer Commission reported that water trading has brought substantial benefits to many water users across the Basin. Water markets allow irrigators to increase their available water seasonally, earn income by selling water rights when they are more valuable to someone else, or release capital for investment in their businesses. However, the inquiry also reported that participants found the markets were untrustworthy and unfair, with no specific agency to oversee trading activities; that the complex nature of Basin water markets are best understood and leveraged by professional traders and large agribusinesses; general lack of transparency and guidance [https://www.accc.gov.au/publications/guide-to-the-murray-darling-basin-water-markets-inquiry-final-report].

Water management theme	Details	Commentary
Water for the Environment (Water Recovery)	▪ Recovering water for environmental restoration is managed by Commonwealth Environmental Water Holder (CEWH, Federal organisation) and requires recovering, planning and delivering water to protect vital ecosystems. ▪ The original 'Bridging the Gap' water recovery target for surface water was 2,750 GL/y. Following two amendments to the Basin plan in 2018 this target was changed to 2,075 GL/y subject to the implementation of a range of measures to achieve the environmental outcomes with less water [https://www.dcceew.gov.au/water/policy/mdb/progress-recovery]. The Bridging the Gap target is broken down into a number of smaller targets for different local areas called Sustainable Diversion Limit (SDL) resource units, which limits to the amount of water permitted for extraction. ▪ Water licence buybacks (undertaken by federal and state governments) are part of a scheme where farmers are allocated a certain amount of water from the river system that they can opt to use or sell. The government buys back water entitlements from farmers, known as buybacks, which reduces the amount of water taken from the river system. However, as of November 2022, There are no Commonwealth water purchase programs currently open [https://www.dcceew.gov.au/water/policy/mdb/commonwealth-water-mdb]. ▪ Aside from buybacks, budget is used for infrastructure projects designed to conserve water and control it better in the river system.	▪ Progress towards the 450 GL/y for enhanced environmental outcomes was reported in October 2022 - so far only 25.9 GL/y has been recovered [https://www.dcceew.gov.au/water/policy/mdb/progress-recovery]. Some SDL resource units have recovered water above their targets, while other units are yet to achieve their target in full. ▪ Farmers, irrigators and others were opposed to water buybacks. In 2015, the Coalition government put a stop to the practice, despite its proven cost-effectiveness compared to alternatives such as subsidising dams [https://www.dcceew.gov.au/water/policy/mdb/policy/wesa-review]. The federal government now only buys water for the environment when farmers offer to sell. This has raised concern over value for money as a number of water purchases since 2016 have involved rights to water that is less reliable [https://www.theguardian.com/environment/ng-interactive/2018/apr/05/murray-darling-when-the-river-runs-dry]. ▪ While there have been some environmental successes due to infrastructure projects, there are many examples of misuse. Private dams and diversions have stopped water reaching the rivers. Reportedly there are relatively few prosecutions for such 'water theft', where irrigators are not meant to pump water when the government releases it for environmental flows [https://theconversation.com/its-official-the-murray-darling-basin-plan-hasnt-met-its-promise-to-our-precious-rivers-so-where-to-now-188074].

Water management theme	Details	Commentary
Water Quality	▪ The National Health and Medical Research Council (NHMRC) provide standardised policy for water quality through the National Water Quality Management Strategy (guidance only, not mandatory). Water quality targets are set out in MDBP and basin state water resource plans are required to include water quality management plans. ▪ MDBA annually assesses performance against water quality targets and evaluates the Plan every 5 years. ▪ Basin governments can apply for adaptive management - a focus on fit for purpose – these are designed to achieve water quality that meets the needs of our intended use, and ability to trial new techniques, use new information, etc.	▪ The State of the Environment report (2022) [https://www.dcceew.gov.au/science-research/soe] found water extraction and drought left water levels at record lows in 2019. Rivers and catchments are mostly in poor condition, and native fish populations fell by more than 90% in the past 150 years. ▪ There have been several extreme poor water quality events in the MDB in last decade - expected that these will worsen with climate change (Baldwin, 2021). There was extreme flooding in NSW in 2022 causing inundation of areas previous not flooded, causing risk of hypoxic blackwater events (low dissolved oxygen). ▪ Large-scale fish kills occurred along the Barwon-Darling River in 2019 [https://www.theguardian.com/australia-news/2019/jan/28/menindee-fish-kill-another-mass-death-on-darling-river-worse-than-last-time]. ▪ An expanse of wetlands (23 Ramsar designated sites) is located at the mouth of the Murray-Darling system. This part of the river has been severely degraded by river regulation and over-abstraction causing low flows and increased siltation. If the river silts up and flows are blocked, it has disastrous impacts for the wetlands. Near-continuous dredging is necessary because flows are no longer sufficient to scour the sand from the mouth of the river [https://www.theguardian.com/environment/ng-interactive/2018/apr/05/murray-darling-when-the-river-runs-dry].

Appendix D.2

Norway

Summary of lessons learnt and relevant to UK's water sector post the exit from the EU

The key aspects of the approach taken in Norway that are relevant to the water sector in England and Northern Ireland and could be adopted as best practices include:

- Smart water metering to reduce leakage;
- Increased public awareness around efficient water use – use of text message services (although reported limited success);
- Introduction of The Land Act to provide both guidance and enforcement to agriculture, to reduce diffuse water pollution (particularly nutrients – phosphorus and nitrogen); and
- Infrastructure improvement for both drinking water and sewage treatment.

Table D-1 - Norway

Water management theme	Details	Commentary
Water loses	▪ Norway has an old and breaking water system with a large amount of water lost through leaks. It is estimated that over 30% of water is lost before it reaches the consumer.	▪ Digitising the water system is aiming to increase awareness of any potential losses in the network. Worked through a smart metering system, like that used by energy suppliers to get a better understanding of the demand.
Drought (Oslo)	▪ An increasing population has put an increased strain on the water supply in the city. Residents are being urged to reduce their water consumption to save water resources in the area. The city has embarked on a costly program to monitor and repair old systems to improve efficiency. As well as finding a new drinking water source by 2028 to meet demand [https://sciencenorway.no/biology-chemistry-climate/wasting-water-in-norway-has-consequences-for-the-environment/1578207].	▪ Government implemented a text message service that warns and encourages residents to reduce water usage. However, residents have shown to not follow the instructions. Other measures will be required to help the drought issues being faced.
Agricultural pollution	▪ For many years the south west and east of the country have seen large anthropogenic pollution inputs from farmers. This has led to heavy	▪ Increased regulation to set limits for farmers pesticide and fertiliser use. The Land Act enforces this as well as teaching

Water management theme	Details	Commentary
	nitrate and phosphate loading in rivers and lakes in the areas, leading to eutrophication and low oxygen levels. Aquaculture has also added to coastal water inputs of nitrogen, again leading to further environmental pollution	farmers about other issues such as erosion and regulating the use of sewage sludge as a fertiliser.
Inadequate sewerage system	▪ Norway has seen several human health issues related to the treatment of drinking water. A number of the coastal islands have seen deaths and illness for large proportions of the residents. On the island of Askoey in 2019, two residents died after being infected by E.Coli from unsafe drinking water.	▪ Government investment to improve the existing sewage network and to build new plants to cope with demand. A total of 70 million euros has been invested so far [https://www.nib.int/releases/nib-finances-improved-wastewater-treatment-for-oslo-norway].

Appendix D.3

Switzerland

Summary of lessons learnt and relevant to UK's water sector post the exit from the EU

- The key aspects of the approach taken in Switzerland that are relevant to the water sector in England and Northern Ireland and could be adopted as best practices include:
- Natural regeneration (river restoration) to improve ecological status, reduce flood risk and increase public amenity value;
- Increased use of nature-based solution approaches around dams and reservoirs, to reduce impact of impoundment for hydropower and renewable energy;
- Water Protection Act largely successful in achieving good ecological status in fresh water bodies, however, issues in areas of intensive agriculture; and
- Control of invasive species through combination of mandating of boat cleaning, introduction of monitoring and increased public awareness and citizen science approach to reporting issues.

Table D-1 - Switzerland

Water management theme	Details	Commentary
Natural restoration	▪ The River Thur is the largest river in Switzerland without any dams or reservoirs, that exhibits extreme flow changes throughout the year with numerous flood events. Initially a 1.5km stretch of the river was allowed to naturally regenerate.	▪ Natural regeneration has decreased flood events in the area and improved the ecological status of the river. The implementation had a positive social impact that increased visitors to the river as access was increased and created opportunities for recreational activities in the area.
Water Quality	▪ The first water protection act was implemented in 1953 has allowed Switzerland to have one of the cleanest and most sustainable water sources in Europe [https://unece.org/DAM/env/water/Protocol_reports/reports_pdf_web/Switzerland_summary_report_en.pdf].	▪ Switzerland has achieved good ecological status in many of its lakes and rivers. However, several lakes still experience eutrophic events and suffer from oxygen depletion. Micropollutants are below the limit levels. Phosphorous loading is still an issue in several lakes especially in the cattle grazing and more agriculturally intensive areas of the country. [https://www.bafu.admin.ch/bafu/en/home/topics/water/info-specialists/state-of-waterbodies/state-of-lakes/water-quality-in-

Water management theme	Details	Commentary
		lakes.html/#:~:text=The%20hygienic%20water%20quality%20of,almost%20all%20lakes%20and%20rivers].
Hydropower and renewable energy	▪ Increased need for renewable energy has led to the country installing over 1000 dams that cause several physical and ecological issues. They are barriers for fish migration, they slow river flow and bed load that is an important for ecology and overall river health.	▪ Improved management and design of new dams and reservoirs to incorporate nature and natural processes [https://www.bfe.admin.ch/bfe/en/home/supply/renewable-energy/hydropower/water-usage-levy.html].
Invasive plants and animals	▪ Invasive plants and animals are common in the larger river systems that are transboundary. Species such as signal crayfish and quagga and zebra mussel.	▪ Increasing public awareness to look out for and report any sightings of invasive species. Mandating the cleaning of boats travelling between infected areas to areas of not infestation. Introduction of regular and coherent monitoring of infected areas. https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-87721.html#:~:text=One%20such%20invasive%20species%20that,of%20Europe%20and%20North%20America

Appendix D.4

Israel

Summary of lessons learnt and relevant to a post UK's water sector post the exit from the EU

Israel provides an example of where an integrated water management approach has been applied successfully.

The key aspects of this approach that are relevant to the water sector in England and Northern Ireland and could be adopted as best practices include:

- A national bulk water conveyance system – a national grid of water would address the issue of uneven rainfall/water distribution and alleviate water scarcity in areas such as the southeast of England;
- The private ownership of water and sewerage companies in the UK is a barrier to this at present;
- Not using potable water for agricultural and other industrial purposes and instead using other sources such as grey water and wastewater reuse; and
- Increased demand management through public awareness and increased cost of water.

Table D-1 - Israel

Water management theme	Details	Commentary
Overview	▪ Israel is one of the most water stressed countries in the world [https://openknowledge.worldbank.org/bitstream/handle/10986/28097/119309-WP-PUBLIC-56p-WcmpeProof.pdf?sequence=1&isAllowed=y]. ▪ Other notable water management issues Israel face include a rapidly growing economy, ca. 50% water use by agriculture through irrigation; climate change; and nutrient pollution of groundwater caused by extensive fertiliser use in agriculture.	▪ Israel provides an example of where an integrated water management approach has been applied successfully.
Legal and institutional reform	▪ The Israel Water Authority (IWA) [https://www.gov.il/he/departments/water_authority/govil-landing-page] was established in 2007 as an autonomous government agency combining planning and regulatory responsibilities for all the elements of the water chain.	▪ While the Israel case study is widely regarded as an example of good water management, there have been challenges during the reform, mistakes made and there are still areas for improvement [https://openknowledge.worldbank.org/bitstream/handle/10986/2809

Water management theme	Details	Commentary
	▪ Reform has been implemented over the course of the last 15+ years. This includes changing the pricing principles of water from a public and social good to a commodity, institutional reforms with corporatization of service providers and the establishment of a national regulator. Water tariffs for all users were gradually increased to approach full cost recovery.	7/119309-WP-PUBLIC-56p-WcmpeProof.pdf?sequence=1&isAllowed=y].
Water security	▪ Orchestrated by the IWA, water security has been achieved primarily through the production of non-conventional waters – wastewater reuse (since 1998) and seawater desalination (since 2006) – together with a legal framework that makes metering compulsory and asserts a strong government's control over water resources [https://www.oecd.org/climate-action/ipac/webbooks-practices/dynamic/ipac-case-studies/d81db5f5/pdf/israel-s-sustainable-water-management-plans.pdf]. ▪ **Desalination** - large-scale desalination of seawater to provide the main source of potable water (~85%), notably this water is not used for agricultural purposes. ▪ **Large-scale reuse of wastewater** – over 90% of wastewater is collected, treated, and reused, primarily for agriculture (representing approximately half of all irrigation water nationwide). ▪ **National bulk water conveyance system** – water is distributed to citizens (via regional providers) cross country from various sources and can be varied depending on demand. ▪ **Demand management** – the IWA carried out massive public awareness campaigns (ca. 2008) to reduce per capita potable water consumption, while setting performance targets for improved efficiency.	▪ The level of desalination achieved was through massive capital investment and the construction of 5 'mega' seawater reverse osmosis plants. However, the IWA obtained a relatively low price for desalinated water through PPP (public-private partnerships) contracts. Note that there are examples of where the PP approach has led to difficulties in the form of cost overruns and delays [https://openknowledge.worldbank.org/bitstream/handle/10986/28097/119309-WP-PUBLIC-56p-WcmpeProof.pdf?sequence=1&isAllowed=y]. ▪ It is very expensive to achieve tertiary level of wastewater treatment, but also to convey and store reclaimed water, so implementation may not be realistic without significant public subsides. Wastewater reuse is the only part in the Israeli water cycle in which full cost recovery through tariffs has not been achieved. ▪ Water is priced at its actual cost, as a strong signal to users that water is a precious resource not to be wasted. ▪ There is quasi-universal water metering for strict enforcement of water abstraction quotas and comprehensive monitoring of aquifer levels. ▪ The IWA relies on its Hydrological Services Unit to collect, analyses, and model water data and factors in the effects of global warming.

Water management theme	Details	Commentary
	▪ **Using aquifers as reservoirs** – aquifers are recharged using treated wastewater during low-demand months and through the capture of occasional flash floods and runoff events. ▪ Climate change – monitoring of the impacts of global warming. ▪ **Master Plan for the Supply of Water to Nature** - the Plan determines how much water to discharge, what type and when. In some places, they set aside a minimum quota of water for ecosystems.	▪ To increase the resilience of natural systems, the Israel Nature and Parks Authority, the Ministry of Environmental Protection and the IWA jointly issued in 2013 a Master Plan for the Supply of Water to Nature.

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