ASSESSMENT OF THE IMPLEMENTATION OF ENVIRONMENTAL LAW IN RELATION TO BATHING WATERS

February 2023

Prepared for:

Office for Environmental Protection

Prepared by:

Stantec / CREH

Project Number: 330202402

Revision	Description	Author(s)	Date	Quality Check	Date	Independent Review	Date
1.0	Final Report	Rob Palmer (Stantec) & Dr Carl Stapleton (CREH)	October 2023	Prof Sean Comber (Stantec) & Prof David Kay (CREH)	October 2023	George Hare (Stantec)	October 2023
1.1	Minor Amendments	Rob Palmer (Stantec)	February 2024	Prof Sean Comber (Stantec)	February 2024	George Hare (Stantec)	February 2024

Noted contributions also from Bruce Horton, Giorgia Comana, Hannah Guest and Rebecca Smart (All Stantec).

The conclusions in the Report titled Assessment of the implementation of environmental law in relation to bathing waters are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not consider any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Office for Environmental Protection (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by: 

Signature

Rob Palmer and Dr Carl Stapleton

Printed Name

Reviewed by: 

Signature

Prof. Sean Comber and Prof. Dave Kay

Printed Name

Approved by: ***G Hare***

Signature

George Hare

Printed Name

Table of Contents

Executive Summary

Introduction

This report seeks to review the current legal provisions for bathing waters in England and Northern Ireland, assess their implementation and effectiveness, and then compare these provisions against the rest of the UK and selected EU and Worldwide jurisdictions.

Review of the Current Legal Provisions

Bathing water legislation in England (the Bathing Water Regulations 2013) and Northern Ireland (the Quality of Bathing Water Regulations (Northern Ireland) 2008) were derived from the EU revised Bathing Water Directive (2006/7/EC) which has its basis in human health.

Following UK's exit from the EU, the Bathing Water Regulations 2013 and the Quality of Bathing Water Regulations (Northern Ireland) 2008 (together, the "Regulations") became part of a body of retained EU law that entered into force at the end of the transition period on 31 December 2020.

The EU Directive is currently under review, the conclusions of which were due to be published in 2023. Within England, the Department for Environment, Food and Rural Affairs (DEFRA) are currently reviewing the Bathing Water Regulations 2013, with the review due for completion by the end of 2024.

According to the existing "Regulations", bathing waters are sampled throughout the bathing season and classified depending on the quantities of two faecal indicator organisms (FIOs), i.e., *Escherichia coli (E. coli*) and intestinal enterococci (IE). Concentrations of these two parameters, which can be found in the gut of any warm-blooded animal, have been shown to correlate to rates of gastrointestinal infection in humans (Kay et al. 2004[1] and Wiedenmann 2006[2])[3]. These gastrointestinal infection rates have been used to inform a four-tier classification system for categories of microbial water quality. Other parameters such as cyanobacteria, macro-algae, marine phytoplankton and wastes are considered but aren't used to inform the classification.

High concentrations of FIOs are typically associated with continuous or intermittent sewage discharges, agricultural pollution or livestock grazing, leaking or misconnected sewerage infrastructure or faeces from pets or wildlife. These FIOs will generally survive within the environment

[1] Kay D, Bartram J, Prüss A, Ashbolt N, Wyer MD, Fleisher JM, Fewtrell L, Rogers A, Rees G. Derivation of numerical values for the World Health Organisation Guidelines for recreational waters. Water Research (2004a) Mar Vol 38(5), Pages 1296-304. doi: 10.1016/j.watres.2003.11.032.

[2] Wiedenmann, A., Krüger, P., Dietz, K., López-Pila, J.M., Szewzyk, R. Botzenhart , K. (2006) A Randomized Controlled Trial Assessing Infectious Disease Risks from Bathing in Fresh Recreational Waters in Relation to the Concentration of *Escherichia coli*, Intestinal Enterococci, *Clostridium perfringens*, and Somatic Coliphages. *Environmental Health Perspectives 119(2), Pages 228-236*. doi:10.1289/ehp.8115

[3] Detailed information on the history and epidemiology evidence for the current standards are found in Chapter 2

for a period of several hours to a few days depending on environmental stress factors such as sunlight, salinity, disinfection, starvation and predation[4].

The main authorities as defined by the "Regulations" are DEFRA, Environment Agency (EA) and local authorities in England, and the Department of Agriculture, Environment and Rural Affairs (DAERA) and bathing water operators in Northern Ireland.

The "Regulations" set out provisions, functions and duties on the main authorities regarding the:

- Identification of bathing waters – how bathing waters are identified.
- Sampling and monitoring – sampling methods, locations, frequency, storage, transport and laboratory parameters to be analysed.
- Assessment and classification of identified sites – determination of classification and ability to disregard samples during 'abnormal situations', or periods of 'short term pollution'.
- Minimum and targets standards – outlining bathing water standards.
- Communication of information and risk – provision of information through bathing water profiles, signage, the internet, and other appropriate media.
- Bathing water management measures – management responsibilities in response to specific situations such as 'pollution incidents', 'abnormal situations' and 'short term pollution'.

In particular, the "Regulations" set out requirements to achieve a minimum 'Sufficient' classification at every identified bathing water by 2015 and to increase the number of bathing waters achieving the target 'Good' or 'Excellent' classifications.

The "Regulations" are not well aligned with key environmental legislation such as the Water Framework and Urban Wastewater Treatment Regulations and the recent UK Environment Act 2021 with limited crossovers in scope and the use of data. Alignment could be improved through variety of measures including allocating the bathing water sample point as an alternative or additional Water Framework sampling and compliance location. This would allow nutrient and chemical parameter data collected for the Water Framework and which has a direct or indirect influence on human health (i.e., nutrient data which could be used to predict cyanobacteria proliferations or concentrations of chemicals such as PFOS), to be used for multiple purposes. Another practical improvement in alignment would be the use of Urban Wastewater storm overflow event duration monitoring data as a leading indicator in the bathing water pollution prediction and forecasting tools.

Assessment of the Implementation and Effectiveness of the Current "Regulations"

In 2023, England had 424 identified bathing waters, of which 407 were coastal and 17 were inland. This includes four new bathing waters, added prior to the 2023 bathing season, and one un-

[4] The authors acknowledge that this may not always be the case as FIOs have been shown to survive for longer periods or even grow in certain circumstances (e.g., within sediments or seaweed piles).

classification[5]. At the end of the 2022 bathing season, the last for which full results are available during the period of this contract, 2.9% (12) of all sites, including all of the riverine bathing waters, failed to achieve the minimum 'Sufficient' classification. 71.7% of all sites achieved the target 'Excellent' classification.

In 2023 Northern Ireland had 26 identified bathing waters (all coastal) and a further seven 'Candidate'[6] sites (6 coastal and 1 inland). At the end of the 2022 bathing season, one site failed to achieve the minimum 'Sufficient' classification whilst 80.8% of identified sites achieved the target 'Excellent' classification.

Table 1 shows the overall bathing water results for England and Northern Ireland, set in comparison to the rest of the UK.

Table 1 – Summary of 2022 UK Bathing Water performance

Country	Number of bathing waters	Percentages of bathing waters achieving the classifications				
		Un-assessed	Poor	Sufficient	Good	Excellent
England	421	0.5%	2.9%	4.3%	20.7%	71.7%
Northern Ireland	26	-	3.9%	3.9%	11.5%	80.8%
Scotland	87	-	2.3%	13.8%	40.2%	43.7%
Wales	107	0.9%	0.9%	3.7%	15.0%	79.4%

The report found that the main authorities in England and Northern Ireland are generally considered to be undertaking their functions, and taking appropriate measures to fulfil their duties, as defined and required by the "Regulations". The report highlights areas where it appears from the information assessed that the required standards are or may not be being met, where opportunities for change or improvement may exist as well as highlighting examples of good practice where appropriate. These are summarised in Table 2.

Table 2 – Summary of the key findings on the implementation of the "Regulations"

Required standards not being met	Opportunities for change or improvement	Examples of good practice
Both England and Northern Ireland had 'Poor' bathing waters in 2022	Better alignment with other related legislation and water industry AMP cycles	Northern Ireland ability to react to high sample results by the following day
12% of English bathing waters were found to not have the required bathing water signage in place during a 2022 audit	Structured pre-identification process to allow improvements prior to formal classification	Northern Ireland public consultation of bathing waters
	Public consultation in England as part of the identification criteria and processes for new bathing waters	England's statistical pollution risk forecasting system and Swimfo tool

[5] The term 'un-classification' is used to describe sites where formal bathing water status has been rescinded or removed.
[6] A term specific to Northern Ireland referring to sites which are being investigated for their potential to become future identified bathing waters. Please refer to Chapter 4.3 for further details.

Required standards not being met	Opportunities for change or improvement	Examples of good practice
	Dissemination of information around ongoing works to improve 'Poor' bathing waters	Proposed changes to agricultural subsidies in England will promote environmental stewardship and have a positive effect on bathing water quality at a national level
	Dissemination of information regarding reasons for rejected bathing water applications	
	Dissemination of real time water quality information via electronic beach signage. This reduces exposure to polluted waters and can improve classifications[7].	
	Information and communication of cyanobacteria risks	
	Consideration of pollution hotspots (England only) and additional temporal and spatial factors when designing the monitoring programme.[8]	
	Closure of the legal gaps in Northern Ireland around misconnections and diffuse bacteria pollution from agriculture	

The report also demonstrates that whilst there are areas for improvement in current implementation, the effectiveness of the "Regulations" is fundamentally limited by the scope and coverage of the existing provisions. Table 3 summarises the key findings on the effectiveness of the current "Regulations". Many of these findings are supported by the 2018 World Health Organization (WHO) review of the EU revised Bathing Water Directive[9].

Table 3 – Summary of the key findings on the effectiveness of the "Regulations"

Element	Key Findings
Provisions of the current "Regulations"	- The definition of "bathers" and "bathing season" means other recreational water users aren't covered by the "Regulations" and "bathers" are only covered during certain periods of the year. - The focus on microbial water quality means many other factors impacting human health when using recreational waters aren't covered (i.e., drowning, impact injuries, physiological harm, infection, and non-microbial intoxication) - By using the previous four seasons of bathing water data to determine a classification, the existing system can only offer a retrospective assessment of historic water quality.

[7] Within the Regulations up to 15% of samples per bathing season can be disregarded at the end of the season if there is evidence that the public was warned of an increased short term risk of reduced water quality on the day or time a high sample was recorded. Increasing the reliability of predictive modelling systems therefore increases the likelihood of first predicting, and then disregarding the highest recorded values in the dataset.

[8] Bathing water quality in the UK can be both highly spatially and temporally (both within day and seasonally) variable. Ensuring sufficient samples are taken across a range of tidal / river flow conditions at different times of day and ensuring the correct method of calculation is used depending on the nature of the data, should provide a much more accurate assessment of water quality.

[9] who-recommendations-on-ec-bwd-august-2018.pdf

Element	Key Findings
Assessment of current parameters, thresholds and classification system	- *E.coli* and IE remain the most appropriate parameters to assess risk of gastrointestinal illness. There is currently insufficient evidence to use enteric viruses and / or bacteriophages as potential alternative indicators. - The classification system should be retained but all thresholds set to 95th percentiles to avoid confusion. This is in comparison to the existing system which uses a mix of 90th and 95th percentiles depending on the classification. - An alert level system for cyanobacteria is recommended to help reduce the risks to human health. - Risks from 'Swimmers Itch' (cercarial dermatitis) & wound infection (primarily Vibrio infection) should be detailed in bathing water profiles. - Further research into the transmission of, and surveillance methods for, antimicrobial resistant microorganisms is required before it can be included.

Comparison with Approaches and Performance across the UK

As UK bathing water regulations are all based on the EU revised Bathing Water Directive there are inherent similarities in both legislation and approaches across all four jurisdictions. The biggest differences can be found in the identification / designation process, the length of the bathing season and average number of samples taken, short-term pollution risk forecasting, legislative and funding approaches to agricultural subsidies and pollution and overall bathing water performance.

UK bathing water regulations all state bathing waters should be identified / designated where it is expected that *"a large number of people bathe*". England and Wales also require consideration of "*infrastructure or facilities provided, or other measures taken, to promote bathing at those waters*". The interpretation of "*a large number*" varies across the UK with minimum eligibility criteria ranging from 150 beach users over a single day within the bathing season in Scotland[10] to 45 bathers on one occasion and 100 beach users on at least two occasions during the bathing season in Northern Ireland. Whilst UK bathing water regulations maintain this degree of subjectivity there will always be scope for public challenge as to whether the regulations are being applied appropriately.

Given the retrospective nature of the classification system outlined in Table 3, short-term pollution risk forecasting systems are required to prevent exposure to changes in water quality at the bathing waters. This report demonstrates that statistical regression (or black box) models calibrated using intensive sample data, similar to those created by CREH and used by Natural Resource Wales at Cemaes bathing water in Anglesey, are the most effective at predicting pollution, whilst the English system of statistical linear regression calibrated using historic sample data, offers the most pragmatic solution for the majority of sites. Any real time predictive risk modelling (short-term forecasting systems) should be communicated by electronic beach signage where possible.

Medium to longer term water quality predictions as a result of catchment changes or climate change are currently considered by regulatory and water industry 'No Deterioration' investigations. No change to this approach is recommended.

[10] This requirement is set to be revised following an investigation into the bathing water application process in December 2023 by Environmental Services Scotland (https://environmentalstandards.scot/wp-content/uploads/2023/12/News-Release-Bathing-Waters-Summary-Report-Published.pdf)

Both Wales and Northern Ireland have comparable overall bathing water performance with approximately 80% of all sites achieving the target 'Excellent' classification. Scotland is much lower with only 44% achieving 'Excellent'. This is shown in Table 1.

Comparison with Approaches and Performance from selected EU jurisdictions

As part of the review of existing "Regulations", bathing water management approaches and performance in England and Northern Ireland have been compared against selected EU jurisdictions. Although transposed from the EU Bathing Water Directive and inherently similar to England and Northern Ireland, chapter 5 assesses key differences in bathing water legislation and management for four comparable EU member states: Denmark, France, Germany and the Republic of Ireland.

Across the EU, the highest performing jurisdictions are generally those with very hot climates such as Cyprus (99.2% Excellent) and Greece (96.6% Excellent) and / or those demonstrating very high compliance rates with the EU Urban Wastewater Treatment Directive, such as Austria (96.9%) and Denmark (94.3%)[11]. Within this wider context, Wales and Northern Ireland demonstrate about average performance (47th and 53rd percentiles respectively), England is within the bottom 20% and Scotland performs worse than any other nation reporting against the EU Bathing Water Directive.

Across the selected jurisdictions, Denmark and Germany currently have the highest percentage of bathing waters at 'Excellent' status (94% and 90%, respectively) compared with England at 72% and Northern Ireland at 81%. This report suggests that the highest performing jurisdictions have favourable climatic conditions and have invested heavily over several decades in wastewater and stormwater collection and treatment. As France, Germany and Denmark have a long history of inland bathing waters, the Urban Wastewater Treatment Directive has then meant that wastewater treatment works impacting these inland sites are required to have tertiary ultra-violet disinfection systems. In contrast, since England and Northern Ireland do not have many inland, and in particular riverine, bathing waters there has been no historical reason, or driver, for bacterial treatment at inland wastewater treatment work discharges.

Another key finding is related to the established 'pre-identification', 'candidate' or 'working towards' formal bathing water status that can be found across these other jurisdictions. Whilst Northern Ireland does have a 'candidate' process prior to formal identification, a structured 'pre-identification' process such as that used by Germany ensures that bathing is only encouraged at sites which already achieve the minimum standards[12]. Nominated sites undergo various steps including addressing issues with access, planning and facilities as well as investigations and works to ensure water quality standards, all ahead of formal identification.

The concept of tiered systems of protection is also something that can be seen in France and Ireland. France has bathing waters and '*organised bathing waters*' – both are protected by the same legislation but '*organised bathing waters*' will have facilities and lifeguarding which other sites do not. In Ireland,

[11] European bathing water quality in 2022 — European Environment Agency (europa.eu)

[12] England and Northern Ireland do not require a minimum standard of water quality prior to identification.

if a 'candidate' site fails to meet the minimum eligibility criteria for bathing water status, it can still be sampled and reported on as a 'monitored water'.

Germany also offers an example to the UK of potential protocols for dealing with cyanobacteria, with an alert level system with associated action plans depending on alert level. The 2023 cyanobacteria proliferations in Northern Ireland and the increase in inland bathing water sites in England means this is something both jurisdictions will need to address in the near future.

National, rather than state or municipality level, approaches in England and Northern Ireland are able to offer much more consistent approaches to bathing water management and public communications than are seen across France, Denmark and Germany. Additionally, England and Northern Ireland have much greater confidence in the classifications, taking more samples on average than the selected EU counterparts.

Comparison with Performance and Approaches from selected Worldwide Jurisdictions

There are three main global systems for recreational water management, the EU Bathing Water Directive, the WHO Guidelines, and the United States Recreational Water Quality Criteria (RWQC). This report considers how these different systems work when applied at a country level (and state level where appropriate) and any lessons that can be learned within the context of the UK. Australia (Tasmania), New Zealand and the United States of America (Connecticut) were chosen to highlight some of the aspects of these different systems alongside Japan, which was chosen for its unique approach to recreational water management.

In all these examples, the scope and coverage of the individual guidelines / regulations extends beyond "*bathers*" to all recreational water users although standards may change depending on typical use. In Connecticut there is a tiered classification system with areas attracting "*primary contact*" activities (such as bathing) having tighter standards than those attracting "*secondary contact*" activities (such as surfing or kayaking)[13]. Japan takes this slightly further with every waterbody in the country classified with regards to suitability for recreational use.

Australian national guidelines also extend the parameters defining the overall classification to include all factors which can impact human health, with consideration for physical (such as dangerous tides or currents) and chemical hazards alongside the recognized microbiological and algal (cyanotoxin) hazards. This allows for a single message to be provided to the public on the overall suitability of the water for recreational use.

All the examples put significant focus on 'sanitary inspections' where the efforts are made to determine the sources, causes and factors influencing poor water quality. The results of these models and inspections can inform 'Alert Level' systems indicating future water quality over the coming hours and days. These short-term systems are designed to prevent exposure to factors impacting human health

[13] This is based on the perception that there are different likelihoods of ingesting polluted waters depending on the recreational activity. There is currently no epidemiological evidence to support different thresholds for different recreational uses.

and are done alongside longer-term water quality classifications. The emphasis on preventative measures over retrospective assessment is highlighted by the fact that recreational water management is the responsibility of local and national public health authorities rather than the environmental regulator as in the UK.

Regarding performance, Japan perhaps demonstrates an exemplar of global recreational water quality. Although many of the parameters and thresholds are not based on the latest global academic studies, the investment in wastewater and stormwater collection and treatment alongside the promotion of traditional and sustainable agricultural practices has seen water quality improve significantly. In 2022, 63% of Japan's recreational water averaged less than 2 cfu/100ml of *colon bacillus*[14] across the bathing season. This figure is below the standard limit of detection used in UK bathing water management (i.e., 10 cfu/100ml).

Concluding Remarks

In conclusion, the report demonstrates that while the England and Northern Ireland authorities are implementing the requirements of the current regulations reasonably well, there is scope for improvement to increase the effectiveness of the regulations. Overall bathing water performance could also be improved, a factor most clearly demonstrated by comparing the percentage of sites achieving the target 'Excellent' classifications in England and Northern Ireland against other EU and non-EU countries which report against the EU Bathing Water Directive. Some of these nations offer positive lessons on how to achieve better outcomes, including measures which could be taken now by the main authorities or incorporated into future reviews of the bathing water regulations. Further afield, other recreational water guidelines and approaches have been considered which can offer lessons, with a key focus on the primacy of human health in decision making, which could be incorporated in the current or future reviews to bathing water regulations.

A full list of the recommendations arising from this report is available in Chapter 7.

[14] Stantec and CREH have been unable to confirm the exact meaning of *colon bacillus* and if it responds to specific microbiological tests recognised by the UK, EU, US or WHO. It is perhaps most likely to translate as 'Faecal Coliform', a subset of Total Coliforms which includes *E.coli*

Acronyms / Abbreviations

AFBI	Agri-Food and Biosciences Institute
AMR	Anti-Microbial Resistance
AMP	Asset Management Plan
CAP	European Union Common Agricultural Policy
cfu	Colony Forming Units
CREH	Centre for Research into Environment and Health
DAERA	Department of Agriculture, Environment and Rural Affairs
DEFRA	Department for Environment, Food and Rural Affairs
DFI	Department for Infrastructure
EA	Environment Agency
E.coli	*Escherichia coli*
EMFG	Environment Marine and Fisheries Group
EPA	United States Environmental Protection Agency
EPR	Environmental Permitting Regulation
EU	European Union
FIO	Faecal Indicator Organisms
GI	Gastro-intestinal Infection
IE	Intestinal Enterococci
MST	Microbial Source Tracking
NAP	Nutrient Action Programme
NIEA	Northern Ireland Environment Agency
NRW	Natural Resources Wales
OEP	Office for Environmental Protection
OFWAT	Water Services Regulation Authority
PC	Price Control (Northern Ireland)
PR	Price Review (England and Wales)
RWQC	United States Recreational Water Quality Criteria
SEPA	Scottish Environmental Protection Agency
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WINEP	Water Industry National Environment Plan
WHO	World Health Organisation

Glossary

Anormal Situation	An event or combination of events impacting on bathing water quality which the appropriate agency would not expect to occur, on average, more than once every four years.
Disregard(ing) / Discount(ing)	The terms 'disregard' and 'disregarding' are used within this report when discussing the ability within the Regulations to remove particular sample results from inclusion of the final classification. This is done to align with specific text from UK bathing water regulations. Outside of the regulatory environment the terms 'discount' and 'discounting' are instead used by the majority of main authorities. NB 'discounting' in the UK, generally involves the process of prediction to give the public pre-warning (i.e., informed choice before the health risk is encountered)
EU Bathing Water Directive	Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality and repealing Directive 76/160/EEC.
Identified / Designated	The terms 'identified' bathing water is used within this report when discussing sites which have been granted bathing water status. This is done to align with specific text from UK bathing water regulations. Outside of the regulatory environment the term 'designated' bathing water is instead used by the majority of main authorities within England.
Regulations	Bathing Water Regulations 2013 and the Quality of Bathing Water Regulations (Northern Ireland) 2008.
Short Term Pollution	Microbiological contamination where the appropriate agency has clearly identified the causes and does not normally expect contamination to affect bathing water quality for more than approximately 72 hours after the bathing water quality is first affected.
Un-classification	The term 'un-classification' is used with this report to describe sites where formal bathing water status has been rescinded or removed. This is done to align with specific text from UK bathing water regulations. Outside of the regulatory environment the terms 'de-designation' and 'de-listing' are often used by the main authorities.

Chapter 1: Introduction

This report seeks to review the current legal provisions for bathing waters in England and Northern Ireland, assess their implementation and effectiveness, and compare these provisions against the rest of the UK and selected EU and Worldwide jurisdictions.

The legislative provisions concerning the management of bathing water quality in the UK are derived from the *Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality and repealing Directive 76/160/EEC*[15] (henceforth "EU Bathing Water Directive") and subsequent clarifications deriving from *EU Commission Implementing Decision 2011/321/EC*[16].

As environmental policy is a devolved matter the EU Bathing Water Directive was transposed into separate regulations for England and Wales, Scotland, and Northern Ireland. The EU minimum standards of environmental protection in retained legislation currently apply to all parts of the UK[17] but each devolved government can apply varying levels of policy ambition.

The EU Bathing Water Directive was originally transposed into law for England and Wales through the '*Bathing Water Regulations 2008' (SI2008/1097)*[18]. Following '*EU Commission Implementing Decision 2011/321/EC'* the '*Bathing Water Regulations 2013' (SI2013/1675)*[19] were enacted revoking the '*Bathing Water Regulations 2008'*.

In Northern Ireland, the EU Bathing Water Directive was originally transposed into law through the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*' (SR2008/231)[20]. Following *EU Commission Implementing Decision 2011/321/EC* the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*' were amended in accordance with the '*Quality of Bathing Water (Amendment) Regulations (Northern Ireland) 2013*' (SR2013/151)[21].

Following the UK exit from the EU, the '*Bathing Water Regulations 2013'* and the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*' (together, the "Regulations") became part of a body of retained EU law that remained in force at the end of the transition period on 31 December 2020.[22]

As England and Northern Ireland have separate bathing water regulations, the report separates all analysis, findings, and conclusions to make them specific to each jurisdiction.

---

[15] Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (legislation.gov.uk)
[16] Commission Implementing Decision 2011/321/EU establishing, pursuant to Directive 2006/7/EC of the European Parliament and of the Council, a symbol for information to the public on bathing water classification and any bathing prohibition or advice against bathing.
[17] Burns, C., Gravey, V., and Jordan, A., 2018. UK environmental policy post-Brexit: A risk analysis.
[18] The Bathing Water Regulations 2008 (legislation.gov.uk)
[19] The Bathing Water Regulations 2013 (legislation.gov.uk)
[20] The Quality of Bathing Water Regulations (Northern Ireland) 2008 (legislation.gov.uk)
[21] The Quality of Bathing Water (Amendment) Regulations (Northern Ireland) 2013 (legislation.gov.uk)
[22] Ss. 2-4 European Union (Withdrawal) Act 2018

Chapter 2: Review of the current legal provisions in England and Northern Ireland

2.1 Summary of the Origins and Objectives of the Directive and Regulations

The origins of English and Northern Ireland bathing water regulation began with the '*1976 EU Bathing Water Directive (76/160/EEC)'*[23] and its transposition into UK regulation[24,25]. The Directive set mandatory standards for a number of microbiological parameters (total coliforms, faecal coliforms, faecal streptococci, salmonella, and enteroviruses) to protect and improve bathing water quality, with the aim of protecting human health and facilitating recreational use of natural waters.

There are a wide variety of human pathogens or disease causing agents which can be transmitted via water including bacteria, viruses, and protozoa. The probability of their being found at any specific location will depend on their prevalence in the community, on the nature of sewage treatment in the locality, agricultural practice in the wider catchment, and on their ability to survive in fresh and saline waters. In most cases it is viruses, as opposed to bacteria, which are most likely to be responsible for causing infection and disease from bathing in contaminated water.

It is very difficult to measure some of these pathogens in water, particularly viruses, so 'microbial indicators' are usually used to determine whether a particular water sample is contaminated. In most cases these faecal indicator organisms (FIOs) do not cause disease, but because they are present in high numbers in the faeces of humans and warm-blooded animals and their persistence in water is similar to pathogens, the presence of FIOs in bathing water therefore is a good indication that the water has been contaminated with these pathogens or disease causing agents[26].

The 'Guideline' and 'Mandatory' microbiological standards for bathing waters set out in the 1976 Directive were not supported by epidemiological evidence[27]. No information has been found which sets out the basis for the original standards.

The World Health Organisation (WHO) is the first organisation known to have developed evidence based public health risk-based standards for bathing waters. The WHO first addressed the issue of

[23] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31976L0160
[24] The Bathing Waters (Classification) Regulations 1991 SI 1991/1597 (https://www.legislation.gov.uk/uksi/1991/1597/made?view=plain)
[25] The Quality of Bathing Water Regulations (Northern Ireland) 1993 SR 1993/205 (No longer available online)
[26] Standards for Recreational Water Quality. Foundation for Water Research FR/G0005. www.fwr.org/environw/frg0005.pdf
[27] Standards for Recreational Water Quality. Foundation for Water Research FR/G0005. www.fwr.org/environw/frg0005.pdf

bathing water quality standards and regulation in a series of meetings held in the WHO Head Offices in Switzerland, Germany, and the USA between 1987 and 1998 culminating in the WHO 'Guidelines for Safe Recreational Water Environments' in 2003[28]. These are the foundation of many current global bathing water regulations, including the '2006 EU Bathing Water Directive (2006/7/EC)'[29].

In producing the 2003 guidelines, the WHO undertook a comprehensive review of global epidemiology[30] and concluded that faecal streptococci (now referred to as intestinal enterococci (IE)) showed the most credible relationship with gastro-intestinal illness in marine waters[31]. The Prüss (1998) review recommended that results from randomised control trials by Kay et al. (1994)[32] should be used to inform new health based standards for recreational water use in marine waters.

The correlation between IE concentrations and levels of gastro-intestinal infection (GI) allowed the definition of 95 percentile standards (Kay et al 2004)[33]. These standards aimed to ensure that levels of gastro-intestinal infection are less than those considered unacceptable for marine bathing waters. These guidelines, adopted by WHO[34] were:

A. <1% likelihood of GI (negligible risk) occurs when 95%ile IE concentrations are <40 cfu/100ml.
B. 1%-5% likelihood of GI (low risk) occurs when 95%ile IE concentrations are between 40-200 cfu/100ml.
C. 5%-10% likelihood of GI (moderate risk) occurs when 95%ile IE concentrations are between 200-500 cfu/100ml.
D. >10% likelihood of GI (unacceptably high risk) occurs when 95%ile IE concentrations are >500 cfu/100ml.

Following the release of the 2003 WHO Guidelines, Weidenmann et al (2006) [35] used the epidemiological protocols pioneered by Kay at al. (1994) in a series of German trials and concluded

[28] WHO (2003) Guidelines for Safe recreational water environments. Volume 1 Coastal and Fresh Waters WHO Geneva ISBN 92 4 154580 1. 219 Pages. Kay D, Bartram J, Prüss A, Ashbolt N, Wyer MD, Fleisher JM, Fewtrell L, Rogers A, Rees G. Derivation of numerical values for the World Health Organisation Guidelines for recreational waters. Water Research 2004 Mar Vol 38(5), Pages 1296-304. doi: 10.1016/j.watres.2003.11.032. Available at https://www.who.int/publications/i/item/9241545801

[29] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006L0007-20140101

[30] Pruss, A (1998) Review of epidemiological studies on health effects from exposure to recreational water. International Journal of Epidemiology February 27(1): Pages 1-9. doi: 10.1093/ije/27.1.1; Available online at https://pubmed.ncbi.nlm.nih.gov/9563686/

[31] Cabelli, V.J. (1989) Swimming-Associated Illness and Recreational Water Quality Criteria. Water Sci Technol (1989) 21 (2): 13–21. Available online at https://doi.org/10.2166/wst.1989.0022

[32] Kay, D. Fleisher, J.M., Salmon, R.L., Jones, F., Wyer, M.D., Godfree, A.F., Zelenauch-Jacquotte, Z., Shore, R. Predicting the likelihood of gastroenteritis from sea bathing: results from randomised exposure. Lancet. 1994 Oct 1 Vol 344, Pages 905-909. doi: 10.1016/s0140-6736(94)92267-5.

[33] Kay, D., Bartram, J., Pruss, A., Ashbolt, N., Wyer, M.D., Fliesher, J.M., Fewtrell, L., Rogers, A. and Rees, G. Derivation of numerical values for the World Health Organisation guidelines for recreational waters. Water Research 38(5), Pages1296-1304. doi.org/10.1016/j.watres.2003.11.032

[34] Guidelines for safe recreational water environments. Volume 1 – Coastal and Freshwaters. Page 70. Available at Water Sanitation and Health (who.int)

[35] Wiedenmann, A., Krüger, P., Dietz, K., López-Pila, J.M., Szewzyk, R. Botzenhart , K. (2006) A Randomized Controlled Trial Assessing Infectious Disease Risks from Bathing in Fresh Recreational Waters in Relation to the Concentration of Escherichia coli, Intestinal Enterococci, Clostridium perfringens, and Somatic Coliphages. Environmental Health Perspectives 119(2), Pages 228-236. doi:10.1289/ehp.8115

that *Escherichia coli (E. coli*) had the most credible relationship with gastro-intestinal illness in freshwater environments.

> IE and *E.coli*, measured in colony forming units (cfu), are well known indices of faecal pollution excreted by warm-blooded animals which might contain pathogens if generated by human or animal pathogen carriers. These faecal indicator organisms (FIOs) may be typically found in waters downstream of treated or untreated sewage effluent, storm overflows, agricultural pollution, urban diffuse pollution (i.e., foul to surface water misconnections) and other sources such as domestic animals and wildlife (i.e., dogs, birds, etc.). These FIOs will generally survive within the environment for a period of several hours to a few days depending on environmental stressors such as sunlight, salinity, disinfection, starvation and predation.[36,37]

Building upon the work done by the WHO, the EU used the Randomised Controlled Trial (RCT) studies by Kay at al. (1994) and Wiedenmann et al. (2006) to refine standards for coastal and inland bathing waters and develop the current risk-based standards found in the 2006 EU Bathing Water Directive and shown in Table 4.

Table 4 – Classifications and Standards for Inland and Coastal Bathing Waters

Parameter	Excellent Quality	Good Quality	Sufficient Quality
For Inland Waters			
Intestinal enterococci (cfu/100ml)	200(*)	400(*)	330(**)
Escherichia coli (cfu/100ml)	500(*)	1000(*)	900(**)
For Coastal Waters			
Intestinal enterococci (cfu/100ml)	100(*)	200(*)	185(**)
Escherichia coli (cfu/100ml)	250(*)	500(*)	500(**)
(*) Based on a 95-percentile evaluation. (**) Based on a 90-percentile evaluation			

The 2006 EU Bathing Water Directive specifies banded bathing water quality classifications of 'Excellent', 'Good', 'Sufficient', or 'Poor', depending on the 90th and 95th percentile evaluations[38] of faecal indicator organisms (IE / *E. coli*) detected. The EU Bathing Water Directive's stated objectives are to protect the environment and the health of the public by attaining 'Good' (or better) bathing water quality throughout the EU. More specifically, the Directive aims to [39]:

- "*Provide better and earlier information to citizens about the quality of their bathing waters.*"
- *"Move from simple sampling and monitoring to bathing water quality management."*

[36] Muruleedhara N. Byappanahalli, Meredith B. Nevers,a Asja Korajkic, Zachery R. Staley,c and Valerie J. Harwood (2012) Enterococci in the Environment. American Society for Microbiology - Microbiology and Molecular Biology Reviews Volume 76 Number 4 pages 685-706; doi:10.1128/MMBR.00023-12

[37] The authors acknowledge that this may not always be the case as FIOs have been shown to survive for longer periods or even grow in certain circumstances (e.g., within sediments or seaweed piles).

[38] Percentile evaluations, rather than mandatory thresholds, mean that water quality is allowed to exceed the standards for a given period of time or number of samples. The higher the percentile, the lower the period of time or number of samples which can exceed the water quality standards.

[39] Taken from https://environment.ec.europa.eu/topics/water/bathing-water_en and discussed in further detail in later chapters.

- *"Integrate into other EU measures protecting the quality of all our waters (rivers, lakes, ground waters and coastal waters) through the Water Framework Directive"*[40]

This Directive was transposed into Regulation for England through '*The Bathing Water Regulations 2008*'. The 2008 Regulations were superseded by the 'Bathing Water Regulations 2013' following *EU Commission Implementing Decision 2011/321/EC* which required information to be made available to the public on bathing water classifications and any bathing prohibition or advice against bathing.

The EU Directive was transposed into Northern Ireland Regulation as the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*'. This was amended by the '*Quality of Bathing Water (Amendment) Regulations (Northern Ireland) 2013*' (together "*Quality of Bathing Water Regulations (Northern Ireland)*"), creating similar requirements on the availability of information and communication of bathing water prohibition or advice against bathing.

In England, the '*Bathing Water Regulations 2013*' were phased in between July 2013 and March 2015 in accordance with the provisions within the Regulations[41]. In Northern Ireland, the '*Quality of Bathing Waters Regulations (Northern Ireland)'* came into operation in entirety in June 2013.

It should be noted that, as required under Article 14, the EU Bathing Water Directive is currently under review, with particular regard to the parameters for bathing water quality, including whether it would be appropriate to phase out the 'Sufficient' classification or modify the applicable standards[42]. The outcome of the process was due to be published in the second quarter of 2023 but is not currently available at the time of writing.

Similarly, within England, the Department for Environment, Food and Rural Affairs (DEFRA) has recently committed to undertake a review on the Bathing Water Regulations 2013; aiming to consult on policy options in 2023 and complete the review by the end of 2024[43].

Figure 1 summarises the evolution of bathing water regulation in England and Northern Ireland.

[40] Bathing water. https://environment.ec.europa.eu/topics/water/bathing-water_en
[41] Bathing Water Regulations 2013, Reg. 1 (1-3)
[42] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12658-Bathing-water-quality-review-of-EU-rules_en
[43] Storm Overflows Discharge Reduction Plan; updated September 2023 (DEFRA)

Figure 1 – Timeline of the evolution of bathing water regulation in England and Northern Ireland.

Although often linked and discussed together, the requirements of UK bathing water regulation should not be confused with the wider ranging requirements of 'Blue Flag' beaches[44].

'Blue Flag' beaches

The Blue Flag programme is run by the Foundation for Environmental Education (Denmark). The Blue Flag is a prestigious environmental award, given to communities that make a special effort to manage their coastal / inland water environment and beaches. In order to qualify for the award, a wide range of environmental, educational, safety-related and access-related criteria must be met and maintained. This includes Bathing Water 'Excellent' status, as defined by UK Regulations.[45]

[44] https://www.blueflag.global/

[45] https://static1.squarespace.com/static/55371ebde4b0e49a1e2ee9f6/t/5fbf70eee18c5c478ef4edfc/1606381808548/Beach+Criteria+and+Explanatory+Notes+2021.pdf

2.2 Summary of the Main Authorities Involved in the Regulations

As environmental legislation is a devolved responsibility the main authorities involved in the management of bathing water quality in England and Northern Ireland are different. It is important to first understand the main authorities named within the regulations before looking at the details of the regulations.

Main Authorities

England

The 'Bathing Water Regulations 2013' assign various functions, powers, and duties to the 'appropriate minister', the 'appropriate agencies' and the 'local authority'.

The 'appropriate minister' is defined within the Regulations as the Secretary of State[46]. The Secretary of State has overall responsibility for DEFRA[47]. Whilst maintaining overall responsibility, in practice it is DEFRA who will carry out the specific functions and duties of the 'appropriate minister'. The 'appropriate agency' is defined as the Environment Agency (EA)[48], which has various duties relating to information, bathing water profiles and classification, monitoring, management, and other matters.

During the bathing season, the relevant 'local authority' has a duty to provide public information about water quality and potential pollution sources at the bathing water. They also have duties regarding management measures, usually in the form of providing warning signage, as advised by the Environment Agency, during pollution incidents. DEFRA provides funding to 'local authorities' in line with its obligations in Section 31 of the Local Government Act 2003[49] to assist with the cost of ongoing bathing water management.

Northern Ireland

The 'Quality of Bathing Water Regulations (Northern Ireland)' assigns functions, powers, and duties to 'the department' and 'bathing water operator'.

'The Department' is defined within the Regulations as the Department of Environment[50], a part of the Northern Ireland Executive which has now been replaced by the Department of Agriculture, Environment and Rural Affairs (DAERA). The policy and monitoring of bathing waters is the responsibility of DAERA Marine and Fisheries Division. In all matters of bathing water management, DAERA is answerable to the Minister of Agriculture, Environment and Rural Affairs.

---

[46] Bathing Water Regulations 2013, Reg. 2(1)
[47] Secretary of State for Environment, Food and Rural Affairs - GOV.UK (www.gov.uk)
[48] Bathing Water Regulations 2013, Reg. 2(1)
[49] https://www.legislation.gov.uk/ukpga/2003/26/introduction
[50] Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 2(2)

The "bathing water operator" is defined as "any person [or organisation] who controls the land immediately adjacent to a bathing water which is normally used to access the bathing water from the landward side and, where the bathing water is tidal, control of such land above the high water mark."[51] The bathing water operator may therefore be a local authority, charity, business, private estate or individual that owns or leases such land.[52] The majority of bathing water operators are local authorities, but the Northern Ireland Environment Agency (NIEA) (Helen's Bay and Crawfordsburn) and National Trust (Portstewart) are also assigned this role at particular bathing waters.

Other Relevant Authorities

In addition to main authorities as outlined above there are a number of other interested or relevant authorities and parties in both England and Northern Ireland including the regulated Water Industry, private sewerage operators and the agricultural sector.

England

There are nine privatised drainage and sewerage companies within England, referred to hereafter as the 'Water Industry.' In England and Wales, the economic regulator is the Water Service Regulation Authority (OFWAT).

Northern Ireland

Northern Ireland Water is a public body, funded by the Department for Infrastructure, responsible for water and sewerage services in Northern Ireland. The economic regulator is the Northern Ireland Authority for Utility Regulation.

[51] Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 2(2)
[52] Guidance for Bathing Water Operators in Northern Ireland. DAERA. https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Guidance%20for%20Bathing%20Water%20Operators%202019.pdf

2.3 Summary of the Main Provisions, Functions and Duties of the Regulations

The 'Bathing Water Regulations 2013' (England) and the 'Quality of Bathing Water Regulations (Northern Ireland)' set out a number of general provisions and duties upon the designated authorities. The provisions of the 'Regulations' were phased in ahead of the 2015 bathing season[53] and can apply to any identified body of water, other than 'excluded pools and water'[54], where a large number of people are expected to bathe[55]. It is the duty of the Secretary of State and EA in England, and DAERA in Northern Ireland, to ensure all requirements of the Regulation are complied with[56].

Identification of Bathing Waters

The Regulation requires the Secretary of State (England) / DAERA (NI) to specify a list of identified bathing waters in England and Northern Ireland[57]. This list is to be updated annually with results from consultations around newly identified / un-classified bathing waters[58,59]. The list is to include the current bathing water quality classification and state any locations with permanent advice against bathing[60]. The information must be actively disseminated prior to each bathing season using appropriate technologies, media and the internet[61].

The EA (England) and DAERA (NI) must also ensure every identified bathing water has a bathing water profile[62] which provides information about the site and the associated water quality[63]. These profiles are to be reviewed and updated at specific frequencies depending on the classification[64].

Every identified bathing water should have physical signage at the bathing water providing information about the bathing water and the associated water quality[65]. It is the duty of the local authority (England) or bathing water operator (Northern Ireland) to provide and maintain this signage[66].

[53] Bathing Water Regulations 2013, Reg. 1 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 1
[54] Defined as '(1) swimming pools and spa pools, (2) confined waters subject to treatment or used for therapeutic purposes or (3) artificially created confined water separated from surface water and groundwater.'
[55] Bathing Water Regulations 2013, Reg. 3(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 2(2)
[56] Bathing Water Regulations 2013, Reg. 5(1)(c) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(1)(c)
[57] Bathing Water Regulations 2013, Reg. 3(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3
[58] Bathing Water Regulations 2013, Reg. 3(4)(a) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3
[59] Updates to the original list of identified bathing waters in Schedule 1 of the Regulations in England are not required. It is recommended the wording of the Northern Ireland Regulation is clarified in future revisions to remove ambiguities around the need to update Schedule 1.
[60] Bathing Water Regulations 2013, Reg. 3(4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3
[61] Bathing Water Regulations 2013, Reg. 3(6) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3
[62] Bathing Water Regulations 2013, Reg. 7 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 7
[63] Bathing Water Regulations 2013, Sch. 3 para 1. / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 2 para 1.
[64] Bathing Water Regulations 2013, Sch. 3 para 2(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 2 para 2(1).
[65] Bathing Water Regulations 2013, Reg. 9(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9
[66] Bathing Water Regulations 2013, Reg. 9(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9

Sampling and Monitoring

The bathing season is defined by the Regulations as being between 15th May and 30th September in England[67] and 1st June and 15th September in Northern Ireland[68]. During the bathing season, samples are to be taken from a specified monitoring location at each bathing water[69] and in line with a pre-defined monitoring calendar[70]. In England and Northern Ireland samples must be collected at regular intervals not exceeding one month, including one sample taken before the start of the bathing season[71]. A minimum of four samples per bathing season are required for Northern Ireland[72]. No minimum number of samples per bathing season is explicitly stated for England but based on the requirements described above, a minimum of five samples would be required.

All samples are to be tested for the faecal indicator organisms, *E.coli* and IE. Bathing water sampling methods and equipment[73], storage and transport[74], and laboratory methods[75] are to be carried out in accordance with protocols defined in the Regulation.

In England, sampling practices should have 'regard to the handling of samples for microbiological analyses given in Annex V to the EU Bathing Water Directive'[76]. This refers to the ambition within the EU Directive for samples taken at 'Poor' or 'Sufficient' bathing waters to undergo microbial source tracking (MST) to help identify the source(s) of faecal contamination (e.g., human, bovine, canine sources etc).

In addition to sampling, visual inspections for waste, including tarry residues, glass, plastic, or rubber are to be regularly undertaken[77]. Investigations and monitoring are also required where any bathing water profile indicates a potential for cyanobacterial, macro-algae and / or marine phytoplankton proliferation[78]. There are no threshold standards for wastes, cyanobacteria, macro-algae and / or marine phytoplankton.

A series of bathing water management measures, which are discussed further in following sections, must be undertaken should wastes, cyanobacteria, macro-algae or marine phytoplankton be detected in quantities that are deemed unacceptable or which may pose a risk to human health[79].

The responsibility for sampling and monitoring of bathing waters is ascribed to the EA (England) in the 2013 Regulations and DAERA (NI) in the 2008 Regulations and 2013 amendment.

---

[67] Bathing Water Regulations 2013, Reg. 4
[68] Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 4
[69] Bathing Water Regulations 2013, Sch. 4 para 1(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1.
[70] Bathing Water Regulations 2013, Sch. 4 para 2(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 2.
[71] Bathing Water Regulations 2013, Sch. 4 para 1(3). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 2(1)(a).
[72] Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 3(a).
[73] Bathing Water Regulations 2013, Sch. 4 para 1(4). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 4.
[74] Bathing Water Regulations 2013, Sch. 4 para 1(5). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 5.
[75] Bathing Water Regulations 2013, Sch. 4 para 1(6). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 6.
[76] Bathing Water Regulations 2013, Sch. 4 para 7.
[77] Bathing Water Regulations 2013, Reg. 8 (5) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 8 (2)(c)
[78] Bathing Water Regulations 2013, Reg. 8 (3-4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 8 (3)
[79] Bathing Water Regulations 2013, Reg. 12 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 13

Classification and Assessment

Every bathing water is to be assessed and classified at the end of each bathing season[80] according to the threshold standards for inland or coastal bathing waters[81] and bathing water classification assessment methods[82] outlined in the Regulations. Every bathing water must be classified as either 'Poor', 'Sufficient', 'Good' or 'Excellent'[83] depending on the concentrations of *E. coli* and IE[84]. The bathing water assessment is based on a log normal percentile calculation of the data from the current and preceding three bathing seasons[85,86]. This means the classification is only ever a record of past condition.

Monitoring can be suspended in England and Northern Ireland, and samples 'disregarded' in the event of an 'Abnormal Situation'[87,88]. In England and Northern Ireland samples can also be 'disregarded' if there is evidence of management measures (e.g., signage) being in place to warn the public of a risk of 'Short Term Pollution[89,90]. Up to 15% of samples can be 'disregarded' for these reasons, provided the minimum number of samples per season is still achieved and there is evidence of the necessary management measures being in place.

If a bathing water is classified as 'Poor', signage must be provided at the bathing water advising the public against bathing[91]. Five consecutive annual 'Poor' classifications will result in the bathing water becoming 'un-classified' and permanent signage advising against bathing[92]. The designated authorities are also required to undertake management measures to bring the bathing water up to at least Sufficient status (see section 2.4).

All bathing water classifications, 'abnormal situations', 'short term pollution' risks and 'pollution incidents' must be actively and promptly disseminated to the public through a variety of appropriate technologies and media[93].

The responsibility for classification and assessment of bathing waters is ascribed within the Regulations to the EA (England) and DAERA (NI). The local authority (England) or bathing water

[80] Bathing Water Regulations 2013, Reg. 10 (1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 11
[81] Bathing Water Regulations 2013, Sch. 5 para 1. / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 para 1
[82] Bathing Water Regulations 2013, Sch. 5 para 2-3. / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 para 2.
[83] Bathing Water Regulations 2013, Reg. 11(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 12
[84] Bathing Water Regulations 2013, Sch. 5 para 1. / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 para 1.
[85] Where available, or fewer if the bathing water has not been identified for four years. Alternatively, the appropriate agency has the ability to reset this if it can be demonstrated that there has been a step change in bathing water quality due to significant improvement works.
[86] Bathing Water Regulations 2013, Reg. 10(2-4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 para 2.
[87] Defined as 'an event or combination of events impacting on bathing water quality which would not be expected to occur, on average, more than once every four years.'
[88] Bathing Water Regulations 2013, Sch. 4 para 1(2) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 2.
[89] Defined as 'contamination by IE or *E.coli* where the appropriate agency (a) has identified the causes, and (b) does not normally expect the contamination to affect bathing water quality for more than approximately 72 hours after the bathing water is first affected.'
[90] Bathing Water Regulations 2013, Reg. 14 (5) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 7.
[91] Bathing Water Regulations 2013, Reg. 9(1)(b) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9
[92] Bathing Water Regulations 2013, Reg. 13(2)(a) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 14
[93] Bathing Water Regulations 2013, Reg. 9(2) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 10

operator (Northern Ireland) has a duty to update bathing water signage including warning the public of the risk of short term pollution risk[94].

Minimum and Target Standards

The Regulations state that the Secretary of State and EA (England) / DAERA (NI) must exercise their relevant functions so that all identified bathing waters achieve at least the minimum 'Sufficient' status by the end of the 2015 bathing season[95]. Where the minimum standards are not achieved and a bathing water is classified as 'Poor', appropriate measures must be undertaken, including investigations into the cause(s) and actions to reduce / remove pollution[96].

The Secretary of State and EA (England) / DAERA (NI) must also exercise their relevant functions[97, 98] to ensure that realistic and proportionate measures are undertaken in order to increase the number of bathing waters meeting the target 'Good' and 'Excellent' classifications[99].

In England, a review of progress towards achieving the minimum and target standards is to be undertaken every five years[100]. A similar review is carried out in Northern Ireland every seven years but there is no requirement within the Regulations. The objectives and content of these reviews are discussed in section 3.3.

Powers and Enforcement

The Regulations grant the Secretary of State (England) / DAERA (NI) the power to issue notice upon the local authority / beach operator, in instances where they are failing in their duties, to ensure measures are taken to comply with the requirements of the Regulations[101].

The Regulations also grant the Secretary of State (England) / DAERA (NI) the power to obtain information required for them to carry out their functions under the Regulations, from any person on whom a notice is served[102].

Bathing Water Management Measures

The Regulations also ascribe additional management duties on the main authorities in the event of specific circumstances including 'short term pollution,' 'abnormal situations', 'pollution incidents', proliferations of wastes, cyanobacteria, macro-algae and / or marine phytoplankton[103]. These will not

[94] Bathing Water Regulations 2013, Reg. 9(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9
[95] Bathing Water Regulations 2013, Reg. 5(1)(a) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(1)(a)
[96] Bathing Water Regulations 2013, Reg. 13(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 14
[97] "Relevant functions" means functions, so far as relevant, under the Bathing Water Regulations and the enactments specified in Schedule 2 of the Water Framework Regulations
[98] Bathing Water Regulations 2013, Reg. 5(2) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(2)
[99] Bathing Water Regulations 2013, Reg. 5(1)(b) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(1)(b)
[100] Bathing Water Regulations 2013, Reg. 20
[101] Bathing Water Regulations 2013, Reg. 16 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 16
[102] Bathing Water Regulations 2013, Reg. 16(6) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 19
[103] Bathing Water Regulations 2013, Reg. 12 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 13

be discussed at length in this report but relate to specific duties for informing the public, reactive monitoring and prompt or immediate measures to be taken to address the issue.

2.4 Other Relevant Legislation and Non-Statutory Mechanisms

The designated authorities are given limited powers[104] to obtain information and issue notices upon local authorities / beach operators by the bathing water regulations. Aside from the powers and functions set out in these regulations they are expected to use existing powers and functions from other legislation to address pollution incidents and help achieve the minimum and target bathing water classifications. Given the nature of the pollution sources, the existing powers and functions from other legislation are primarily linked with the permitting of sewage discharges, control of pollution incidents and prevention of agricultural pollution.

The relevant legislation and non-statutory mechanisms which can be used to make the necessary improvements are different for England and Northern Ireland and are summarised below.

England

The '*Water Act 1989*'[105] privatised the former water authorities in England and consequently water related legislation (including the '*Water Act 1989*') was consolidated into new Acts of Parliament; namely:

- The '*Water Industry Act 1991*'[106] which set out the powers and duties of the newly privatised water and sewerage companies and the economic regulator, now OFWAT.
- The '*Water Resources Act 1991*'[107] which set out functions of what is now the Environment Agency and introduced water quality objectives and classifications for the first time.

Subsequent acts, such as the '*Water Industry Act 1999*' [108] (which made several important amendments to the '*Water Industry Act 1991*') and the '*Environment Act 1995*' [109] leading to a restructuring of environmental regulation and the creation of the Environment Agency) have since amended the framework. These Acts set out the powers of the Environment Agency and the legal obligations on the Water Industry to address the environmental issues caused by their activities and assets.

Much of England's recent environmental legislation has originated from the European Union and is currently part of what was retained EU law since the UK's exit from the EU, and is now assimilated law under the Retained EU Law (Revocation and Reform Act) 2023. The EU Directives set the environmental outcomes to be achieved but left implementation to be transposed into Regulations

[104] Refer to Section 2.3 'Powers and Enforcement' for details.
[105] https://www.legislation.gov.uk/ukpga/1989/15/contents
[106] https://www.legislation.gov.uk/ukpga/1991/56/contents
[107] https://www.legislation.gov.uk/ukpga/1991/57/contents
[108] https://www.legislation.gov.uk/ukpga/1999/9/contents
[109] https://www.legislation.gov.uk/ukpga/1995/25/contents

appropriate to the individual member state. Some of the most relevant EU directives indirectly related to bathing waters are:

- The '*Water Framework Directive (2000/60/EC)*'[110], first transposed in law by the '*Water Environment (Water Framework Directive) (England and Wales) Regulations 2003'* [111] (subsequently revoked and replaced by the '*Water Environment (Water Framework Directive) (England and Wales) Regulations 2017*'[112]), creates a single system of water management, based around a natural river basin. The regulations set objectives and deadlines for improving water quality. It looks overall at both the ecology of the water and its chemical characteristics but does not directly include microbiological parameters. The regulations however are relevant to bathing waters as the measures required to improve the ecology and chemical parameters across all sectors will often also reduce the bacterial loads going into the environment. For example, applying tertiary treatment to a sewage works to achieve a Water Framework Phosphorus target in the receiving watercourse would also reduce faecal indicator concentrations by approximately a factor of 100[113].

- The '*Urban Waste Water Treatment Directive (91/271/EEC)*' [114] aims to protect the environment from the adverse effects of waste water by prescribing limits on the collection, treatment, and discharge of urban waste water from certain industrial sectors. This was transposed into the '*Urban Waste Water Treatment (England and Wales) Regulations 1994'*[115]. This regulation has two key aspects in relation to bathing waters. Firstly, many of the measures required to meet the prescribed emission limits will also cause a reduction in the bacterial loads going into the environment. Secondly, the regulation requires advanced treatment of waste water, in the form of ultra violet disinfection, in places with a population equivalent of 10,000 in "sensitive areas", a term including identified bathing water sites. UV disinfection systems are primarily designed to reduce the amount of *E. coli* and IE in the final effluent. The Directive does not set an emission standard for *E. coli* and IE but rather a specified dosage or disinfection rate which must be achieved.

England also has a number of other recent environmental regulations relevant to bathing waters:

- The '*Environmental Permitting (England and Wales) Regulations 2016*' [116] provide a consolidated system for environmental permitting across both the waste water and agricultural sectors. It also makes it a strict liability offence to misconnect foul sewerage into storm water sewerage systems, a common source of pollution to bathing waters. Environmental Permitting Regulation (EPR) 7.01 guidance was withdrawn on 8th May 2018 to be replaced by a series of individual guidance documents. The critical document updating 7.01 guidance on bathing

[110] https://www.eea.europa.eu/policy-documents/water-framework-directive-wfd-2000
[111] https://www.legislation.gov.uk/uksi/2003/3242/contents/made
[112] https://www.legislation.gov.uk/uksi/2017/407/contents/made
[113] A sewage works with secondary treatment may be expected to achieve approximately 2 x 10^7 cfu/100ml, this would be expected to reduce to approximately 2 x 10^5 cfu/100ml with the addition of tertiary treatment.
[114] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31991L0271
[115] https://www.legislation.gov.uk/uksi/1994/2841/contents/made
[116] The Environmental Permitting (England and Wales) Regulations 2016 (legislation.gov.uk)

waters however is still outstanding[117]. EPR 7.01 guidance on continuous discharges impacting bathing water requiring disinfection[118] must "*demonstrate a minimum of 25,000 fold (4.4 log) reduction in enteroviruses and a 250,000 fold (5.4 log) reduction in faecal coliforms between the crude influent at the treatment works and the bathing water monitoring point*." This introduced the concept of enteroviruses (taken from the United States Recreational Water Quality Criteria – see Chapter 6) into UK bathing water management. The WHO have advised the EU that analytical quality control for the quantification of various enteroviruses, such as noroviruses, cannot be assured and therefore should not be considered as part of future revisions to the EU Bathing Water Directive[119]. Aside from ultra-violet disinfection which has an agreed reduction in enteroviruses no other treatment process or technology can be tested and therefore approved for discharges impacting bathing waters.

- The '*Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018'*[120] (also known as the Farming Rules for Water) were introduced because expected water quality improvements associated with following codes of good agricultural practice were not occurring[121]. The Farming Rules for Water is one of the main tools available to the EA to improve the environmental performance of the agricultural sector. Although primarily focussed on Phosphorus, many of the measures will also reduce faecal pollution upstream of bathing waters, for example, preventing the storage of manures or slurries in areas of high runoff potential.

- The '*Agriculture Act 2020*'[122] provides the legal framework for the Government to implement new approaches in supporting agricultural practices following Brexit and subsequent replacement of the EU's Common Agricultural Policy (CAP)[123]. The approaches are set out in '*The Path to Sustainable Farming: An Agricultural Transition Plan 2021*'[124], a seven-year plan that commenced in 2021 and runs to 2027. This aims to phase out the EU CAP direct payments and introduce a new grant payment scheme to reward farmers and land managers for delivering public goods that improve the environmental and animal welfare rather than the quantity of land they own. Grants will be provided to farmers and other land managers, for the investment in new equipment, technology, and infrastructure. At the heart of the new programme is the '*Environmental Land Management Scheme*' [125], that will deliver improvements to water quality and biodiversity with pilot tests running from 2021-2024.

[117] https://www.gov.uk/government/publications/water-discharge-and-groundwater-activity-permits-additional-guidance
[118] EPR 7.01 section 2.7.2.1
[119] who-recommendations-on-ec-bwd-august-2018.pdf
[120] https://www.legislation.gov.uk/uksi/2018/151/contents/made
[121] Environment Agency – written response to a one-off evidence session 10 December 2021 (https://committees.parliament.uk/writtenevidence/41483/pdf)
[122] Agriculture Act 2020 (legislation.gov.uk)
[123] csp-at-a-glance-eu-countries_en.pdf (europa.eu)
[124] The Path to Sustainable Farming: An Agricultural Transition Plan 2021 to 2024 (publishing.service.gov.uk)
[125] Environmental Land Management (ELM) update: how government will pay for land-based environment and climate goods and services - GOV.UK (www.gov.uk)

- The '*Environment Act 2021*'[126] is part of a new legal framework for environmental protection now EU law no longer applies following the UK exit from the EU. The '*Environment Act 2021*' is a wide ranging piece of legislation aiming to improve air and water quality, protect wildlife, increase recycling, and reduce waste. It is of particular relevance to bathing waters as it prescribes limits on the frequency of intermittent discharges from storm overflows within set distances of identified bathing water sites. The Act does not cover impacts from continuous discharges such as sewage works, or the impact of agriculture upon bathing waters.

- The '*Anti-social Behaviour, Crime and Policing Act 2014'*[127], which allows local authorities to issue localised Public Space Protection Orders. Public Space Protection Orders are regularly used by local authorities to manage litter disposal and prohibit dogs from using beaches during the bathing season[128].

Northern Ireland

The '*Water Act (Northern Ireland) 1972*'[129] transferred responsibility for water and sewerage services from local authorities and the Belfast Water Commission to a new Water Executive within the Department of the Environment. In 1996 the Water Executive became an executive agency and was rebranded as the Northern Ireland Water Service.

The '*Water (Northern Ireland) Order 1999*'[130] repealed and re-enacted the '*Water Act (Northern Ireland) 1972*'. The Order:

- Transferred responsibility for the Northern Ireland Water Service to the Department for Regional Development
- Modified provisions relating to discharge consents.
- Enabled the Department of Environment to make more extensive provision, by regulations, to prevent pollution.
- Conferred more extensive powers on the Department of Environment to carry out anti-pollution works and enable the Department to issue notices requiring persons to carry out anti-pollution works.
- Conferred powers on the Department of Agriculture to carry out works in relation to waterways.

On 1 April 2007, the '*Water and Sewerage Services (Northern Ireland) Order 2006*'[131] brought about significant reform of the water industry. This involved transferring responsibility for delivery of water

[126] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[127] https://www.legislation.gov.uk/ukpga/2014/12/contents/enacted
[128] The impact from dog waste or bird roosts can be significant; in a study of English bathing water quality between 2015-18 conducted by the EA (Faecal Contamination Pressure Narrative. EA, 2019. https://consult.environment-agency.gov.uk/++preview++/environment-and-business/challenges-and-choices/user_uploads/faecal-contamination-pressure-rbmp-2021.pdf), of the 52 bathing waters at risk of being 'Poor', other sources (including urban and dogs and birds) contribute more than 10% of the total contamination at 42 bathing waters.
[129] Unavailable online
[130] https://www.legislation.gov.uk/nisi/1999/662/contents/made
[131] https://www.legislation.gov.uk/nisi/2006/3336/contents

and sewerage services from the Department for Regional Development to a government owned company, Northern Ireland Water. This was initially appointed as the sole water and sewerage undertaker for the whole of Northern Ireland and was to be run on a commercial basis subject to utility regulation. The Order also makes amendments to the provisions of the Water (Northern Ireland) Order 1999 to update and expand Department of Environment's functions relating to environmental regulation.

The Department of Agriculture, Environment and Rural Affairs (DAERA) was established in May 2016 under the Fresh Start Agreement[132]. The new department inherited the main functions of the former Department of Agriculture and Rural Development and responsibility for inland fisheries from the former Department of Culture, Arts and Leisure. Environmental regulation was transferred into its remit from the former Department of the Environment.

As in England, much of Northern Ireland's recent environmental legislation has originated from the European Union and is currently part of assimilated law. These EU Directives set the environmental outcomes to be achieved but left implementation to be transposed into Regulations appropriate to the individual member state. Some of the most relevant to bathing waters are:

- The '*Water Framework Directive*' was transposed in law by '*The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017*'[133].
- The '*Urban Waste Water Treatment Directive*' was transposed into the '*Urban Waste Water Treatment Regulations (Northern Ireland) 2007*'[134].

Northern Ireland has other recent environmental regulations relevant to bathing waters:

- The '*Nutrient Action Programme* [NAP] *Regulations (Northern Ireland) 2019*' [135] were introduced to better manage the use of agricultural nutrients on farms and reduce their impact on Northern Ireland's water environment. The NAP Regulations, and the NAP Derogation, is one of the main tools available to DAERA to improve the environmental performance of the agricultural sector. Although primarily focussed on nutrients, many of the measures will also reduce faecal pollution upstream of bathing waters.
- Due to the Northern Ireland protocol[136] farmers in Northern Ireland are still supported through the EU's CAP scheme whereby payments are largely driven by the quantity of land that is farmed. The UK '*Agriculture Act 2020*'[137] permitted DAERA to administer direct payments to farmers up until 2022 with the expectation that Northern Ireland will legislate a new agriculture policy framework. Following the agreed transition period, the CAP will no longer apply in

[132] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/479116/A_Fresh_Start_-_The_Stormont_Agreement_and_Implementation_Plan_-_Final_Version_20_Nov_2015_for_PDF.pdf
[133] https://www.legislation.gov.uk/uksi/2017/407/contents/made
[134] https://www.legislation.gov.uk/nisr/2007/187/contents/made
[135] https://www.legislation.gov.uk/nisr/2019/81/contents/made
[136] Microsoft Word - Northern Ireland Protocol - Command Paper.docx (publishing.service.gov.uk)
[137] Agriculture Act 2020 (legislation.gov.uk)

Northern Ireland. The '*Future Agricultural Policy Framework Portfolio for Northern Ireland, August 2021*'[138] sets out the agricultural policy framework with four essential outcomes: increased productivity; improved resilience; environmental sustainability; and a responsive supply chain.

- The '*Dog Control Orders (Prescribed Offences and Penalties, etc.) Regulations (Northern Ireland) 2012*'[139] creates the legislative platform to allow local authorities to ban dog from beaches during the bathing season.

[138] 21.22.086 Future Agriculture Framework final V2.PDF (daera-ni.gov.uk)
[139] https://www.legislation.gov.uk/nisr/2012/114/contents/made

2.5 How These Legislative, Institutional and Operational Frameworks Operate

The legislative, institutional, and operational frameworks surrounding bathing water management are different depending on whether you are in England or Northern Ireland. A review of the effectiveness of these frameworks can be found in Chapter 3.

England

There are some practical considerations with regards to the methods and abilities of the EA and local authorities to meet their duties arising from the 'Bathing Water Regulations 2013'.

> Within England, bathing water quality samples are taken by local EA officers and transported to the EA National Laboratory Service in Devon. In order to work as efficiently as possible and get the samples to the designated courier collection point in time, samples are often taken at the same time of day from particular bathing waters as part of a regular sampling collection route. Given the couriering distances and the time of arrival at the laboratory, the samples will then be filtered the following morning (within 24 hours of the sample being taken). Once filtered a 24 hour incubation period is required for *E.coli*[140] before counting, quality assurance and reporting. This means initial *E.coli* results will not be available until 48 – 72 hours after the sample is taken. This limits the ability of the EA and local authorities to quickly respond to 'short term pollution' identified by sampling as in the majority of cases the pollution effects will already have subsided.
>
> Bathing water profiles and short term pollution warnings are published by the EA on https://environment.data.gov.uk/bwq/profiles/. Short term pollution warnings are updated daily via the website and this information is provided to the relevant local authorities who will then need to send a representative to the bathing water typically to pin a physical sign to the bathing water information board. If the EA sampler does not record seeing this sign during the sampling visit, any sample taken during a short term pollution incident is not eligible to be disregarded [141]. For more information on 'disregarding' samples please refer to the Classification and Assessment sub-section of Chapter 2.3.

The obligations on water and sewerage companies in England arising from environmental legislation, such as the 'Bathing Water Regulations 2013', and UK Government Policy are managed through the Water Industry National Environment Programme (WINEP)[142].

> **Water Industry National Environment Programme**

[140] 48 hours for presumptive IE and 72 hours for confirmed IE.
[141] Meaning it is not included in the dataset determining the overall classification of the bathing water.
[142] https://www.gov.uk/government/publications/developing-the-environmental-resilience-and-flood-risk-actions-for-the-price-review-2024/water-industry-national-environment-programme-winep-methodology

The primary role of the WINEP is to provide direction to water companies on the actions they need to take to meet statutory environmental obligations, non-statutory environmental requirements, or delivery against a water company's statutory functions.

WINEP actions are assigned to the water and sewerage undertakers at the business planning stage, ahead of implementation in the following Water Industry five year Asset Management Plan (AMP). The current AMP period, AMP7, runs from April 2020 to March 2025.

These actions are set out, along with the associated improvements required, and costed during the business planning stage for Price Review (PR). Price Review, and the subsequent final determination, are part of the process used by OFWAT to regulate water and sewerage services in England and Wales to control prices water companies can charge their customers. OFWAT carry out a Price Review every five years, with planning for the price review for 2024 (PR24) currently underway. Measures agreed in PR24 will be implemented by the water companies in AMP8 (2025-2030).

If a bathing water is identified between Price Reviews, there is no WINEP driver or mechanism currently available for the water and sewerage companies to fund any necessary improvements to their assets. This means that new bathing waters which get assessed as 'Poor' can get un-classified[143] before investigations and improvement actions can take place.

OFWAT use of Performance Commitments

OFWAT, in its role of economic regulator to the Water Industry, sets a number of Performance Commitments on the water and sewerage undertakers. These commitments have financial implications on the water and sewerage undertakers and are used to assess comparative performance against a number of key performance indicators.

By linking the Performance Commitments to bathing water outcomes (i.e., achieving 'Excellent' status) and not just Water Industry contributions, the water and sewerage undertakers have found themselves needing to address other 'non-water industry' pollution sources, such as agricultural diffuse pollution, in order to avoid financial penalty.

For the next AMP (AMP8), OFWAT has set a Bathing Water Performance Commitment on the water and sewerage undertakers which is separate from the classification derived under the Regulations (refer to footnote[144] for further details). This has the effect of creating dual standards to assess and measure bathing water performance within the Water Industry. Stantec and CREH have been unable to confirm the reasons for OFWAT's decision to introduce a dual standard to assess Bathing Water quality. This also acts as a disincentive for the water industry to invest in the development of water quality prediction tools which could

[143] This term is used to describe bathing waters being de-listed and formal bathing water status being removed.

[144] Classification of each eligible bathing water will be consistent with the classification of that water by the appropriate agency, save with regard to short term pollution. Samples taken during short term pollution will be included when determining classification, irrespective of whether these have been disregarded in the appropriate agency's classification.

result in improved classifications through the disregarding of samples, since the benefit would not be reflected in the performance commitments.

The obligations on the agricultural sector to reduce diffuse pollution are based around the 24 best management practices[145] and the Farming Rules for Water ('*Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018*'). This will be supported by the new agricultural policy, as set out in the '*Agriculture Act 2020*', which is being transitioned in to replace the EU Common Agricultural Policy post Brexit.

The Manual for Best Farming Practices set out 24 best management practices to overcome diffuse pollution. These were designed to be used by the Environment Agency inspectors during farm inspections to reduce the risk of diffuse pollution. As these practices had no basis in law further legislation in the form of the '*Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018*' was introduced. Also known as the Farming Rules for Water, this set of Regulations set out legally enforceable controls on agriculture covering a range of topics including:

- Assessing the pollution risks that apply to land and activities.
- Planning for each application of manure or fertiliser on land
- Soil testing for cultivated agricultural land to inform the application of manure or fertiliser.
- When and where fertiliser and manures may be applied.
- Taking reasonable precautions to prevent the risk of pollution when applying manures or fertilisers.
- Taking account of risk factors for runoff when storing manure.
- Taking reasonable precautions to prevent soil erosion caused by horticultural activities and the management of livestock.

The Environment Agency is responsible for enforcing the farming rules for water which will be done through its programme of farm inspections. If found to be breaking the rules the Environment Agency will help identify the changes needed to be made and agree a timescale for the changes to be made. If there is already pollution or a high risk of pollution the Environment Agency make take enforcement action, including potential prosecutions.[146] A review of the effectiveness of this approach is discussed in the next chapter.

Whilst the Farming Rules for Water set out a minimum standard of practice to be upheld farmers will also be incentivised to undertake additional initiatives to increase biodiversity, restore landscapes, promote animal welfare and increase productivity through investment. The updated subsidy regimes, as legislated through the '*Agriculture Act 2020*' and outlined in

[145] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290207/str-p40-e-e.pdf
[146] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/695598/farming-rules-for-water-policy-paper-v2.pdf

the '*Environmental Land Management Scheme*', should have the impact of enhancing water quality generally and reducing the impact of agricultural pollution upon bathing waters.

Whilst the agriculture and wastewater sectors are the primary causes of bathing water pollution other factors, generally grouped under the headings 'urban diffuse' or 'other' need to be addressed. These categories generally include the impact caused by foul to storm sewerage misconnections, and by dogs, birds and other wildlife.

The misconnection of foul sewerage into storm water sewerage systems is a strict liability offence under Regulation 38 and Schedule 21 of the '*Environmental Permitting (England and Wales) Regulations 2016*'.

It is estimated that up to 9% of all identified bathing waters within the UK are impacted to some extent by misconnections[147]. In England, if the point of misconnection is located on the 'public' sewerage network, it is the responsibility of the water and sewerage undertaker to address the issue[148]. Where the misconnection occurs on 'private' sewerage networks, as defined by '*The Water Industry (Schemes for the Adoption of Private Sewers) Regulations 2011*' (England)[149], it is the responsibility of the local authority[150] to issue enforcement notices upon the property owner to address the issue. It should be noted however that the rectification measures themselves can be prohibitively expensive to the property owner who is often unable to recover the costs. Where the property owner cannot, or will not, address the misconnection the local authority has the legal right to address the issue directly and levy the charge against the property. These costs can then be recovered by the local authority upon the future sale of the property[151].

Addressing potential pollution impacts from dogs and birds is done in coordination with the local authority who may be able to issue localised public space protection orders banning dog fouling and dogs from the beach during the bathing season. Public space protection orders can be enforced with fines upon those found to be breaching the order. The impact from birds is harder to manage but deterrents such as seagull proof bins, and regular litter collections and disposal can be arranged with the local authorities. There is currently very little that can be done to address pollution from other wildlife, such as seals.

On occasion the local authorities and / or harbour / port authorities may also assist in the management of seaweed removal, dredging activities and beach raking. These activities may

[147] Misconnections – Good Practice Guide (2014) WaterUK
[148] Water Industry Act 1991, Section 109(2) - disconnection of wrongly connected drains and sewers to the public sewer.
[149] https://www.legislation.gov.uk/uksi/2011/1566/contents/made [Regulations ceased to have effect at the end of June 2018]
[150] Building Act 1984, Section 59 – Where the private drainage is unsatisfactory or is a hazard to health or a nuisance, the local authority can serve notice requiring the owner to make satisfactory provision for the drainage of the building. If the person on whom the notice is served fails to execute the works, then the local authority has powers to carry out works in default and recover its costs in doing so under section 99.
[151] Building Act 1984, Section 99

be required in specific situations to prevent faecal indicator organisms surviving longer, or even increasing in concentrations, within the environment.

Northern Ireland

There are some practical considerations with regards to the methods and abilities of DAERA and bathing water operators to meet their duties arising from the Regulations.

Within Northern Ireland bathing water quality samples are taken by DAERA Environment Marine and Fisheries Group (EMFG) staff and transported to DAERA laboratories in Lisburn. As samples within Northern Ireland can be couriered to the DAERA laboratories on the same day, the processing and analysis can be completed by the following day. This allows short term pollution management measures to be put in place the day after a high sample result is returned. When MST analysis is required, samples are transferred to the DAERA Agri-Food and Biosciences Institute (AFBI) laboratory. Currently, the AFBI laboratory is not accredited to undertake MST.

The obligations on NI Water arising from environmental legislation, such as the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*', and UK Government Policy are set out in a business plan system termed Price Control (PC) spanning six years. The current plan, PC21, covers the period from April 2021 to March 2027.

In the absence of domestic charging for water and sewerage, the Water and Drainage Policy Division within the Department for Infrastructure (DFI) ensures NI Water is funded through payment of subsidies. It also monitors NI Water's performance, both financial and non-financial, against the budget and operating plan and Price Control 21 (PC21), the six-year plan set out by the Utility Regulator for NI Water.

The Water and Drainage Policy Division is responsible for discharging the DFI's statutory and other duties under the Water & Sewerage Services (NI) Order 2006. The DFI ensures NI Water is funded to fulfil these statutory obligations through the payment of subsidies. It also monitors the performance of NI Water against the budget, operating plan and PC21.

The Water Utility Regulation Group within DAERA is responsible for regulating the sewage discharges made by the Water Utility Sector. This includes NI Water, Public Private Partnerships and private emergency overflows connecting to Water Utility infrastructure.

The obligations on the agricultural sector to reduce diffuse pollution are based around the Nutrient Action Programme (NAP) 2019 Regulation. The NAP Regulations are sufficiently different from the Farming Rules for Water for England for them to be discussed here in more detail. The NAP Regulations will be supported by a new agricultural policy framework which is yet to be fully defined. Meanwhile the Northern Ireland Executive are committed to maintaining the current Basic Payment Regime whereby 80% of available funding is provided to farmers based on the amount of land they

farm. The new agricultural policy will replace the 20% of funding previously allocated for rural development payments.[152]

The 'NAP Regulations 2019', covering the period 2018-2022, apply to all agricultural land in Northern Ireland and compliance with NAP is required for farmers claiming the Basic Payment Scheme and other direct payments.

The NAP Regulations include a limit on the amount of nitrogen from livestock manure that can be applied to land. In 2019, Northern Ireland renewed a Derogation from the Nitrates Directive permitting an increase in the land application of nitrogen per year from grazing livestock manure under certain conditions. For a farm to operate under a derogation a successful application must be made to the Northern Ireland Environment Agency (NIEA). A derogation will allow the farmer to farm using the higher application threshold, provided their farm meets certain key criteria including:

- Planning for each application of manure or fertiliser on your land
- Meeting the seasonal timing requirements for the application of manures and slurries

While this focuses on nitrates, the measures required by the derogation will also help to reduce faecal pollution coming from the farm.

Agri-environment schemes are also available to provide funding to farmers and land managers to farm in a way that supports biodiversity, enhances the landscape, and improves the quality of water, air, and soil.

Whilst the agriculture and waste water sectors are the primary causes of bathing water pollution other factors, generally grouped under the headings 'urban diffuse' or 'other' need to be addressed.

Misconnections are not explicitly covered under '*The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009'* which has presented difficulties in addressing the issue. If the point of misconnection is located on the 'public' sewerage network, NI Water are responsible for addressing the issue. Where the misconnection occurs on 'private' sewerage networks however, as defined by the '*Water and Sewerage Services Act (Northern Ireland) 2016'* it becomes more difficult to rectify. NI Water currently has powers to disconnect and prosecute the owner of the property where foul water is incorrectly connected to a stormwater drain, but it cannot repair the misconnection and recover the cost unless the owner consents[153].

Whilst the legal frameworks differ, the operational frameworks to reduce the risk of pollution from dogs, birds and other sources is the same as for England.

[152] Agriculture subsidies after Brexit | Institute for Government

[153] A recent consultation (Water, Flooding and Sustainable Drainage: Improving how we manage water (2022) Department for Infrastructure) ending June 2022 proposed that NI Water should be provided the power to fix misconnections and recover costs in cases where the landowner refuses permission. The outcome of the consultation is unclear at time of writing.

Chapter 3: Assessment of the implementation and effectiveness of the current regulations

3.1 Identified Bathing Waters

Bathing water Regulations in England and Northern Ireland requires the list of identified bathing waters to be updated annually.

England

At the end of the 2015 bathing season, the first since the full implementation of the 'Bathing Water Regulations 2013', there were 418 identified bathing waters in England[154]. By 2023 this number had increased to 424, of which 407 are coastal, 14 are lacustrine and 3 are riverine. A map of the bathing waters is shown in Figure 2

Between 2015 and 2023, 18 new sites were granted formal bathing water status and 11 were un-classified[155]. The timeline of identification / un-classification is shown in Table 5.

Table 5 - Bathing water identifications and un-classifications (2015-2023)[156].

Bathing Season	Newly Identified	Un-Classified
2015	Rayrigg Meadow (+1)	
2016	West Runton (+1)	Rock, Newhaven, Lyme Regis Church Cliff Beach, Staithes (-4)
2017	Booby's Bay, Fistral South, Godrevy, Towans Gwynver Mexico Towans, Northcott Mouth, Tregonhawke, Upton Towans, Manor Steps Beach (+9)	Silloth, Instow (-2)
2018		
2019		Allonby South (1)
2020		
2021	River Wharfe (+1)	Burnham Jetty North, Clacton (Groyne 41), Ilfracombe Wildersmouth (-3)
2022	East Cowes Esplanade, Wolvercote Mill Stream (+2)	
2023	Sykes Lane, Whitwell Creek, Firestone Bay, River Deben (+4)	Tunstall Beach (-1)

The identification / un-classification process and eligibility criteria are discussed in section 3.4.

[154] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/474258/2015-bathing-water-classifications.pdf

[155] Formal bathing water status having been removed or rescinded

[156] Bathing waters - GOV.UK (www.gov.uk)

Whilst bathing waters can get removed for five consecutive years at 'Poor' status not all un-classifications are as a result of poor water quality. Tunstall Beach for example was un-classified due to concerns surrounding accessibility following cliff erosion and the subsequent low numbers of bathers[157].

Of the 11 un-classifications between 2015 and 2023, 5 consecutive years of 'Poor' water quality was attributed to three un-classifications: Burnham Jetty North, Clacton (Groyne 41) and Ilfracombe Wildersmouth. Instow was un-classified as it was believed achieving the minimum classification of 'Sufficient' was infeasible. Six sites were un-classified due to insufficient bathers (this includes Tunstall) and the remaining site, Newhaven, was un-classified following closure by the bathing water operator in 2008 due to the introduction of a harbour bye law that prohibited bathing.

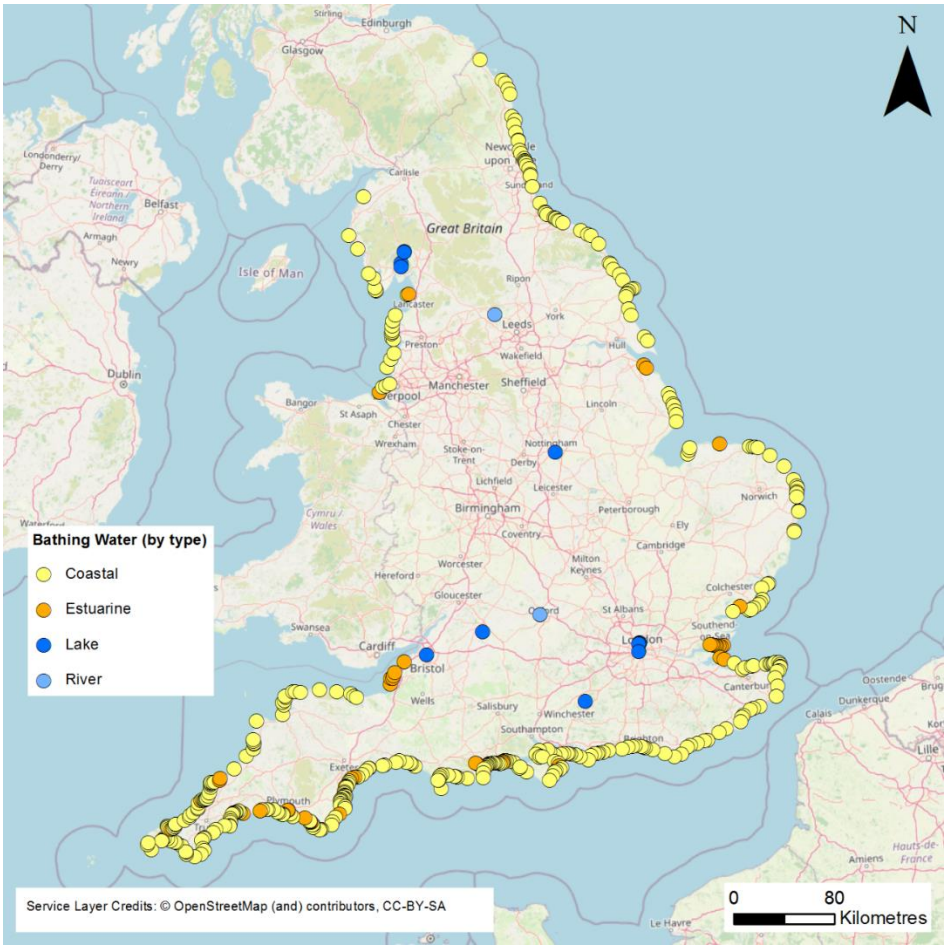


Figure 2 – Map of English Bathing Waters (presented data correct as of December 2022).

[157] Bathing waters: removing Tunstall Beach from the list of designated bathing waters - GOV.UK (www.gov.uk)

Northern Ireland

At the end of the 2013 bathing season, the first since the full implementation of the updated '*Quality of Bathing Water Regulations (Northern Ireland) 2008*', there were 23 identified bathing waters, all coastal. By 2023 this number has increased to 26, with three new coastal sites (Ballyhornan, Cloughley and Kilclief) granted bathing water status in 2018. A further seven 'Candidate' bathing waters (six coastal and one lacustrine) started sampling in 2023. A map of the bathing waters is shown in Figure 3.

No bathing waters have been formally un-classified between 2015 and 2023.

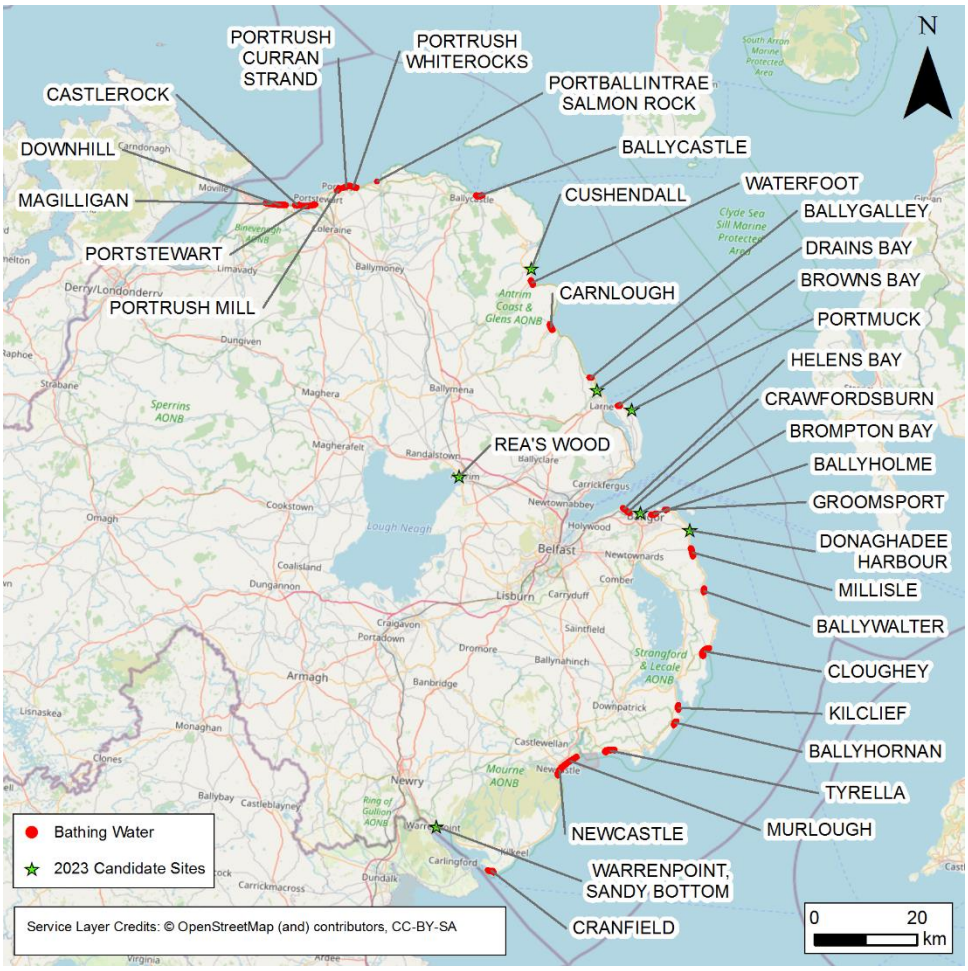


Figure 3 – Map of Northern Ireland Bathing Waters

3.2 Assessment of Changing Bathing Water Performance

Bathing water Regulations in England and Northern Ireland required all bathing waters to achieve at least the minimum 'Sufficient' classification by the end of 2015 bathing season. It also requires the Secretary of State and EA (England) / DAERA (NI) to exercise their relevant functions to ensure that realistic and proportionate measures are undertaken in order to increase the number of bathing waters meeting the target 'Good' and 'Excellent' classifications.

England

At the end of the 2015 bathing season there were 12 bathing waters which failed to meet at least the minimum 'Sufficient' classification; of which all 12 sites were coastal bathing areas. At the end of the 2022 bathing season there were still 12 bathing waters failing to meet the minimum 'Sufficient' classification (two inland [riverine] and ten coastal), although these are all different locations than those from 2015.

Figure 4 shows the changing percentage of classifications of coastal and inland bathing waters for England from 2015 to 2022. Due to Coronavirus restrictions during the 2020 bathing water season, there was no classification in 2020.

A number of sites have been classified as 'Un-assessed' for various lengths of time between 2015 and 2023. The reasons for this vary by site but are often connected with access issues or a change in land ownership which may or may not end up with un-classification.

Two sites, Watcombe and Tunstall beach, were not classified due to temporary beach closure in 2021 following coastal erosion incidents but remained bathing waters. Whilst Watcombe beach has re-opened and will be included in the 2023 bathing water list, Tunstall beach has been un-classified.

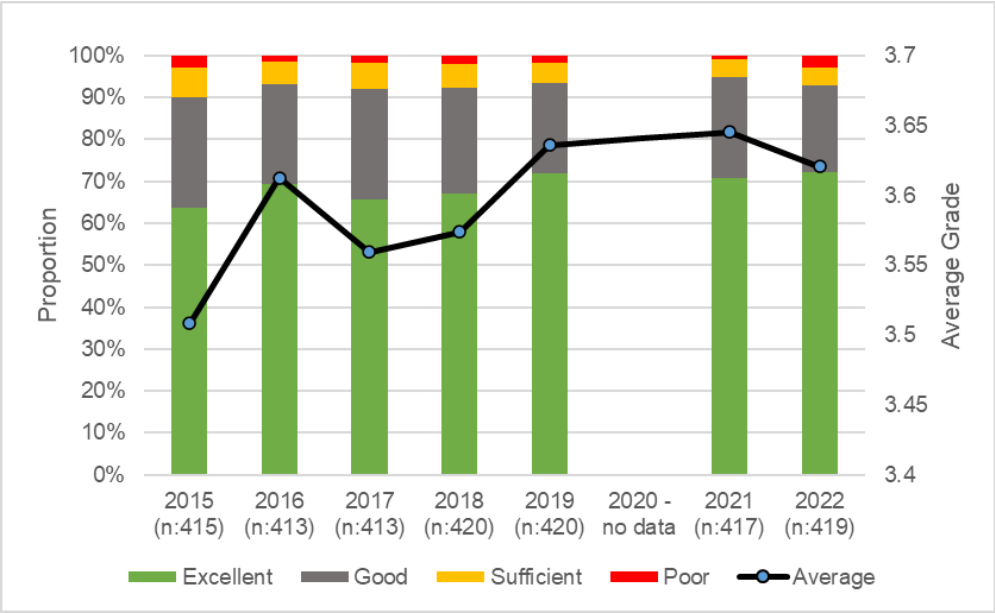


Figure 4 – Trends in English Bathing Water Performance Over Time from 2015 to 2022.

In 2022

- 72.1% of bathing waters achieved 'Excellent' in 2022 up from 63.6% in 2015.
- 97.1% of bathing waters achieved at least 'Sufficient', unchanged from 2015.
- 2.9% (12 sites) failed to meet the minimum standard and were classified as 'Poor', this is unchanged from 2015.

Overall bathing water performance over the last seven years shows a gentle but statistically significant improvement. Over this period the number of 'Excellent' sites has increased from 264 in 2015 to 302 in 2022. The average grade (with 4 representing 'Excellent' and 1 representing 'Poor') has increased from 3.51 to 3.62. Although gentle, the improvement is significant at 5% level, using a one-sided t-test on the regression slope coefficient. This conclusion should be treated with care given that the slope is so gentle and only seven data points are used but nonetheless this is evidence that improvement is occurring.

The improvement is offset by the introduction of new inland bathing waters such as The River Wharfe at Cromwheel, Ilkley and Wolvercote Mill Stream (Oxford), which have been classified as 'Poor'.

Northern Ireland

At the end of the 2015 bathing season, there were no bathing waters which failed to meet at least the minimum 'Sufficient' classification. At the end of the 2022 bathing season, one coastal bathing water (Ballyholme) failed to meet the minimum 'Sufficient' classification and was classified as 'Poor'.

Figure 5 shows the changing percentage of classifications of coastal bathing waters for Northern Ireland from 2015 to 2022.

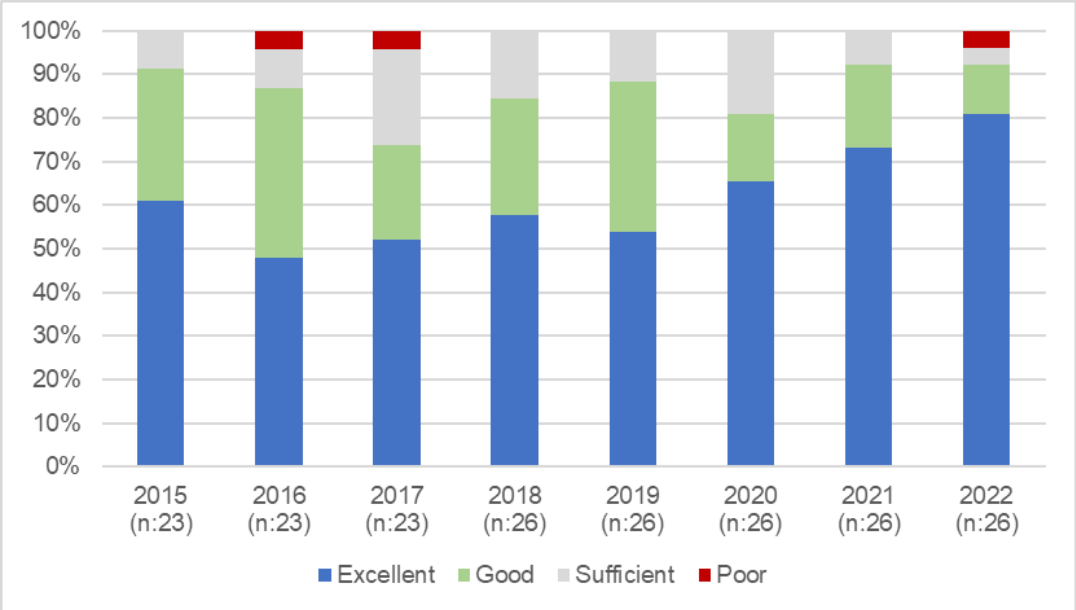


Figure 5 – Trends in Northern Ireland Bathing Water Performance Over Time (source: DAERA)

In 2022

- 81% of bathing waters achieved 'Excellent' in 2022, up from 61% in 2015.
- 96% of bathing waters achieved at least 'Sufficient', down from 100% in 2015.
- 4% (1 site - Ballyholme) failed to meet the minimum standard and was classified as 'Poor', up from zero in 2015.

Bathing water performance in Northern Ireland appears to be improving, a factor which can be inferred from the increasing number of 'Excellent' bathing waters. This conclusion has not been confirmed by statistical analysis on the data due to the small number of bathing waters.

3.3 Assessment of the Role and Performance of the Main Authorities

Whilst bathing water performance in England and Northern Ireland can be said to be improving, both jurisdictions still have bathing waters which are failing to meet the minimum requirements as defined by the Regulations. Maintaining minimum standards of bathing water quality[158] is one of the key duties of the main authorities as defined by English and Northern Ireland bathing water Regulations.

This chapter seeks to provide an independent, and evidence based, assessment of the performance of the main authorities, including analysis of efforts made to meet minimum standards of bathing water performance.

The style of the bullets points below have been designed to provide a quick visual assessment of performance and compliance with the Regulations.

✓ Compliance with Regulations
✗ Uncompliant with Regulations
❖ Note or Clarification

Identification of Bathing Waters

Bathing Water Regulations require the Secretary of State (England) / DAERA (NI) to publish annually a complete list of identified bathing waters in England and Northern Ireland[159]. The list is to include the current bathing water quality classification and state any locations with permanent advice against bathing, including the reasons for that advice[160]. The information must be actively disseminated prior to each bathing season using appropriate technologies and media, including the internet[161].

- ✓ Lists of annual identified bathing waters (including review of new identifications / un-classifications) are available[162,163,164,165].
- ✓ This information is easily available online and widely covered in regional and national news media[166,167].

[158] The Secretary of State and EA (England) / DAERA (NI) must exercise their relevant functions so that all identified bathing waters achieve at least the minimum 'Sufficient' status. Where the minimum standards are not achieved and a bathing water is classified as 'Poor', appropriate measures must be undertaken, including investigations into the cause(s) and actions to reduce / remove pollution .
[159] Bathing Water Regulations 2013, Reg. 3(4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3
[160] Bathing Water Regulations 2013, Reg. 3(4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3(3)
[161] Bathing Water Regulations 2013, Reg. 3(6) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 3(4)
[162] Bathing water classifications 2022 - GOV.UK (www.gov.uk)
[163] Designation of 4 new bathing waters in England - GOV.UK (www.gov.uk)
[164] https://www.daera-ni.gov.uk/publications/2022-bathing-water-profiles
[165] NI set to monitor and manage seven new official bathing waters | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)
[166] https://www.bbc.co.uk/news/uk-england-devon-65230717
[167] https://www.belfastlive.co.uk/whats-on/be/current-water-quality-beaches-right-20820275

- ❖ Both DEFRA and DAERA have published their minimum eligibility criteria required for new bathing waters in England and Northern Ireland. The identification / un-classification process is discussed further in section 3.4.

- ❖ The OEP Project Belisama Stakeholder Group has highlighted a desire for better dissemination and regular updates to information within England and Northern Ireland around the works being done to improve 'Poor' bathing waters.

Every identified bathing water must have a bathing water profile[168] which provides information about the site and the associated water quality[169]. These profiles are to be reviewed and updated at specific frequencies depending on the classification[170].

- ✓ **[England]** Bathing Water profiles are available online[171] and include data from the previous bathing seasons. Stantec and CREH have a working knowledge of many of these bathing waters and it is our opinion that information in the profiles has been reviewed and updated appropriately although detailed findings from third party investigations or the Water Industry WINEP bathing water investigations are rarely published.

- ✓ **[Northern Ireland]** Bathing water profiles are available online[172] and include data from the previous bathing season.

- ❖ During OEP Project Belisama bathing water stakeholder meetings[173], several campaign and / or stakeholder interest groups have expressed a desire for more and regular information to be published describing the steps the authorities are taking when a bathing water is classified as 'Poor'[174].

Every identified bathing water should have physical signage at the bathing water providing information about the bathing water and the associated water quality[175]. It is the duty of the local authority (England) or bathing water operator (Northern Ireland) to provide and maintain this signage[176].

- × **[England]** The EA carried out a signage audit[177] in 2022[178] which showed that out of 421 bathing waters, 369 bathing waters had all the required information in place and 52 sites did not. This is an improvement on the 2017 audit figure used for previous review purposes but still short of the requirement of the Regulation.

[168] Bathing Water Regulations 2013, Reg. 7 / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 7
[169] Bathing Water Regulations 2013, Sch. 3(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 2(1)
[170] Bathing Water Regulations 2013, Sch. 3 para 2(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 2 para 2(1).
[171] Bathing water quality (data.gov.uk)
[172] https://www.daera-ni.gov.uk/publications/2022-bathing-water-profiles
[173] Meeting minutes not available online
[174] OEP Project Belisama bathing water stakeholder group meeting – 05/07/2023
[175] Bathing Water Regulations 2013, Reg. 9(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 7(1)
[176] Bathing Water Regulations 2013, Reg. 9(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 7(1)
[177] This is not a statutory requirement under the Bathing Water Regulations 2013
[178] ukia_20230099_en.pdf (legislation.gov.uk)

- **[Northern Ireland]** Stantec and CREH have been unable to find any signage audits confirming all physical bathing water signage is present and maintained.

Sampling and Monitoring

During the bathing season, bacterial samples are to be taken from a specified monitoring location at each bathing water[179] and in line with a pre-defined monitoring calendar[180, 181]. In England and Northern Ireland samples must be collected at regular intervals not exceeding one month, plus one sample must be taken shortly before the start of the bathing season[182].

All bacterial samples are to be tested for the faecal indicator organisms, *E. coli* and IE[183]. Bathing water bacterial sampling methods and equipment[184], storage and transport[185], and laboratory methods[186] are to be carried out in accordance with the Regulations.

- ✓ **[England]** Aside from 2020 when COVID prevented the safe sampling and monitoring of bathing waters, the EA appears to have fully undertaken monitoring and microbiological sampling of identified bathing waters in accordance with the Regulations.
- ✓ **[Northern Ireland]** DAERA appears to have generally undertaken monitoring and microbiological sampling of identified bathing waters in accordance with the Regulations. A series of results from the end of July 2022 through to early August 2022 were recalled due to quality control failures and were not used in the overall classification. This is allowable within the Regulations.
- ❖ **[England]** Whilst still meeting its duties under the Regulations the Environment Agency has reduced the frequency of sampling at many bathing waters across England. Prior to 2017 all English bathing waters were sampled 20 times per bathing season. Since then, if a bathing water is achieving a consistent 'Good' or 'Excellent' classification and is deemed as having a low risk of change in the near future the bathing water may be sampled ten or five times a season depending on the classification.

In England, sampling practices should have 'regard to the handling of samples for microbiological analyses given in Annex V to the Bathing Water Directive'[187]. This refers to the ambition within the EU

[179] Bathing Water Regulations 2013, Sch. 4 para 1(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(1).
[180] Bathing Water Regulations 2013, Sch. 4 para 2(1). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(2).
[181] Bathing Water Regulations 2013, Reg. 8 / Quality of Bathing Water Regulations (Northern Ireland) Reg. 8
[182] Bathing Water Regulations 2013, Sch. 4 para 1(3). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(3).
[183] Bathing Water Regulations 2013, Reg. 8(2) / Quality of Bathing Water Regulations (Northern Ireland) Reg. 8(2)
[184] Bathing Water Regulations 2013, Sch. 4 para 1(4). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(4).
[185] Bathing Water Regulations 2013, Sch. 4 para 1(5). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(5).
[186] Bathing Water Regulations 2013, Sch. 4 para 1(6). / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 3 para 1(6).
[187] Bathing Water Regulations 2013, Sch. 4 para 1(7).

Directive for samples taken at 'Poor' or 'Sufficient' bathing waters to undergo microbial source tracking (MST) to help identify the source(s) of faecal contamination (e.g., human, avian, bovine, canine sources etc).

- ✓ **[England]** The Environment Agency National Laboratory Service is accredited to undertake MST[188]. Aside from periods when the laboratory was utilised for COVID testing, MST appears to have been regularly undertaken on samples over 500 cfu/100ml[189] for *E.coli* and / or IE at bathing waters classified at 'Poor'.

- ❖ **[Northern Ireland]** Whilst not a duty under bathing water Regulations, Northern Ireland suffers from the lack of an accredited laboratory capable of performing MST. The Agri-Food Biosciences Institute is currently seeking the necessary accreditations to be able to perform these analyses.

In addition to sampling, visual inspections for waste, including tarry residues, glass, plastic, or rubber are to be undertaken at a frequency necessary to allow adequate management measures to be put in place [190]. Investigations into macro-algae and / or marine phytoplankton and monitoring for cyanobacteria, where any bathing water profile indicates a potential for cyanobacterial proliferation, are to be undertaken at a frequency needed to allow adequate management measures to be put in place[191].

- ✓ **[England]** Cyanobacteria (blue-green algae) has been deemed a 'low risk' at all coastal bathing water sites. Cyanobacteria is assessed at all inland bathing waters and signs advising against bathing are erected if a bloom is visible and proven to be toxic following testing of water samples. Monitoring results and commentary for macro-algae (Seaweed) and marine phytoplankton is available for each site on the bathing water profiles.

- ❖ **[England]** Stantec and CREH are unaware of any bathing waters deemed to have a proliferation of macro-algae and / or marine phytoplankton which would require further investigation for purposes in their own right. Investigations have taken place at specific bathing waters (i.e., Walpole Bay, Margate), where there was a concern that macro-algae is acting to prolong *E.coli* and IE concentrations within the environment.

- ✓ **[Northern Ireland]** Marine phytoplankton samples are taken during foaming events and the results fed back to the bathing water operators to advise against bathing where necessary. All 2022 Bathing Water profiles state that the bathing water "is not at risk of a proliferation of phytoplankton or cyanobacteria (blue/green algae)[192].

---

[188] 0754Testing Multiple (ukas.com)

[189] Whilst MST testing has been undertaken on samples lower than 500 cfu/100ml, this internal EA threshold has been put in place to ensure there are enough faecal indicator organisms from which to analyse and derive a reliable count. MST has also been undertaken on samples over 500 cfu/100ml at bathing waters not at 'Poor' status but this is done at the discretion of the EA or as privately funded initiatives by the water industry or campaign groups.

[190] Bathing Water Regulations 2013, Reg. 8 (5) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 8 (2)(c)

[191] Bathing Water Regulations 2013, Reg. 8 (3-4) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 8(3)

[192] 2022 Bathing Water Profiles | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)

- ❖ During the 2023 bathing season however cyanobacteria proliferations were recorded at a number of locations in rivers, lakes and coastlines. Impacts were primarily seen in Lough Neagh and the Lower Bann, but other sites have also been impacted including north coast bathing waters and the Fermanagh lakes [193]. DAERA has responded to reports of cyanobacteria proliferations and has put in place emergency planning measures to deal with the situation. Monitoring, assessment and emergency pollution response activities have been carried out in accordance with the Regulations and an urgent review of existing policies has been commissioned[194].

- ✓ **[Northern Ireland]** Stantec and CREH are unaware of any bathing waters deemed to have a proliferation of macro-algae which would require further investigation. All 2022 Bathing Water profiles state that the bathing water "is not at risk of a proliferation of macro-algae"[195].

Classification and Assessment

Every bathing water is to be assessed and classified in accordance with the Regulations at the end of each bathing season[196] according to the threshold standards for inland or coastal bathing waters[197] (as shown in Table 4) and bathing water classification assessment methods [198] outlined in the Regulations. Every bathing water must be classified as either 'Poor', 'Sufficient', 'Good', or 'Excellent'[199] depending on the concentrations of *E. coli* and IE[200].

- ✓ Bathing water classifications are updated at the end of each bathing season [201, 202] in accordance with the threshold standards and formula detailed in the Regulations.

All bathing water classifications, 'abnormal situations', 'short term pollution' risks and 'pollution incidents' must be actively and promptly disseminated to the public through a variety of appropriate technologies and media[203].

- ✓ **[England]** Information on short term pollution or pollution incidents at inland and coastal sites[204] can be easily accessed online[205] and active warnings of advice against bathing continue outside the bathing season. The EA Swimfo tool[206] also allows this data to be made

[193] https://www.bbc.co.uk/news/uk-northern-ireland-66117867
[194] Information taken from DAERA responses to the Stantec and CREH 'Review of the Implementation and Effectiveness of Existing Bathing Water Regulations in England and Northern Ireland' presentation to the OEP Project Belisama Stakeholder Group
[195] 2022 Bathing Water Profiles | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)
[196] Bathing Water Regulations 2013, Reg. 10 (1) & 11(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9
[197] Bathing Water Regulations 2013, Sch. 5 (1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 (1)
[198] Bathing Water Regulations 2013, Sch. 5 (2-3) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 (2)
[199] Bathing Water Regulations 2013, Reg. 11 (1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 9
[200] Bathing Water Regulations 2013, Sch. 5 (1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Sch. 4 (1)
[201] Bathing water classifications 2022 - GOV.UK (www.gov.uk)
[202] About bathing water quality | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)
[203] Bathing Water Regulations 2013, Reg. 9(2) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 8(1)
[204] Pollution risk forecasting information is not currently available for any inland waters and is not available for newly identified bathing waters until there is sufficient data from which to draw statistical correlations.
[205] Bathing water quality (data.gov.uk)
[206] https://environment.data.gov.uk/bwq/profiles/

available on other media platforms such as the Surfers Against Sewage Safer Seas App[207]. Although warnings of pollution events are displayed at every bathing water, pollution risk forecasts are not necessarily implemented at every site. Inland bathing waters do not have pollution risk forecasting in operation.

- ❖ **[England]** The EA short term pollution risk forecasting tool (operational at 171 bathing waters correct as of the 2022 bathing season) was significantly updated in 2020, moving from correlations against a single parameter (rainfall) to a stepwise multiple parameter linear regression approach thereby improving the accuracy of predictions. The lack of electronic signage (as opposed to standard fixed signage) at most English bathing waters, however, means this information is not always disseminated or communicated effectively. See Section 3.7 Assessment of Alignment with other Legislation for further discussion and recommendations around Short Term Pollution Risk Forecasting.

- × **[Northern Ireland]** Six bathing waters have daily water quality predictions available online and displayed via electronic LED signage at the beach during the bathing season[208]. This is a result of water quality predictions from an INTERREG VA- funded SWIM NI project completed in December 2020 by a collaboration between University College Dublin (Agri-Food and Biosciences Institute) and Keep Northern Ireland Beautiful. Since the completion of the SWIM NI project, DAERA has been working on a legacy project to ensure prediction work can continue at the six existing sites and could potentially be extended to include other identified bathing waters. This information is shared with third parties such as the Surfers Against Sewage Safer Seas App. At this time however no information is available regarding 'abnormal situations', 'short term pollution' risks and 'pollution incidents' at the other bathing waters.

  The effectiveness and utilisation of the DAERA and EA predictive models is discussed further in Section 3.8.

Minimum and Target Standards

The Regulations state that the Secretary of State and EA (England) / DAERA (NI) must exercise their relevant functions so that all identified bathing waters achieve at least the minimum 'Sufficient' status by the end of the 2015 bathing season[209]. Where the minimum standards are not achieved and a bathing water is classified as 'Poor', management measures must be undertaken, including investigations into the cause(s) and actions to reduce / remove pollution[210].

- × **[England]** At the end of the 2022 bathing season there were 12 identified bathing waters (2.9% of total) failing to reach the minimum 'Sufficient' classification. These were either newly identified bathing waters or sites where, despite extensive investigation, the cause or source of the pollution is not actively understood or easily rectifiable (see example of Tynemouth

[207] The Safer Seas & Rivers Service - Surfers Against Sewage (sas.org.uk)
[208] https://www.keepnorthernirelandbeautiful.org/cgi-bin/generic?instanceID=57
[209] Bathing Water Regulations 2013, Reg. 5(1)(a) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(1)(a)
[210] Bathing Water Regulations 2013, Reg. 13(1) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 14

Cullercoats on next page). Since 2015, four bathing waters have been un-classified for consistently failing to achieve the minimum 'Sufficient' classification.

- **[Northern Ireland]** At the end of the 2022 bathing season there was one bathing water, Ballyholme, which due to a deterioration in water quality, failed to reach the minimum 'Sufficient' classification.

- There are a number of factors worth considering when discussing the ability and effectiveness of the main authorities to achieve at least the minimum 'Sufficient' classification:

    - There are a number of bathing waters in the UK which despite extensive investigations and improvements over many years still fail to achieve the minimum standards. Tynemouth Cullercoats bathing water in Northumbria is an example of some of the difficulties faced. This site has been classified as 'Poor' since 2018.

Tynemouth Cullercoats Bathing Water Investigation Statement

Bathing water quality has reduced during the latter half of the bathing water seasons in recent years coinciding with the deterioration to 'Poor' status. In 2017, a joint investigation was launched between the EA, North Tyneside Council and Northumbrian Water into the potential source(s) of pollution. The investigations found that the deterioration was local to Cullercoats, could not be linked to any known water company or agricultural activity in the catchment and did not appear to be driven by wet weather. MST analysis on the water samples showed that human sewage is the major contributor to the reduced water quality, but comprehensive surveys and remedial works have failed to identify and address the source(s) of pollution.

As the source of the pollution could not be identified investigations moved onto the pathway by which the pollution arrives at the bathing water. Survey and modelling work strongly suggest that the pollution is entering, and then travelling through, the groundwater to the bathing water. Desktop hydrogeological investigations revealed a major fault in the limestone ending on the beach, suggesting the source of pollution could be a considerable distance from the bathing water. However, samples taken from ponding water on the beach both close to, and at a distance from, the major fault line show similar elevated levels of bacteria. Investigations are continuing but at this point in time, every suspected pollution source and likely pathway has been investigated and bathing water quality remains 'Poor'.

- Tynemouth Cullercoats highlights some of the issues which can be faced, firstly in identifying the sources of pollution and then secondly being able to address or mitigate the issue. Other examples of difficulties faced include:

- Attempting to trace the source of pollution through long stretches of culverted watercourse and / or groundwater and mitigating the impact from these pathways if the source(s) cannot be found.
- Attempting to mitigate the water quality impacts from wildlife such as birds and sea mammals. Impacts can be either direct to the bathing water or indirectly such as waterbodies flowing through wildlife ponds or nature reserves prior to discharging near the bathing water.
- There are also a small number of sites where it is theorised that bacteria are growing within particular environments such as polluted harbour sediments (Bridlington Bathing Water) or seaweed piles[211].
- Certain industrial effluents, discharging a treated food processing waste effluent, have also been shown to have high levels of faecal indicators organisms present (such as the Wheatcroft Long Sea Outfall near to the Scarborough South, bathing Water)[212].

The Secretary of State and EA (England) / DAERA (NI) must also exercise their relevant functions to ensure that realistic and proportionate measures are undertaken in order to increase the number of bathing waters meeting the target 'Good' and 'Excellent' classifications[213].

- ✓ **[England]** The percentage of bathing waters currently achieving the target 'Good' or 'Excellent' is 92.9%. This is an improvement on the 90.1% in 2015. The percentage of bathing waters achieving the highest 'Excellent' classification also increased from 63.6% to 72.1%.
- ✓ **[Northern Ireland]** The percentage of bathing waters currently achieving the target 'Good' or 'Excellent' is 92%. This is an improvement on the 90% in 2015. The percentage of bathing waters achieving the highest 'Excellent' classification also increased from 63% to 81%.
- ❖ There are a number of factors worth raising when discussing the ability and effectiveness of the main authorities to achieve the target 'Good' and 'Excellent' classifications. Achieving the target classifications often involves improvements or mitigations to all pollution sources and sectors previously discussed. The following are examples of difficulties faced by the main authorities which may be encountered when trying to achieve the target classifications:
  - Agriculture – An ENDS Report from September 2020[214] concluded that, based on 2018/2019 data for England, EA officers would inspect one farm on average every 263 years[215], with focus on high-risk locations, previously non-compliant businesses,

[211] Findings taken from PR19 WINEP Investigations undertaken by Stantec and CREH
[212] Findings taken from PR19 WINEP Investigations undertaken by Stantec and CREH
[213] Bathing Water Regulations 2013, Reg. 5(1)(b) / Quality of Bathing Water Regulations (Northern Ireland) 2008, Reg. 5(1)(b)
[214] https://www.endsreport.com/article/1695475/free-all-ea-officers-inspect-just-one-farm-every-263-years
[215] This figure reduces to 153 years based on latest 2021 data (https://www.endsreport.com/article/1803862/ea-doubles-farm-inspections-2021-52-sites-breach-permits)

and those farming sectors of greatest concern[216]. If the inspectors identify issues needing to be addressed there is £15m of government funding available for farmers to tackle water pollution via the Catchment Sensitive Farming programme[217]. This has led to a 'proportionate approach based on risk to the environment'[218] which focuses monies and efforts towards meeting the minimum statutory environmental targets. Whilst justifiable, it does limit the ability of the main authorities to achieve the targets classifications of the bathing water Regulations.

- Misconnections – Stantec and CREH experience in bathing water management suggests that many English local authorities do not have the procedures[219] or resources in place to monitor and police the necessary rectifications. In Northern Ireland, without consent from the property owner, it is not legally possible to address all identified misconnections.
- Private Sewerage – many private sewerage assets are too small to be permitted under the Environmental Permitting Regulations. In order for the Regulator to enforce works to these assets they need to be able to evidence a link between the source of pollution and its impact on water quality. This can be very difficult particularly for sewerage assets like septic tanks, which discharge to ground.

In England, a review of progress towards achieving the minimum and target standards is to be undertaken every five years[220]. A similar review is carried out in Northern Ireland every six years but there is no requirement within the Regulations for this.

- ✓ **[England]** A Post Implementation Review of the Bathing Water Regulations 2013 was undertaken by DEFRA in November 2018[221] and most recently in September 2023[222]. Both reviews were very limited in scope, showed no evidence of its failure to meet the minimum statutory standards and offered no ambition or targets for improving performance.
- ✓ **[Northern Ireland]** DAERA reviews bathing water performance every six years. The Bathing Water Review 2022/23[223] incorporated a public consultation which saw over 300 nominations for approximately 100 bathing water sites, which also included inland water sites. Additionally, the review received calls for the bathing season to be extended and DAERA will subsequently explore with stakeholders the implications of such an extension. DAERA should be credited for the scope and breadth of the consultation and subsequent review which appears to cover many of the evolving trends discussed in Section 3.8.

[216] https://environmentagency.blog.gov.uk/2023/03/10/working-to-reduce-pollution-from-farming/
[217] https://environmentagency.blog.gov.uk/2023/03/10/working-to-reduce-pollution-from-farming/
[218] https://environmentagency.blog.gov.uk/2023/03/10/working-to-reduce-pollution-from-farming/
[219] Such as those outlined in 'Misconnections – Good Practice Guide (2014) WaterUK'.
[220] Bathing Water Regulations 2013, Reg. 20
[221] uksiod_20131675_en_003.pdf (legislation.gov.uk)
[222] The Bathing water Regulations 2013 Post implementation review (2023) ukia_20230099_en.pdf (legislation.gov.uk)
[223] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/202223%20Bathing%20Waters%20Review%20report.pdf

Non Regulatory Considerations

There are also additional aspects, not specifically covered by the provisions and duties of the Regulations, which in the opinion of Stantec and CREH merit discussion. These generally concern England rather than Northern Ireland and are connected with the aims and ambitions of the original EU Bathing Water Directive and some of the evolving trends discussed in Section 3.8. It should be noted this represents a subjective assessment based on the expert judgement of Stantec and CREH.

- The UK, DEFRA and its former incarnation as the Department of Environment was at the forefront of bathing waters research in the 1990s and early 2000's, contributing in large parts to '*WHO 2003 Safe Guidelines for Recreational Waters'*[224] and the EU Bathing Water Directive. DEFRA contributions towards global bathing water innovation has significantly dropped off since this period, with less UK research involvement in recent WHO reviews. UK academic science has continued to contribute during this period through EU funded projects such as the Epibathe, Virobathe, Viroclime and Acclimatize Projects[225].

- There is an argument that this has led the UK and DEFRA to become reliant on the EU and WHO for knowledge and leadership in matters of bathing waters regulation and ambition. This becomes problematic for DEFRA when attempting to respond to national level issues and responses to evolving trends following the UK exit from the EU. Examples of this include:

    - A lack of transparency and public consultation of bathing water matters during recent DEFRA bathing water identifications and guidance updates. See Section 3.4.

    - Statutory actions related to bathing waters in the '*Environment Act 2021*' have no basis in scientific research and appear to misunderstand the key pollution sources impacting inland [riverine] bathing waters, instead reacting to public pressure on storm overflows. See Section 3.7.

    - No progress towards the EU stated ambition for Member States to move from simple sampling and monitoring to holistic bathing water quality management[226]. This ambition is not included in UK bathing water Regulations and Stantec and CREH have found no evidence to indicate progress towards this. The 2019 EU review of compliance with the Bathing Water Directive[227] highlights the approach taken by Natural Resource Wales to Cemaes Bathing Water as an example of best practice in this regard. See Section 4.5 for more detail on Cemaes.

[224] Guidelines for safe recreational water environments Volume 2 Swimming pools and similar environments (who.int)

[225] This research effort is likely to decrease in to the future due to the loss of access to European funding streams for academic research and loss of the collaborative cross-territory research, evident in the projects noted here.

[226] https://environment.ec.europa.eu/topics/water/bathing-water_en

[227] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

- Cuts to the Environment Agency budget (reported as £170 million in 2009-10 to £76 million in 2019-20[228]) will have reduced the ability of the EA to undertake its general duties under the Regulations. Directly or indirectly, this has led to the burden of responsibility for bathing water performance being pushed onto the water and sewerage companies. See OFWAT use of Performance Commitments in Section 2.5.

3.4 Assessment of the Identification Process and Site Selection used by the Main Authorities

The process by which the main authorities in England and Northern Ireland decide whether new bathing water applications are approved, and the minimum eligibility criteria for identification, differ between the two jurisdictions. An assessment of this process for both jurisdictions is summarised below.

Identification Process and Criteria

England

Figure 6 details the 2023 updates to the published DEFRA guidance for the identification of a future bathing water site in England and the minimum eligibility criteria needed for formal identification[229].

[228] https://hansard.parliament.uk/commons/2022-11-17/debates/29A0035B-708A-4796-8C52-395CA86C7C54/EnvironmentAgencyEnforcementBudget#:~:text=However%2C%20the%20Government%20more%20than,was%20only%20%C2%A394%20million.

[229] Designate a bathing water: guidance on how to apply - GOV.UK (www.gov.uk)

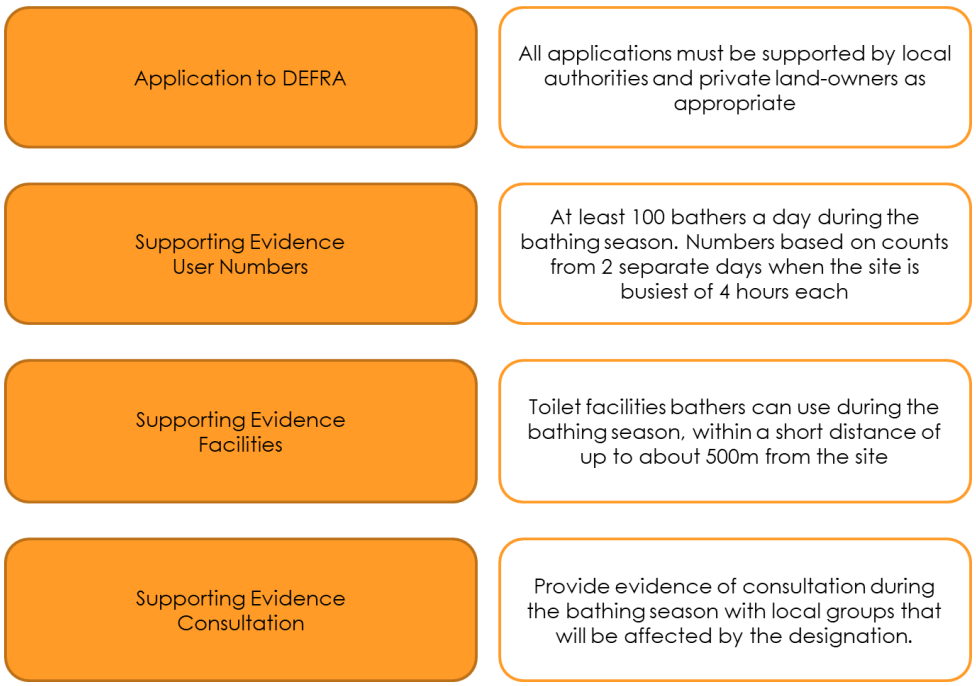


Figure 6 – Criteria for new bathing water applications in England

Following a two week public consultation Sykes Lane Bathing Beach and Whitwell Creek at Rutland Water, Firestone Bay in Plymouth, and a section of the River Deben at Waldringfield, Suffolk, were granted bathing water status ahead of the 2023 bathing water season. This will take the total number of bathing waters across the country to 424[230].

Between March 2018 and February 2022 DEFRA received five applications from the public or local authorities for sites to be granted bathing water status of which three applications were successful. Between March 2022 and February 2023 DEFRA received four times the amount of bathing water applications (21) than it received in the whole of the previous five years[231]. Despite the significant number of applications ahead of the 2023 bathing season only four went on to be granted bathing water status. There has been criticism from politicians, media, and campaign groups around the number of rejections and the lack of transparency around the process[232]. Several freedom of information requests have been submitted to find out why certain sites have been rejected but the applications for information have been refused by DEFRA[233].

> DEFRA said: "*We would not comment on individual applications that are not being taken forward to consultation, but all applicants have been informed of the outcome of their application. When selecting new sites for potential bathing water designation, we consider how*

[230] https://www.gov.uk/government/news/green-light-for-four-new-bathing-sites
[231] https://www.endsreport.com/article/1825978/defra-flooded-unprecedented-number-bathing-applications-past-year
[232] https://www.theguardian.com/environment/2023/mar/23/bathing-water-status-rarely-granted-england-environment-agency-lib-dems-analysis
[233] https://www.theguardian.com/environment/2023/mar/23/bathing-water-status-rarely-granted-england-environment-agency-lib-dems-analysis

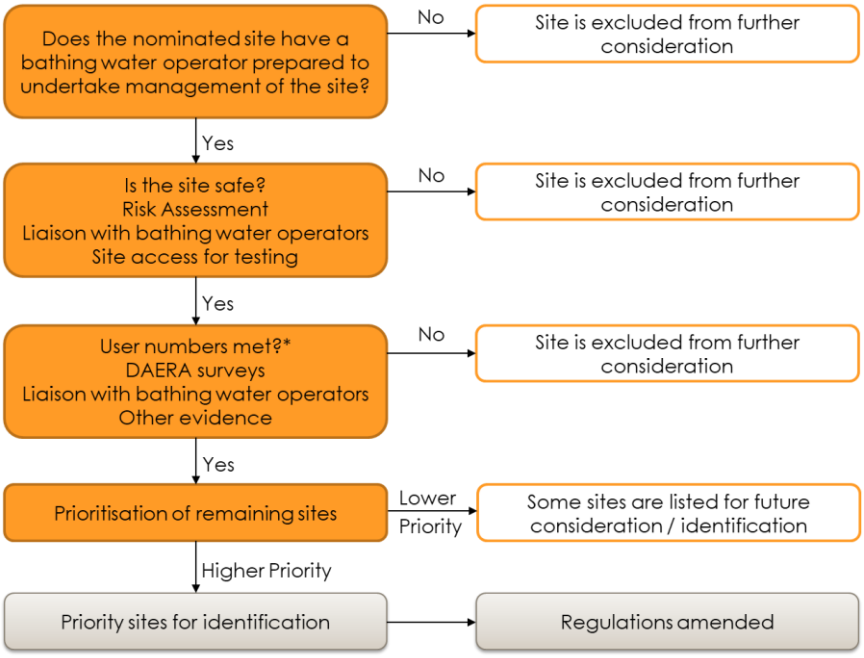
many people bathe there, if the site has suitable infrastructure and facilities, such as toilets, and if measures are being taken to promote bathing at those waters. All applications are assessed against these factors and applications that do not meet the essential criteria will not proceed to national consultation."[234]

DEFRA published new guidelines in July 2023 on the minimum eligibility criteria for bathing water applications[235] which should now answer many of the questions from the local action groups and media. The updated guidance however still raises several issues:

- Is it appropriate that bathing counts are not allowed to be undertaken on days when organised events such as festivals, swimming races or competitions are being held?
- How are DEFRA taking the bathing water user surveys from a 'busy' day to determine the number of bathers on an 'average' day during the bathing season? Does this mean it is not simply an average of the two bathing water counts?

Northern Ireland

Figure 7 details the published DAERA guidance and minimum eligibility criteria for 'Candidate' bathing waters in Northern Ireland.



* 45 bathers on at least one occasion, 100 beach users on at least two occassions

[234] https://www.theguardian.com/environment/2023/mar/23/bathing-water-status-rarely-granted-england-environment-agency-lib-dems-analysis

[235] Designate a bathing water: guidance on how to apply - GOV.UK (www.gov.uk)

Figure 7 – Criteria for new bathing water applications in Northern Ireland[236]

The 2017 DAERA review of bathing waters[237] determined that six yearly reviews were an appropriate timescale for consideration of new bathing water applications, and these could be undertaken as part of the non-statutory review of bathing waters. This however does not preclude interested parties in nominating a site for formal identification at any other time. The 2017 review received recommendations for four 'Candidate' bathing waters of which three were granted full bathing water status in 2018. As part of the 2023 public consultation and review, DAERA received 175 responses, with 352 nominations for 101 potential bathing waters, both coastal and inland[238]. The 20 sites with the highest number of public nominations were surveyed by DAERA over the 2022 bathing season to determine user numbers. Ten of the 20 priority sites met the criteria for inclusion[239]. Following discussions with bathing water operators, seven of these sites were chosen as 'Candidate' bathing waters ahead of 2023 bathing season[240]. This consisted of six 'Candidate' coastal bathing waters at Brompton Bay (Bangor), Cushendall, Donaghadee Harbour, Drain's Bay (near Larne), Portmuck, Warrenpoint (Sandy Bottom) and what would be Northern Ireland's first inland bathing water at Rea's Wood (Antrim). DAERA will continue to liaise with bathing water operators over the 2023 bathing season to identify which sites continue to meet the criteria for identification and anticipate adding the new sites as formal bathing waters in the "coming months"[241].

Assessment of Process and Site Selections

DEFRA and DAERA have taken significantly different approaches to the bathing water identification process and the minimum eligibility criteria required.

England reviews bathing water nominations on an annual basis compared with once every six years (at least historically) within Northern Ireland. Once the applications are successful in England, the new sites will get formally granted bathing water status ahead of the next bathing season. In Northern Ireland, sites will assume 'Candidate' status whilst water quality sampling and bathing water user counts are undertaken. The results of the counts will then determine if the 'Candidate' site is granted full bathing water status.

England has a much stricter definition of 'large numbers of bathers' with evidence needed for at least 100 bathers a day on average during the bathing season. The process outlined by DEFRA makes no specific reference to site safety, potentially ignoring factors such as dangerous rip tides or underwater obstacles. Whilst understandable, placing importance on specific site facilities, could also result in popular swimming spots missing out on bathing water status on grounds unrelated to public health.

Northern Ireland has a less stringent definition of 'large numbers' with evidence needed for at least 45 bathers on one occasion and 100 beach users on two occasions. Within Northern Ireland the process

[236] https://www.daera-ni.gov.uk/articles/bathing-water-quality#toc-5
[237] https://www.daera-ni.gov.uk/https%3A//www.daera-ni.gov.uk/consultations/review-bathing-waters
[238] Information contained in DAERA responses to OEP requests for information.
[239] Information contained in DAERA responses to OEP requests for information.
[240] https://www.daera-ni.gov.uk/news/ni-set-monitor-and-manage-seven-new-official-bathing-waters
[241] Information contained in DAERA responses to OEP requests for information.

outlined by DAERA shows awareness of the evolving trends and issues and demonstrates a better grounding in public health than England. For example, making it clear in the process that the proposed site needs to be safe and looking into the options for extending the bathing season at surfing beaches which are popular year round.

The approach taken in Northern Ireland is perhaps more closely aligned with the Republic of Ireland than England (refer to Chapter 5 for further discussion on the Republic of Ireland). It allows time to assess water quality before making the formal identification and the review process shows greater degrees of public consultation than in England. The timelines for new bathing water nominations, historically at least, is significantly longer than the rest of the UK. Both England and Northern Ireland could benefit from a defined pre-application process (such as that seen in Germany and as discussed in Chapter 5.3).

It is Stantec and CREH recommendation that a defined pre-application process be considered as part of any future review or update to UK Bathing Water Regulation[242]. A structured pre-application process would also allow opportunities to align with the WINEP and water industry Price Review timeframes.

When undertaking a review of English Bathing Water Regulations, it is also recommended that DEFRA undertake public consultation around the minimum eligibility criteria for identification, as well as understanding public concerns around many of the new and evolving trends. DEFRA should look at the DAERA formal review as an example of best practice.

[242] This could include an assessment of water quality and identification of whether a minimum water quality standard could actually be achieved through improvement actions to reduce key contributing sources.

3.5 Assessment of Parameters, Standards, and Thresholds

This section considers the appropriateness of the parameters, standards, and thresholds within current bathing water Regulations in England and Northern Ireland. Assessment is based on Stantec and CREH expert judgement, UK experience and findings of the '*2018 WHO recommendations on scientific, analytical, and epidemiological developments relevant to the parameters for bathing water quality*'[243]. The 2018 WHO review was undertaken in partial response to the requirements of Article 14 of the EU Bathing Water Directive to review the existing directive with particular regard to the parameters for bathing water quality, including whether it would be appropriate to phase out the 'Sufficient' classification or modify the applicable standards[244]. The full EU review has not been published at the time of writing but the WHO recommendations to the EU are available online[245].

Assessment of Current Parameters and Thresholds

- *E. coli* and intestinal enterococci

The legal compliance parameters in UK (and EU) bathing water Regulations are the two faecal indicators, *E. coli* and intestinal enterococci. These parameters are both supported by published epidemiological studies[246] which employed the recommended randomized controlled trial protocols.

The 2018 WHO recommendations to the EU conclude that "*E. coli* and intestinal enterococci as well as the four levels within the current classification system ('Excellent', 'Good', 'Sufficient', and 'Poor') should be retained." [247]

These classifications are based on a series of 90 and 95 percentile threshold values (Table 4).

The WHO recommends the usage of 95 percentile values only for each category of the classification system instead of a mixture of 95 and 90 percentile water quality standards which are deemed "too confusing and unjustifiable"[248].

Table 6 details the thresholds for coastal and inland bathing waters when applying a consistent 95 percentile standards to all classifications[249].

[243] who-recommendations-on-ec-bwd-august-2018.pdf
[244] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12658-Bathing-water-quality-review-of-EU-rules_en
[245] who-recommendations-on-ec-bwd-august-2018.pdf
[246] Such as (A. Wiedenmann et al. 2005; Infectious Disease Risks from Bathing in Fresh Recreational Waters in Relation to the Concentration of *Escherichia coli*, Intestinal Enterococci, Clostridium perfringens and Somatic Coliphages)
[247] who-recommendations-on-ec-bwd-august-2018.pdf
[248] who-recommendations-on-ec-bwd-august-2018.pdf
[249] Based on a standard deviation of 0.8103 (derived from data from 11000 EU bathing waters and the value from which the WHO guidelines for marine water were calculated). These values retain the same level of health protection as the current 'Sufficient' classification (who-recommendations-on-ec-bwd-august-2018.pdf)

Table 6 – Proposed Revisions to Classifications and Standards for Inland and Coastal Bathing Waters

Parameter	Excellent Quality	Good Quality	Sufficient Quality
For Inland Waters			
Intestinal enterococci (cfu/100ml)	200(*)	400(*)	656(*)
Escherichia coli (cfu/100ml)	500(*)	1000(*)	1789(*)
For Coastal Waters			
Intestinal enterococci (cfu/100ml)	100(*)	200(*)	367(*)
Escherichia coli (cfu/100ml)	250(*)	500(*)	993(*)
(*) Based on a 95-percentile evaluation			

- Cyanobacteria

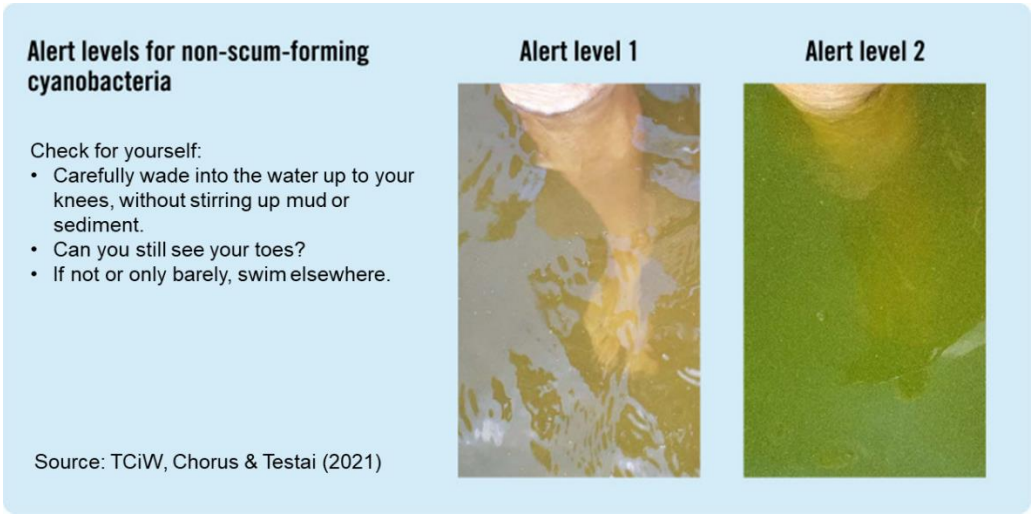
Quantities of, or the impact from, Cyanobacteria (blue/green algae) are not currently included as part of the bathing water classification calculations. There is a requirement within the UK bathing water Regulations to consider them as part of the bathing water profile and bathing water management measures are required when the blooms are deemed unacceptable or may pose a risk to public health.

Cyanobacteria were discussed during the development of the 2018 WHO report, and recommendations were made that locations at risk of freshwater blooms should be subject to a new classification / management system developed at the discretion of the EU member states[250]. It should be noted that work to derive the definition of numerical standards in this area is still ongoing and it is Stantec and CREH expert opinion that the derivation of such standards would likely require more extensive epidemiological investigations than those available to the WHO.

The German Government science team have experience of dealing with Cyanobacteria issues at their inland bathing waters and rather than providing numerical standards have instead presented the concept of 'Alert Levels'. These levels are based on cyanobacterial derived levels of turbidity (see Figure 8, taken from Harmful algal blooms - Guidelines on Recreational Water Quality - NCBI Bookshelf (nih.gov).

It is Stantec and CREH opinion that the WHO recommendations of use of the German 'Alert Levels' are a good start on the cyanobacterial toxins problem.

[250] Discussion of the various approaches taken by EU Member States is shown in Chapter 5 Comparison with Other EU Jurisdictions



At Alert Level 1, where the foot is clearly visible in knee depth water, *the cyanobacteria may increase to a heavy bloom within a few days if conditions are conducive*. Thus, vigilance is required and '*watching out for scums is recommended*'.

At Alert Level 2, where the foot is not clearly visible in knee depth water, there is more risk of harmful toxin effects particularly on young children and avoiding water contact is recommended.

Figure 8 – Alert levels for non-scum-forming Cyanobacteria.

- Macro-Algae (Seaweed) and / or Marine Phytoplankton

The 2018 WHO report[251] recommends "*that no change is needed to the current method used… for macro-algae and / or marine phytoplankton, i.e., their consideration as part of the bathing water profile.*"

- Alternative Indicators / Parameters

Due to their role in recreational water illness and recent breakthroughs in analytical laboratory methods, enteric viruses and/or bacteriophages (non-human pathogens which infect bacteria) have been suggested as alternative / supplementary indicators to *E. coli* and intestinal enterococci[252].

The utility of qPCR[253] and enteric viruses and / or bacteriophages as potential indicators of water quality, and possibly health risk, were examined as part of the EU Virobathe project. The project

[251] who-recommendations-on-ec-bwd-august-2018.pdf

[252] Methods for the concentration and detection of adenoviruses and noroviruses in European bathing waters with reference to the revision of the bathing water directive 76/160/EEC | VIROBATHE | Project | News & Multimedia | FP6 | CORDIS | European Commission (europa.eu)

[253] qPCR or 'quantitative Polymerase Chain Reaction' would provide a much quicker method for analysing microbial water compared to existing techniques but with much less confidence in the data. qPCR is a recognised method used in the United States with its own thresholds and standards set out in the US Recreational Water Quality Criteria. Refer to Chapter 6.4 for further details.

concluded viral pathogen parameters should not yet be considered for inclusion due to concerns over analytical quality control and a lack of epidemiological evidence to allow the derivation of numerical standards[254,255].

- Other Infectious Agents / Emerging Concerns[256]

Swimmer's Itch

Swimmer's itch (or cercarial dermatitis) is an allergic reaction caused by exposure to the larval form of a naturally occurring freshwater parasite (schistosome). Cases have been reported in a number of European countries, including the UK, and it may be locally common[257]. Eradication of the parasite is difficult given its complex lifecycle and avoiding contaminated waters is the only known way to avoid infection.

Where cases have been identified, Stantec and CREH recommend this should be included in the bathing water profile and information provided to the public.

Wound Infection

Vibrio infection is an emerging disease in Europe which has been related to an increase in surface sea temperatures, most notably when temperatures are >15˚C[258]. There is no reported *vibrio* wound infections and / or septicaemia within England or Northern Ireland as a result of exposure to recreational waters. However, this is likely to change with predicted increases to sea temperatures around the UK associated with climate change.

In addition to *Vibrio* spp., there are a number of other microorganisms that can cause wound infection following exposure to recreational water, such as *Aeromonas* spp and *Leptospira* spp (freshwater).

Stantec and CREH recommend that where cases of such infection are identified that this information be covered in the bathing water profile.

Antimicrobial Resistance (AMR)

2018 WHO advice to the EU, states "bathing waters are not thought to be a major route of transmission for antimicrobial resistant microorganisms and environmental surveillance techniques are not currently sufficiently advanced for obligatory routine monitoring."

[254] Methods for the concentration and detection of adenoviruses and noroviruses in European bathing waters with reference to the revision of the bathing water directive 76/160/EEC | VIROBATHE | Project | News & Multimedia | FP6 | CORDIS | European Commission (europa.eu)
[255] Safer swimming on the horizon | VIROBATHE Project | Results in brief | FP6 | CORDIS | European Commission (europa.eu)
[256] As identified by the 2018 WHO recommendations to the EU
[257] Soldánová et al. (2013) Swimmer's itch: etiology, impact and risk factors in Europe. Trends in Parasitology 29: 65-74.
[258] Baker-Austin et al. (2013) Emerging Vibrio risk at high latitudes in response to ocean warming. Nature Climate Change 3: 73-77.

A 2022 AFBI research project, **"**Microbial Source Tracking of Antimicrobial Resistance in Bathing Waters in Northern Ireland[259]" reported that evidence of the presence of AMR bacteria was found at all six studied bathing water locations and suggested that further research would be required to address the risk to bathing waters of AMR contamination from human sewage.

It is Stantec and CREHs recommendation that further research into the transmission of, and surveillance methods for, antimicrobial resistant microorganisms are required before becoming part of bathing water Regulations.

Microplastics

The issue of microplastics falls within the scope of the '*EU Marine Strategy Framework Directive* (2008/56/EC)'[260,261], notably through the implementation of Commission Decision 2017/848/EU that lists micro-litter as one of the criteria elements which EU Member States have to consider in their marine strategies.

The WHO recommends that ongoing research on the issue of microplastics that falls within the scope of the EU Marine Strategy Framework Directive should reveal in the short to medium term whether it is relevant also for consideration within bathing water Regulations.

Assessment of Current Standards for Monitoring and Analysis

There are a multitude of factors which should be considered when developing a sampling and monitoring plan. These factors are widely covered by other regional recreational water guidelines (see 'Chapter 4.3 Factors to Consider When Developing a Monitoring Plan' of the United States 'National Beach Guidance'[262]) but are not widely covered or considered within current EU or UK Regulations or guidance.

- Spatial Variability (Choice, and Justification, of Sample Location)

The 'EU Bathing Water Directive' states that sampling should be undertaken at one single defined location within the bathing water area. This should be at a location within the bathing water where:

a) Most bathers are expected; or
b) The greatest risk of pollution is expected, according to the bathing water profile.

The 'Bathing Water Regulations 2013' state that monitoring should occur where most bathers are expected and does not allow for consideration of the greatest risk of pollution. The wording of the

[259] "Microbial Source Tracking of Antimicrobial Resistance in Bathing Waters in Northern Ireland" (Food Hygiene Unit of AFBI Veterinary Sciences Division) 2022. Article not available online.
[260] EUR-Lex - 32008L0056 - EN - EUR-Lex (europa.eu)
[261] https://research-and-innovation.ec.europa.eu/research-area/environment/oceans-and-seas/eu-marine-strategy-framework-directive_en
[262] https://www.epa.gov/sites/default/files/2014-07/documents/beach-guidance-final-2014.pdf

'Quality of Bathing Water Regulations (Northern Ireland)' aligns with the EU Bathing Water Directive, offering a choice of locations.

At many bathing waters, water quality varies, often significantly, across the bathing water area for a variety of possible reasons. One such example is the recent identification of the River Wharfe at Cromwheel, Ilkley where Ilkley wastewater treatment works discharges final treated effluent into the river approximately one hundred meters downstream of the designated sample point. Downstream of the wastewater treatment works levels of *E. coli* and IE consistently exceeds minimum standards and bathing should be avoided due to the public health risk[263]. As people bathe along this entire stretch of river it is important that bathers understand the changing water quality and public health implications as you move downstream.

It is Stantec and CREHs recommendation that any future review or update to Bathing Water Regulation in England allows the main authorities to factor in public health considerations and not just bather numbers[264] when deciding upon the most appropriate bathing water sample point. This will bring English bathing water Regulations in line with Northern Ireland and the EU and prevent instances as detailed above.

- Temporal (Daily) Variability (Choice, and Justification, of Sample Times)

The 2018 WHO report[265] states that "Water quality at many locations is known to vary throughout the day (due to the influence of a number of factors including the intensity of sunlight and the presence of bathers)." This pattern of temporal or within-day variability of *E. coli* and IE has been evidenced at a number of UK bathing waters[266]. This variability can be a factor of time throughout the day[267] or tidal phase conditions[268] depending on the bathing water in question.

The extent of this variance is highlighted in the work done by the University of Wales (Aberystwyth) for two EU funded Ireland-Wales (Interreg) projects across five Welsh bathing waters[269]. The projects involved, at each site, sampling on 60 bathing season days for 12 hours at half-hourly intervals (i.e., 25 samples per bathing day, with samples analysed using high precision methods[270]). All sites sampled exhibited significant within-day variability in *E.coli* and IE (100 to 10,000 fold variance per day). This

[263] https://consult.environment-agency.gov.uk/yorkshire/river-wharfe-and-ilkley-bathing-water-site-informa/#:~:text=Evidence%20collected%20at%20the%20Stepping,Bathing%20here%20should%20be%20avoided.
[264] Allow the placement of the bathing water sample point at the location defined by the bathing water profile as having the highest risk of pollution.
[265] who-recommendations-on-ec-bwd-august-2018.pdf
[266] https://www.sciencedirect.com/science/article/pii/S2589914718300069
[267] The key pollution source(s) may contribute higher loads at certain times of day, for example the diurnal flow pattern from sewage treatment works.
[268] The key pollution source(s) may be a given direction and distance away from the bathing water so particular tidal conditions are required to transport the pollution to the bathing water.
[269] Swansea (Smart Coast Sustainable Communities Project), Cemaes, New Quay North, Traeth Gwyn and Nolton Haven (Acclimatize Project) bathing waters.
[270] The high precision method involves the filtering of a larger volume (100ml) with triplicate filtration to achieve a lower detection limit of 0.3 cfu/100ml. The EA typically filter 10ml with a lower detection limit of 10 cfu/100ml.

raises concerns that single weekly compliance samples cannot characterise the bathing day, let alone the bathing week.

This within-day variability demonstrates the importance of sampling at different times of the day and different phases of the tide. Currently EA / DAERA monitoring schedules are designed to capture samples taken from different phases of the tide but samples from each bathing water are generally collected at similar times during each visit to coincide with sample delivery picks or drop offs at the laboratories.

It is Stantec and CREHs recommendation that any future review or update to UK Bathing Water Regulation considers the impact of within-day variability as part of the planning of the bathing water sampling and monitoring calendars.

- Temporal (Seasonal) Variability (Choice, and Justification, of Sample Frequencies)

There is a seasonal pattern across English bathing waters where bacterial concentrations increase throughout the bathing season to a peak in August / September. Although not widely explored in academic literature this is believed to be connected to changing surface sea temperatures throughout the bathing season[271]. Average or geometric mean[272] bacterial concentrations during August and September are often double those in May or June. These patterns will vary by bathing water and region. Figure 9 summarizes concentration data for *E. coli* and IE from all bathing water samples taken from English bathing waters between 2015-2022. A general increase in bacterial concentrations through the year can also be observed in samples taken from bathing waters in Northern Ireland (Figure 10).

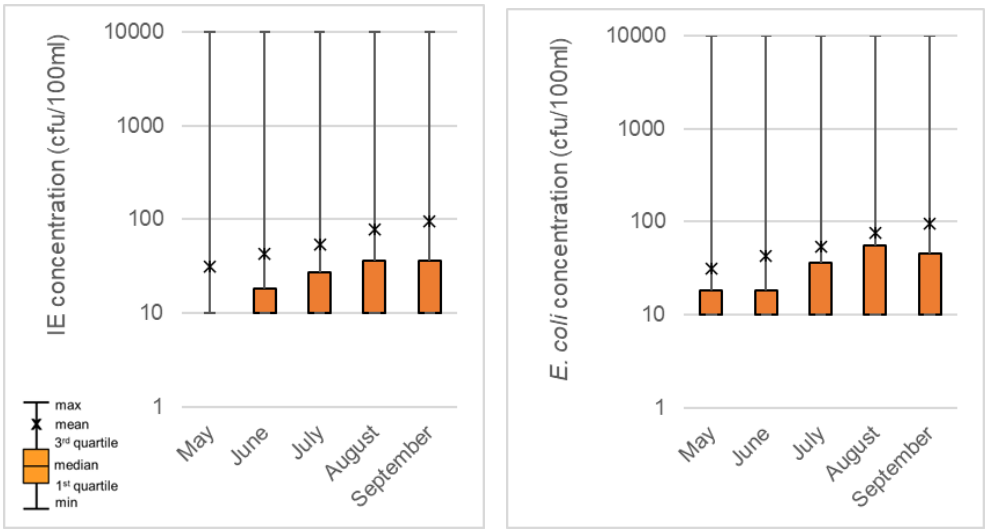


Figure 9 – Concentrations of FIOs detected in all English bathing water quality sample data (2015-2022)

[271] *E.coli* and intestinal enterococci populations can grow in warmer temperatures and become dormant in colder temperatures.
[272] The geometric mean is a mean or average which indicates a central tendency of a finite set of real numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum).

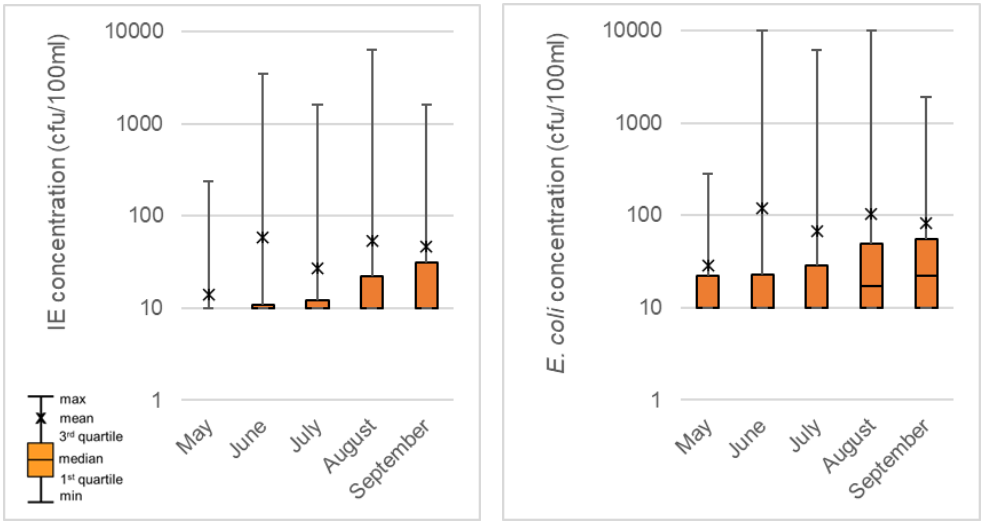


Figure 10 – Concentrations of FIOs detected in all Northern Ireland bathing water quality sample data (2017-2022)

If the primary aim of the Regulations is public health protection it may be more appropriate for example, to take fewer samples earlier in the season and increase the number during the peak summer months when quality is generally worse.

Seasonal variability is also influenced by agricultural practices such as slurry spreading or the movement of livestock around a catchment, or seasonal event such as a music or boating festival which bring large numbers of people to a small area.

It is Stantec and CREHs recommendation that any future review or update to UK Bathing Water Regulation considers the impact of seasonal water quality trends and bathing water usage with regards to sampling frequencies.

- Statistical Confidence in Classification (Minimum Sample Numbers)

The in-day variability discussed implies that (at least in the case of the UK) a single sample cannot be relied upon to characterize the bathing day or week in which the sample was collected. This casts doubt on the utility of weekly sampling (or less in the case of many English bathing waters as discussed in Section 3.3) as employed in the UK for the derivation of 95 or 90%ile values as required as part of compliance assessment by England and Northern Ireland Bathing Water Regulation.

The risk of misclassification based on varying sample sizes in shown below. This figure shows that there is approximately a 22% risk of misclassification of bathing water quality when 10 samples are taken a year compared with a 1% risk when 100 samples are taken.

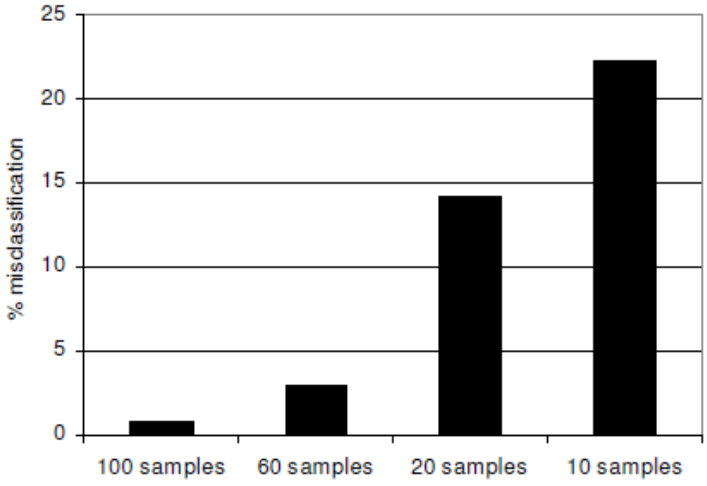


Figure 11 – Risk of Misclassification based on Varying Sample Sizes[273]

WHO guidelines suggest that at least 100 samples should be used to estimate the upper percentile values if significant misclassification of bathing waters is not to occur[274]. More pragmatically, the 2018 WHO report[275] recommends a minimum of 20 samples per year to reduce the risk of misclassification.

- Use of Current Percentile Calculation for deriving Classifications

There is an assumption within England and Northern Ireland Bathing Water Regulation that the key microbiological parameters (*E.* coli and IE) have a 'normal' distribution when transformed into log_{10} values. Many recent EU studies have shown this is not always correct.[276]

As the standard calculation to assess bathing water quality determines the 90th and 95th percentiles as a fixed number of standard deviations from the mean, if the data is not normally distributed these constants are inappropriate and the bathing water would be mis-classified.

The WHO recommends that "*data from bathing water sites with at least 80 samples should be tested for log_{10} normality (using the Shapiro-Wilk test). If log_{10} normality is demonstrated, the [current calculation] can be used for percentile calculation. Where the data are not shown to be normally distributed, the Hazen calculation method should be used*[277]*. This measure will reduce misclassification of sites.*"

- Use of Min / Max Values

England and Northern Ireland have set minimum and maximum reportable values for *E. coli* and IE of 10 and 10,000 cfu/100ml respectively. These threshold values are a result of the standard EA / DAERA

[273] Source WHO (2009) Addendum to Guidelines for Safe Recreational Water Environments, Volume 1, Coastal and Fresh Waters List of Agreed Updates Figure 4.4. Page 17
[274] Guidelines on recreational water quality: Volume 1 coastal and fresh waters (who.int)
[275] who-recommendations-on-ec-bwd-august-2018.pdf
[276] Section A8 - who-recommendations-on-ec-bwd-august-2018.pdf
[277] As outlined in WHO Guidelines Addendum (who-recommendations-on-ec-bwd-august-2018.pdf)

filtering policy within the UK. The implications of this practice on real time prediction and disregarding of samples are discussed further in the next section.

It is Stantec and CREH recommendation that whilst min / max values can be retained for calculation of classification, enhanced precision in laboratory enumerations is recommended. This would need to be justified on a cost-benefit basis.

This enhanced precision would benefit both EA / DAERA short term pollution risk forecasting systems and third-party prediction or compliance models (such as those used by the Water Industry to define investment needed in water company assets).

3.6 Assessment of the Ability and Effectiveness of Methods to Inform and Protect the Public

Understanding the issues associated with the parameters, standards and thresholds of current bathing water Regulations and the subsequent implications is critical in order to assess the ability and effectiveness of the measures taken to inform and protect the public.

Implications of Misclassification

The risk of misclassification (or misrepresentation) of bathing water quality has been shown to be significant given the temporal and spatial variability of the microbiological parameters and the limited number of samples taken over the bathing season.

Misclassification of a bathing water wrongly believed to be 'Good' or 'Excellent' would have adverse impacts to public health[278,279] as classifications thresholds are based on rates of GI illness. Similarly, bathing waters misclassified as 'Poor' would have economic implications to local communities and businesses and drive unnecessary investigations and / or improvements.[280]

Implications of Retrospective Regulation

Accurate real time monitoring of *E. coli* and IE is not currently possible, so the physical collection and laboratory analysis of microbial parameters is the only way to accurately assess bathing water quality. Unfortunately, this approach can only offer a retrospective assessment of risk. Similarly, any bathing water classification is only a retrospective assessment of microbiological water quality from the previous four bathing seasons.

Given the timeframes associated with identifying 'high samples'[281] in England[282], results occur too late to implement protective measures to reduce health risk at the time of exposure. Northern Ireland is able to analyse the bathing water samples quicker than England[283] and a high sample[284] will result in advice against bathing the following day offering some protection to the public.

Unless risk-based frameworks are employed (see examples from Australia and New Zealand in Chapter 6) or until such time as it becomes possible for the real time monitoring of bathing water quality, predictive water quality modelling offers the only option for effective real time risk prediction, communication of risk, and mitigation measures to be put in place in a timely manner.

---

[278] who-recommendations-on-ec-bwd-august-2018.pdf
[279] Leonard A., Singer A., Ukoumunne O., Gaze W., Garside R., 2018. Is it safe to go back into the water? A systematic review and meta-analysis of the risk of acquiring infections from recreational exposure to seawater. International Journal of Epidemiology, Volume 47, Issue 2, Pages 572–586, https://doi.org/10.1093/ije/dyx281.
[280] who-recommendations-on-ec-bwd-august-2018.pdf
[281] Value undefined
[282] Refer to Chapter 2.5 for further details.
[283] Refer to Chapter 2.5 for further details.
[284] Defined as 1250 cfu/100ml of *E.coli*

Ability and Effectiveness of Predictive Assessment Methods

Predictive models (deterministic[285] or statistical regression[286]) are needed to predict the variability in water quality and the associated risk to public health. These same models are often also needed to understand and evidence the actions needed to help achieve the target 'Good' or 'Excellent' classifications as set out in the Regulations. The WHO recommends predictive models should be able to provide an explained variance (R^2) of at least 60%[287], that is to say they should be able to predict at least 60% of the variability in the measured sample data.

Deterministic models (such as those used by Northern Ireland as part of the INTERREG VA- funded SWIM project) are commonly used to predict long-term water quality but are heavily reliant on the quality of the input data which can be highly variable.

When comparing deterministic model outputs against the temporal and spatial variability seen in intensive sampling results, deterministic models have shown a very low degree of explained variance, meaning they are unable to explain the variability of the measured sample data.

The Smart Coasts[288] project produced and tested a deterministic model of Swansea Bay against intensive sample data. Figure 12 shows the modelled and measured concentration for IE.

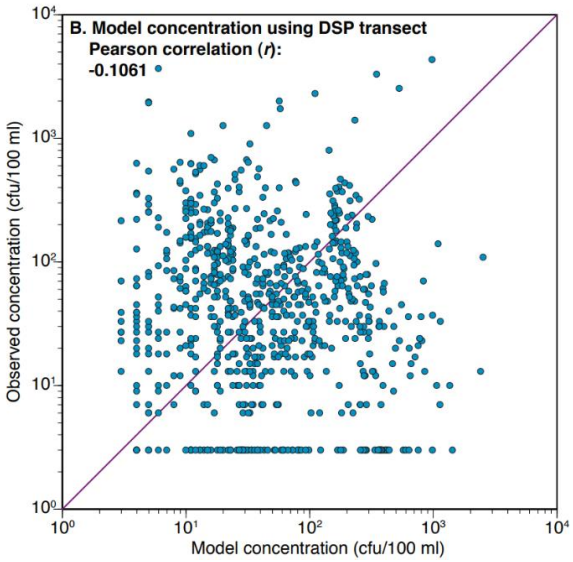


Figure 12 – Scatter Plot of Results from the Deterministic Model of Swansea Bay

Figure 12 shows that the hydrodynamic predicted model concentrations showed no correlation (R^2 < 0.1%) with the observed concentrations provided by enhanced precision sample data. This is only

[285] Deterministic models will input time series data (such as rainfall) into a catchment or hydraulic model and predict the bathing water quality over time. These models are limited by the quality of input data.

[286] Statistical regression models look for patterns in the observed data against a number of other measured parameters such as tidal state or rainfall intensity. These measured parameters are then used to back calculate or infer the likely water quality.

[287] who-recommendations-on-ec-bwd-august-2018.pdf

[288] http://www.smartcoasts.eu/research/research.asp

one example but one which can be used to highlight the concerns of using deterministic modelling to inform bathing water compliance assessments and evidence investment programmes.

For comparison, Figure 13 below shows the results of a statistical multiple regression model calibrated using the half-hourly IE sample data gathered at Swansea Bay. This model, and 4 subsequent models, calibrated for Welsh bathing waters were shown to have an explained variance often exceeding 80%.

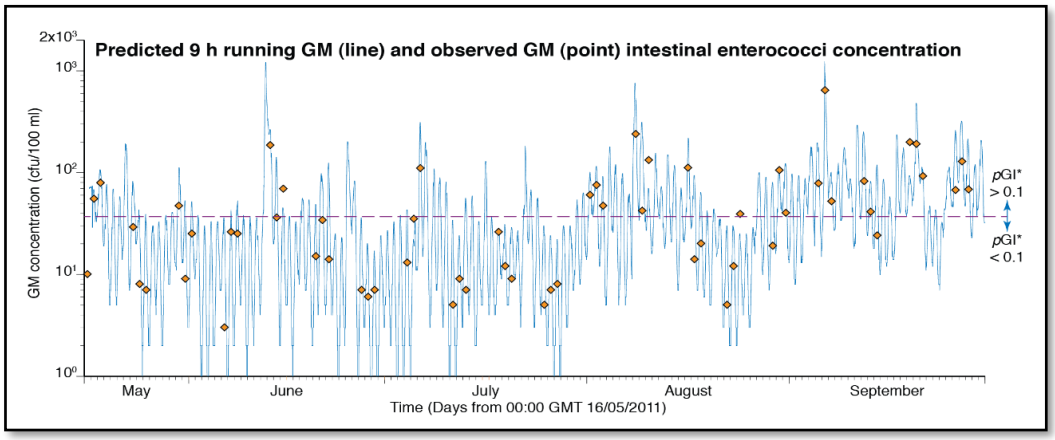


Figure 13 – Predicted and observed intestinal enterococci concentration.

In many cases however the expense of collecting the additional samples needed to calibrate and validate the models can be prohibitive and the statistical models cannot be easily calibrated against historic compliance samples due to the inherent imprecision of compliance samples. However, the statistical prediction models can be run in real-time to predict actual concentrations of compliance parameters experienced by bathers. Unless the deterministic models can be evidenced to have a better correlation with water quality, multi-parameter statistical prediction models, such as used by the EA in England for pollution risk forecasting, are probably the more reliable tools for predicting the public health risk at bathing waters.

It is Stantec and CREH's recommendation that setting guideline threshold values for explained variance (R^2) is an important consideration, particularly for compliance models being used to inform investment. However, from a public health perspective, pollution risk forecasting systems only need to predict the high values and periods of poor water quality. As such, there may be metrics, other than R^2, which would be more useful to assess the suitability of pollution risk forecasting systems.

Prediction from both deterministic and statistical models could be improved (in terms of explained variance) if the current FIO analytical policy (i.e., filtering 10ml and 1ml volumes) is not used for compliance samples and faecal indicators are measured more accurately (and therefore minimum and maximum concentrations for E. coli and IE are extended beyond 10 and 10,000 cfu/100ml). It is recognised however that this would come with significant cost and resource implications.

Both deterministic and statistical models could also be improved by linking the models with the near real time event duration monitoring data from storm overflows (where the storm overflows have been evidenced at impacting at specific bathing waters). This is discussed further in section 3.7.

Effectiveness of Informing and Communication

It is important to first consider the public perception and understanding of bathing water Regulations when assessing the effectiveness of bathing water communication approaches.

- Public Perception and Extent of the Public Health Risk Considered

The OEP Project Belisama bathing water stakeholder groups have raised the issue of the public understanding of the England and Northern Ireland bathing water Regulations. The group has highlighted the lack of awareness for example that the bathing water classification only relates to bacterial water quality and does not include any provision for other public health considerations from bathing. 'Physical factors' such as cold water shock, strong tidal currents or rip tides, hidden underwater obstacles and safe access / egress to and from the bathing site are not considered by the Regulations, including during the identification process.

It is Stantec and CREH recommendation that additional factors of recreational water use impacting human health be considered as part of any future review or update to UK Bathing Water Regulation.

There is a lack of awareness from the public that a 'Good' or 'Excellent' classification does not mean water quality can, on occasion, be significantly worse and bathing should be avoided. Similarly bathing waters classified as 'Poor' may regularly have periods of good water quality. The River Wharfe at Cromwheel, Ilkley for example is classified as 'Poor' but will usually achieve sufficient or better water quality after 10am on most dry days during the summer months[289].

Systems such as those employed by Natural Resource Wales at Cemaes Bathing Water and DAERA at the INTERREG VA- funded SWIM project bathing waters, update the bathing water quality information throughout the day and bathing season via the internet and / or on electronic signboards depending on the results of the predictive models. Such approaches should be recognised as meeting the EU aim of moving from simple sampling and monitoring to holistic bathing water quality management.

It is Stantec and CREH recommendation that these continuous modelling and automated signage based bathing water management approaches be considered as part of any future review or update to UK Bathing Water Regulation.

There is also a public perception raised during the OEP Project Belisama bathing water stakeholder groups that 'Poor' bathing waters are predominantly caused by discharges from storm overflows. This can lead to measures such as those required under the Environment Act for all storm overflows within 5km upstream of an inland bathing water to discharge less than twice per bathing season. Whilst this is highly admirable, many of these storm overflow may already only discharge small volumes for several hours a bathing season and have a minimal overall contribution to the bathing water classification. This, potentially, takes investment away from agricultural pollution sources and continuous water

[289] Information taken from Yorkshire Water investigations into the River Wharfe at Cromwheel, Ilkley undertaken by Stantec.

company and private sewerage discharges such as sewage treatment works which often have a much greater impact for much longer periods. This is discussed further in Section 3.7.

- Bathing Water Signage

There is a concern raised by OEP Project Belisama bathing water stakeholder group that provisions for bathing water signage are inadequate. For example, a bathing water deemed 'Poor' or unsafe for bathing only requires a notice to be placed upon the standard fixed bathing water sign. At many locations bathing waters can be accessed from numerous locations and a single sign will not be visible to many of the beach users.

It is Stantec and CREH recommendation that provisions for multiple signs covering all key beach access points be considered for the advice against bathing as part of any future review or update to UK Bathing Water Regulation.

Electronic bathing water signage, such as those being trialled in Northern Ireland are preferable to standard fixed signs, being able to update in real-time, having an auditable record and not requiring the 'local authority' or 'bathing water operator' to visit the bathing water to update the fixed signage.

Manually updating the standard fixed signs is reliant on the individual local authority or bathing water operator, and EA signage audits have proven that this is not always occurring with statutory information often not present or missing[290]. Should the individual not have updated the signage this creates a public health risk, an inability to disregard samples[291] and a potential loss of public confidence. Electronic signage provides the guarantee that the public health information is displayed and allows near-real-time updates in line with the outputs from the prediction models and storm overflow EDM outputs.

It is Stantec and CREH recommendation that results of the predictive water quality models be displayed on electronic bathing water signage and via the internet for English and Northern Ireland bathing waters which are prone to significant variance in water quality.

- Use of Appropriate Media and Technologies

The OEP Project Belisama bathing water stakeholder group acknowledged the success of the EA's Swimfo. The tool provides a platform for disseminating bathing water information, profiles and predictive water quality results to be utilized by third party platforms such as the Surfers Against Sewage's "Safer Seas" application.

[290] uksiod_20131675_en_003.pdf (legislation.gov.uk)

[291] Samples cannot be disregarded from the official bathing water calculation if the EA sample has not recorded evidence of the pollution risk forecasting having been in place at site warning the public of the increased health risk.

3.7 Assessment of Alignment with Other Legislation

There is an ambition behind the EU Bathing Water Directive to integrate bathing water Regulation into other EU measures protecting the quality of all waters[292], primarily the Urban Waste Water Treatment Directive and the Water Framework Directive. Within England this would also include alignment with the Environment Act 2021. Background to these individual pieces of legislation is provided in Section 2.4. In both England and Northern Ireland work also needs to be done to align diffuse and agricultural pollution Regulations with bathing water Regulations.

Urban Waste Water Treatment

The Urban Waste Water Treatment Directive and the Regulations that implemented the Directive in England and Northern Ireland (now assimilated law) are not closely aligned with Bathing Water Regulations. However, the EU Urban Waste Water Directive is currently under EU review, and it is expected that the Urban Wastewater and Bathing Water Directives will become more closely aligned following review. It is not known if England and Northern Ireland will update assimilated law associated with the Urban Waste Water Directive in line with any changes to the Directive following the EU's review.

One obvious place alignment could be improved is around real time storm overflow monitoring (a requirement under UWWTD) to bathing water short term pollution risk forecasting systems.

There are examples, such as South West Water's WaterFit Live[293], which provide near real time information to beach users on localised storm overflow discharges. Currently this, and other similar systems such as Northumbrian Water's Beach Aware[294] and Southern Water's Beachbuoy[295] do not feed into EA pollution risk forecasts.

It is Stantec and CREH recommendation that connecting real time storm overflow event duration monitoring data required under the Urban Waste Water Treatment Regulation to bathing water short term pollution forecasting systems be considered as part of any future review or update to UK Bathing Water Regulation.

Water Framework Regulations

Whilst bathing water are protected areas for the purposes of Water Framework Regulations there are currently few crossovers between the Water Framework Regulations in England and Northern Ireland with Bathing Water Regulations. Whilst covering the same spatial areas and both focussing on environmental water quality the two sets of Regulations measure compliance using different parameters. It should be noted however that whilst bacterial water quality cannot be directly correlated with any of the WFD compliance parameters, the majority of improvement measures driven by the

[292] Refer to chapter 2.1 for further details.
[293] WaterFit Live map (southwestwater.co.uk)
[294] A map of our bathing waters (nwl.co.uk)
[295] https://www.southernwater.co.uk/water-for-life/beachbuoy

WFD Regulations will have some positive impact in reducing the concentrations of *E. coli* and IE in recreational waters.

Closer alignment of environmental water quality and bathing water Regulations, and what this may look like, are discussed further in Chapter 6.5 which looks at the holistic Japanese approaches to environmental water quality and human health.

It is Stantec and CREH recommendation that Water Framework and Bathing Water Regulations could be better aligned by allocating the bathing water sample point as an additional WFD sampling and compliance location. This would allow WFD nutrient and chemical parameter data, which have an influence on human health (for example nutrient data which could be used to predict cyanobacteria proliferations or concentrations of specific chemicals such as PFOS), to be used for multiple purposes.

Environment Act 2021

Under the Environment Act 2021, the government was required to publish, by 1 September 2022, a plan to reduce storm overflow spills and their adverse impact, and a report setting out a cost-benefit analysis of the actions needed to eliminate spills. This plan, the Storm Overflow Discharge Reduction Plan[296] overlaps significantly with the bathing water Regulations. It requires all storm overflows within 1km hydraulic continuity of a coastal bathing water, or within 5km upstream hydraulic continuity of an inland bathing water, to discharge no more than three times per bathing season for coastal bathing waters or less than twice per bathing season for inland discharges by 2035.

There is no published scientific basis for the distances stated in the Storm Overflow Discharge Reduction Plan, or spill frequency thresholds associated with inland waters[297]. The reasoning for tighter standards for discharges to inland waters is also questionable given that riverine storm overflow discharges are likely to have significantly less impact than coastal discharges, flowing past the bathing water site and not at risk of recirculating with tides.

There is no requirement within the Environment Act for enhanced bacterial treatment at wastewater treatment works upstream of bathing waters. Current wastewater treatment systems, especially ones discharging to rivers, do not generally treat for bacteria and final effluent concentrations for *E. coli* and IE will often be in the region of 2 x 10^5 cfu/100ml 10,000 times over current minimal standards). As these loadings to the river are continuous, rather than intermittent like storm overflows, and often of higher concentrations than storm overflows the prioritisation of investment into storm overflows can be questioned.

There is also no requirement within the Environment Act for reducing bacterial pollution from agriculture or any other non Water Industry sources. This is important as Kay et al. (2008)[298] has

[296] https://assets.publishing.service.gov.uk/media/6537e1c55e47a50014989910/Expanded_Storm_Overflows_Discharge_Reduction_Plan.pdf

[297] 3 spills for coastal waters is based on a percentile assessment for Shellfish Water compliance.

[298] Faecal indicator organism concentrations and catchment export coefficients in the UK (D.Kay et al.) 2008

shown that the majority of UK riverine sites would not achieve the minimum 'Sufficient' status without significant reductions in loads from agriculture.

It is hoped that enhanced bacterial treatment upstream on inland storm overflows will be captured by reviews and updates to the Urban Waste Water Treatment Directive and incorporated in revisions to England and Northern Ireland Urban Waste Water Treatment Regulations.

Stantec and CREH recommend that the Storm Overflow Discharge Reduction Plan, as enshrined in law by the Environment Act, should be updated to better align with the Bathing Water Regulations. This would include any requirements on storm overflows to be based on impact to bathing water classifications or water quality rather than proximity to bathing waters. Additional provisions within the Environment Act should also be made for continuous sewage discharges and pollution from agriculture which impact bathing waters.

The Agriculture Act 2020

In England, the Agriculture Act 2020[299], and approaches set out in '*The Path to Sustainable Farming: An Agricultural Transition Plan 2021*'[300], should help incentivise the agricultural sector to undertake initiatives which will benefit water quality and reduce agricultural pollution to bathing waters. The ambitions of the Agriculture Act are aligned with the Environment Act as part of the Government's Environmental improvement Plan (2023)[301].

In Northern Ireland, the agriculture sector is in a rather different position from England because of the Northern Ireland protocol. Northern Ireland has direct access to the EU's single market and as such any deviations from the EU CAP become more complex. This limits the ability of any new agricultural policy to prioritise, through subsidies, environmental and water quality improvements.

Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 / Nutrient Action Programme Regulations (Northern Ireland) 2019

Whilst neither set of Regulations mention bathing waters, faecal contamination is listed as a pollutant type within the English Regulation[302] allowing the EA to enforce measures to reduce faecal pollution from agriculture. Within Northern Ireland the NAP regulations focus entirely on nutrients which leaves a significant gap in Northern Ireland legislation around faecal pollution from agriculture.

Stantec and CREH strongly recommend that closing the legislative gaps which cover reducing faecal pollution from agriculture and fixing misconnected properties (as covered in section 2.4) is addressed.

[299] Agriculture Act 2020 (legislation.gov.uk)
[300] The Path to Sustainable Farming: An Agricultural Transition Plan 2021 to 2024 (publishing.service.gov.uk)
[301] Environmental Improvement Plan 2023 - GOV.UK (www.gov.uk)
[302] Regulation 2(3c); The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018

The Environmental Permitting (England and Wales) Regulations 2016

As mentioned in Section 2.4, the withdrawn EPR 7.01 guidance for permitted discharges from wastewater or agriculture impacting bathing waters includes reference to the removal of enteroviruses, something outside the scope of England and Northern Ireland bathing water Regulations.

Due to the problems of quantifying enteroviruses (see section 3.5) the WHO recommended that they should not be included in future revisions to EU bathing water regulations[303]. Stantec and CREH are not aware of any current epidemiological studies for enteroviruses being undertaken by the EU (i.e., since the Virobathe project conducted by CREH). It is therefore highly unlikely that enterovirus removal will be included in the updated EU guidance.

Stantec and CREH recommend updates to the Environmental Permitting Regulations are aligned with UK Bathing Water Regulations rather than the United States Recreational Water Quality Criteria.

Other Legislation

As discussed previously, the ability to identify a bathing water in England between Price Reviews creates significant problems whereby WINEP drivers and funding cannot be secured until the next Price Review. This means that many new bathing water sites which would get classified as 'Poor' cannot be mitigated within the necessary timeframes before they would get un-classified.

Figure 14 shows the issues faced by Yorkshire Water following the identification of Ilkley bathing water in 2021. In this instance Yorkshire Water could not secure funding to improve Ilkley until PR24 final determination in late 2024 leaving one bathing season to complete all investigations, designs, and construction before the bathing water is potentially un-classified.

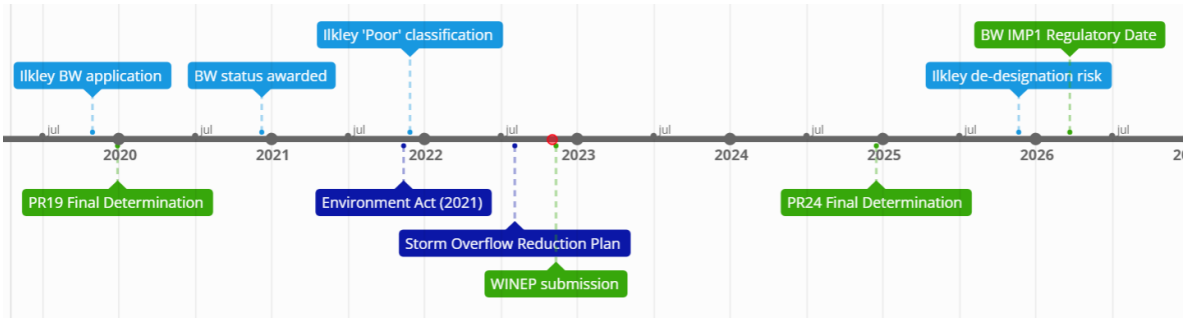


Figure 14 – Issues faced by Yorkshire Water following identification of Ilkley in 2021[304]

Similarly, with the introduction of the latest OFWAT Performance Commitments[305] the English Water Companies are being judged to different standards of bathing water performance and quality than is

[303] who-recommendations-on-ec-bwd-august-2018.pdf
[304] BW_IMP1 corresponds to the environmental driver code used within WINEP to address bathing water with a classification of 'Poor'. Graphic used with the permission of Yorkshire Water
[305] Refer back to section 2.5 – How these legislative, institutional and operational frameworks operate.

required by the Regulations. This creates confusion and means the Water Company is held financially responsible for the impact of pollution from Water Company and non-Water Company sources alike.

If significant numbers of new sites are to be granted bathing water status OFWAT will need to consider new funding mechanisms for bathing water improvements which can be agreed between periodic reviews.

Stantec and CREH recommend any review of Bathing Water Regulations takes into consideration how the Regulations can best align with Water Industry AMP cycles and Price Reviews. If the Water Industry is to be incentivized for delivering the target standard of 'Excellent' bathing waters, Stantec and CREH recommend they are judged according to standards set out in the Regulations.

3.8 Assessment of Evolving Trends and Gap Analysis

Bathing water quality, and in particular the impact of storm overflow discharges on bathing water quality are the focus of much current media and political attention. The attention has highlighted several evolving trends and perceived issues with the Regulations. Trends and issues with the identification, standards and parameters and other issues have been covered already within this report. This section seeks to cover those trends and issues which by their nature do not naturally fall within any of the previous sections of the report.

What are the Main Evolving Trends and Perceived Issues with Regulation

Some of the key evolving trends impacting bathing water management in England and Northern Ireland, as identified by Stantec and CREH and discussed during the OEP Project Belisama bathing water stakeholder groups are summarised in the word cloud in Figure 15.

Figure 15 – Word Cloud of Evolving Trends in Bathing Water Management and Regulation

Definition of 'Bathers' within the Regulations

The term 'bather' or 'bathers' is not defined explicitly within the EU Bathing Water Directive or England and Northern Ireland Regulations. However, following on from EU '*Explanatory Memorandum to COM(2002)581 – Quality of Bathing Water*'[306] the Directive is considered to be limited only to 'swimming'. This has the effect of limiting the applicability of the Regulations to 'swimmers' and thus excluding other recreational water uses such as surfers, kayakers, paddleboarders, sailors or anglers etc.

[306] https://www.eumonitor.eu/9353000/1/j4nvhdfdk3hydzq_j9vvik7m1c3gyxp/vi8rm2zhs5zz - Section 17.4.3 Scope

Section 17.4.3 of the EU '*Explanatory Memorandum to COM(2002)581 – Quality of Bathing Water*' states:

> "The 1976 [EU Bathing Water] Directive's main aim was improving water quality and thereby protecting the health of citizens who use natural water bodies for bathing. At that time, bathing meant mainly *swimming*. During the past 25 years, a lot of social and technical changes have occurred. New water activities like surfing, windsurfing, kayaking, etc. have developed…
>
> …These new patterns of recreational water use present significant challenges. First of all, at any given site, windsurfing, kayaking, sailboarding are often practised at significant distances (1 km or more) from the shore. In contrast bathing/swimming typically takes place within a distance of 50 to 100 metres. Secondly, practitioners of these more physically demanding water sports are often prepared to go to sites, which are not suitable for bathing/swimming. Thirdly, with the development of new materials, recreational water sports can now be undertaken over an extended period: far longer than the traditional bathing season. Finally, some of the new recreational uses of water are not always compatible with swimming and bathing, necessitating the division of a bathing area into different zones.
>
> In the light of the above considerations it is legitimate to ask whether the level of protection (in terms of water quality and management practices) which is currently afforded to bathers should be extended to those pursuing other recreational water uses irrespective of location, or time of the year.
>
> The Commission has taken the view that it would not be appropriate to include the new recreational uses of water in the definition of bathing waters as to do so would oblige Member States to significantly increase the extent, both physically and temporally, of water quality protection, monitoring and management obligations."

It is Stantec and CREH recommendation that the definition of 'bather' and the potential to extend to include other recreational water users be considered as part of any future review or update to UK Bathing Water Regulation.

The Length of the Bathing Season

The EU Bathing Water Directive defines the 'bathing season' as the period during which large numbers of bathers can be expected. In England this is defined within Regulation as 15th May - 30th September; in Northern Ireland as 1st June – 15th September.

Given the increase in other water based recreational activities and the increasing popularity of the year-round wild swimming movement in recent years, the length of the bathing season in England and Northern Ireland is being questioned with calls for it to be expanded.

The 2022 consultation[307] for the DAERA review of Bathing Waters raised the potential for extending the existing bathing season in Northern Ireland[308]. This is perhaps particularly relevant at the bathing waters popular year round with surfers on the North Atlantic Coast.

As the bathing water Regulations have a basis in public health it is a Stantec and CREH recommendation that the length of the bathing season and the potential to extend this be considered as part of any future review or update to UK Bathing Water Regulations.

Current Framework for Inland (Riverine) Bathing Waters

Since the identification of the first UK riverine bathing water at the 'Wharfe at Cromwheel, Ilkley', in 2021, there has been a sharp increase in applications for new inland bathing waters in both England and Northern Ireland. This is partly explained by the increased popularity of wild swimming and also an increased media exposure and public awareness of river water quality issues. With the introduction of the '*Environment Act 2021*' and the associated statutory responsibilities, a bathing water identification can now be seen as an effective mechanism to secure funding to address pollution issues caused by storm overflows upstream of the bathing water site.

This rise in applications creates an issue for the main authorities as the majority of new riverine sites will generally be classified as 'Poor' as a result of upstream livestock farming and less dilution and dispersion of pollutants when compared to coastal environments.

The impact of the lower rates of dilution and dispersion of pollutants alongside the often limited ability of the main authorities to reduce the impact from agriculture and other diffuse sources means it is fundamentally harder to improve riverine bathing water quality when compared with coastal environments. Similarly, if the identification occurs during the Water Industry AMP cycle there will be no funded WINEP obligation on the water and sewerage undertakers to improve water quality until the following AMP cycle. As the Regulations state that five consecutive years of 'Poor' status will result as un-classification and permanent advice against bathing the Water Industry is also unable to address its obligation within the necessary timeframes.

[307] https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/2022%20Bathing%20Waters%20Review%20Consultation%2008022022.pdf
[308] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/202223%20Bathing%20Waters%20Review%20report.pdf

If significant numbers of riverine bathing water applications are accepted there inevitably will be difficult political ramifications for DEFRA / DAERA to deal with. This knowledge provides a significant incentive to reject the majority of future riverine bathing water applications thereby bringing into question the purpose of the Directive and Regulations.

There are a number of other complexities with the current framework. While many of these may only impact specific bathing water sites, factors such as how to define the boundaries or delineate bathing water boundaries need further clarification.

It is a Stantec and CREH recommendation that a holistic review of the aims and processes that form the basis of inland bathing water identification be considered as part of any future review or update to UK Bathing Water Regulations.

A Water UK report looking at a potential new framework for inland bathing water identifications is due out in the coming months and along with this report, would represent a basis for discussions.

Chapter 4: Comparison with Approaches and Performance in Scotland and Wales

As part of the review of existing bathing water Regulations, Stantec and CREH have been asked to compare bathing water management approaches and associated performance in England and Northern Ireland against other UK jurisdictions.

The '*Bathing Water Regulations 2013'* extend to England and Wales so there are no legislative differences between the jurisdictions. Scottish bathing water regulations are also transposed from the EU Bathing Water Directive so are inherently similar to those of England and Northern Ireland. This chapter therefore seeks to highlight the key differences in approaches to implementation of the legislation and resulting performance across the four jurisdictions.

4.1 Number of Bathing Waters and Current Status

Scotland

The management of bathing waters in Scotland is governed by the '*Bathing Waters (Scotland) Regulations 2008* [309] ' and subsequent amendments through the '*Bathing Waters (Scotland) Amendment Regulations 2012'*[310] (together '*Bathing Waters (Scotland) Regulations*').

At the end of the 2022 bathing season, Scotland had 87 designated[311] bathing waters: 3 inland [lacustrine] (Dores, Loch Morlich, and Luss Bay) and 84 coastal[312]. There are no riverine bathing waters. A further two coastal sites were granted bathing water status ahead of the 2023 bathing season (Wardie Bay, and the re-identification of Fisherrow Sands)[313]. A map of the bathing waters is shown in Figure 16.

Wales

The management of bathing waters is governed by the '*Bathing Waters Regulations 2013'*[314] which extend to England and Wales.

At the end of the 2022 bathing season, Wales had 107 bathing waters[315]: 2 inland [lacustrine] (Llyn Padarn and Marine Lake, Rhyl) and the remainder coastal[316]. In 2022, Colwyn Bay was closed for ongoing coastal defence work and was not sampled[317]. A further two coastal sites were granted

[309] https://www.legislation.gov.uk/ssi/2008/170/made
[310] The Bathing Waters (Scotland) Amendment Regulations 2012 (legislation.gov.uk)
[311] Scottish Bathing Water Regulations refer to 'designated' rather than 'Identified' bathing waters.
[312] BathingWaters (sepa.org.uk)
[313] Media | Scottish Environment Protection Agency (SEPA)
[314] The Bathing Water Regulations 2013 (legislation.gov.uk)
[315] Find a bathing water (data.gov.uk)
[316] Find a bathing water (data.gov.uk)
[317] Bathing water list for Wales 2022 [HTML] | GOV.WALES

bathing water status ahead of the 2023 bathing season[318]. There are no riverine bathing waters. A map of the bathing waters is shown in Figure 17.

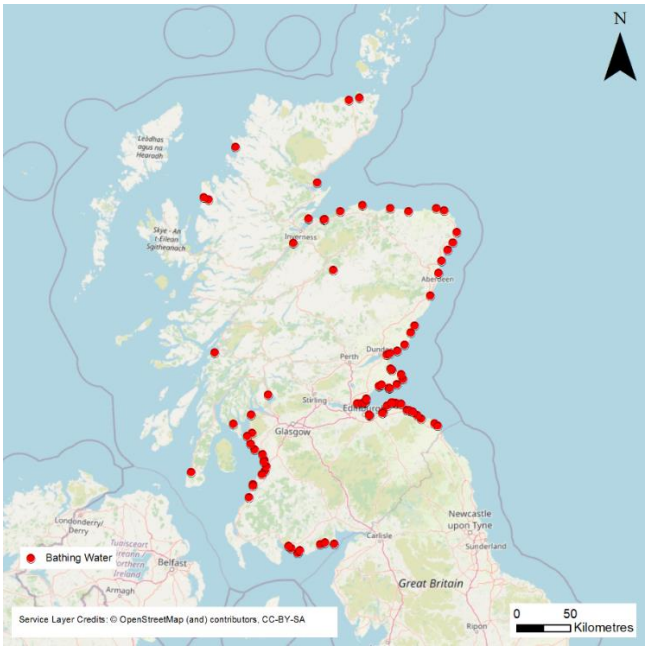


Figure 16 – Map of Scottish Bathing Waters.

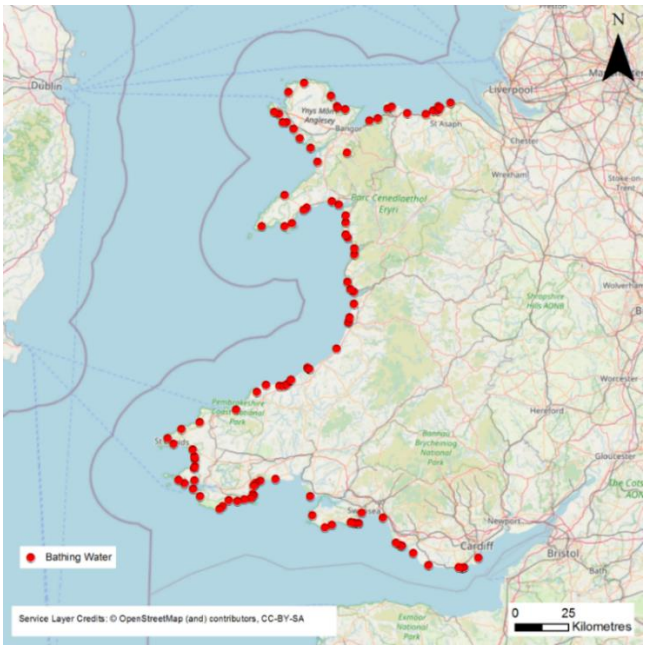


Figure 17 – Map of Welsh Bathing Waters.

[318] Samplers hit the shores as bathing water sampling begins - AberdareOnline

4.2 Bathing Water Performance

Table 7 highlights the number of bathing waters in England, Northern Ireland, Scotland and Wales and their classifications as of 2022.

Table 7 – Bathing Water numbers and classifications by UK jurisdiction (2022) (England[319], Northern Ireland[320], Scotland[321], and Wales[322]).

Country	Number of bathing waters (2022)	Percentages of bathing waters achieving the classifications				
		Un-assessed	Poor	Sufficient	Good	Excellent
England	421	0.5% (2 sites)[323]	2.9% (12 sites)	4.3% (18 sites)	20.7% (87 sites)	71.7% (302 sites)
N. Ireland	26	-	3.9% (1 site)	3.9% (1 site)	11.5% (3 sites)	80.8% (21 sites)
Scotland	87	-	2.3% (2 sites)	13.8% (12 sites)	40.2% (35 sites)	43.7% (38 sites)
Wales	107	0.9% (1 site)[324]	0.9% (1 site)	3.7% (4 sites)	15.0% (16 sites)	79.4% (85 sites)

Table 7 shows that all parts of the UK are failing to achieve the minimum 'Sufficient' classification for at least one of their respective bathing waters. Performance against the minimum 'Sufficient' classification is comparable across the UK, ranging from 96% in Northern Ireland and 99% in Wales. The variability in performance across the UK becomes more apparent when comparing percentages of bathing waters achieving the target 'Good' and 'Excellent' classifications[325], with Scotland achieving only 84% at the 'Good' or 'Excellent' classifications and falling short of the rest of the UK. At the 'Excellent' classification, Wales and Northern Ireland are the highest performers at 79.4% and 80.8% respectively. Scotland has a significantly smaller percentage of 'Excellent' bathing waters than the rest of the UK at only 43.7%, a factor connected with historic performance as shown in the following section.

Scotland

Figure 18 shows the changing percentage classifications of coastal and inland bathing waters for Scotland from 2015 to 2022. Note that, due to Coronavirus restrictions during the 2020 bathing water season, there was no classification in 2020.

In 2022

[319] Bathing water classifications 2022 - GOV.UK (www.gov.uk)
[320] About bathing water quality | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)
[321] Bathing Waters : Summary of last season (sepa.org.uk)
[322] Wales bathing water report 2022 (naturalresources.wales)
[323] Watcombe and Tunstall were closed in 2022 due to coastal erosion.
[324] Colwyn Bay was closed in 2022 due to ongoing coastal defence works.
[325] As defined by each of the individual UK bathing water regulations

- 44% of bathing waters achieved 'Excellent', up from 21% in 2015.
- 98% of bathing waters achieved at least 'Sufficient', up from 82% in 2015.
- 2% (2 sites – Kinghorn (Harbour Beach) and Lower Largo) failed to meet the minimum standard and were classified as 'Poor', down from 18% (15 sites) in 2015.

Bathing water performance in Scotland appears to be improving as shown by the increasing number of 'Excellent' bathing waters and the significant decrease in 'Poor' bathing waters[326]. Whilst Scotland has a long way to go to achieve comparable bathing water performance with England, Northern Ireland and Wales, the visible progress made over the last eight years should be recognised.

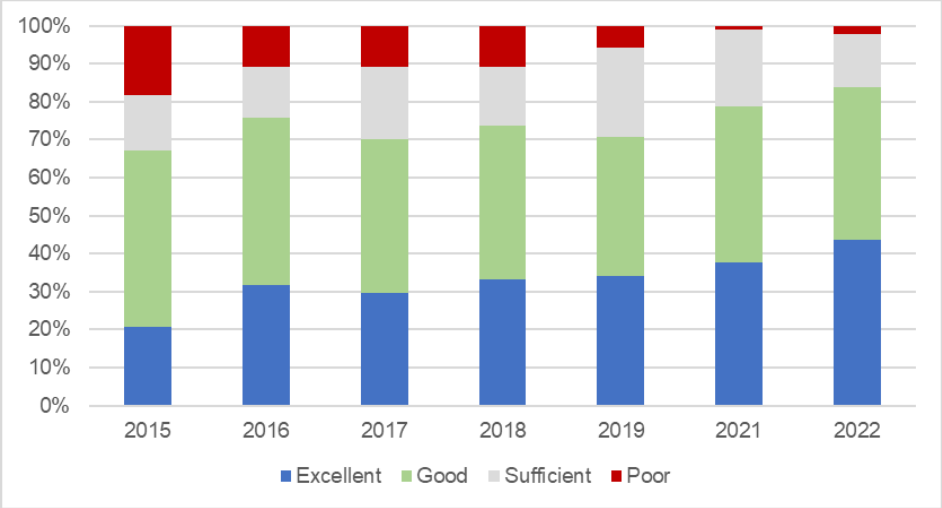


Figure 18 – Trends in Scottish Bathing Water Performance Over Time[327].

Stantec and CREH have been unable to find any evidence in literature that explains why Scottish bathing water performance is poorer than the rest of the UK. However, it may be connected to Scotland's investment in wastewater infrastructure impacting bathing waters historically lagging behind England and Wales, and to a lesser extent Northern Ireland.

It is Stantec and CREH understanding that capital investment in waste water treatment and storm storage in England and Wales, for the purposes of bathing water improvements, began in the 1990s, a decade or so before the same significant investment began in Scotland. Many of the measures now being installed across waste water assets in Scotland, such as UV disinfection systems have been in place more-widely across England and Wales for a number of years.

Wales

[326] No tests for statistical significance were undertaken on this data.
[327] BathingWaters (sepa.org.uk)

Figure 19 shows the changing percentage classifications of coastal and inland bathing waters for Wales from 2015, when the current Bathing Water Regulations[328] entered into force, to 2022. Note that, due to Coronavirus restrictions during the 2020 bathing water season, only the regulatory minimum number of samples were collected.

In 2022

- 80% of bathing waters achieved 'Excellent', unchanged from 2015.
- 99% of bathing waters achieved at least 'Sufficient', down from 100% in 2015.
- 1% (1 site – Marine Lake) failed to meet the minimum standard, up from 0% (0 sites) in 2015.

Bathing water performance in Wales has remained very high since 2015, as evidenced by the consistently high number of 'Excellent' bathing waters and low number of 'Poor' bathing waters. Cemaes on Anglesey was the only site to fail in 2016 and 2017. Marine Lake in Rhyl was the only site to fail in 2022.

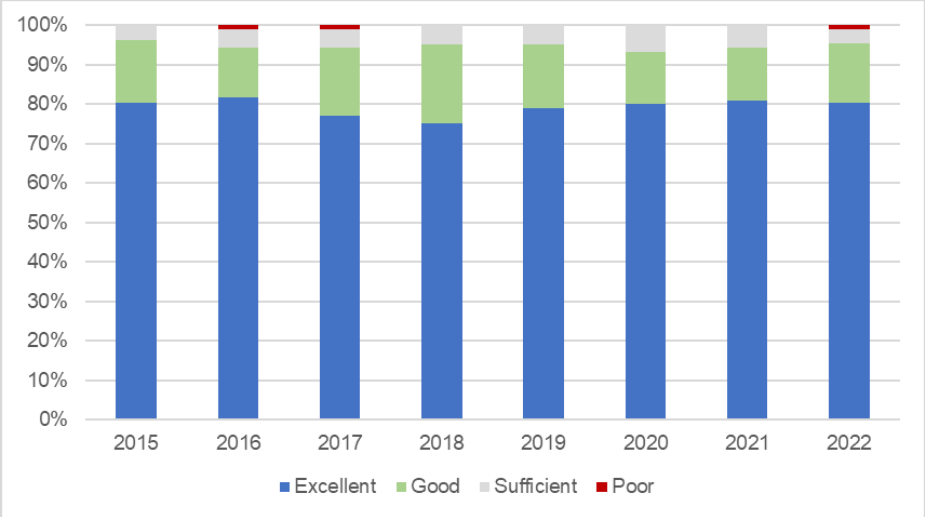


Figure 19 – Trends in Welsh Bathing Water Performance Over Time[329].

[328] The Bathing Water Regulations 2013

[329] Wales bathing water report 2022 (naturalresources.wales), Natural Resources Wales / Wales bathing water quality report 2021, Natural Resources Wales / Wales bathing water quality report 2020, Natural Resources Wales / Wales bathing water quality report 2019, Wales Bathing Water Report 2018 (naturalresources.wales), Wales Bathing Water Report 2017 (naturalresources.wales), Bathing Waters in Wales 2016 (naturalresources.wales) & Bathing Waters in Wales 2015 (naturalresources.wales)

4.3 Identification Criteria

The process by which the main authorities in Scotland and Wales decide whether new bathing water applications are approved only varies slightly from England and Northern Ireland. However, each UK jurisdiction has taken a different approach to consulting on, defining and publishing minimum eligibility criteria for bathing water identification.

Scotland

In Scotland, applications are usually submitted to SEPA (Scottish Environment Protection Agency) by local authorities. However, any organisation or individual can submit one if they have the full support from the local authorities and landowners. Figure 20 details the published SEPA non statutory guidelines on the timeline and process for the identification of a future bathing water site in Scotland.

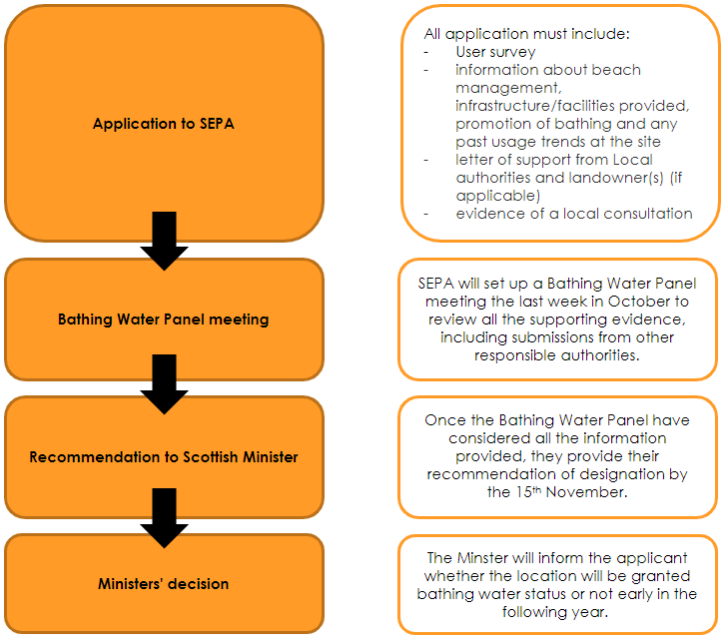


Figure 20 – Process for new bathing water designations in Scotland (SEPA, 2023[330]).

Under the Scottish Regulations, Scottish Ministers must, having regards to certain matters, designate bathing waters where they expect 'a large number of people to bathe'[331]. The bathing water application form on the SEPA website states "*To qualify for designation a* ***minimum of 150 people*** *must have been counted or calculated as using the beach or bathing waters over the course of a single day during daylight hours or beach opening hours. "Use" is defined by a person's presence on the beach; a person does not need to be in the water to be counted as a beach or bathing water user. Applicants*

[330] SEPA, 2023. Bathing waters designation. https://www2.sepa.org.uk/bathingwaters/Designation.aspx
[331] Regulation 3(3), Bathing Waters (Scotland) Regulations 2008.

must provide evidence of this level of use on at least three separate dates, which must be in three different months, during the bathing season"[332].

It should be noted however that following the first draft of this report this requirement is now set to be revised following an investigation into the bathing water application process in December 2023 by Environmental Services Scotland[333].

In 2022 four new bathing water applications were made. Two of these sites, Lower Largo in Fife and Barassie in Ayrshire were granted full bathing water status[334]. Ahead of the 2023 bathing season, a further two sites, Wardie Bay and Fisherrow Sands, were granted bathing water status[335]. Stantec and CREH have not been able to confirm how many applications were made during this period. One of these sites, Fisherrow Sands, was historically a bathing water before getting un-classified due to five consecutive years at 'Poor' status. Subsequent improvements to water quality have meant the site has been re-approved for bathing water status[336].

Bathing water applications in Scotland, unlike the rest of the UK, are reviewed by a panel of different organisations including SEPA and Keep Scotland Beautiful. Other UK bathing water applications are reviewed exclusively by the main authority before opening a public consultation. The Scottish panel is not a statutory requirement but does provide a platform for designating bathing waters which could be seen as preferable to England, Wales and Northern Ireland in that it appears to encourage greater public consultation and involvement.

Wales

Figure 21 details the published Welsh Government non statutory guidelines on the timeline and process for the identification of a future bathing water site in Wales.

Stantec and CREH have been unable to find any published minimum eligibility criteria for Wales bathing water applications. Ahead of the 2023 bathing season the Welsh Government received four bathing water applications[337]. After assessing the submitted information the Welsh Government granted bathing water status to two sites, Ogmore by Sea Beach and Watch House Bay. Whilst the Welsh Ministers felt there was appropriate evidence on the number of bathers at two other sites, Burry Port West Beach and Burry Port East Beach, there were concerns regarding the safety at these sites due to the strong currents and the rapid change of tide. Subsequently, these sites were not granted bathing water status ahead of the 2023 bathing season[338].

[332] https://www.sepa.org.uk/media/59897/bathing-waters-application-form.doc
[333] https://environmentalstandards.scot/wp-content/uploads/2023/12/News-Release-Bathing-Waters-Summary-Report-Published.pdf
[334] Media | Scottish Environment Protection Agency (SEPA)
[335] Media | Scottish Environment Protection Agency (SEPA)
[336] Media | Scottish Environment Protection Agency (SEPA)
[337] Welsh Government, 2023b. *Consultation - summary of response: Bathing Water Review Wales 2023.* https://www.gov.wales/sites/default/files/consultations/2023-04/summary-of-responses-bathing-water-review-2023-consultation.pdf
[338] Bathing Water Review Wales 2023: summary of response (gov.wales)

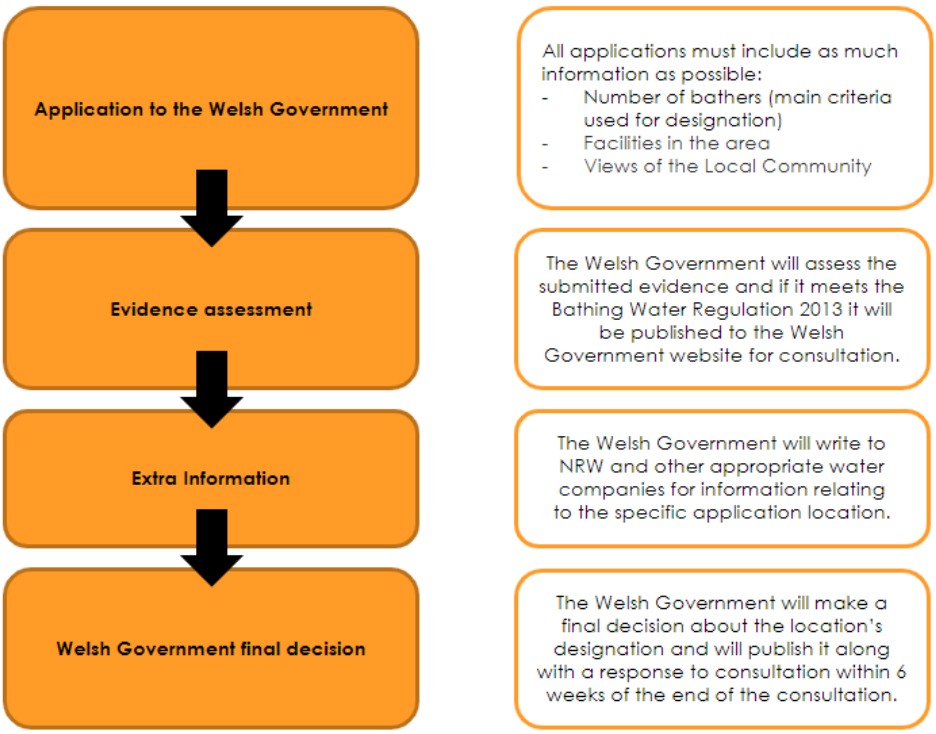


Figure 21 – Process for new bathing water identification in Wales[339].

Discussion

Scotland and Wales have not experienced the significant increase in number of new bathing water applications that has been seen in England and Northern Ireland. In addition, none of the recent bathing water applications in Scotland and Wales have been for riverine or inland bathing waters. In the Stantec and CREH views, this is likely to be why both governments are yet to publish formal minimum eligibility criteria and review and respond to each application on an individual basis. Identification / designation criteria offer the ability to quickly screen a large number of applications and whilst published criteria can be advantageous for reasons of transparency and to encourage good governance and accountability the same outcomes can be achieved by publishing the full findings of the individual reviews as Welsh Ministers have done in 2022[340]. Given the number of applications in 2022 and 2023, Scotland and Wales are approving a higher percentage of applications for bathing water status than England and Northern Ireland.

The Environmental Rights Centre for Scotland (ERCS) has lodged a formal complaint to Environmental Standards Scotland regarding a perceived 'unlawful' approach to the designation of bathing waters in Scotland[341]. The complaint focuses on Scottish Ministers' interpretation that 150 bathers constitute a

[339] Welsh Government, 2023a. Designation and de-designation of bathing waters: guidance. https://www.gov.wales/designation-and-de-designation-bathing-waters-guidance-html#55239
[340] Bathing Water Review Wales 2023: summary of response (gov.wales)
[341] ERCS challenges Scottish Government on bathing water quality

'large number of people' for the purposes of the Scottish Regulations. The Complainant's argument is that this number is not justified given the interpretations of the authorities in England and Northern Ireland for the purposes of the equivalent legislation in those countries. In England and Northern Ireland, the authorities interpret 'a large number of people' to mean respectively: (i) an average of at least 100 bathers a day during the bathing season[342], with applicants required to provide user surveys demonstrating this over two days during the bathing season[343]; and (ii) over 45 bathers on at least one occasion or over 100 beach users on at least two occasions across a review period. The ERCS also questions the justification of why bathing water counts cannot be undertaken during organized events[344].

[342] It should be noted that the compliant was issued prior to the update of English criteria, whilst DEFRA had 'no set limit' on the minimum number of bathers.

[343] Designate a bathing water: guidance on how to apply - GOV.UK (www.gov.uk)

[344] ERCS challenges Scottish Government on bathing water quality

4.4 Sampling and Testing

Table 8 highlights differences in bathing water sampling and monitoring approaches across the UK. The period that each nation defines as their bathing season varies. In England and Wales, it is between 15th May and 30th September and in Northern Ireland and Scotland it is between 1st June and 15th September. Under the Bathing Water Directive, it is at the discretion of the EU Member States to define their own bathing water seasons.

Table 8 – Differences in Sampling and Monitoring approaches across the UK.

	England	Northern Ireland	Scotland	Wales
Bathing Water Season	15 May – 30 September	1 June – 15 September	Defined per bathing water. Typically, 1 June – 15 September	15 May – 30 September
Bacterial Sampling Programme (Statutory)	Minimum of 1 pre-season and bathing season samples taken at intervals not exceeding one months (Total 5)[345]	Minimum of 1 pre-season and 4 bathing season samples taken at intervals not exceeding one month (Total 5)[346]	Minimum of 1 pre-season and 4 bathing season samples taken at intervals not exceeding one months (Total 5) Where bathing season does not exceed 8 weeks a minimum of 3 bathing season samples must be taken (Total 4)[347]	Minimum of 1 pre-season and bathing season samples taken at intervals not exceeding one month (Total 5)[348]
Bacterial Sampling Programme (Normal Practice)	Between 5 and 20 samples per bathing season (including pre-season sample) depending on the consistency of the classification[349]	16 to 20 bathing season samples plus one pre-season sample[350]	Most bathing waters are sampled 18 times including pre-season sample. Some geographically remote sites are sampled 10 times. Sites which have consistently demonstrated 'Excellent' water quality are sampled five times[351].	Between 10 and 16 samples per bathing season (including pre-season sample).[352].

Scotland

[345] Bathing Water Regulations 2013 Sch. 4 para 2.
[346] Quality of Bathing Water (Northern Ireland) Regulations 2008 Sch. 3 para 2
[347] Bathing Water (Scotland) Regulations 2008 Sch. 2 para 2.
[348] Bathing Water Regulations 2013 Sch. 4 para 2.
[349] Done at the discretion of the Environment Agency. For more information refer to Chapter 3.5
[350] 20 samples were collected at each site in 2022 Northern Ireland's Bathing Waters show overall improvement in 2022 | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)
[351] Bathing Waters : Sampling results (sepa.org.uk)
[352] Natural Resources Wales / Bathing water quality

SEPA is responsible for the sampling and monitoring of designated bathing waters. Whilst SEPA state they sample from 1st June to 15th September; it should be noted that the Scottish Regulations do not stipulate a statutory bathing season. Instead, the regulations provide that the Scottish Ministers must establish and keep under annual review the bathing water season which relates to each bathing water, while Part 1 of Schedule 2 provides for less frequent sampling where the bathing season at a particular bathing water does not exceed 8 weeks [353]. Unlike the rest of the UK, there is a statutory provision for less frequent sampling where a bathing water is situated in a region subject to 'special geographic constraint', with SEPA confirming that it samples less frequently at some geographically remote sites [354].

Northern Ireland, Scotland, Wales and England may decide to suspend the monitoring calendar for the duration of an 'abnormal situation'[355]. In Northern Ireland and Scotland one additional sample is to be taken to confirm the abnormal situation has ended. However, this sample is not included in the final water quality dataset as per Schedule 3 of the '*Quality of Bathing Water Regulations (Northern Ireland) 2008*'[356] and Schedule 2 of the '*Bathing Waters (Scotland) Regulations 2008*'[357]. Additional samples are to be taken after the abnormal situation to ensure the minimum number of samples have been taken for the bathing water season for all four countries. Whilst the approaches to the issues of wastes, cyanobacteria, marine phytoplankton and macro-algae are similar to the rest of the UK, SEPA also actively encourages the use of citizen science to monitor for cyanobacteria proliferations. According to a 2022 Health Protection Scotland update on SEPA's cyanobacteria (blue-green algae) analysis service, in 2021 SEPA were "providing limited service" to local authorities, councils and others for analysis of water samples and identifying and quantifying the levels of cyanobacteria[358]. Since the review SEPA have issued advice to the public on how to report and get support with a potential bloom which includes reporting the bloom on the 'Bloomin' Algae' app and Web portal[359]. This has resulted in this tool becoming much more widely utilized in Scotland than other parts of the UK.

Wales

Natural Resources Wales (NRW) is responsible for the sampling and monitoring of identified bathing waters. As both England and Wales are covered by the Bathing Water Regulations 2013, sampling and monitoring approaches in Wales are very similar to those in England. The key difference is the minimum and maximum number of samples taken during the bathing season as shown in Table 8.

Discussion

[353] The Bathing Waters (Scotland) Regulations 2008 (legislation.gov.uk) Reg 3(1) and Sch. 2 para 1(3).
[354] Paragraph 3, Part 1 of Sch. 2 to the Bathing Waters (Scotland) Regulations 2008 and Bathing Waters : Sampling results (sepa.org.uk)
[355] Defined as 'an event or combination of events impacting on bathing water quality at the location concerned and not expected to occur on average more than once every four years'.
[356] The Quality of Bathing Water Regulations (Northern Ireland) 2008 (legislation.gov.uk)
[357] The Bathing Waters (Scotland) Regulations 2008 (legislation.gov.uk)
[358] https://www.hps.scot.nhs.uk/publications/hps-weekly-report/volume-56/issue-14/update-on-sepa-s-cyanobacterial-blue-green-algae-analysis-service-2022/
[359] Citizen Science app used for reporting presence of harmful algal blooms of blue-green algae: https://www.ceh.ac.uk/our-science/projects/bloomin-algae

The statutory differences to sampling frequency are predominantly based on geographical considerations or the length of the bathing season. For example, there are practical reasons when considering the frequency of sampling for a number of Scotland's more remote bathing waters which cannot be easily resolved, given the current location of the testing laboratories. The non-statutory differences in sampling practices are due to the individual jurisdictions having to balance the benefits of taking more samples (refer to Chapter 3.6) against the economic factors of doing so. Wherever economic considerations allow, it is preferable to take more samples thereby decreasing the risk of misclassification.

The differences in the length of the bathing season across the UK is a matter of choice for each jurisdiction as no minimum period is set out in the EU Bathing Water Directive. If Northern Ireland decide to extend the bathing season at the popular surfing beaches as discussed in Chapter 3.6 there may be calls to do similarly across the rest of the UK. As stated previously (Chapter 3.8) however, surfing is not actually recognized under the definitions of the bathing water Regulations.

The Scottish use of public reporting and citizen science to flag cyanobacteria proliferations should be recognized as this will allow the regulator and local authorities to respond quicker and reduce the risk to public health.

4.5 Management Approaches

Scotland and Wales, like England and Northern Ireland, detail the bathing water management approaches on the online bathing water profiles[360,361]. The majority of management approaches are very similar across the UK. The key differences in approaches are around short-term pollution risk forecasting and public communication.

Scotland

In addition to meeting statutory obligations on bathing water signage real time electronic signboards informing the public about bathing water quality are installed across 36 of the 89 bathing waters. The work was initially funded by the Scottish Government and piloted in 2003–2004. SEPA provide "scientific advice and technical input and manage the daily operation of the sign network"[362].

The electronic signboards, SEPA website[363] and Beachline telephone service[364], allow SEPA to inform the public of their forecast of predicted bathing water quality, either via the message 'Water quality is forecast to be acceptable today' or to advise of potentially poorer quality following a short-term pollution event. Although generally of a high quality, the bathing waters where electronic signage is installed were selected because they were previously found to be at risk of not meeting European standards during or after wet weather[365]. The daily water quality forecasts are based on rainfall and hydrological information.

Wales

Information on short term pollution and pollution incidents can be easily accessed online on the NRW website[366]. 24hr water quality prediction is also available at 14 bathing waters across Wales. These provide daily updates on bathing water quality during the bathing water season.

These bathing water quality predictions are based on the pollution risk forecasting approach also used by the Environment Agency in England. In addition, a further five bathing waters have electronic signage and/or live web based forecasts which provide hourly pollution risk forecasts. This work, undertaken by the University of Wales (Aberystwyth) and funded by two Ireland-Wales (Interreg) projects[367] involved calibration of hourly water quality prediction models for Swansea (Smart Coast Sustainable Communities Project), Cemaes, New Quay North, Traeth Gwyn and Nolton Haven (Acclimatize Project) bathing waters. These models are some of the most sophisticated in the UK, having high levels of 'explained variance', with R^2 in 4 of the 5 sites modelled exceeding 80% (refer back to Chapter 3.6 for explanations of explained variance and subsequent implications). These

[360] Bathing Waters : Profiles (sepa.org.uk)
[361] Find a bathing water (data.gov.uk)
[362] www.sepa.org.uk/media/38995/scottish-bathing-waters-report-2003.pdf
[363] Bathing Waters : Predictions (sepa.org.uk)
[364] Beachline telephone service: 08452 303098 (Bathing Waters : Predictions (sepa.org.uk))
[365] Bathing Waters : Predictions (sepa.org.uk)
[366] https://environment.data.gov.uk/wales/bathing-waters/profiles/
[367] Refer to Chapter 3.5 for further details.

accurate bathing water quality predictions can result in significant improvements in compliance. For example, Cemaes bathing water was classed as 'Poor' in 2016 and 2017 but it rose to 'Excellent' in 2021 after the models were able to accurately predict and warn bathers of poor water quality. The models predicted the high FIO samples taken by NRW, warning the public via the internet and / or electronic signage and could therefore be disregarded from the calculation of the final classifications.

Wales has a bathing water quality "widget designer" or "Robot", similar to that of the EA Swimfo tool, which can be used by third party applications and websites to access water quality predictions.

Discussion

Electronic signboards are preferable to traditional fixed signs as they can update the public of water quality issues in near real time. Further advantages of electronic signboards are discussed in section 3.6. Scotland has the highest proportion of electronic signboards at their bathing waters when compared with the rest of the UK. Scotland has electronic signs at 40% of their bathing waters, Northern Ireland at 18%, Wales at 6%. Data on the prevalence of electronic signboards is not available for England but Stantec and CREH understand the figure is likely to be <1%.

As Scotland is still using a single parameter statistical model[368] for pollution risk forecasting it will not be as effective in predicting periods of poor water quality than systems utilised in England (multi-parameter statistical models calibrated against historical compliance samples) and Wales (mix of English approach and multi-parameter statistical models calibrated against specialist calibration datasets)[369]. The relative performance of the Scottish statistical approach against Northern Ireland's deterministic model[370] approach is likely to vary on a site by site basis.

Stantec and CREH would recommend that the multi-parameter statistical model approach used by England (refer to Section 3.6) would improve upon the system currently in use in Northern Ireland which is very limited by the quality of the modelled input data. This would provide more accurate pollution risk forecasting ensuring the public are better informed of the risks before bathing. There may also be specific bathing waters in England and Northern Ireland which would benefit from using multi-parameter statistical models calibrated against specialist calibration datasets. These are likely to be bathing waters, such as Scarborough South in England, where these pollution risk forecasting systems are struggling to accurately predict periods of poor bathing water quality. This may occur when the water quality is related to a complex or undefined mix of pollution sources which cannot easily be modelled.

[368] A single parameter statistical model will attempt to correlate bathing water quality with one other single parameter, namely rainfall. Whilst there may be relationships with rainfall at many sites, water quality at any given bathing water is likely to be determined by a more complex range of factors. Refer to Chapter 3.6 for more information.

[369] Multi-parameter models will attempt to correlate bathing water quality with many more factors rainfall. These models however are limited by data availability so the most accurate models are those which can be calibrated against a bespoke sampling dataset. Refer to section 3.6 for further details.

[370] Deterministic models will input time series data (such as rainfall) into a catchment or hydraulic model and predict the bathing water quality over time. These models are limited by the quality of input data. Refer to section 3.6 for further details.

4.6 Bathing Water Improvements

This section seeks to provide a high-level overview, rather than a deep dive, into Scottish and Welsh legal and operational frameworks used to plan and implement measures to improve bathing water quality.

Organizational Structure

Within Scotland, operational responsibility for delivering the environmental outcomes of the bathing water regulations sits with SEPA.

Within Wales, operational responsibility for delivery the environmental outcomes of the bathing water Regulations sits with NRW.

Wastewater Infrastructure

Water supply and sanitation services within Scotland are provided by Scottish Water. If the bathing water is not achieving the desired target standards, SEPA may instruct Scottish Water to undertake an investigation to quantify the impact of their assets upon the bathing water. If wastewater infrastructure is evidenced to be a contributory factor to pollution, SEPA will require Scottish Water to undertake remedial measures such as storm water storage or disinfection of final effluent from a wastewater treatment works.

Water supply and sanitation services within Wales are provided by Dwr Cymru. If the bathing water is not achieving the desired target standards, NRW may instruct Dwr Cymru to undertake the investigations and remedial measures required.

Measures around improvements to wastewater infrastructure in this respect are similar across the four UK jurisdictions. It is Stantec and CREH opinion that the impact of the OFWAT Performance Commitments on the water and sewerage companies in England and Wales[371] however should not be underestimated and may explain some of the slight performance differences between UK regions.

Agriculture and Diffuse Pollution

As agriculture is a devolved matter across the UK, each jurisdiction is taking a different approach.

Scotland

Within Scotland, the Scottish parliament passed the '*Agriculture (Retained EU Law and Data) (Scotland) Act 2020'*, giving ministers the power to amend the previous CAP regime. This was followed in 2021 by a consultation on the future of agricultural support in Scotland which established the Agricultural Reform Implementation Board (consisting of farmers, crofters and conservationists) to advise on policy development[372].

[371] Refer to Section 2.5 How the Legislative, Institutional and Operational Frameworks Work

[372] Agriculture subsidies after Brexit | Institute for Government

In the medium term, the Scottish government plans to keep the existing system of direct payments to farmers in place until the end of the current Holyrood parliament (expected to be 2026), although by 2025 around 50% of these payments will be conditional on delivering environmental benefits, and the remaining 50% will continue to be based on the area of land farmed.[373] Unlike England, the Scottish government has set out that an explicit aim of the new regime will be to maintain food production and keep farmers on the land. This different policy approach, partly reflects the very different nature of farming in Scotland, with 85% of Scottish land made up of less favoured farmland.[374]

Within Scotland, the Prevention of Environmental Pollution From Agricultural Activity (PEPFAA code) – Code of good practice[375] offers advice to farmers on minimising the risk of environmental pollution as a result of farming practices. SEPA work alongside the Scottish Government Environment Directorate, the National Farmers Union Scotland, and the Scottish Agricultural College in producing and maintaining the code. It is the responsibility of SEPA to enforce environmental legislation within the PEPFAA, with the exception of nitrates legislation, and advise land managers on sustainable practices.

For the 2022 bathing season, Scotland observed its highest percentage of bathing water sites classified as 'Excellent' on record (44%). Further, since 2015, bathing water status has improved from 'Poor' to 'Sufficient' or higher at 15 sites. These improvements are attributed to increased compliance with environmental regulations from farmers and land managers in addition to targeted investments by Scottish Water[376].

An example of a significant step change improvement resulting from collaborative work involving SEPA, Scottish Water, the Scottish Government, South Ayrshire Council, farmers and rural land managers, the National Farmers Union and Keep Scotland Beautiful is Ayr (South Beach). After being classified as 'Poor' for four consecutive years, successful collaborative approaches and significant investment saw improvements to 'Good' status in 2021[377]

Since 2010, SEPA have been working alongside National Farmers Union, Scotland with 350 farmers and land managers in various catchments across Ayrshire to tackle diffuse pollution. Approximately £50 million has been spent on new practices including slurry storages, fencing off water courses and installing alternative water supplies for livestock; the majority of farmers and land managers in the catchment are now fully compliant[378].

The Scottish approach allows SEPA to target investment in priority catchments and has been shown to make a considerable difference to bathing water quality at specific sites. Stantec and CREH believe this approach will continue to aid bathing water improvements but may ultimately fail to be sufficient to help deliver the target Excellent classification at all sites without further incentivisation through

[373] BBC Radio 4, Farming Today Methane and net zero; Scottish subsidy system; Carbon auditing; COP26, 5 November 2021, www.bbc.co.uk/programmes/m00114pc
[374] BBC Radio 4, Farming Today, Fishing accidents, Scottish farm payments, fly tipping, www.bbc.co.uk/programmes/m00127wf
[375] Prevention of environmental pollution from agricultural activity: guidance - gov.scot (www.gov.scot)
[376] Media | Scottish Environment Protection Agency (SEPA)
[377] Media | Scottish Environment Protection Agency (SEPA)
[378] SEPA have been working alongside National Farmers Union, Scotland (NFUS) since 2010

changes to agricultural policy to prioritise water quality and the environment. This may be particularly important at bathing waters which are impacted by effluent from very large agricultural catchments and requiring large numbers of repeat farm inspections.

Wales

Following the Agriculture (Wales) white paper in 2020, the Welsh government had planned to end CAP style direct payments and begin phasing in a new funding regime from 2021. However, the new 'Sustainable Farming Scheme' outlined in the white paper is now not expected to open until January 2025[379]. Under the proposals, farmers and land managers will be financially incentivised to farm in ways that promote environmental benefits such as carbon storage and soil and water quality.

In 2021 the Welsh Government released '*The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021: guidance for farmers and land managers*'[380] to aid farmers and land managers across Wales in compliance with the '*Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021*'[381]. The regulations apply to all farming businesses across Wales and were introduced to reduce pollution losses from agriculture to the environment.

It is the responsibility of NRW to assess compliance via farm inspections and through checking records. Breach of regulations will result in actions taken according to the NRW Enforcement and Prosecution policy[382]. Where NRW have identified significant risks of pollution to controlled waters, they may serve a notice requiring additional action to improve existing practices and installations within 28 days.

Bathing waters in Wales, like England, are likely to benefit from the focus on the environment and water quality within the changes to agricultural policy. This may be particularly important at bathing waters which are impacted very large agricultural catchments and requiring large numbers of repeated farm inspections.

[379] Agriculture subsidies after Brexit | Institute for Government

[380] https://www.gov.wales/sites/default/files/publications/2023-04/water-resources-control-agricultural-pollution-wales-regulations-2021-guidance-farmers-and-land.pdf

[381] The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 (legislation.gov.uk)

[382] https://naturalresources.wales/media/1140/enforcement-and-prosecution-policy.doc

Chapter 5: Comparison with Approaches and Performance from selected EU jurisdictions

As part of the review of existing bathing water Regulations, Stantec and CREH have been asked to compare bathing water management approaches and associated performance in England and Northern Ireland against other selected EU jurisdictions.

As bathing water regulations across the EU are also transposed from the Bathing Water Directive, they are inherently similar to those of England and Northern Ireland. This chapter seeks to highlight the key differences in approaches and resulting performance across selected jurisdictions.

Across the EU, bathing water performance varies substantially as shown in Figure 22[383] with comparative data for Scotland placing it as the worst in Europe in terms of the proportion of bathing waters classified as 'Excellent'. Whilst England has a significantly higher percentage of bathing waters at 'Excellent' than Scotland it is also lagging behind much of the rest of the EU.

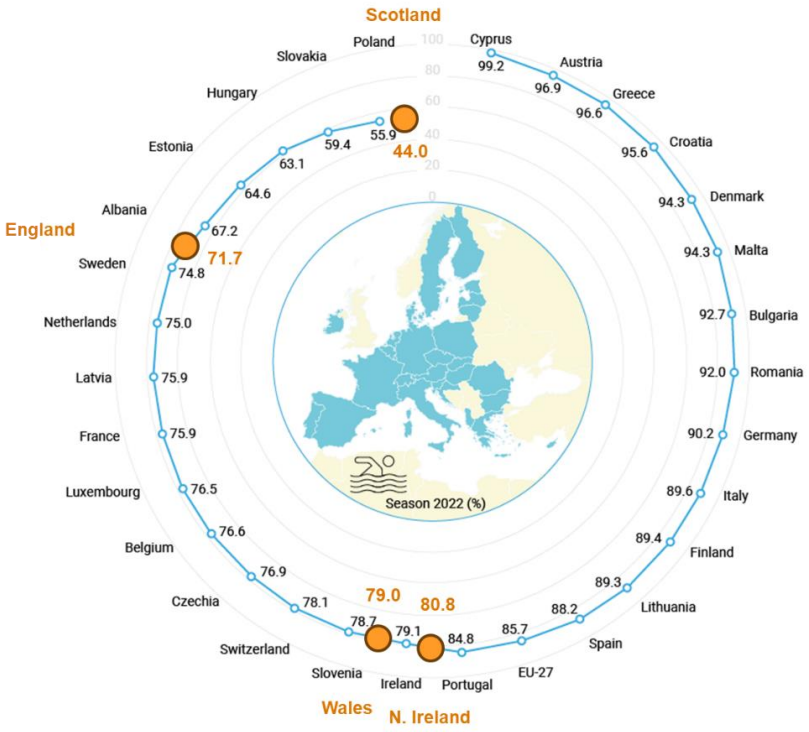


Figure 22 - Proportion of bathing waters classified as 'Excellent' in 2022 (in the EU Member States, Albania and Switzerland). Information taken from European bathing water quality in 2022 — European Environment Agency (europa.eu)

[383] European bathing water quality in 2022 — European Environment Agency (europa.eu)

Bathing water quality across the EU is generally of high quality and has been improving since the introduction of the EU Bathing Water Directive in 2006[384]. In 2022, 85.7% of bathing waters were classified as 'Excellent' and 95.9% of sites met the minimum or higher water quality standards. Water quality at coastal bathing waters is typically higher than that observed at inland sites with 88.9% of costal bathing waters achieving 'Excellent' status in comparison to 79.3% of inland bathing waters in 2022[385]. There are clear exceptions to this rule however with the likes of Austria, which only has inland bathing waters achieving a remarkable 96.9% at 'Excellent'. Only 1.5% of bathing waters across the EU were classified as 'Poor' in 2022[386].

[384] European bathing water quality in 2022 — European Environment Agency (europa.eu)
[385] European bathing water quality in 2022 — European Environment Agency (europa.eu)
[386] European bathing water quality in 2022 — European Environment Agency (europa.eu)

5.1 Criteria for Selection

In selecting EU jurisdictions for comparison, Stantec and CREH have considered a range of criteria, including:

- Wastewater collection and treatment systems

Wastewater collection systems within the UK have historically operated under a combined sewage system, meaning systems take both foul and storm water. These systems typically require relief points in the network, known as storm overflows, to prevent property flooding or sewage treatment works being overwhelmed during periods of heavy rainfall. Whilst these storm overflows can be a source of pollution to bathing waters, significant investment has taken place to reduce spills and the subsequent impact from storm overflows at bathing waters across the UK. Since the 1970s, most modern homes have been constructed with separate drainage systems for surface water and wastewater. It is estimated that approximately half the properties across Britain are now connected to a separate drainage system[387]

In 2020, England collected and treated 99.8%[388] of generated load from wastewater treatment works in accordance with the Urban Waste Water Treatment Regulations[389]. The most recent and readily available information for Northern Ireland suggest that in 2015, 97% of wastewater was collected and treated to urban wastewater treatment standards[390].

In order to maximise possible lessons learned it is helpful therefore if the selected jurisdictions have comparable wastewater collection and treatment systems to England and Northern Ireland and similar levels of compliance with UWWT Regulations. The assessment was made according to the jurisdiction's percentage treatment to urban wastewater treatment standards[391] and if storm overflows were identified[392] as contributing significantly to less than 'Good' water quality.

- Climate

Climate is an important factor in bathing water quality, with sea temperatures, sunlight hours, rate and volumes of rainfall able to influence quality. It is helpful therefore, for comparison purposes, if the selected jurisdictions have a similar climate to England and / or Northern Ireland. The assessment has

[387] Does your house have the right drain connections? | JDP (jdpipes.co.uk)
[388] Wastewater treatment in England: data for 2020 - GOV.UK (www.gov.uk)
[389] The EU Urban Waste Water Treatment Directive (UWWTD) sets common standards among countries for the concentrations of organic pollution, suspended solids, nitrogen and phosphorus in the discharges of treated urban waste water, as well as the necessary monitoring frequency. Each urban area that generates waste water more than 2 000 population equivalent is assessed for its compliance with the UWWTD. An urban area is considered to be compliant with the UWWTD requirements, when all generated waste water is collected and receives treatment in line with the UWWTD provisions.
[390] regulation-of-water-utility-sector-discharges-2014-and-2015.pdf (daera-ni.gov.uk)
[391] Country profiles on urban waste water treatment (europa.eu)
[392] This is determined by whether or not storm overflows are mentioned in WISE country profiles https://water.europa.eu/freshwater/countries/uwwt/

used the Köppen climate classification system[393] in which, varying climates are categorised into five main climate groups and 30 further sub-divisions according to seasonal precipitation and temperature patterns. The UK is considered as a predominantly oceanic climate with no defined dry season and warm summers (Cfb)[394]. Average temperature and precipitation during the bathing water season have also been considered.

- Bathing water performance

In 2022, 72.1% of UK bathing waters met 'Excellent' standard of the Bathing Water Regulations. Countries with a higher percentage of bathing waters at 'Excellent' status, such as Denmark (94.3%) and Germany (90.2%), were considered for comparison. Countries that observed gradual improvement in bathing water quality, such as Ireland, offered potential lessons for improvement. In order to maximise possible lessons learned countries with consistently poorer bathing water quality, such as Poland (55.9% at 'Excellent' status), were deemed less preferable for comparison purposes.

- Coastal and inland bathing waters mix

The majority of England and Northern Ireland's bathing waters are coastal with only a small number of inland (either lacustrine or riverine). However, there has been an increasing number of inland bathing water applications and formal identifications in recent years. It is helpful therefore, for comparison purposes, if the selected jurisdictions have a mix of coastal and inland bathing waters, to represent both where the UK is now and where things could end up if current trends continue.

- Degree of urbanization[395]

The degree of urbanization will typically influence the apportionment of pollution sources, for example it makes sense that you would expect a large percentage apportionment coming from agricultural sources in areas with low urbanization. It is helpful therefore, for comparison purposes, if the selected jurisdictions have a similar degree of urbanisation to England and Northern Ireland. The UK has an urbanised area of 8.2% according to CORINE, 2018[396] data.

The results of the comparative EU assessment are shown in Table 9. The table also includes data from non-EU member states, such as Albania and Switzerland, which report data under the EU Bathing Water Directive.

[393] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)
[394] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)
[395] Urban population (% of total population) https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=EU
[396] CLC 2018 — Copernicus Land Monitoring Service

Assessment of the Implementation of Environmental Law in Relation to Bathing Waters

Chapter 5: Comparison with Approaches and Performance from selected EU jurisdictions

Table 9 – Comparison of EU jurisdictions to England and Northern Ireland according to descriptive criteria

	Comparable wastewater collection and treatment	Comparable Köppen Climate Classification [397]	Comparable average bathing season temperature (13-19°C)	Comparable average bathing season precipitation (40-80 mm)	Percentage of bathing waters achieving Excellent (>85%)	Inland bathing waters present?	Coastal bathing waters present?	Comparable Urbanized land area (5-11%)	Total count
Switzerland		☑	☑			☑		☑	4
Sweden	☑		☑	☑		☑	☑		5
Spain	☑				☑	☑	☑		4
Slovenia		☑				☑	☑		3
Slovakia				☑		☑		☑	3
Romania	☑	☑		☑		☑	☑	☑	6
Portugal		☑			☑	☑	☑		4
Poland	☑	☑		☑		☑	☑	☑	6
Netherlands	☑	☑	☑			☑	☑		5
Malta		☑			☑		☑		3
Luxembourg	☑	☑	☑	☑		☑		☑	6
Lithuania	☑		☑		☑	☑	☑		5
Latvia			☑	☑	☑	☑	☑		5
Italy	☑				☑	☑	☑	☑	5
Ireland	☑	☑	☑	☑		☑	☑		6
Hungary	☑	☑		☑		☑		☑	5
Greece		☑			☑	☑	☑		4
Germany	☑	☑		☑	☑	☑	☑	☑	7
France	☑	☑	☑	☑		☑	☑	☑	7

[397] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)

Assessment of the Implementation of Environmental Law in Relation to Bathing Waters

Chapter 5: Comparison with Approaches and Performance from selected EU jurisdictions

	Comparable wastewater collection and treatment	Comparable Köppen Climate Classification [397]	Comparable average bathing season temperature (13-19°C)	Comparable average bathing season precipitation (40-80 mm)	Percentage of bathing waters achieving Excellent (>85%)	Inland bathing waters present?	Coastal bathing waters present?	Comparable Urbanized land area (5-11%)	Total count
Finland	☑		☑	☑	☑	☑	☑		6
Estonia			☑	☑		☑	☑		4
Denmark	☑	☑	☑	☑	☑	☑	☑	☑	8
Czechia	☑	☑				☑		☑	4
Cyprus					☑		☑	☑	3
Croatia		☑		☑	☑	☑	☑		5
Belgium	☑	☑	☑	☑	☑	☑	☑		7
Austria		☑		☑	☑	☑		☑	5
Albania		☑				☑	☑		3

There are eight jurisdictions based on this analysis which have a total score of 6 or more. From these the Republic of Ireland, Germany, Denmark and France have been taken forward for comparison purposes[398].

It was felt that the climates of Finland, Romania and Poland were not as comparable with the UK and these jurisdictions did not offers benefits beyond those already chosen. Belgium was strongly considered although in the end discounted as it shared many similarities with Denmark but with slightly poorer bathing water performance.

As each of these jurisdictions operate under the EU Bathing Water Directive the following assessment has been broken down in to the key areas of difference in the interpretation and implementation of the Directive.

[398] Four sites as per contract of works between Stantec and CREH and the OEP

5.2 Background on Selected Jurisdictions

This section provides high level context and background to the selected jurisdictions.

The Republic of Ireland

The Republic of Ireland was selected for comparison as it shares a land border with Northern Ireland, has the same temperate oceanic climate (Cfb) and has a mix of inland and coastal bathing waters with a comparable performance to the UK average. Bathing water quality, which is discussed further in the next section, is comparable to UK averages.

The Republic of Ireland also predominantly operates under a combined wastewater system. Since 2015, the water supply for the 31 City and County Councils in Ireland has been managed by the State owned by a single utility, Uisce Éireann (formerly Irish Water) who are accountable to its stakeholders: the public; industry; the Commission for Energy Regulation; the Environmental Protection Agency; the Government; and to consult with the Health Services Executive[399]. Prior to this, water services were managed by the 31 separate local authorities. 44% of sewage is treated in line with EU UWWT legislation in Ireland[400]. This figure is likely to be a factor of low population densities falling below UWWT thresholds.

The EU Bathing Water Directive was transposed in law in the Republic of Ireland under the S.I. No. 79/2008 - Bathing Water Quality Regulations 2008[319].

Denmark

According to CORINE (2018)[401], Denmark shares a similar urban landcover percentage to the UK with 7% of Denmark categorized as 'urban' in comparison to the 8.2% in the UK. The climate of Denmark is predominantly classed humid continental climate (Dfb) with areas of the southern Jutland Peninsula falling within a temperate oceanic climate (Cfb)[402] and it experiences a similar average temperature during the bathing water season (16.8°C in Denmark and 16.45°C in the UK[403]). Despite having a higher overall number of bathing waters (1,039) than England (419), Denmark shares a similar percentage of inland and coastal bathing waters to that observed in the UK[404]. Bathing water quality, which is discussed further in the next section, is one of the highest across all the EU.

[399] Irish-Water-Business-Plan
[400] Ireland (europa.eu)
CLC 2018 — Copernicus Land Monitoring Service
[402] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)
[403] Climate of Europe: Temperature, climate graph, Climate tables for Europe - Climate-Data.org
[404] State of bathing waters in 2022 — European Environment Agency (europa.eu)

In addition, Denmark also operates a combined sewerage network system. The Danish water sector is managed by 98 municipally owned drinking water and sewerage companies[405,406.] Denmark has the highest average bill for water and sanitation of the selected jurisdictions at 9.32 €/m^3 of treated sewage[407].

The EU Bathing Water Directive was transposed into law in Denmark under 'Executive Order no. 917 of 27 June 2016 on bathing water and bathing areas (the Bathing Water Order)'.

France

France has a slightly lower degree of urbanization, with 5.8% of land cover considered to be urbanized in comparison to 8.2% in the UK (CORINE, 2018[408]). The climate of France, although slightly warmer and dryer, falls within the same 'Temperate' classification (C) as the UK[409]. France has significantly more bathing waters (3,370) and includes both inland (1296) and coastal (2074) bathing waters[410]. This figure also includes approximately 250 bathing waters in France's overseas territories including the Caribbean, French Guiana, Mayotte and Reunion[411].

France operates a combined sewerage system, with 90% of sewage treated in line with EU legislation[412]. Local councils are responsible for the provision of water and drainage services in France[413]. However, smaller districts may choose to operate on an inter-communal basis in which many councils work together under the Syndicate d'Eau et Assainissement (Water and Sanitation Union)[414]. The Water and Sanitation Union can decide to manage the water supply and sanitation directly or contract the responsibility out to a private company such as Veolia, Suez-Lyonnaise des Eaux and Saur[415],[416]. At a national and regional level however, the management of water capacity and control of water pollution is the responsibility of the six water agencies that are defined by the six main river basins across mainland France: Adour-Garonne, Artois-Picardie, Rhin-Meuse, Loire-Bretagne, Rhône- Méditerranée and Seine-Normandie[417]. Water Agencies in France are defined as public institutions of the State who are responsible for the management of water resources and the protection of the aquatic environments[418]. The average bill for water and sanitation in France is 2 €/m^3 of treated sewage[419].

---

[405] Aquatech | 5 things I learned from Denmark's water sector (aquatechtrade.com)
[406] file (eureau.org)
[407] file (eureau.org)
[408] CLC 2018 — Copernicus Land Monitoring Service
[409] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)
[410] State of bathing waters in 2022 — European Environment Agency (europa.eu)
[411] www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments
[412] France (europa.eu)
[413] Water Supply and Drainage Services in France (french-property.com)
[414] Water Supply and Drainage Services in France (french-property.com)
[415] French policy on water and sanitation - Ministry for Europe and Foreign Affairs (diplomatie.gouv.fr)
[416] Water Supply and Drainage Services in France (french-property.com)
[417] Water Supply and Drainage Services in France (french-property.com)
[418] Priorities and missions | Water agencies (lesagencesdeleau.fr)
[419] file (eureau.org)

The EU Bathing Water Directive was transposed into French law in Articles D.1332-14 to D.1332-38-1 of the Public Health Code (CSP)[420].

Germany

Germany was chosen in part as an example of the impact of potential future trends in UK bathing waters. Germany shares a similar population (83 million[421]), population density (239 capita/km^2 [422]), % of urban landcover (9.3%, CORINE, 2018[423]), average bathing season temperature (18.4 °C), and climate (Cfb[424]). However, Germany does have a significantly higher number of overall bathing waters (2,292) with the majority of these being located inland (84.2%[425]). Within England and Northern Ireland there has been an increasing number of inland bathing water applications in recent years. Germany therefore offers a comparative example of what may be in store if this trend were to continue. Bathing water quality, discussed further in the next section, is higher than UK averages.

Germany has both combined and separate sewerage systems with ~100% of sewage treated in line with EU UWWT legislation[426]. Public water supply and water sanitation across Germany is the responsibility of the various municipalities[427], however municipalities may decide to contract the responsibility to private companies[428]. 2016 statistics from the German Federal Statistical Office (2019) infer a total of 5,934 different companies were involved in the supply of water and sanitation across Germany[429]. Publicly owned companies accounted for 67% of all water companies in 2018 while private companies comprise 33%[430]. The average bill for water and sanitation in Germany is 4.03 €/m^3 of treated sewage[431].

There is currently no principal environmental and economic regulator in Germany with state authorities acting in partnership with the state Environmental Ministry conducting operational activities[432]. However, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Environment Agency (Umweltbundesamt) hold certain responsibilities over the federal agencies and the private sector[433].

[421] https://ec.europa.eu/eurostat/web/products-catalogues/-/ks-09-21-344
[422] Germany Population (2023) - Worldometer (worldometers.info)
[423] CLC 2018 — Copernicus Land Monitoring Service
[424] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)
[425] State of bathing waters in 2022 — European Environment Agency (europa.eu)
[426] Germany (europa.eu)
[427] Statistisches Jahrbuch 2019 (destatis.de)
[428] branchenbild_2020_engl.pdf (dvgw.de)
[429] branchenbild_2020_engl.pdf (dvgw.de)
[430] branchenbild_2020_engl.pdf (dvgw.de)
[431] file (eureau.org)
[432] Environmental law and practice in Germany: overview | Practical Law (thomsonreuters.com)
[433] Environmental law and practice in Germany: overview | Practical Law (thomsonreuters.com)

5.2 Number of Bathing Waters and Current Status

The number of bathing waters in each jurisdiction and the percentage of bathing waters in each classification is detailed in Table 10. All data are correct as of the end of the 2022 bathing season.

Table 10 – Bathing water classifications for 2022 across comparison countries [434]

Country	Number of bathing waters (2022)	Percentages of bathing waters achieving the classifications				
		Un-assessed	Poor	Sufficient	Good	Excellent
England	421	<1%	3%	4%	21%	72%
N. Ireland	26	-	4%	4%	12%	81%
Denmark	1039	<1%	<1%	<1%	4%	94%
France	3370	3%	3%	4%	14%	76%
Germany	2292	2%	<1%	2%	6%	90%
Ireland	148	<1%	2%	5%	14%	79%

Denmark, closely followed by Germany, have the highest percentage of bathing waters meeting the minimum standards (98.9% and 97.7%, respectively) and the highest percentage of bathing waters at 'Excellent' status (94.3% and 90.2%, respectively). In comparison, France has the lowest percentage of bathing waters that meet the minimum standards (94%).

Maps of bathing water locations, their respective classifications and the overall performance trends since 2015[435] can be found on Table 11.

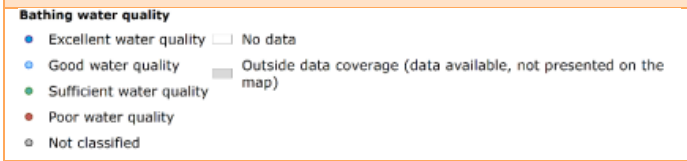
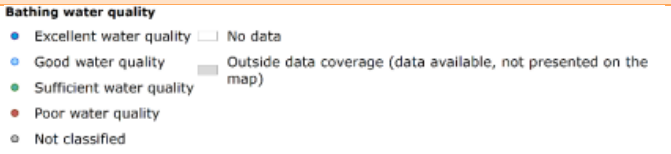
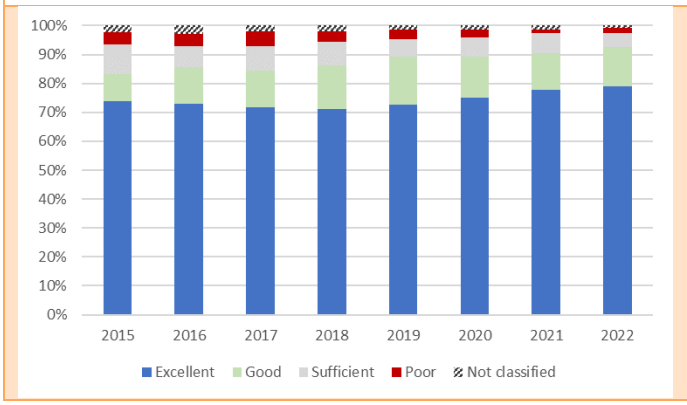
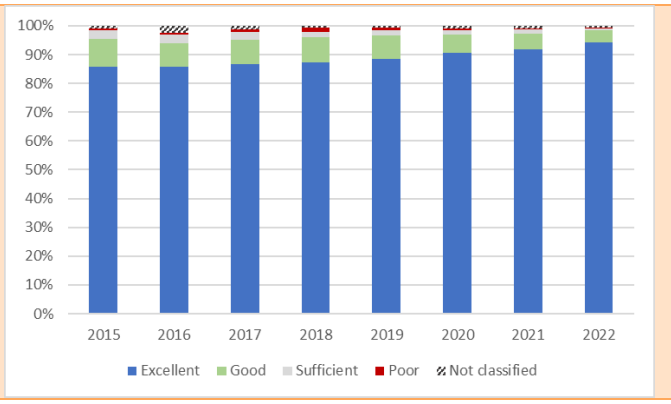
[434] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france, https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/denmark, https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/germany & https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland

[435] Ireland — European Environment Agency (europa.eu), Germany — European Environment Agency (europa.eu), Denmark — European Environment Agency (europa.eu) & France — European Environment Agency (europa.eu)

Assessment of the Implementation of Environmental Law in Relation to Bathing Waters

Chapter 5: Comparison with Approaches and Performance from selected EU jurisdictions

Table 11 – Map of Bathing Water locations and percentages of bathing waters in each classification (2015-2022)

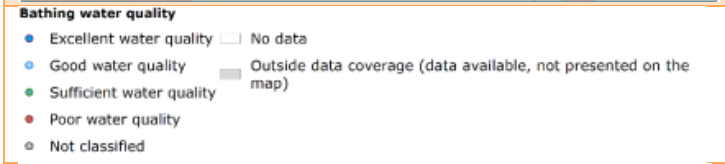
Republic of Ireland	Denmark
	
	
	

Assessment of the Implementation of Environmental Law in Relation to Bathing Waters

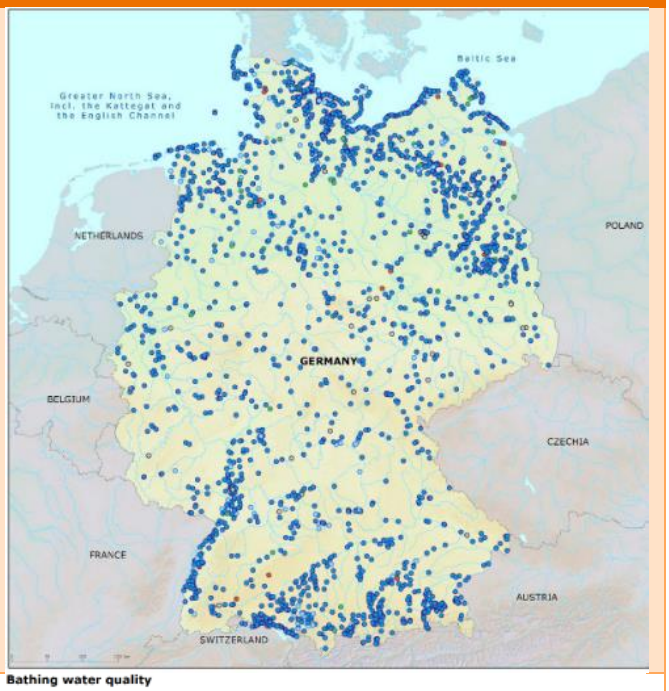
Chapter 5: Comparison with Approaches and Performance from selected EU jurisdictions

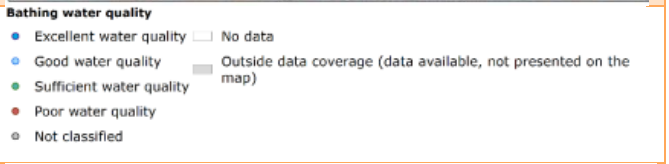
Table 12 – Map of Bathing Water locations and percentages of bathing waters in each classification (2015-2022)

France



Germany





Republic of Ireland

By the end of the 2022 bathing season, Ireland had 148 bathing waters[436]. Of these, 9 are inland and 139 are coastal[437]. In 2022, 117 bathing waters (79.1%) achieved 'Excellent'[438] up from 101 (73%) in 2015[439]. 144 sites (97%) achieved the minimum required standard of 'Sufficient' or higher[440], up from 128 (93.4%) in 2015[441]. 3 sites (2.03%) were classified as 'Poor'[442] and will have swimming restrictions for the 2023 bathing season[443]. This is an improvement from 2015 where 6 bathing waters were classed as 'Poor'[444]. 34 pollution events were reported to the EPA and resulting in beach closures[445].

The Bathing Water Quality in Ireland (2022) report[446] identifies wastewater incidents, agricultural run-off, dog fouling, and algal blooms as factors impacting bathing water quality across Ireland. Bathing water performance is generally improving, a factor which can be most clearly seen by the increasing number of 'Excellent' bathing waters (Table 11). Improvements are attributed to "on-going management and investment in urban wastewater infrastructure"[447].

Germany

By the end of the 2022 bathing season, Germany had a total of 2,292 bathing waters monitored in accordance with the EC Bathing Water Directive 2006/7EC, 362 of these are situated on the North and Baltic Seas, 36 are located on rivers and 1,894 are lakes[448]. In 2022, 2,068 bathing waters (90.2%) achieved 'Excellent' status[449]; down from 2,070 (90.3%) in 2015[450]. 2,239 sites (97.7%) were at the minimum required standard of 'Sufficient' or higher[451], down from 2,243 (97.9%) in 2015[452]. 14 bathing waters (0.6%) failed to meet the minimum standard and were categorized as 'Poor'[453], up from 5 (0.2%) in 2015[454]. There were 118 recorded cases in which bathing waters were temporarily closed[455]. 84 of these cases were attributed to Cyanobacteria and 23 incidents were attributed to a short-term pollution incident, typically occurring following a period of heavy

[436] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland
[437] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland
[438] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland
[439] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/ireland-2015-bathing-water-report
[440] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland
[441] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/ireland-2015-bathing-water-report
[442] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/ireland
[443] Bathing-Water-Quality-in-Ireland-2022.pdf (beaches.ie)
[444] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/ireland-2015-bathing-water-report
[445] Bathing-Water-Quality-in-Ireland-2022.pdf (beaches.ie)
[446] Bathing-Water-Quality-in-Ireland-2022.pdf (epa.ie)
[447] Bathing-Water-Quality-in-Ireland-2022.pdf (beaches.ie)
[448] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/germany
[449] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/germany
[450] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/germany-2015-bathing-water-report
[451] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/germany
[452] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/germany-2015-bathing-water-report
[453] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/germany
[454] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/germany-2015-bathing-water-report
[455] Water quality in bathing waters | Federal Environment Agency (umweltbundesamt.de)

rainfall[456]. Bathing water quality improved significantly in Germany between 1992 – 2001 and maintained a consistently high quality since 2001[457].

Denmark

By the end of the 2022 bathing season, Denmark had 1,039 bathing waters; of this, 917 are coastal and 122 are inland[458]. In 2022, 980 bathing waters (94.3%) achieved 'Excellent' status[459]; up from 881 (85.7%) in 2015[460]. 1,028 sites (98.9%) achieved the minimum required standard of 'Sufficient' or higher[461], up from 1,011 (98.3%) in 2015[462]. 3 sites (0.3%) failed to meet the minimum requirements[463], down from 6 (0.6%) in 2015[464].

France

By the end of the 2022 bathing season France had 3,370 bathing waters[465]. Of this, 2,074 are coastal and 1,296 are inland[466]. In 2022, 2,558 sites (75.9%) achieved 'Excellent'[467], up from 930 (72%) in 2015[468]. A total of 3,168 bathing waters (94.2%) met the minimum requirement of 'Sufficient' or higher[469]; up from 1,185 sites (91.7%) in 2015[470]. 93 sites (2.8%) failed to meet the minimum requirement and were classified as 'Poor'[471], down from 95 sites (2.8%) in 2015[472].

[456] Water quality in bathing waters | Federal Environment Agency (umweltbundesamt.de)
[457] Bathing water quality | Federal Environment Agency (umweltbundesamt.de)
[458] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/denmark
[459] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/denmark
[460] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/denmark-2015-bathing-water-report
[461] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/denmark
[462] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/denmark-2015-bathing-water-report
[463] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/denmark
[464] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/denmark-2015-bathing-water-report
[465] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france
[466] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france
[467] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france
[468] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/france-2015-bathing-water-report
[469] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france
[470] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/france-2015-bathing-water-report
[471] https://www.eea.europa.eu/publications/european-bathing-water-quality-in-2022/france
[472] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/country-reports-2015-bathing-season/france-2015-bathing-water-report

5.3 Identification Process and Criteria

The processes by which the selected EU jurisdictions identify bathing waters vary significantly to those in England and Northern Ireland. The respective processes and criteria are outlined in this section.

Republic of Ireland

Local authorities are responsible for identifying existing and proposed bathing water locations and submitting the compiled list to the Irish Environmental Protection Agency along with any reasons for change in water quality compared to the previous year[320],[321]. The identified bathing waters may not include any waters in which the authority has previously issued a permanent prohibition or advice against bathing.

Public participation in identifying potential bathing water areas is facilitated by local authorities; the Environmental Protection Agency have issued the 'Public advice on the identification of new bathing waters'[473] and 'A framework to assist Local Authorities in the assessment of submission for the identification of new bathing waters'[474] to aid in new bathing water nominations. Between June and July, any individual, or community body, can nominate an inland or coastal water currently used for bathing to be formally identified as a bathing site[475]. However, for sites to be formally identified, the bathing site must meet the relevant criteria for classification as well as display evidence of bathing and other uses (Table 13)[476]. In the 2019 EU review of compliance with the Bathing Water Directive[477], Ireland's approach to setting a different reference number of bathers according to the size of the beach is highlighted as an example of best practice which could be rolled out across the rest of the EU.

Table 13 – Requirements for Irish bathing water identification[478]

Item to Consider	Requirements
Location and Physical and Environment Information.	Bathing waters should be readily accessible without the influx of bathers resulting in environmental damage, specifically for areas within a region of designated natural heritage.
Beach users / Bathing numbers	A minimum of two user surveys should be conducted on separate days during the bathing season and when peak bathing is expected (in good weather conditions, on weekends/bank holidays and during peak times (11am-3pm)). In addition, information regarding number of bathers (swimmers and paddlers), users engaged in water activities, and general beach users should be provided and if possible, evidence to support historical trends in site usage. It is advised that sites proposed for bathing water status should have a minimum of 50 beach users or a minimum of 10-15 bathers for smaller sites/more remote areas at peak times. For larger, more accessible areas, at least 100 beach users or a minimum of 20 – 30 bathers should be expected at peak times. However, local authorities may decide to apply higher thresholds.
Car Parking availability and Facilities.	Sites should be able to cope with the influx of visitors without causing traffic obstructions, litter or noise pollution[332]. Where no designated parking is available, roadside parking should not impact road traffic or cause environmental damage. The absence of toilet facilities will not necessarily

[473] Public-Advice-Identifying-Bathing-Waters.pdf (beaches.ie)

[474] It is advised that sites proposed for designation should have a minimum of 50 beach users or a minimum of 10-15 bathers for smaller sites/more remote areas at peak times. For larger, more accessible areas, at least 100 beach users or a minimum of 20 – 30 bathers should be expected at peak times. However, local authorities may decide to apply larger thresholds.

[475] Public-Advice-Identifying-Bathing-Waters.pdf (beaches.ie)

[476] Public-Advice-Identifying-Bathing-Waters.pdf (beaches.ie)

[477] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

[478] Framework_LA_Bathing_Water.pdf (beaches.ie)

Item to Consider	Requirements
	impede identification but could result in faecal contamination. Additionally, litter management plans at bathing water sites are advised, particularly in cases where picnicking facilities are present.
Commercial Impact	Increased tourist-based revenue is often favoured, however an adequately developed commercial sector is required.
Safety	Although lifeguard provision is not required for the identification of a bathing site, Irish Water Safety provide a risk assessments[336] to local authorities regarding the potential need for lifeguard cover or safety equipment[337.479].
Local community support	Submissions that indicate approval from local communities are preferred. Uisce Éireann may need to be consulted in relation to newly proposed bathing sites where identification may impact the quality of water used for abstraction, or for sites that may be impacted by wastewater discharges.
Water Quality	In the absence of water quality information, local authorities should arrange monitoring programs for the proposed location. It is recommended that a minimum of five samples are to be taken in accordance with the BWD; at least 16 samples are required for formal classification however, monitoring can be continued under 'other monitored water' until a complete dataset is available.
Signage / Other information	Assessment of the current quality and level of existing signage and the consideration of costs and challenges of updating signage.
Planned infrastructure / WWTP developments.	There should be consideration of the potential positive and negative impacts to any environmental, urban, or infrastructural changes taking place on the proposed site.
Costs	The cost of monitoring should also be considered, especially for local authorities whereby monitoring existing sites causes challenges.

Each of the factors listed above is ranked between 1-5 (1 = Not Suitable, Low, Expensive and 5 = Very Suitable, High, Inexpensive). A weighted score of 65 or more is required for accepting the proposed site as an EU identified bathing water, and a minimum of 50 is required to be accepted as an 'other monitored water'[480]. An 'other monitored water' is monitored under the same bacterial threshold as outlined in the Bathing Water Regulations but is not formally managed or reportable under the regulations[481]. Additionally, bathing areas classed as 'other monitored waters' may not be sampled to the same minimum frequency and standard as those required at identified bathing waters.

A bathing water is un-classified when it is no longer recognised under the Bathing Water Regulations; typically, un-classification occurs when a bathing water is at 'Poor' status for five consecutive years[349]. Where local authorities feel it necessary to de-list a bathing water, approval from both the Environmental Protection Agency and the Department of Environment, Community and Local Government is required before implementation[350].

Germany

In Germany, the responsibility for new bathing waters nominations varies across the 16 federal states but the processes are set at national level by the Umweltbundesamt, Germany's central environmental authority. Any 'candidate' site which has been put forward by the federal states must go through a defined pre-identification process, including analysis of the location, development of an outline project to achieve bathing water quality targets and project initiation, planning and approval procedures[482]. The following information on the German

[479] Home - Water Safety Ireland
[480] Framework_LA_Bathing_Water.pdf (beaches.ie)
[481] Framework_LA_Bathing_Water.pdf (beaches.ie)
[482] Flussbadegewässer | Umweltbundesamt

approach is taken from discussions between Yorkshire Water and Umweltbundesamt in 2021 following the identification of Ilkley bathing water.

Location Analysis

This takes into account the local, natural, technical and socio-spatial conditions as well as identifying any potential sources of conflict. It includes exclusion criteria for rejection of potential bathing waters based on sources of serious danger – allowing early identification of sites with little or no prospect of success. A checklist is used alongside analysis and assessment of the water quality of the potential bathing water. This includes:

1. Sampling and analysis to determine bathing water quality.
2. Analysis of the upstream catchment area with its technical, geographical and hydrological properties and possible hazards and sources of pollution.

This process provides a high-level suitability analysis of the stretch for a bathing water.

Development of an outline project for the Bathing Water

If the location has been deemed suitable, work on the project outline can begin, providing the basis for discussion based on what is conceptually and spatially planned, for example:

- Where, when and how a new river bathing site would be opened.
- Responsibilities of different parties.
- Preliminary bathing water profile.
- An understanding of local requirements.

Further specification of the Bathing Water includes the following:

- Identification of what infrastructure is required, for example:
    - Traffic and access routes
    - Waste disposal and sanitary infrastructure
    - Water rescue
    - Information boards for bathers
    - Water access (beach, stairs, etc.)
    - Demarcation of the bathing water on the water side (chain of buoys)
- Identify what routine operation and maintenance is required:
    - Control and maintenance of the bathing and surrounding areas including litter management, removal of hazards and cleaning of public toilets.
    - Management of traffic
    - Updating bathing water signage boards including issuing of bathing bans and updating of early warning systems influenced by heavy rain, fluctuating water levels or flow velocities.
    - Provision of lifeguards
- Identification of key stakeholders, roles and responsibilities and financing opportunities.

This highlights the benefits of public - private partnerships and strategic alliances dependent on the type of bathing water, ownership structure and local and political conditions and the importance of clear roles and responsibilities for the various partners.

- Importance of riparian landowner's support.
- Identify the interests and capabilities of all actors early in the planning process.
- Identify responsibilities and potential burden sharing/ forming of public-private partnerships or joint companies to deliver.
- Potential funding opportunities such as local grants.
- The project outline should also contain profitability analysis to determine economic feasibility.

Project initiation, planning and approval procedures

In Germany the planning and approval process for river bathing areas is complex because water and land have differing responsible authorities and potentially multiple municipalities stretching upstream may need to co-ordinate to deliver water quality improvements.

Most German bathing waters pre-date the Bathing Water Directive (2006) – some bathing waters are on public land; however, others are private where landowners can generate revenues through ticketing access to the bathing waters.

- Planning considerations are therefore required for landscape planning of the river bathing area and calling in relevant expertise.
- Advanced planning applications are supported e.g., for riverine swimming pools where construction may be necessary.
- It may also be necessary to reallocate land, lease agreements, detailed urban planning and seek approvals for additional financial resources.

Due to the public interest, forming an interest group or development association can increase the chances of success bringing all relevant stakeholders together at an early stage and offering a forum for discussing proposals.

This process allows 'candidate' bathing water sites to be fully investigated and water quality suitably improved before a site gets full bathing water status.

Denmark

In Denmark, it is the responsibility of the individual municipal councils to identify bathing waters and forward a list to the Danish Agency for Water and Nature Management no later than April 1st of each year[483].

Unlike Ireland, Germany, and France, there is no mention of public participation in nominated new bathing sites in the Bathing Water Order[484]. In the 2019 EU review of compliance with the Bathing Water Directive[485], Denmark is highlighted as having 'room for improvement in the identification of bathing waters' with the report questioning the limited public consultation and the lack of available details in the process.

[483] Bekendtgørelse om badevand og badeområder (retsinformation.dk)
[484] Bekendtgørelse om badevand og badeområder (retsinformation.dk)
[485] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

Stantec and CREH have not been able to find any additional details for the process and criteria for new bathing waters in Denmark outside of what is stated in this publication.

France

According to France's national bathing water portal[486], France recognizes bathing waters as "areas visited frequently, where the additional influx of people during the bathing season exceeds ten bathers". This is much lower than comparative UK definitions and the lowest across the EU altogether.

Unlike other selected EU jurisdictions, bathing waters are then sub-divided into 'bathing waters' and 'organised bathing waters'. Both are reportable under the EU Bathing Water Directive. A 'bathing water' is defined in Article L1332-2 of the Public Health Code as any part of surface water that the municipality expects a large number of people to bathe, and where bathing has not been prohibited[487]. An 'organised bathing water' is defined as a site that is designed to encourage bathers (information, signs, parking, etc.), has had measures implemented to reduce contamination, with a minimum of two sanitary facilities and information regarding the site's safety and water quality.

To gain bathing water status, an individual is required to file a documented operating permit application to the Town Council. In accordance with Article L1332-1 of the Public Health Code[488], public or private bathing areas must make a declaration to the associated town hall before opening, with evidence that the bathing area meets the hygiene and safety standards outlined in Article L.1332-7 and L1332-8[489]. An individual wishing to nominate a bathing site can make a declaration to the commune before 30th November, or for overseas areas, before 31st March[490].

Municipalities are responsible for compiling a list of all bathing waters preceding each bathing season; public participation in identifying bathing waters is encouraged[491],[492]. Each municipality is responsible for completing a census of bathing waters located within its territory commencing no later than 1st July and extending to 30th September of each year, or in the case of overseas locations, 1st November - 31st January[493]. During this period, the public may submit suggestions for new bathing water sites which they believe meet the required standards[494]. Applications are recorded in a register that is stored at the town hall for one year[495].

Submissions and comments from the public are compiled into a list by the municipality for the following bathing season and are to include the factors listed below[496] in addition to any changes from the previous year. The final list is reported to the prefect and the director general of the regional health agency before January 31st (May 31st for overseas sites)[497].

---

[486] Health Ministry / Bathing water / Home (sante.gouv.fr)
[487] Article L1332-2 - Public Health Code - Légifrance (legifrance.gouv.fr)
[488] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000006686630
[489] www.legifrance.gouv.fr/affichCodeArticle.do?cidTexte=LEGITEXT000006072665&idArticle=LEGIARTI000006686633&dateTexte=&categorieLien=cid
[490] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641884
[491] Article L1332-1 - Public Health Code - Légifrance (legifrance.gouv.fr)
[492] Article L1332-1 - Public Health Code - Légifrance (legifrance.gouv.fr)
[493] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641884
[494] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641884
[495] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641884
[496] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000019506589
[497] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024642050

1. Name of the site
2. Name of the commune and institute for Statistics and Economic Studies (INSEE) number
3. Name of the natural / legal person responsible for the bathing water
4. Equipped or undeveloped swimming (used to define the 'organised' bathing water status)
5. Type of water
6. Duration and foreseeable dates of the bathing season

Sites granted bathing water status at the discretion of the municipality, are then listed in the register of protected areas as per Article R.212-4 of the Environmental Code,[498]. The list of bathing waters is to be forwarded to the Minister responsible for health by the prefect of no later than 30th April (31st August for overseas sites[499]).

In the 2019 EU review of compliance with the Bathing Water Directive[500], France is highlighted as having 'room for improvement in the identification of bathing waters' with the report questioning the lack of easily accessible information and opportunities for public comment. The report also states specific recreational waters it believes should have been granted bathing water status (namely 'Plages de poches' in Brittany, rocky inlets close to Marseille, and the long sandy beaches in Aquitaine). This, it believes is due to a lack of consistency in approach when identifications occur at municipality level.

[498] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641889
[499] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000024641889
[500] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

5.4 Sampling and Testing

Table 14 highlights differences in bathing water sampling and monitoring approaches across the selected EU jurisdictions.

Table 14 – Bathing Water sampling and monitoring approaches across selected EU jurisdictions

	Ireland [501]	Germany [502]	Denmark [503]	France [504]
Bathing water season	1st June – 15th Sept	15th May – 15th Sept	1st June – 1st or 15th Sept depending on bathing water	Varies by bathing water and region. Year round for overseas administrations
Sampling numbers / frequency (statutory)	Minimum of 4 per bathing season (16 in total over four years). 3 per season for geographically remote sites.	Minimum of 4 per bathing season (16 in total over four years)	Minimum of 4 for shorter bathing season, 5 for extended bathing season and 10 for sites at 'Poor'	Minimum of 4 per bathing season (16 in total over four years). 3 per season for geographically remote sites.
Sampling numbers / frequency (normal practice)[505]	Varies by local authority and bathing water performance. Average 10.5 samples per season	Average 5.7 samples per season	Average 9.1 samples per season	Varies by local authority and bathing water performance. Average 10.2 samples per season
Monitoring Location	Most bathers or greatest risk of pollution	Most bathers or greatest risk of pollution	Most bathers or greatest risk of pollution	Most bathers or greatest risk of pollution
Testing parameters	*E. coli*, IE	*E. coli*, IE	*E. coli*, IE	*E. coli*, IE and Total Coliforms, Presence of foams, phenols, water colour, water transparency and others depending on field observations

Republic of Ireland

For each individual bathing water, the local authority is responsible for establishing a monitoring calendar and forwarding this to the Environmental Protection Agency by the 24th of March[506]. All samples should be taken within four days of the date stated on the monitoring calendar. It is the local authority's responsibility to conduct monitoring, inspections, and investigations for all identified bathing waters[507].

[501] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[502] REVOSax Landesrecht Sachsen - Saxon Bathing Water Ordinance – SächsBadegewVO
[503] https://mst.dk/natur-vand/vandmiljoe/badevand/#
[504] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000038373803
[505] Individual country pages from European bathing water quality in 2022 — European Environment Agency (europa.eu)
[506] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[507] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)

A minimum of four samples are collected and analysed per bathing season, with one sample to be taken shortly before the bathing season commences[508]. Exceptions are provided for bathing waters that are situated in a region whereby the Environmental Protection Agency believes is subjected to specific geographical constraints; in this circumstance, a minimum of three samples are required per bathing season[509]. Sampling dates are to be distributed throughout the bathing season, with the interval between sampling dates never exceeding one month[510]. Nevertheless, many local authorities in the Republic of Ireland may sample once a fortnight, or for certain bathing waters, once a week.

If a short-term pollution event has been identified, one additional sample is to be collected to confirm the pollution incident has ended; this sample, however, is not included in the bathing water quality dataset[511]. The monitoring calendar may be suspended by the local authority, with the approval of the Environmental Protection Agency, in the case of abnormal situations[512]. New samples are required to be taken immediately after the abnormal situation has ended to replace any that were not collected during the monitoring calendar suspension[513].

The Republic of Ireland aims to analyse samples on the same working day in which they were collected[514]. However, if this is not possible, samples are to be processed and analysed within no more than 24 hours[515].

Denmark

Sampling and monitoring is conducted by municipal councils with a minimum of four samples required for each bathing site per year with the first sample being taken 5-10 days preceding the start of the bathing season[516]. For sites with an extended bathing season (through to 15th September) a minimum of five samples are collected[517]. Samples are staggered throughout the bathing season with the interval between samples never exceeding 30 days[518]. However, in circumstances where bathing water quality is recorded as statistically lower than 'Sufficient', the number of samples is to be increased to a minimum of 10 per season. All samples should be taken within four days of the date stated on the monitoring calendar issued to the Danish Agency for Water and Nature. The chosen monitoring point should be the location within the bathing water whereby most bathers are anticipated or, where the greatest risk of pollution is expected[519].

There is an option with the EU Bathing Water Directive to 'group' bathing waters if there is deemed to be contiguity, similar water quality assessments and common risk factors. This option has not been transposed into UK bathing water Regulation. It is however practiced in Denmark, which had 18 bathing waters in eight groups in 2016[520]. This approach however was scrutinized within the 2019 EU review of compliance with the

[508] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[509] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[510] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[511] Ireland — European Environment Agency (europa.eu)
[512] Ireland — European Environment Agency (europa.eu)
[513] Ireland — European Environment Agency (europa.eu)
[514] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[515] S.I. No. 79/2008 - Bathing Water Quality Regulations 2008 (irishstatutebook.ie)
[516] https://www.retsinformation.dk/eli/lta/2016/917#id9bfb7a8c-de2d-4083-bf6e-89c560fbdf21
[517] https://www.retsinformation.dk/eli/lta/2016/917#id9bfb7a8c-de2d-4083-bf6e-89c560fbdf21
[518] https://www.retsinformation.dk/eli/lta/2016/917#id9bfb7a8c-de2d-4083-bf6e-89c560fbdf21
[519] https://mst.dk/natur-vand/vandmiljoe/badevand/#
[520] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

Bathing Water Directive where bathing waters within the same groupings were assigned difference classifications.

Denmark has an 'Alert Level' system for Cyanobacteria, similar to that used by Germany and discussed in Chapter 3.5. These alert levels trigger management actions including testing water and foams and scums for cyanobacteria cell counts, chlorophyll-a and increased visual inspections[521].

France

It is the responsibility of the bathing water managing authority to establish the bathing water monitoring program, but should include, as a minimum, daily visual inspections throughout the bathing season[522]. However, samples may also be collected by the agents of the regional health agency[523]. The bathing season in mainland France typically occurs between 15th June – 15th September, however, will vary by region due to climate variations[524]. The bathing water season may be shorter for freshwater sites. In contrast, the overseas administrative areas monitoring is conducted all year[525].

Samples are taken twice every month throughout the bathing season, with a minimum requirement of four samples per bathing season[526]. An exception to this would be in circumstances where the bathing season does not exceed eight weeks or where the site is located in an area with geographical constraints. In these cases, sampling may be reduced to three samples[527].

In circumstances where a bathing water has remained 'Sufficient' or greater the number of samples collected may be reduced but may not fall below one sample per month; total sample count must not fall below four samples per bathing season[528]. For coastal bathing water sites, certain towns may increase sampling frequency to exceed the minimum regulatory requirements, with certain areas collecting >20 samples per bathing season[529].

Bathing water quality assessment is conducted with the provision of the Public Health Code and focusses on microbial analysis of *E. coli* and IE and physical and chemical parameters: the presence of foams/phenols; water colour; and transparency[530]. Depending on field observations, typically for inland bathing waters, other parameters may also be measured: pH, nitrate, phosphates, chlorophyll and micro-pollutants[531].

France has an 'Alert Level' system for cyanobacteria similar to that used by Germany and discussed in Chapter 3.5. These alert levels trigger management actions including testing water and foams and scums for cyanobacteria cell counts and increased visual inspections[532].

Germany

[521] https://cdn.who.int/media/docs/default-source/wash-documents/who-recommendations-on-ec-bwd-august-2018.pdf?sfvrsn=5c9ce1e0_6
[522] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000038373803
[523] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000043539401
[524] Health Ministry / Bathing water / Implementation of the control (sante.gouv.fr)
[525] Health Ministry / Bathing water / Implementation of the control (sante.gouv.fr)
[526] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000038373803
[527] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000038373803
[528] Health Ministry / Bathing water / Implementation of the control (sante.gouv.fr)
[529] Health Ministry / Bathing water / Implementation of the control (sante.gouv.fr)
[530] https://baignades.sante.gouv.fr/baignades/editorial/en/controle/critere.html
[531] https://baignades.sante.gouv.fr/baignades/editorial/en/controle/critere.html
[532] https://cdn.who.int/media/docs/default-source/wash-documents/who-recommendations-on-ec-bwd-august-2018.pdf?sfvrsn=5c9ce1e0_6

Primarily the responsibility for bathing water monitoring is the responsibility of either the lower authority for health or district administrative authority with the federal state. The exceptions are Baden-Wuttemberg, where the monitoring calendar is produced by the Ministry of Social Affairs[533] and for Schleswig-Holstein where monitoring is done at district and city level[534]. The monitoring location must be where most bathers are anticipated or where the risk of pollution is greatest[535].

Monitoring commences shortly before the bathing season begins and samples are taken no later than four days succeeding the date specified in the monitoring calendar[536]. Monitoring responsibilities include visiting, sampling and analysis of data collected[537]. Additional monitoring parameters for coastal bathing waters may be required depending on the federal state and the particular bathing water. For example, Mecklenburg-Western Pomerania monitor temperature and pH and in selected bathing sites choosing to record visibility depth.

In addition to the criteria outlined in the Bathing Water Directive for inland bathing waters, the Bathing Water Ordinance for Berlin also outlines the quality requirements displayed in Table 15. The monitoring of these additional parameters is done at the discretion of the local managing authority and varies by federal state.

Table 15 – Additional parameters to be measured for bathing waters in Berlin[538]

Parameter	Minimum frequency of sampling
Microbiological parameters	
Total coliforms (/100 ml)[539]	monthly
Physical and chemical parameters	
Air temperature (°C)	14 days
Water temperature (°C)	14 days
pH value	14 days
Conductivity (µS/cm)	14 days
Transparency (m)	14 days
Dissolved oxygen (% saturation (O_2))	14 days
Ammonium (mg/l NH_4)	14 days
Nitrate (mg/l $NO_{3)}$	14 days
Total phosphorus (mg/l TP)	14 days
Orthophosphate (mg/l PO_4)	14 days
Biological parameters	
Phytoplankton (Frequency)	14 days

[533] State law BW BadegVO | State standard Baden-Württemberg | Complete Edition | Ordinance of the Ministry of Social Affairs and the Ministry of the Environment on the Quality and Management of Bathing Water (Bathing Water Ordinance - BadegVO) of 16 January 2008 | valid from: 01.01.2008 (landesrecht-bw.de)

[534] Schleswig-Holstein - § 3 BadegewVO | Landesnorm Schleswig-Holstein | Überwachung, Untersuchung, Untersuchungsstellen | § 3 - Überwachung, Untersuchung, Untersuchungsstellen | gültig ab: 01.10.2018 (juris.de)

[535] BayBadeGewV: § 3 Monitoring - Citizen Service (gesetze-bayern.de)

[536] REVOSax Landesrecht Sachsen - Saxon Bathing Water Ordinance – SächsBadegewVO

[537] REVOSax Landesrecht Sachsen - Saxon Bathing Water Ordinance – SächsBadegewVO

[538] https://gesetze.berlin.de/bsbe/document/jlr-BadGewVBE2008pAnlage1/format/xsl?oi=mqDGHSaWXE&sourceP=%7B%22source%22%3A%22TOC%22%7D&docAcc=true

[539] It is not clear to Stantec and CREH why you would need to measure Total Coliforms if you are already collecting *E.coli* and IE data.

Parameter	Minimum frequency of sampling
Microcystin (µg/l)	14 days

Germany also uses the 'grouping' approach and like Denmark was scrutinized by the 2019 EU review of compliance with the Bathing Water Directive[540] for differences in classifications within groups and for a lack of justifications of the groupings.

Germany has an 'Alert Level' system for cyanobacteria which was discussed in Chapter 3.5. 'Alert Level 2' triggers management actions including testing water and foams and scums for total phosphorus, cyanobacteria biovolume, cyanobacterial chlorophyll-a and chlorophyll-a and increased visual inspections. Using these parameters, the toxicity of the proliferation is assessed and advice against bathing updated[541].

Results from the bathing water sampling conducted by the federal states are forwarded to and summarised by the Federal Environment Agency (Umweltbundesamt). The summaries are then distributed to the hydrological state service and the higher water authority before they are forwarded to the European Commission via the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

[540] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

[541] https://cdn.who.int/media/docs/default-source/wash-documents/who-recommendations-on-ec-bwd-august-2018.pdf?sfvrsn=5c9ce1e0_6

5.5 Reporting and Communication

This section has not been broken down into individual jurisdictions as it was felt that the processes and outputs are inherently similar. Any differences in approaches are summarized below.

The authorities responsible for completing the bathing water profile vary, and in the case of Germany, may differ across the 16 federal states. In Denmark and Ireland, it is the responsibility of the local authorities / municipal councils to complete the bathing water profile. In Germany this responsibility is predominantly assigned to the various lower state health authorities or the local competent authority. In France, the Public Health Code states it is the responsibility of the private individual or the local authority.

Denmark is the only country that provides guidance in the production of the bathing water profiles. Of particular note is the requirement to advise the public within the bathing water profile of any links between pollution risk and tidal phase or conditions, for example if pollution was more regularly seen coming on the ebb tide.

Whilst information provided in the bathing water profile differs vastly and in the case of Germany and Denmark, differs across the various states and municipalities, there are no examples of best practice obvious to Stantec and CREH which offer an improvement upon what is currently produced for England. In fact, the benefits of a single entity managing and compiling the profiles, as is the case in England, Northern Ireland and the Republic of Ireland offers a greater consistency and quality of approach than seen in Denmark, Germany and France.

Table 16 – Summary of Content within Bathing Water Profiles on each country's website

	Ireland	Denmark	Germany	France
Site Name	✓	✓	✓	✓
Regulated or unregulated site	✓		✓	
Site Description	✓	✓**	✓	
Awards & Amenities*	✓	✓**	✓	
Water Quality Status	✓	✓**	✓	✓
Investigation body	✓	✓**	✓	
Sample dates	✓	✓**	✓**	
Water Quality Results	*E. coli*, IE	*E. coli*, IE, pH, Visibility depth, water temperature	*E. coli*, IE, pH Temperature, visibility depth,	Not displayed
Water Quality Description	✓		✓	
Water Quality History	✓	✓**	✓**	✓
Out of Season Water Quality	✓			
Historical Reported Restrictions (short term pollution) / bans	✓	✓**	✓	
Interactive web map	✓	✓	✓	✓
Number of bathers		✓**		
Risk of cyanobacteria / phytoplankton proliferation		✓**	✓**	
Number of samples				✓

* To include information such as lifeguarded zone, disability access, parking, public transport, toilets, dogs permitted, bins etc.
** Differs across municipalities/states

5.6 Lessons Learned

Public Consultation on Bathing Water Applications

The 2019 EU review of the compliance with Bathing Water Directive[542] highlights the UK approach to the public consultation of bathing water designations as an example of best practice in this area for the rest of the EU to follow.

Pre-Identification of a Bathing Water

The German approach of 'investigating first, then deciding on status' as part of a structured pre-identification process has a lot of benefits and would offer a potential framework for future UK bathing water management. This approach is in direct contrast to the current UK model of 'determining the status first and then investigating'.

Stantec and CREH recommend consideration of a structured pre-identification process as part of any future review of bathing water regulations within England and Northern Ireland.

'Candidate' Sites or 'Working Towards Bathing Water Status'

The German approach of 'investigating first, then deciding on status' allows the main authorities to put plans and measures in place to address water quality, planning and access issues associated with these 'candidate' bathing waters. This has the effect that all sites granted bathing water status should have 'Good' or 'Excellent' water quality at the time of identification. This should be considered as one of several key factors explaining why Germany is able to achieve the bathing water performance figures stated in Table 9.

Similarly, the Republic of Ireland does not grant a site bathing water status until a minimum of 16 samples taken over four bathing seasons have been collected. This is done in order to appropriately classify the 'candidate' site upon such time as bathing water status is granted.

Stantec and CREH recommend use of an interim 'Candidate' or 'Working Towards Status' as structured pre-identification process as part of any future review of bathing water Regulations.

Tiered Systems of Protection for Recreational Waters

The Republic of Ireland has a tiered approach to the legal protection of recreational waters, having both 'bathing waters' and 'other monitored waters'. Locations can be assigned 'other monitored waters' if they are in the process of applying for bathing water status or if they don't meet certain criteria for bathing water identification.

This approach allows the Republic of Ireland a degree of flexibility in identifying bathing waters and will be a factor in their overall performance.

[542] Support to the assessment of Member States' compliance with the Bathing Water Directive 2006/7/EC (BWD) - Final EU Overview Report (Milieu Consulting SPRL) March 2019

This multi-tier approach to the protection of recreational waters is something which has been raised for discussion as part of the OEP Project Belisama Bathing Water stakeholder groups.

France also has a tiered approach, distinguishing between 'bathing waters' and 'organised bathing waters'. This is somewhat different from Ireland, however, as both tiers are reportable under the EU Bathing Water Directive.

Stantec and CREH recommend consideration of a tiered classification system as part of any future review of bathing water Regulations within England and Northern Ireland.

Coastal versus Inland Bathing Waters

Across the EU in 2022 approximately two thirds of the 21,973 bathing waters were coastal, and one third inland. Across coastal and inland waters 85.6% achieved an 'Excellent' classification. However, there is a significant difference between coastal and inland bathing waters. Between 2009 and 2022 the percentage of EU coastal bathing waters achieving 'Excellent' has varied from 81-89%, compared to 60-82% for inland waters with lakes performing better than riverine sites[543]. The bathing water quality of coastal waters is generally better than that of inland waters because of the greater dispersion and dilution and quicker bacteria decay. Especially in summer, riverine sites in particular are more susceptible than lakes and coastal areas to short-term pollution caused by heavy summer rains or droughts. Lake sites tend to have smaller catchment areas, fewer impacting discharges and can be easier to improve than other sites.

England and Northern Ireland should therefore expect bathing water performance to decrease if the proportion of inland (in particular, riverine) to coastal bathing water starts to align with that across the EU.

Sampling and Monitoring

England is the only jurisdiction analysed where there is no provision for the bathing water sample point to be located at an area with the highest risk of pollution. Northern Ireland is shown to be aligned with the selected EU jurisdictions on this issue.

England, in reducing sampling frequency at sites which are consistently achieving 'Good' or 'Excellent' classifications, is coming in line with what is already occurring across many of the selected EU jurisdictions[544]. Whilst providing economic efficiencies this does increase the risk of misclassification as stated in Chapter 3.5. Northern Ireland has a higher average number of samples per bathing water than any of the selected jurisdictions.

It is interesting to note that the monitoring calendar systems in France, Denmark and Germany can be open to manipulation of results. With fewer samples being taken at many sites and four day windows over which any single sample can be taken, there is the opportunity for the sampler to wait until the day which is most favourable towards exhibiting excellent water quality. Stantec and CREH are not suggesting that this is occurring, only rather that the opportunity for it to occur may exist.

[543] European bathing water quality in 2022 — European Environment Agency (europa.eu)
[544] Although the reasons for reduced sampling differ by jurisdiction

In all other matters both England and Northern Ireland are very similar in approaches to the sampling and monitoring of coastal bathing waters. It can be noted though that France, Denmark and Germany all require additional sampling parameters to help monitor and assess inland bathing waters.

Germany, Denmark and France also have various 'alert level' systems with published management actions in the event of a cyanobacteria proliferation for inland waters. Whilst France and Denmark test for a selection of aesthetic and measured parameters, Germany samples a much wider range of measured parameters. The German approach to sampling and assessing cyanobacteria risk for inland bathing waters has been previously highlighted in Chapter 3.5 as a recommended approach to the cyanobacteria toxins problem.

If England and Northern Ireland are likely to gain a significant number of new inland bathing waters in the coming years, more detailed consideration and published guidelines for responding to cyanobacteria proliferations, akin to the German approach, will likely be required.

Recommendations on sampling and monitoring can be found in Chapter 3.5.

Reporting and Communication

Stantec and CREH do not believe any of the approaches taken by the selected EU jurisdictions are preferable to those currently being employed in England. In fact, both England and Northern Ireland offer much greater consistency and quality of communication than many jurisdictions by managing the updating and reporting of the bathing water profiles at national rather than regional or local authority level.

Other Reasons for Performance

Climatic reasons including higher number of average hours of sunlight per day[545] and lower rainfall leading to fewer short term pollution events will all help improve bathing water quality. This helps to explain why the likes of Cyprus, Greece and Croatia are amongst the top five performing EU jurisdictions.

Bathing water quality in Europe has improved markedly in recent decades and across all the selected jurisdictions and the EU as a whole it is the large investments in urban wastewater treatment plants and improvements in wastewater networks which are credited as having led to the drastic reduction in organic pollutants and pathogens released in untreated or partially treated urban wastewaters[546].

In particular, it is the investment in UV disinfection at wastewater treatment works discharging to rivers that is likely to be having the biggest single impact. The UWWT requires UV disinfection (or equivalent) to be installed on all wastewater treatment works with a population equivalent of greater than 10,000[547]. Both Denmark and Germany have had significant numbers of inland bathing waters for greater than 10 years, which has meant that under the UWWT the main authorities have had to ensure UV disinfection was applied to all impacting wastewater treatment works. This isn't the case within the UK which has fewer inland, and in particular riverine, bathing waters. This investment in UV disinfection will improve water quality at inland bathing waters and reduce the base loads in the main rivers impacting the coastal bathing waters.

[545] Increased UV exposure will cause faecal indicators organisms to decay quicker within the aquatic environment.
[546] Quality of Europe's bathing waters remains high • Water News Europe
[547] Refer to Section 2.4

This impact is then magnified as fewer samples are taken, with small reductions in base loads having a far greater impact on the percentile calculation than when more samples are taken.

Other key factors influencing performance include the mix of arable and pastoral agriculture, agricultural policy and enforcement of minimal standards. At national level however bathing water performance cannot be easily linked to comparative assessments of these factors with, for example, indicators such as livestock densities per hectare being significantly lower in France (0.7 livestock units per hectare) than Denmark (1.6 livestock units per hectare)[548].

Some of the key reasons for the performance relative to England and Northern Ireland are summarized in Table 17.

Table 17 – Reasons for Bathing Water Performance Relative to the England and Northern Ireland

	Positive Reasons for Performance Relative to UK	Negative Reasons for Performance Relative to the UK
Denmark 94.3% at 'Excellent'	Greater investment in UV disinfection of inland wastewater treatment discharges for UWWT Higher average number of hours of sunlight per year and lower bathing season rainfall.	Higher percentage of inland bathing waters
Germany 90.2% at 'Excellent'	Can address key water quality issues prior to formal identification. Greater investment in UV disinfection of inland wastewater treatment discharges for UWWT Higher average number of hours of sunlight per year and lower bathing season rainfall.	Higher percentage of inland bathing waters and large river catchments
Northern Ireland (80.8% at Excellent)		
Ireland 79.1% at 'Excellent'	Greater investment in UV disinfection of inland wastewater treatment discharges for UWWT	Higher percentage of inland bathing waters Lower rates of wastewater treatment to UWWT standards
France 75.9% at 'Excellent'	Large number of bathing waters in overseas territories with hotter climates Greater investment in UV disinfection of inland wastewater treatment discharges for UWWT Higher average number of hours of sunlight per year and lower bathing season rainfall.	Higher percentage of inland bathing waters and large river catchments Significant inconsistencies in management approaches
England (71.7% at Excellent)		

[548] Agri-environmental indicator - livestock patterns - Statistics Explained (europa.eu)

Chapter 6: Comparison with Approaches from Selected Worldwide Jurisdictions

As part of the review of existing bathing water Regulations, Stantec and CREH have been asked to compare bathing or recreational water management approaches in England and Northern Ireland against four other selected approaches and jurisdictions.

There are three main sets of guidelines and regulations for the management of recreational waters: WHO guideline standards, the EU Bathing Water Directive, and the US Recreational Water Quality Criteria (RWQC)[549]. Other approaches exist, but these three are the only recognized systems based on clear, peer reviewed, epidemiology published in international epidemiological literature[550]. As the EU Bathing Water Directive has been covered extensively, this chapter will cover the WHO guidelines, US RWQC and seek to highlight other unique approaches to recreational water management. It should be noted that criteria within the EU Directive are very similar to WHO guideline criteria, with both systems based on the same epidemiology studies utilizing randomized control trials. This method is favoured by both approaches as it removes the bias of voluntary self-selection, whereby volunteers are more likely to come forward if they are experiencing gastro-intestinal problems or symptoms.

6.1 Criteria for Selection

In selecting jurisdictions for comparison, Stantec and CREH have considered the basis of the guidelines or regulations and the same range of criteria used for selecting the EU jurisdictions, including:

- Wastewater collection and treatment systems
- Climate
- Bathing / Recreational water performance
- Coastal and inland bathing waters mix
- Degree of urbanization

Availability of data was also introduced as a selection criteria, as unlike the EU, many worldwide jurisdictions are not required to publish information on bathing water management. In larger jurisdictions such as the United States and Australia, Stantec and CREH have sought to provide the initial assessment at state level for the states with climatic similarities to the UK. High level comparisons are shown in Table 18.

[549] EC, European Commission. Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Off. J. Eur. Union. 2006, 64, 37–51.
EPA. Recreational Water Quality Criteria; US Environmental Protection Agency: Washington, DC, USA, 2012.
WHO. Volume 1, Coastal and fresh waters. Chapter 4: Faecal Pollution and Water Quality 51–101. In Guidelines for Safe Recreational Water Environments; World Health Organization: Geneva, Switzerland, 2003.

[550] Review of epidemiological studies on health effects from exposure to recreational water (Pruss) 1998. Part of the review of epidemiology for WHO 2003 guidelines

Assessment of the Implementation of Environmental Law in Relation to Bathing Waters

Chapter 6: Comparison with Approaches from Selected Worldwide Jurisdictions

Table 18 – Comparison of worldwide jurisdictions to England and Northern Ireland according to descriptive criteria

	Comparable wastewater collection and treatment	Comparable Köppen Climate Classification [551]	Comparable average bathing season temperature (13-19°C)	Comparable average bathing season rainfall (40-80 mm)	Percentage of bathing waters achieving Excellent (>85%)	Inland bathing waters present?	Coastal bathing waters present?	Comparable Urbanized land area (5-11%)	Total count	Availability of Data
Australia (Tasmania)	☑	☑	☑			☑	☑		5	Fair
Australia (New South Wales)					☑	☑	☑		3	Fair
Australia (Victoria)		☑		☑		☑	☑		4	Fair
Brazil (Santa Caterina)	☑	☑		☑			☑		4	Limited
Brazil (Rio Grande do Sul)	☑	☑					☑		3	Limited
Canada (British Colombia)	☑		☑			☑	☑		4	Fair
Israel						☑	☑		2	Fair
Japan		☑		☑		☑	☑		4	Extensive
New Zealand		☑	☑	☑		☑	☑		5	Fair
Norway	☑		☑	☑		☑	☑		5	Limited
Singapore					☑		☑		2	Fair
South Africa						☑	☑		2	Fair
South Korea						☑	☑		2	Limited
Switzerland		☑	☑			☑		☑	4	Fair
USA (Connecticut)	☑	☑		☑		☑	☑		5	Fair
USA (Washington)	☑	☑	☑			☑	☑		5	Limited

[551] Present and future Köppen-Geiger climate classification maps at 1-km resolution | Scientific Data (nature.com)

The jurisdictions with the highest scores were deemed by Stantec and CREH to represent the most useful comparative locations, due to the higher number of similarities with UK. There are five jurisdictions based on this analysis which have a total score of 5 or more; Australia (Tasmania), New Zealand, Norway and the USA (Connecticut and Washington) which cover both the WHO and US RWQC. However, it was felt that the limited data available for Norway[552] meant that it would provide a limited comparative assessment. Similarly, it was felt that there would be limited benefit in comparing two different states within the United States. Japan was therefore brought in as it was felt that the extensive information available, allied with a unique approach to the management of recreational water would offer a useful comparison.

The following jurisdictions were therefore selected to be included as part of this comparison:

- Australia (Tasmania)
- Japan
- New Zealand
- USA (Connecticut)

As the frameworks for managing recreational waters are very different from those based on the EU Bathing Water Directive, the selected worldwide jurisdictions will be compared one at a time to avoid confusion.

The focus of these assessments is therefore the wider approaches taken to recreational water management, rather than specific issues such as identification of sites. Issues such as identification, for example, aren't as directly comparable when considering that each of the jurisdictions considered have guidelines and / or regulations covering all recreational water users and not just 'bathers'.

[552] Whilst Norway is part of the European Economic Area it is not bound by the EU Bathing Water Directive, instead utilising its own approaches to recreational water management.

6.2 Australia (Tasmania)

Tasmania has a population of approximately 570,000, with almost 40% of its inhabitants living in the Greater Hobart area (state capital) [553], and a landmass of 68,401 km^2. This is in comparison to England at 130,279 km^2 and Northern Ireland at 11,130 km^2.[554]

Tasmania scored highly in Table 18, with similarities in climate, bathing season temperatures, sewerage systems and has a mix of both coastal and freshwater monitored recreational waters. There is good data availability of bathing water performance.

Climate and Geography

Tasmania has a generally mild year-round climate dominated by maritime air masses over much of the land. Average annual temperatures range from between 6 to -1ºC in the winter and 16 to 6 ºC in the summer and annual average precipitation of 2500mm[555]. Whilst rainfall is significantly higher than the UK, Tasmania's southeast region can suffer from periods of drought, with summer rainfall as low as 32 mm in some months in this region and annual averages of 492mm.

Landcover is not directly comparable with the UK as although a large proportion of Tasmania is used for farming livestock (24% of land cover), 22% is forested and only 0.1% is urbanised[556]. This means many of Tasmania's catchments are extensively covered by natural woodland which has been found to be positively associated with good river quality and stable trends[557].

Guidelines / Regulation

Recreational water risk management guidelines in Australia are based upon frameworks developed by the WHO including its 2003 publication '*Guidelines for safe recreational water environments'*[558].

The principles of these international guidelines are used to inform Australia's '*Guidelines for Managing Risks in Recreational Waters'* 2008.[559] These guidelines were built upon the previous '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*' (2000)[560].

The '*Guidelines for Managing Risks in Recreational Waters'* are non-mandatory guidelines designed to protect human health from threats posed by the recreational use of coastal, estuarine and fresh waters.

State and territory governments use these guidelines as a tool for:

---

[553] https://en.wikipedia.org/wiki/Tasmania
[554] https://en.wikipedia.org/wiki/Great_Britain
[555] Maps of average conditions (bom.gov.au)
[556] tas-practices-grazing.pdf (agriculture.gov.au)
[557] Microsoft Word - Tas state-wide patterns in river condition FINAL (002).docx (nre.tas.gov.au)
[558] Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters (who.int)
[559] https://www.nhmrc.gov.au/about-us/publications/guidelines-managing-risks-recreational-water#block-views-block-file-attachments-content-block-1
[560] https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf

- assuring the safe management of recreational water environments, so that as many people as possible can benefit from using the water; and
- developing legislation and standards appropriate for local conditions and circumstances.

Tasmania is yet to update state legislation in line with the 2008 guidelines[561] with the Tasmania state level '*Recreational Water Quality Guidelines'* 2007[562] based on the previous '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality' (2000)*. This assessment therefore focusses on the latest Australian national guidelines rather than Tasmania state level legislation.

Management Approaches

The Australian '*Guidelines for Managing Risks in Recreational* Waters' advocate a more preventative approach to recreational water management, focusing on assessing and managing hazards and hazardous events within a risk-management framework. These guidelines offer an alternative to systems of percentage compliance with counts of faecal indicators to assess and protect the microbial quality of water.

The guidelines are more wide reaching than those in the UK, covering a range of factors impacting human health including drowning, impact injuries, physiological harm, infection, poisoning and toxicoses. They are also applicable to any public coastal, estuarine or freshwater areas where a significant number of people use the water for recreation[563], not just bathing. Each state is responsible for the identification / un-classification of recreational waters with no set processes or eligibility criteria for this set out in national guidelines. A summary of the guidelines is shown in Table 19.

Table 19 – Summary of Guidelines[564]

Characteristic	Guideline	Comment
Physical Hazards	Recreational water bodies and adjacent areas should be free of physical hazards, such as floating or submerged objects that may lead to injury. Where permanent hazards exist, for example rips and sandbars, appropriate warning signs should be clearly displayed.	Injuries related to these objects may result during activities such as swimming, diving and water skiing.
Sun, heat and cold water temperatures	The temperature of recreational water bodies should be in the range 16–34°C. Recreational water users should be educated to reduce exposure to ultraviolet radiation (UVR), particularly during the middle of the day.	Exposure to cold water (<16°C) can result in hypothermia (excessive heat loss) or a shock response. Prolonged exposure to waters >34°C may result in hyperthermia (heat exhaustion or heat stress). Levels of UVR vary throughout the day, with a

[561] https://nre.tas.gov.au/water/water-monitoring-and-assessment/water-monitoring/surface-water-quality/water-quality-guidelines#ANZECCMicrobiologicalGuidelines
[562] https://www.health.tas.gov.au/sites/default/files/2021-12/Recreational_Water_Quality_Guidelines_DoHTasmania2007.pdf
[563] Recreational use is defined here as "all activities relating to sport, pleasure and relaxation that depend on water resources (e.g., sunbathing, swimming, diving, boating, fishing and sailboarding). Page 15; Guidelines for Managing Risks in Recreational Water
[564] Table 1.5 'Guidelines for Managing Risks in Recreational Waters'

Characteristic	Guideline	Comment
		maximum occurring during the 4 hours around noon.
Microbial Quality	Preventive risk management practices should be adopted to ensure that designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin.	The main health risks are from enteric viruses and protozoa.
Cyanobacteria and algae in fresh waters	Fresh recreational water bodies should not contain: • ≥10 µg/L total microcystins; ≥50 000 cells/mL toxic Microcystis aeruginosa; or biovolume equivalent of ≥4 mm^3/L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or • ≥10 mm^3/L for total biovolume of all cyanobacterial material where known toxins are not present; or • cyanobacterial scums consistently present.	A single guideline value is not appropriate. Instead, two guideline values have been established, based on known risks associated with known toxins and probability of health effects caused by high levels of cyanobacterial material. A situation assessment and alert levels framework for the management of algae / cyanobacteria in recreational waters has been developed that allows for a staged response to the presence and development of blooms.
Cyanobacteria and algae in coastal and estuarine waters	Coastal and estuarine recreational water bodies should not contain: • ≥10 cells/mL *Karenia brevis* and / or have *Lyngbya majuscula* and / or Pfiesteria present in high numbers.	A situation assessment and alert levels framework for the management of algae / cyanobacteria in recreational waters has been developed that allows for a staged response to the presence and development of blooms.
Dangerous aquatic organisms	Direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms (e.g., box jellyfish and bluebottles). Where risks associated with dangerous aquatic organisms are known, appropriate warning signs should be clearly displayed.	Risks associated with dangerous aquatic organisms are generally of local or regional importance and vary depending on recreational activities.
Chemical hazards	Waters contaminated with chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreational purposes.	Chemical contamination can result from point sources (e.g., industrial outfalls) or from run-off (e.g., from agricultural land). All chemical contaminants should be assessed on a local basis.

Characteristic	Guideline	Comment
		Separate guidelines exist setting out the allowable limits of per- and poly-fluoroalkyl substances (PFAS) in recreational waters[565].
pH	6.5–8.5	A wider pH range of 5–9 is acceptable for water with a very low buffering capacity
Dissolved oxygen	>80%	When considered with colour and turbidity, dissolved oxygen is an indicator of the extent of eutrophication of the water body.
Aesthetic aspects	Recreational water bodies should be aesthetically acceptable to recreational users. The water should be free from visible materials that may settle to • form objectionable deposits. • floating debris • oil, scum and other matter • substances producing objectionable colour, odour, taste or turbidity; and • substances and conditions that produce undesirable aquatic life.	Consumer complaints are a useful guide to the suitability of water for recreational use.

A key aspect of the guidelines is the development of monitoring programmes that can provide a near real-time indication of water quality. The responsible management authorities should establish programs for evaluating existing hazards and monitoring the area for any changes that may occur. This is done through a short-term Alert Level framework. Monitoring programs for recreational water should be based on a three-tier system[566]:

- Surveillance mode (green level) involves routine sampling to measure contaminants (e.g., physical, microbial, cyanobacterial and algal).
- Alert mode (amber level) requires investigation into the causes of elevated contaminant levels, and increased sampling to enable a more accurate assessment of the risks to recreational users.
- Action mode (red level) requires the local government authority and health authorities to warn the public that the water body is considered unsuitable for recreational use.

When a guideline value associated with any of the characteristics in Table 19 is triggered during the monitoring program this should be signal to the responsible authorities to:

- Investigate the cause and likelihood of future incidents,
- Identify whether immediate actions are required to reduce exposure to the hazard, and

[565] 'Guidance on per- and poly-fluoroalkyl substances (PFAS) in recreational water' 2019; available online at Guidelines for managing risks in recreational water | NHMRC

[566] Section 2.1 'Guidelines for Managing Risks in Recreational Waters'

- Determine whether actions should be taken to reduce exposure under similar conditions in the future.

In addition to the short-term alert level framework a longer-term grading system is utilized to inform the public about the overall quality of the recreational water. This is done via regular sanitary inspections and microbial water quality sampling.

> Sanitary inspections aim to identify all sources of faecal pollution that may be present. The information is used to create an assessment of risk focusing on:
>
> - Sewage outfalls and stormwater discharges
> - Bather density
> - Presence of septic tanks
> - Potential animal inputs such as livestock access to water
> - Shipping and boating
>
> Information on wind, rainfall, tides and flushing rates are also gathered to create a picture of contamination risks at the recreational water during the bathing season. The risk levels are classified from Very High Risk to Very Low Risk[567].

A schematic of how recreational waters are assessed based on longer-term water quality is shown in Figure 23.

Microbial water quality sampling should occur from the beginning of the season in December and then on a weekly basis for the duration of the bathing season (December to March) at each site[568]. Sanitary Inspections must be taken by the controlling authority at the start of the season and whenever a change in conditions is suspected, such as a spill from a storm overflow.

Australian water quality guidelines recommend sampling for IE for both marine and freshwater environments[569]. Other pathogens and non-pathogenic faecal indicator organisms are discussed in the guidelines which state and territorial authorities may choose to also sample for. These additional parameters do not have associated threshold standards, instead being used to help inform the risk based categorisation of the Sanitary Inspection. For Tasmania, samples are assessed for IE, with some targeted monitoring of *Cryptosporidium* or *Giardia* if a contamination is suspected.

At the end of each bathing season the Controlling Authority will issue a report collating microbial monitoring data and sanitary inspection outcomes to generate a recreational waterbody classification. Microbial Sampling must contain data from more than 20 sampling days, with data from up to 5 years where there is no reason to suspect that conditions in the bathing water have changed in that time,

[567] guidelines-for-managing-risks-in-recreational-water (2).pdf
[568] This would mean typically 16 samples would be taken over the bathing season.
[569] Guidelines were produced prior to peer reviews of Weidenmann et al (2006) and the research into *E.coli* in freshwaters. They therefore represent the best understanding of epidemiology at the time of writing. Whilst the initial findings of Weidenmann et al (2006) are discussed concerns are raised around the applicability of these standards when set in the Australian context.

can be pooled together to derive a microbial assessment[570]. All samples count towards the overall classification with no ability to disregard results.

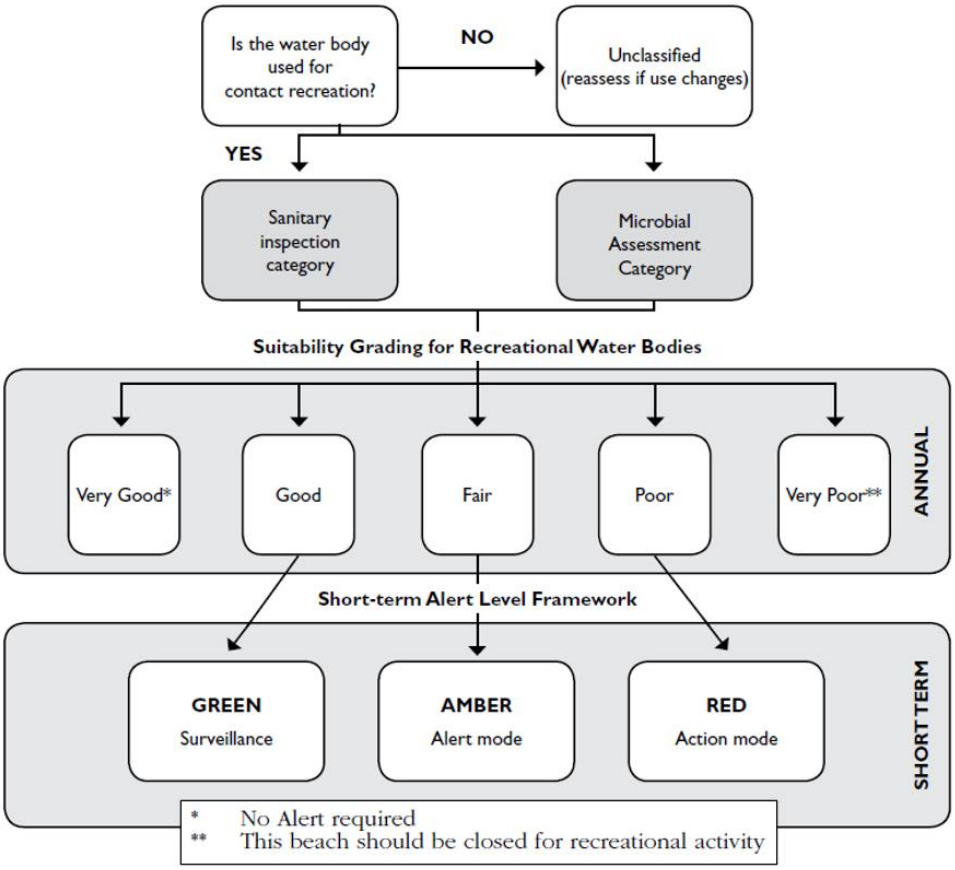


Figure 23 – Simplified Framework for Microbial Water Quality Assessments for Recreational Water [source: *guidelines-for-managing-risks-in-recreational-water.pdf]

As the microbial sampling assessment grades are based on 95th percentile measurements, individual results can be compared against UK standards, however as thresholds standards aren't aligned a simple comparison based on class isn't possible. Table 20 details the Australian guideline long-term water quality classification system. Tasmania and Australia do not differentiate between coastal and freshwater sites.

As mentioned in Table 19, microbial quality is only one of a number of factors which are assessed as part of a risk framework to inform the overall classification. Similar risk-based frameworks exist for Cyanobacteria and the other parameters for consideration. Given the complexities of the frameworks and level of detail within the guidelines these other factors will not be discussed in detail in this report. A high level synopsis of each however can be found in Table 19.

[570] guidelines-for-managing-risks-in-recreational-water (2).pdf

Table 20 – Microbial thresholds for recreational waters in Australia[571]

		Microbial Assessment Category				
	Enterococci only:	A =< 40 cfu/100ml	B 41-200 cfu/100ml	C 201-500 cfu/100ml	D >501 cfu/100ml	Exceptional Circumstances [c]
Sanitary Inspection Category *(Susceptibility To Faecal Influence)*	Very Low	Very Good	Very Good	Follow Up [b]	Follow Up [b]	ACTION
	Low	Very Good	Good	Follow Up [b]	Follow Up [b]	
	Moderate	Good [a]	Good	Poor	Poor	
	High	Good [a]	Fair[a]	Poor	Very Poor	
	Very High	Follow Up [a]	Fair[a]	Poor	Very Poor	
	Exceptional Circumstances [c]	ACTION				

[a] Indicates possible intermittent contamination (often driven by results such as rainfall). This is commonly associated with the presence of sewage – contaminated stormwater. These results should be investigated further, and initial follow-up should include verification of the sanitary inspection category and ensuring that samples recorded include 'event' periods.

[b] Implies non sewage sources of faecal indicators (e.g., livestock), which need to be verified

[c] Exceptional circumstances are known periods of higher risk such as during an outbreak involving a human or other pathogen that may be waterborne (e.g., avian botulism — where outbreaks of avian botulism occur, swimming or other aquatic recreational activities should not be permitted), or a pollution incident etc. Under such circumstances the classification matrix may not fairly represent risk/safety.

Number of Recreational Waters

Tasmania has 134 monitored recreational waters, combining both inland and coastal sites (see Figure 24). Stantec and CREH have been unable to identify the processes or eligibility criteria around recreational water designations within Tasmania. The majority of recreational waters are located along Tasmania's Eastern and Northern coastline, close to major urban areas such as Launceston and Glenorchy. The majority of inland recreational waters are located along the Derwent River and some of the large lakes of the Central Highlands. Information on the most recent water quality classifications is available on local council websites rather than a centralized database as in England.

Access and Use

Access to recreational waters is permitted year-round, including when recreational water quality is found to be unsuitable for swimming. When a water quality sample is found to be below standard and subsequent sanitary inspections indicate poor water quality is still present, local authorities cannot enforce beach closures, but instead must inform the public through signage and online notice boards. Warnings are also placed outside of the bathing season to inform when sites are unmonitored. There is a general public advisory against swimming in any recreational water during or 2-3 days following rainfall.

In general, dogs are not permitted on coastal beaches outside of dog park areas and are not permitted in most National Parks and reserves.

[571] Table 5.13 Classification matrix for faecal pollution of recreational water environments, guidelines-for-managing-risks-in-recreational-water (2).pdf

Figure 24 – Location of Monitored recreational water sites (blue drops), map source: LISTmap - Land Information System Tasmania (thelist.tas.gov.au)

Performance

The most recent published annual report for Tasmania (2019-2020 season) states that 78.4% of sites were 'Good' or 'Very Good' and 12% were classed as 'Poor'[572]. Tasmanian authorities attribute declining performance figures to ageing sewerage infrastructure[573]. Tasmania could be expected to have higher performance than the UK considering the lower population densities and advantageous natural land cover. However, the high rainfall in Tasmania leads to more increased rainfall driven pollution and the large, forested areas have the effect of reducing UV exposure, thereby increasing the persistence of the faecal indicator organisms in the environment.

[572] Recreational water quality | Tasmanian Department of Health
[573] Recreational water quality | Tasmanian Department of Health

6.3 New Zealand

New Zealand has a population of approximately 5.1 million and a landmass of 268,401 km^2,[574] so is similar in size, if not population, to the UK which has a landmass of 243,610km^2.[575]

New Zealand scored highly in the screening assessment (see Table 18), with similarities between its climate, bathing season temperatures and precipitation and it has a mix of both monitored coastal and inland recreational waters. The majority of New Zealand is serviced by separated foul and storm sewers; however, some combined systems exist in cities such as Auckland.

Climate and Geography

New Zealand has an oceanic climate experiencing relatively mild seasonal temperature variations, with an average temperature of 18.2˚C in summer and 9.4˚C in the winter. Average annual precipitation in the country is 1732 mm, compared with 1220mm across the UK[576].

Many river catchments in New Zealand are, at least partially, fed by glacial melt, unlike the UK's rain fed catchments. This seasonal glacier melt may buffer the impacts of summer drought on river discharges and its ability to dilute pollutants.

Across New Zealand, 41.1% of the territory is dedicated to pastureland for dairy farming and sheep grazing[577]. In comparison, 45.7% of the UK is estimated to be 'permanent pasture'[578] although this figure is significantly lower considering just England[579]. Only 0.74% of New Zealand land cover is urbanized[580].

Guidelines / Regulation

Recreational water risk management guidelines are based upon frameworks developed by the WHO including its 2003 publication '*Guidelines for safe recreational water environments'*[581].

The principles of these international guidelines, along with German epidemiological studies for freshwaters[582], are used to inform the 2003 New Zealand '*Microbial Water Quality Guidelines for Marine and Freshwater Recreational Areas'*[583] published by the Ministry for the Environment. These

[574] https://en.wikipedia.org/wiki/Geography_of_New_Zealand
[575] https://en.wikipedia.org/wiki/Great_Britain
[576] New Zealand climate: average weather, temperature, rain - Climates to Travel
[577] https://www.indexmundi.com/new_zealand/land_use
[578] https://www.indexmundi.com/united_kingdom/land_use.html
[579] https://www.gov.uk/government/statistics/agricultural-land-use-in-england/agricultural-land-use-in-england-at-1-june-2023
[580] https://www.stats.govt.nz/news/new-report-shows-impact-of-demands-on-land-in-new-zealand/
[581] Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters (who.int)
[582] Wiedenmann A, Kruger P, Dietz K, Lopez-Pila J, Szewzyk R, Botzenhart K (2006). Randomized controlled trial assessing infectious disease risks from bathing in fresh recreational waters in relation to the concentration of Escherichia coli, intestinal enterococci, Clostridium perfringens, and somatic coliphages. Environ Health Perspect. 114(2):228–36.
[583] Microbiological water quality guidelines for marine and freshwater recreational areas | Ministry for the Environment

guidelines were built upon the previous '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*' (2000)[584].

Other important water industry legislation is the '*National Policy Statement for Freshwater Environments*' (2020), which sets targets to improve or maintain freshwater quality, as well as placing an emphasis on indigenous values in land stewardship for environmental and human health. This policy also outlines a national target to increase the proportion of swimmable freshwaters (rivers and lakes with a perimeter of >1.5km) to 90% by 2040, with 50% at the highest 'Very Good' status[585].

Management Approaches

Current New Zealand guidelines are very similar to those of Australia, having both been derived from WHO Guidelines and the '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*' (2000)[586]. Whereas Australia focuses on a wide range of factors impacting human health associated with contact with recreational waters, New Zealand guidelines focus solely on microbial water quality, with standards based on concentrations of IE for marine waters and *E.coli* for freshwaters.

Both New Zealand and Australian guidelines set out a move away from the sole use of guideline values of faecal indicators, instead using a combination of a qualitative risk assessment, supported by the direct measurement of appropriate faecal indicators to assess the suitability of a site for recreation. In addition, alert and action guideline levels are used for surveillance throughout the bathing season (typically November to March)[587].

The two components to providing a grading for an individual recreational water are:

- the 'Sanitary Inspection Category' (SIC), which generates a measure of the susceptibility of a water body to faecal contamination.
- historical weekly microbiological results, which generate a 'Microbiological Assessment Category' (MAC), which provides a measurement of the actual water quality over time.

These two combined give an overall Suitability for Recreation Grade (SFRG), which describes the general condition of a site at any given time, based on both risk and indicator bacteria counts. This grade helps to determine whether ongoing monitoring is required and provides the basis for informing the public on the suitability for recreational use[588].

The 'Sanitary Inspection Category' is an assessment ranking a site from 'Very High' to 'Very Low' based on its perceived susceptibility to faecal influence. Figure 25 sets out a simplified version of the 'Sanitary Inspection Category' flow chart for marine waters. A similar flow chart exists to assess freshwater environments.

---

[584] https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf
[585] National-Policy-Statement-for-Freshwater-Management-2020.pdf (environment.govt.nz)
[586] https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf
[587] Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (environment.govt.nz)
[588] Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (environment.govt.nz)

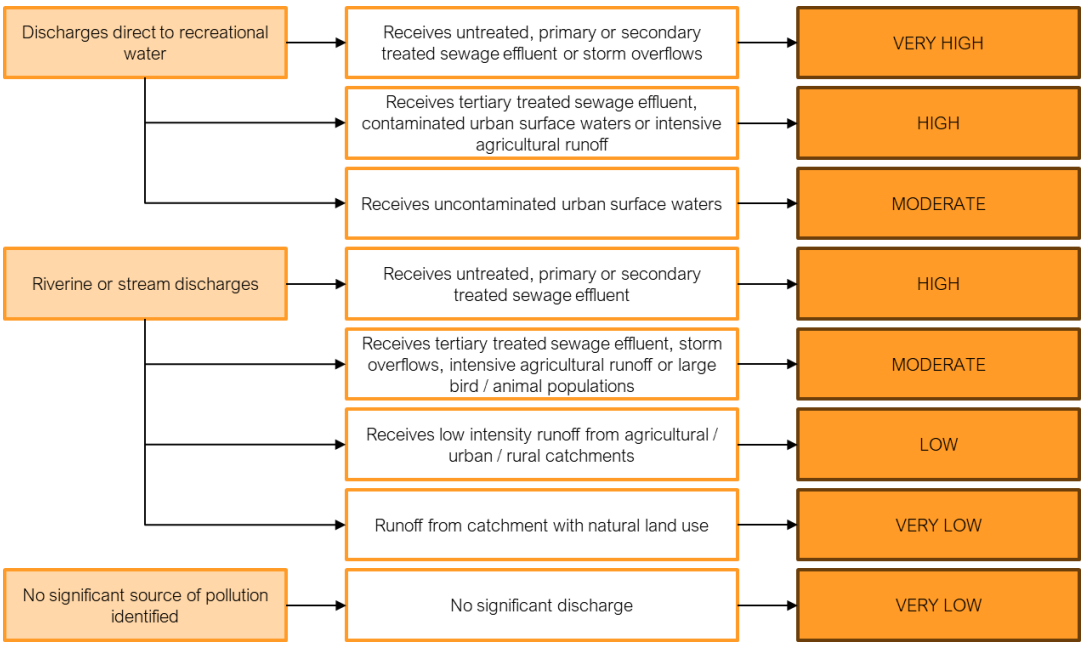


Figure 25 – Sanitary Inspection Flow Chart for Marine Recreational Waters summarised from Figure H2; *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*

The 'Microbiological Assessment Category' provides an actual measure of water quality over time from 'A' high quality to 'D' low quality. For marine waters, weekly sample results over the bathing season[589] for IE are evaluated against 95th percentile water quality criteria. For freshwaters, this is repeated but samples are assessed for *E.coli*. For both IE (marine) and *E.coli* (freshwater) assessments New Zealand uses the Hazen calculation method to determine the classification[590]. The thresholds for the 'A' to 'D' classifications for marine and freshwaters are detailed in Table 21..

The results of the 'Sanitary Inspection Category' and 'Microbiological Assessment Category' for each site are then combined within the Suitability for Recreation Grade' matrix to determine a long term classification. Table 21

[589] This is at least 20 samples but can be more depending on the length of the bathing season at each location.
[590] Refer to Chapter 3.5 for discussion on the methods of calculation of 95 percentile values.

Table 21 - New Zealand Suitability for Recreational Grade Matrix for Marine Waters (upper table) and Freshwaters (lower table)[591]

		Microbial Assessment Category				
	Enterococci only:	A ≤ 40 cfu/100ml	B 41-200 cfu/100ml	C 201-500 cfu/100ml	D >501 cfu/100ml	Exceptional Circumstances [c]
Sanitary Inspection Category *(Susceptibility To Faecal Influence)*	Very Low	Very Good	Very Good	Follow Up [b]	Follow Up [b]	ACTION
	Low	Very Good	Good	Fair	Follow Up [b]	
	Moderate	Follow Up [a]	Good	Fair	Poor	
	High	Follow Up [a]	Follow Up [a]	Poor	Very Poor	
	Very High	Follow Up [a]	Follow Up [a]	Follow Up [a]	Very Poor	
	Exceptional Circumstances [c]	ACTION				

[a] Indicates unexpected results requiring investigation (reassess SIC and MAC). If after reassessment the SFRG is still 'follow up', then assign a conservative grade (i.e., the first grade to the right of the 'follow up' in the same SIC row). This follows the precautionary principle applied in public health.

[b] Implies non-sewage sources of indicators, and this should be verified. If after verification the SFRG is still 'follow up', then assign a conservative grade (i.e., the first grade after 'follow up' in the same MAC column).

[c] Exceptional circumstances: relate to known periods of higher risk for a graded beach, such as during a sewer rupture or an outbreak of a potentially waterborne pathogen in the community of the recreational area catchment. Under such circumstances a grading would not apply until the episode has abated.

		Microbial Assessment Category				
	E.coli only:	A ≤ 130 cfu/100ml	B 131-260 cfu/100ml	C 261-550 cfu/100ml	D >551 cfu/100ml	Exceptional Circumstances [c]
Sanitary Inspection Category *(Susceptibility To Faecal Influence)*	Very Low	Very Good	Very Good	Follow Up [b]	Follow Up [b]	ACTION
	Low	Very Good	Good	Fair	Follow Up [b]	
	Moderate	Follow Up [a]	Good	Fair	Poor	
	High	Follow Up [a]	Follow Up [a]	Poor	Very Poor	
	Very High	Follow Up [a]	Follow Up [a]	Follow Up [a]	Very Poor	
	Exceptional Circumstances [c]	ACTION				

[a] Indicates unexpected results requiring investigation (reassess SIC and MAC).

[b] Implies non-sewage sources of indicators, and this should be verified.

[c] Exceptional circumstances: relate to known periods of higher risk for a graded beach, such as during a sewer rupture or an outbreak of a potentially waterborne pathogen in the community of the recreational area catchment. Under such circumstances a grading would not apply until the episode has abated.

As well as the longer term quality assessment provided by the SFRG matrix single microbiological sample results over specific thresholds will also trigger short term action alerts and management actions. The thresholds and management actions are set out in Table 22.

[591] Tables D2 and E2 of the *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*, available at Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (environment.govt.nz)

Table 22 – Surveillance, Alert and Action Levels for Marine and Freshwaters[592]

Surveillance, alert and action levels for marine waters	Surveillance, alert and action levels for freshwaters
Surveillance/Green Mode: No single sample >140 cfu/100ml IE • Continue routine (e.g., weekly) monitoring.	**Acceptable/Green Mode:** No single sample >260 cfu/100ml *E.coli* • Continue routine (e.g., weekly) monitoring.
Alert/Amber Mode: Single sample >140 cfu/100ml IE • Increase sampling to daily (initial samples will be used to confirm if a problem exists). • Consult the catchment assessment checklist to assist in identifying possible sources. • Undertake a sanitary survey and identify sources of contamination.	**Alert/Amber Mode:** Single sample >260 cfu/100ml *E.coli* • Increase sampling to daily (initial samples will be used to confirm if a problem exists). • Consult the catchment assessment checklist to assist in identifying possible location of sources of faecal contamination. • Undertake a sanitary survey and report on sources of contamination.
Action/Red Mode: Two consecutive single samples (resample within 24 hours of receiving the first sample results, or as soon as is practicable) >280 cfu/100ml IE. • Increase sampling to daily (initial samples will be used to confirm if a problem exists). • Consult the catchment assessment checklist to assist in identifying possible sources. • Undertake a sanitary survey and identify sources of contamination. • Erect warning signs. • Inform public through the media that a public health problem exists.	**Action/Red Mode:** Single sample >550 cfu/100ml *E.coli* • Increase sampling to daily (initial samples will be used to confirm if a problem exists). • Consult the catchment assessment checklist to assist in identifying possible location of sources of faecal contamination. • Undertake a sanitary survey and report on sources of contamination. • Erect warning signs. • Inform public through the media that a public health problem exists.

As a public health issue, recreational water management in New Zealand is the responsibility of local and national public health authorities. It is up to these local health authorities to undertake the inspections and monitoring, complete management action for short term alerts, report on the results up to national authorities and set criteria for identifying which sites to monitor. Although criteria for identification are decided locally, generally, sites are chosen based on usage, available information and the resources available to the monitoring authority[593].

The framework for recreational water management, from the identification of a site through to short term management actions and reporting a classification is set out in a decision tree in Figure 26.

The framework and guidelines make no reference to other factors considered by many other recreational water systems such as cyanobacterial proliferations.

[592] Box 1 (D8) and Box 2 (E8) of the *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*, available at Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (environment.govt.nz)
[593] Section D1 of the *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*

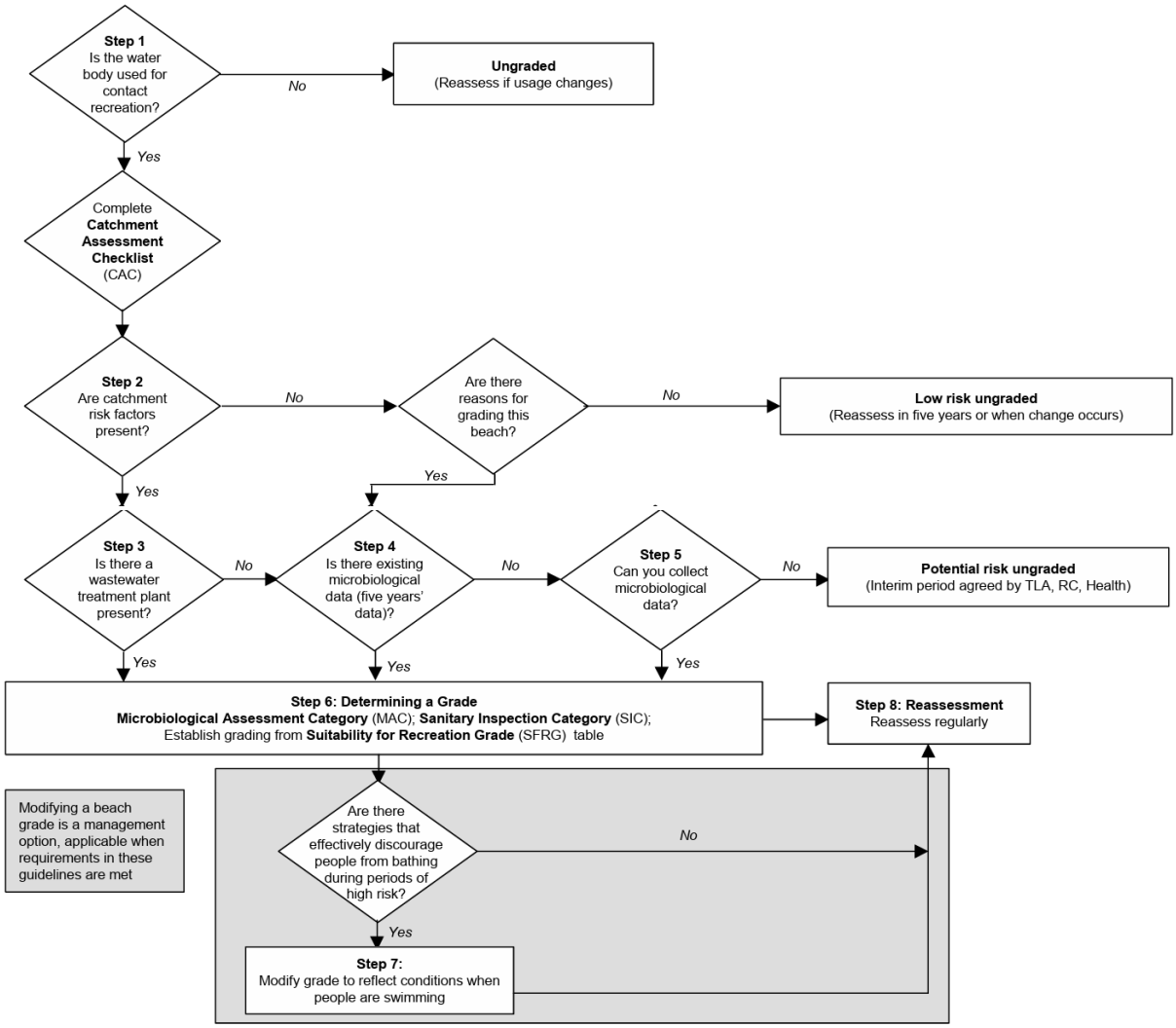


Figure 26 – New Zealand Framework for Grading Recreational Waters [source: microbiological-quality-jun03.pdf (environment.govt.nz)]

Number of Recreational Waters

New Zealand has 813 monitored recreational waters of which 438 (54%) are coastal, 285 are rivers and 90 are lakes (see Figure 27). There are significantly more designated recreational riverine sites than compared with England and Northern Ireland, with many of them having decades of monitoring and management experience.

Information on the recreational waters is available to view on the LAWA website's Can I swim here? page, which also contains daily water quality alert levels and longer term site data.

Figure 27 – Map of monitored Recreational waters in New Zealand, [Source: LAWA swimming data]

Access and Use

The bathing season in New Zealand varies locally but typically lasts between November and March. If a recreational water is reported to be unsuitable for swimming ('Poor' status), signage is erected to inform the public of unsuitability, as well as council and national web-notice boards. There is a general public advisory against swimming in any recreational water during or 2-3 days following rainfall[594]. Stantec and CREH have been unable to clarify whether this is related to a specific duration or intensity of rainfall.

In general dogs have restricted access to beaches to designated dog beach areas, regardless of season, with many councils issuing separate public warnings about water safety for dogs. Across New Zealand there are many conservation zones where dogs are banned without specific permitting to protect vulnerable wildlife. This applies to recreational waters that fall within these conservation zones.

[594] Land, Air, Water Aotearoa (LAWA) - Can I swim here?

Performance

New Zealand has seen a dramatic decrease in water quality in the last few decades, with its freshwater sites in particular often below standards for '*swim-ability*'[595]. Recreational water quality across the country is highly spatially variable, with pastoral and urban catchments generally having the poorest quality, and freshwater and marine sites with native landcover catchments performing best[596]. A particular issue has been identified in catchments that have seen wetland areas replaced with grazing. In recent years New Zealand has seen an intense increase in dairy grazing (70% increase between 1994 and 2017) and loss in sheep grazing. These farming and land use trends along with ageing and inconsistent cover of wastewater infrastructure are identified as primary drivers of freshwater degradation in New Zealand's 2020 Freshwater Report[597].

In 2022, 72.4% of inland sites were classified 'Poor' and therefore unsuitable for swimming compared with 20.4% of coastal sites. Only 1.5% of inland sites and 7.8% of coastal sites achieved the 'Excellent' classification[598]. A summary of recreational water performances (long-term Grade) in New Zealand between 2017-2022 are summarized in Figure 28 below.

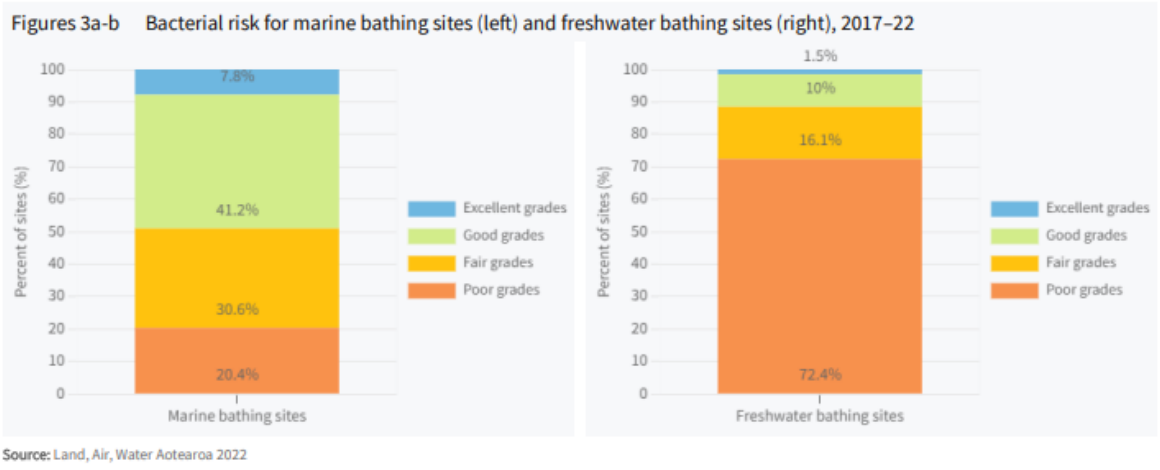


Figure 28 – Long term Bacterial risk class for marine and freshwater sites in NZ, [source: https://www.ehinz.ac.nz/assets/Factsheets/Released_2023/Faecal-indicator-bacteria-at-recreational-bathing-sites-May-2023.pdf]

[595] our-freshwater-2023.pdf (environment.govt.nz)
[596] Faecal-indicator-bacteria-at-recreational-bathing-sites-May-2023.pdf (ehinz.ac.nz)
[597] https://environment.govt.nz/publications/our-freshwater-2020/
[598] Faecal-indicator-bacteria-at-recreational-bathing-sites-May-2023.pdf (ehinz.ac.nz)

6.4 United States of America (Connecticut)

The US Recreational Water Quality Criteria (RWQC)[599] are one of the three main recognised guidelines for recreational waters. As environmental legislation varies at state level within the US, the state of Connecticut has been selected for comparison purposes.

Connecticut has a population of approximately 3.6 million people and a landmass of 13,023 km^2,[600] meaning it is about the same size as Northern Ireland but with twice as many inhabitants. Connecticut scored highly in the screening assessment (see Table 18), with similarities between its climate, bathing season temperatures and precipitation, and it has a large number of both monitored coastal and inland recreational waters, though these are monitored by separate bodies using different classification systems. Connecticut has combined sewer systems present in most of its cities.

Climate and Geography

Connecticut has similarities with the UK in its climate and bathing season precipitation, however, it is characterised by more significant temperature seasonality with average of 23ºC in summer and 0ºC in winter. Connecticut has two main climatic regions; south of, and into the Appalachian mountains. South of the Appalachians there is a highly variable coastal climate (Köppen: Cfb and Cfa) with cool winters and hot and humid summers with frequent rain year-round. Meanwhile the northern portion of the state sits within the Appalachian Mountain chain and has a humid continental climate (Köppen: Dfa and Dfb) with cold winters and hot humid summers. Annual average rainfall is 1026mm.

The state of Connecticut is drained by three major rivers, the Thames, Connecticut, and Housatonic rivers. All of these are predominately snow and rain-fed, many have been historically modified over the last century's industrial growth and are prone to flooding. Approximately 7% of Connecticut's land cover is agricultural land, much of it is pastureland, significantly less than the UK. 19% of Connecticut's land is covered by built development, while 75 million square miles are covered by lawn and turf (8% of the state)[601], meaning there is more turf cover than agriculture. Most of the remaining land use is attributed to forest.

Guidelines / Regulations

The US Environmental Protection Agency (EPA) produced the '*Recreational Water Quality Criteria (RWQC) for Bacterial Indicators of Faecal Contamination'* in 2012[602]. The criteria are designed to protect the public from exposure to harmful levels of pathogens while participating in water-contact activities, such as swimming, wading and surfing, in all water bodies designated for such recreational

[599] EC, European Commission. Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Off. J. Eur. Union. 2006, 64, 37–51.
EPA. Recreational Water Quality Criteria; US Environmental Protection Agency: Washington, DC, USA, 2012.
WHO. Volume 1, Coastal and fresh waters. Chapter 4: Faecal Pollution and Water Quality 51–101. In Guidelines for Safe Recreational Water Environments; World Health Organization: Geneva, Switzerland, 2003.

[600] https://en.wikipedia.org/wiki/Connecticut

[601] Connecticut's Changing Landscape (uconn.edu)

[602] https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods

uses. This was supplemented in 2019 by the '*Recreational Water Quality Criteria or Swimming Advisories for Cyanotoxins*'[603]. These combined recommendations are intended as guidance to states in developing water quality standards for recreational water use.

In Connecticut, these recommendations are incorporated into the '*Connecticut Water Quality Standards'* [604], part of the '*State of Connecticut Guidelines for Monitoring Swimming Water and Closure Protocol*'[605].

Management Approaches

The national RWQC set out recommended threshold values for two different scenarios (Recommendation 1 and 2). These correspond to the different acceptable rates of gastro-intestinal illness which occur per 1000 recreational water users (36 or 32 '*per 1,000 primary contact recreators*')[606] which are legislated for at state level.

The RWQC consists of three components: magnitude, duration and frequency. The magnitudes of the bacterial indicators are described by both a geometric mean and a statistical threshold value[607] (STV) for the bacteria samples[608]. Table 23 summarizes the magnitude component of the recommendations. The geometric mean and STV of the recreational water should not be higher than the values in Table 23 across any given rolling 30-day period.

Table 23 – RWQC for Recreational Waters[609]

Criteria Elements	Recommendation 1 *(Estimated Illness Rate – 36 per 1,000 primary contact recreators)*		Recommendation 2 *(Estimated Illness Rate – 32 per 1,000 primary contact recreators)*	
Indicator	Geometric mean (cfu/100ml)	STV (cfu/100ml)	Geometric mean (cfu/100ml)	STV (cfu/100ml)
Intestinal Enterococci (marine & freshwater)	35	130	30	110
E. coli (freshwater)	126	410	100	320

These values are different from WHO and EU criterion as they are based on epidemiological studies[610] using self-selection protocols, a method not favoured by the WHO and EU due to potential biases in the respondents.

[603] https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods
[604] ctwqs.pdf (epa.gov)
[605] 030316GuidelinesforMonitoringSwimmingWaterpdf.pdf (ct.gov)
[606] Report on 2009 National Epidemiologic and Environmental Assessment of Recreational Water Epidemiology Studies (Wade et al.) 2009. EPA Report Number: EPA/600/R-10/168. Available at report-2009-national-epidemiologic-studies.pdf (epa.gov).
[607] The STV approximates the 90th percentile of the water quality distribution and is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.
[608] https://www.epa.gov/sites/default/files/2015-10/documents/rec-factsheet-2012.pdf
[609] https://www.epa.gov/sites/default/files/2015-10/documents/rec-factsheet-2012.pdf
[610] Report on 2009 National Epidemiologic and Environmental Assessment of Recreational Water Epidemiology Studies (Wade et al.) 2009. EPA Report Number: EPA/600/R-10/168. Available at report-2009-national-epidemiologic-studies.pdf (epa.gov).

In addition to the recommendation criteria the EPA also provides states with Beach Action Values (BAV) for use in notification programs. The BAV is provided for states to use as a precautionary early alert for the public. The recommendations and BAV standards can then be utilized at state level depending on the classification of the individual waterbody. Table 24 details the BAV as set out in the 2014 EPA Guidance[611].

Table 24 – Beach Action Values (BAV) or Single Sample Maximum (SSM)

Indicator	Estimated Illness Rate – 36 per 1,000 primary contact recreators	Estimated Illness Rate – 32 per 1,000 primary contact recreators
Intestinal Enterococci	70 cfu/100ml	60 cfu/100ml
E.coli	235 cfu/100ml	190 cfu/100ml

The 2014 EPA National Beach Guidance covers all aspects of recreational water management including US approaches to tiered levels of monitoring and protection, sanitary inspections and predictive modelling.

The Federal Clean Water Act (1972) [612] requires that every waterbody in the US be evaluated and classified depending on usage, quality and discharges. The water body classes, as defined by the Connecticut Water Quality Act are summarised in Table 25:

Table 25 – Summary of Connecticut Classification and Designated Use[613]

Freshwater		
Class system	Uses	Discharges
AA	Suitable for drinking water and immersion recreation, fish and wildlife habitat, recreational use (may be restricted), agricultural and industrial supply	Discharges from public or private drinking water treatment systems, dredging and dewatering, emergency, and clean water discharges
A	Suitable for immersion recreation, fish and wildlife habitat; recreational use; agricultural and industrial supply and other legitimate uses including navigation	Same as allowed in AA
B	Non immersive recreational use, fish, and wildlife habitat; agricultural and industrial supply and other legitimate uses including navigation	Same as allowed in A and cooling waters, discharges from industrial and municipal wastewater treatment facilities (providing Best Available Treatment and Best Management Practices are applied), and other discharges
B*	Non-immersive recreational use, fish, and wildlife habitat; agricultural and industrial supply and other legitimate uses including navigation	Same as B but no municipal or industrial wastewater
C or lower	Does not meet criteria for above, goal is for its improvement.	

[611] National Beach Guidance and Required Performance Criteria for Grants, 2014 Edition (Environmental Protection Agency) EPA-823-B-14-001 Available at beach-guidance-final-2014.pdf (epa.gov)
[612] USCODE-2018-title33-chap26.pdf (govinfo.gov)
[613] Layout 1 (ct.gov)

Marine waters		
Class system	Uses	Discharges
SA	Marine habitat, Shellfish harvesting for direct human consumption, immersive recreation, all other legitimate uses	None other than clean water drinking water treatment, dredging, and dewatering
SB	Marine habitat, Shellfish harvesting for prior purification before consumption, immersive recreation, other legitimate uses	Same as SA & treated wastewater (providing Best Available Treatment and Best Management Practices are applied)
SC or lower	Does not meet criteria for above, goal is for its improvement.	

At state level, the Connecticut Water Quality Standards use the national RWQC geometric mean guidelines (from Recommendation 1) to assess water quality along with the single sample maximum Beach Action Values. The STV is not used. The Connecticut Water Quality Act also subdivides recreation into designated and non-designated swimming areas and 'all other uses', thereby assigning the RWQC to specific classified and designated waterbodies. Water quality standards are tightest for designated swimming areas. Stantec and CREH have been unable to find any guidance on the processes or eligibility criteria for these designations of recreational waters.

The RWQC associated with each class of waterbody is shown below:

Table 26 – RWQC associated with Waterbody Classifications

Freshwater		AA	A	B	SA	SB
Recreation – designated swimming	*E.coli*	Geometric mean less than 126 cfu/100ml Single sample maximum 235 cfu/100 ml				
Recreation – non designated swimming	*E.coli*	Geometric mean less than 126 cfu/100ml Single sample maximum 410 cfu/100 ml				
Recreation – all other uses	*E.coli*	Geometric mean less than 126 cfu/100ml Single sample maximum 576 cfu/100 ml				
Marine						
Recreation – designated swimming	IE				Geometric mean less than 35 cfu/100ml Single sample maximum 104 cfu/100 ml[614]	
Recreation – all other uses	IE				Geometric mean less than 126 cfu/100ml Single sample maximum 235 cfu/100 ml	

Recreational waters are monitored on a weekly basis between the week before Memorial Day (Last Monday of May) and Labor Day (First Monday of September), typically resulting in 16 samples per season. Sanitary inspections are performed prior to the start of each bathing season and following exceedances of the BAV[615]. The inspection should include checks of beach facilities, signage, on-site sewage and drinking water supplies, potential contamination sources and outfalls in the area. Where

[614] Connecticut has a higher BAV for IE than set out in the EPA 2014 National Beach Guidelines, following its own review of the latest academic epidemiological research.

[615] Guidelines-for-Monitoring-Swimming-Water-and-Closure-Protocol-March-2016.pdf (ct.gov)

possible, daily inspections of the low water and high water mark should be performed by lifeguards to identify any hazardous materials, evidence of sewage contamination or oil slicks.

Table 27 sets out the short-term management responses upon failure of the BAV for class AA, A, B, SA and SB 'designated swimming' sites. Similar responses are available for non-designated swimming recreational waters and recreational waters with other uses.

Table 27 – Guidance on appropriate response to given bacterial thresholds for Designated Swimming Sites

Freshwater	
Sample result:	Response
Single sample *E. coli* <235 cfu/100ml	Water quality is satisfactory for swimming
Single sample *E. coli* >235 cfu/100ml	A resample and sanitary survey should be conducted.
	If apparent or suspected sewage contamination is already known, the beach must be closed.
Second sample >235 cfu/100ml	If sanitary survey yields evidence of sewage contamination the beach must be closed
	If sanitary inspection reveals no evidence of sewage contamination, beach may remain open but advisory signage is placed.
Long term sample Geometric mean < 126 cfu/100ml	Water quality is considered acceptable for contact recreation
Long term sample Geometric mean > 126 cfu/100ml	Unacceptable water quality, steps to be taken by authorities to remediate contamination sources or waterbody may be reclassified.
Marine water	
Sample result	Response
Single sample IE is <104 cfu/100ml	Water quality is acceptable for swimming
Single sample IE is >104 cfu/100ml	A resample and sanitary survey should be conducted.
	If apparent or suspected sewage contamination is already known, the beach must be closed.
Second sample IE is >104 cfu/100ml	If sanitary survey yields evidence of sewage contamination, the beach must be closed
	If Sanitary inspection reveals no evidence of sewage contamination, beach may remain open but advisory signage is placed.
Long term sample Geometric mean < 35 cfu/100ml IE	Water quality is considered acceptable for contact recreation
Long term sample Geometric mean > 35 cfu/100ml IE	Unacceptable water quality, steps to be taken by authorities to remediate contamination sources or waterbody may be reclassified.

Over the longer term, recreational water classification method is primarily based on the number of beach closures over the course of the last season, as well as geometric mean sampling results and sampling frequency achieved through the bathing season[616]. It is these performance metrics that are reported to the Federal EPA year on year.

Table 28 – Tiered classification system for recreational waters in Connecticut

[616] Tiered Monitoring Plan for Connecticut Coastal Beaches

Classification	Definition	Criteria
Tier I	Meets minimum recommended sampling frequency and requirements. No more than one closure in the last bathing season	Weekly sampling; <= 1 closure
Tier II	Meets minimum recommended sampling frequency and requirements and no more than 3 closured during the last bathing season.	Weekly sampling; 2 to 3 closures
Tier III	Does not meet minimum recommended sampling frequency or requirements or had more than three closures during the last bathing season.	No weekly sampling or >3 closures.

Number of Recreational Waters

Recreational waters in Connecticut are managed by either the State Park (responsibility for classification and monitoring with the Connecticut Department of Energy and Environmental Protection) or Local Municipalities and Health Boards (under the responsibility of the Connecticut Department of Public Health).

There are 22 State Park managed recreational waters designated for swimming use, 4 coastal and 18 inland[617], and 72 Public recreational waters, all of which are coastal[618]. There are many more beaches present along Connecticut's shorelines that are owned by private entities; many independently monitored by owners, charities or community groups such as Save the Sound[619]. However, this monitoring is not centrally reported and so has not been included in this assessment. The map below (Figure 27) shows the distribution of State Park Beaches (blue)[620] and Public beaches (green)[621] .

[617] https://portal.ct.gov/DEEP/State-Parks/Recreation-Information/Swimming---CT-State-Parks-and-Forests
[618] 2022-season-BG-Annual-Report-Final.pdf (ct.gov)
[619] Action for our region's environment - Save the Sound
[620] State Swimming Area Water Quality Report (ct.gov)
[621] Swimmable | Sound Health Explorer

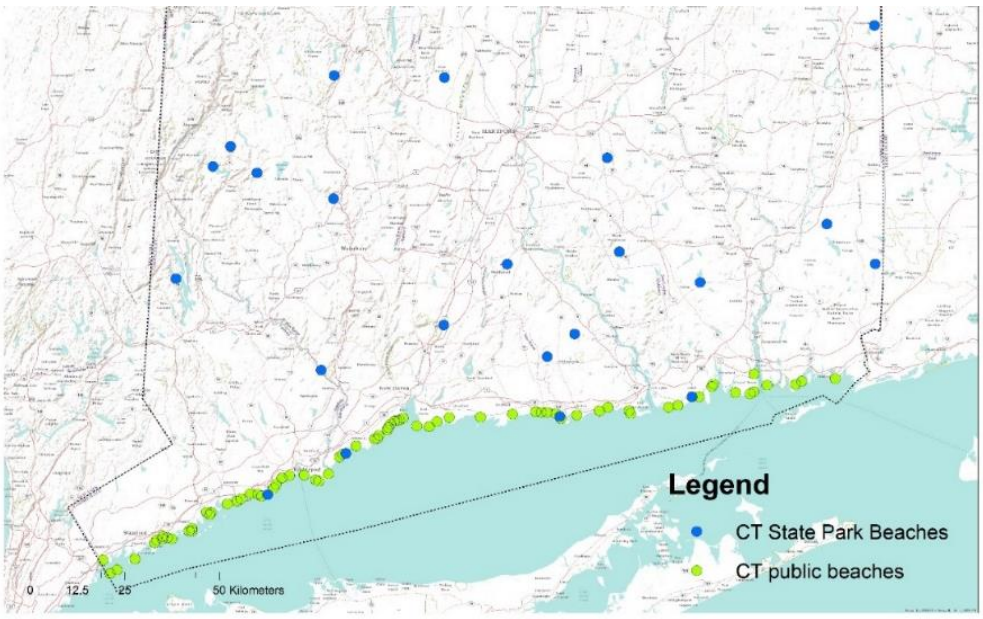


Figure 29 – Location of all monitored State Park and Public beaches in Connecticut [622]

Access and Use

All State Park beaches are on public access land so are free for Connecticut residents. However, many sites will charge for access for non-Connecticut residents. The local council owned beaches (Public Beaches) may be restricted to paying customers or local residents. While federal law states councils must provide access to non-local residents, many do so for high fees or require tickets to be purchased at remote sites, rendering many beaches inaccessible to non-locals. Whilst all foreshore[623] is public land, 80% of Connecticut's coastline (the land immediately behind the foreshore) is privately owned. This can result in limited access to the public shoreline.

Outside of the bathing season recreational water site access may change, with some beaches remaining open without or at a reduced fee, with others closing until the start of the next season. Lifeguarding is not typically present outside of the bathing season.

Recreational water sites can be closed to the public for public health and safety reasons such as poor water quality. The power to close a beach is invested in State Park authorities or local councils.

Dogs are typically not allowed on recreational waterfronts during the bathing season.

Performance

The US primarily assesses recreational water quality based on the number of samples exceeding the BAV and 30-day rolling geometric mean targets. In 2022, Connecticut tested for faecal indicator organisms at all 72 of its Public recreational waters. 52 or 71% of those recreational waters had

[622] Graphic developed by Stantec using data from: State Swimming Area Water Quality Report (ct.gov) and Swimmable | Sound Health Explorer

[623] Defined as the area of land between high and low water spring tide mark.

potentially unsafe levels of faecal indicator organisms on at least one testing day. 10 or 14% of the recreational waters testing had potentially unsafe levels on more than 25% of all days tested in 2022. This information is shown visually in Figure 30. Data for State Park recreational waters are reported separately and so are not shown here.

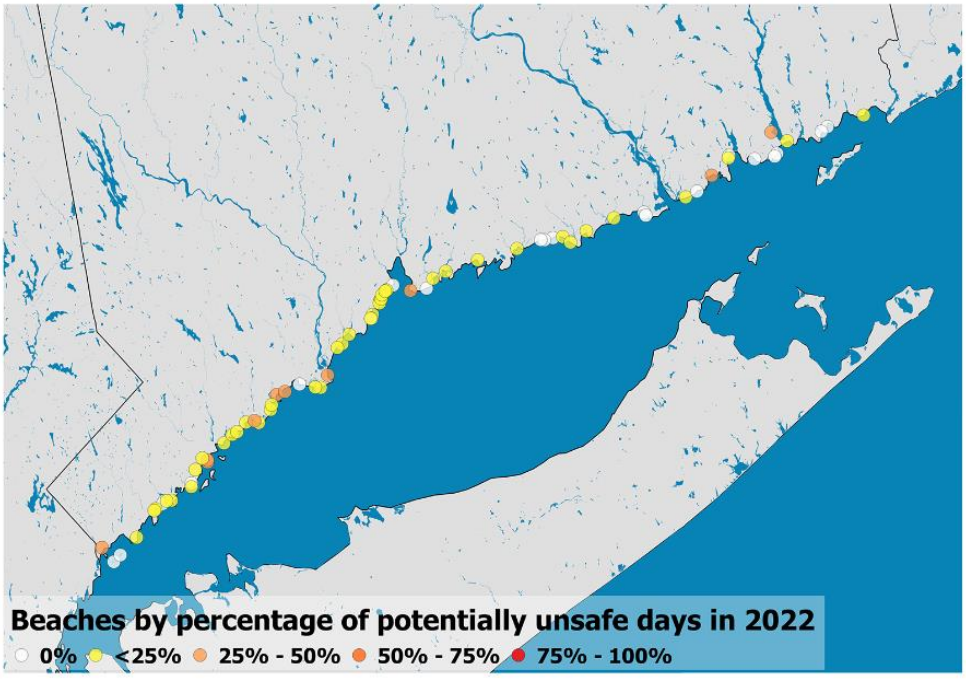


Figure 30 – Connecticut Public Beaches by percentage of potentially unsafe days in 2022[624]

Combining the State Park and Public Beach data for longer term classifications, in 2022 Connecticut had 83 (or 88.3%) Tier 1 sites, 8 (or 8.5%) Tier 2 sites and 3 (or 3.2%) Tier 3 sites.

This system is not easily comparable with the UK.

[624] https://environmentamerica.org/center/resources/safe-for-swimming/

6.5 Japan

Japan has a population of approximately 125.7 million and landmass of 377,973 km^2.[625]

Japan scored a 4 in the screening assessment (see Table 18), with similarities between its climate, bathing season precipitation, and a mix of both monitored coastal and inland recreational waters. Japan has a somewhat unique approach to recreational water management with no basis in any of the three main systems. It appears to demonstrate exemplar performance and has an abundance of good accessible data and reporting.

Japan has a predominantly separated sewage system, however, there are some combined sewer networks still in use, and a large proportion of households are connected to traditional decentralised jōkasō[626] systems.

Climate and Geography

Japan has significant climatic variation between the north and south of the country, with average summer temperatures ranging between 21 ºC and 28 ºC depending on latitude[627]. Average annual precipitation in the country is of 1718mm a year[628], much of which is experienced as heavy monsoon rainfall. During the summer bathing season, monsoons are particularly prevalent along the south and west of the country.

A large portion of Japan's land is mountainous, with 68.6% of the county being forested with sparce habitation despite the country's high population density. This has meant that many remote communities in Japan operate on decentralized jōkasō wastewater systems.

The islands are volcanically active, with many hot springs located through the country, these hot springs are not included as part of this assessment and come under different sets of legislation regarding water safety under Japanese law[629].

Guidelines / Regulations

Japan's recreational water regulations is somewhat unique amongst the G20 countries having little basis in any of the three main management systems: the WHO guidelines, US RWQC and EU Bathing Water Directive.

---

[625] https://www.mofa.go.jp/territory

[626] Johkasou (jōkasō) systems are on-site wastewater treatment systems tanks, not dissimilar to septic tanks. They are used to treat the wastewater of a single household or to treat the wastewater of a small number of buildings in a more decentralized manner than a sewer system.

[627] Japan - Kuroboku Soils, Kuroshio Current, Laurel Forest Zone, and Japanese Macaque | Britannica

[628] Japan - Kuroboku Soils, Kuroshio Current, Laurel Forest Zone, and Japanese Macaque | Britannica

[629] en (jst.go.jp)

Environmental water quality standards, including those for recreational waters, are set by the Japanese Ministry of the Environment and can be subdivided between '*Water Quality standards for the Living Environment'* [630] and '*Water Quality standards for Human Health*'.

The '*Water Quality standards for the Living Environment'* set out a number of condition classes for rivers, lakes, and coastal waters, with set water quality parameter thresholds for each classification, similar to the Water Framework Regulations in the UK. The classes dictate the suitability of a waterbody for different human activities including uses as fisheries, suitability for contact recreation (i.e., bathing), drinking water, irrigation, and industrial water usage. All water body types (river, lake and coastal areas) have an AA-E quality class which is dictated by values and concentrations of parameters in pH, biochemical oxygen demand (BOD), suspended solids, dissolved oxygen (DO), Total Coliforms and N-hexane contamination as well as a specific separate A to B classification for conserving aquatic life from zinc exposure. Lakes and coastal waters also have a separate nutrient loading classes that go from I-V which are used for assessing the water body's suitability for drinking water, fisheries and recreational use in terms of nutrient loading and risk of algal blooms[631]. The quality standards associated with the classification will determine if a waterbody can be considered suitable for bathing from a '*living environment'* perspective.

- A river is only considered suitable for bathing if classified as 'AA' or 'A'. This means the river has an average pH between 6.5 and 8.5, average BOD of ≤2mg/l, average suspended solids of ≤25mg/l, average DO ≥7.5mg/l and average total coliforms of ≤1,000 MPN/100ml[632]. Stantec and CREH are not aware of any epidemiological basis for this arithmetic mean total coliform value[633].

- A lake[634] is considered suitable for bathing if classified as 'AA' or 'A'. This means the lake has an average pH between 6.5 and 8.5, average chemical oxygen demand of ≤3mg/l, average suspended solids of ≤5mg/l, average DO ≥7.5mg/l and average (i.e., arithmetic mean) total coliforms of ≤1,000 MPN/100ml. It must also have a nutrient class of 'I' or 'II' – this requires an annual average of ≤0.2 mg/l total nitrogen and ≤0.01 mg/l total phosphorus.

- Coastal waters are only considered suitable for bathing if classified as 'A'. This means the water has an average pH between 7.8 and 8.3, average chemical oxygen demand of ≤2mg/l, average DO ≥7.5mg/l, average total coliforms of ≤1,000 MPN/100ml and non-detectable levels of N-hexane extract (oil etc.). It must also have a nutrient class of 'I' or 'II' – this requires an annual average of ≤0.3 mg/l total nitrogen and ≤0.03 mg/l total phosphorus.

[630] Environmental Quality Standards for Water Pollution
[631] Environmental Quality Standards for Water Pollution
[632] MPN = Most Probable Number and can be regarded as equivalent to colony forming units (cfu)
[633] Chapter 5 – Environmental Quality Standards for Waters; Standards Related to Conservation on Living Environment (Available at 06-wpctme-05.pdf (env.go.jp) sets out the justifications for the values chosen. For coliforms however the report simply states, "For bathing 1000 MPN/100ml was considered standard."
[634] Natural lakes and reservoirs with 10 million cubic meters of water or more

These criteria are used to pre-screen waterbodies which may be suitable for 'primary contact'[635] recreational water use. If a site is then designated as a monitored recreational water, the '*Water Quality standards for Human Health*' then apply, setting stricter public health standards for recreational water quality. Specific water quality criteria for recreational water[636], as set by the Ministry of the Environment, are then used to classify the quality of the recreational water with regards to human health impacts. Parameters include *colon bacillus*[637], presence of oil films, chemical oxygen demand and transparency. The classification is assigned based on average values obtained at the beach during the survey period. This is set out in Table 29. Stantec and CREH are not aware of any epidemiological basis for these thresholds and no studies are referenced in any the supporting documentation.

Table 29 – Summary of Bathing beach criteria applied at the start of each bathing season [source: Water Quality Criteria for Bathing Beaches (env.go.jp)]

Water quality category		Number of colon bacillus (MPN)	Presence of oil film	COD	Transparency
Good	AA	Below the limit of detection of 2/100ml	Not found	≤2 mg/l (≤3 mg/l in lakes)	Clear (or more than 1m)
	A	≤100/100ml	Not found	≤2 mg/l (≤3 mg/l in lakes)	Clear (or more than 1m)
Satisfactory	B	≤400/100ml	Found at times	≤5 mg/l	50 cm to 1 m
	C	≤1,000/100ml	Found at times	≤8 mg/l	50 cm to 1 m
Unsatisfactory		>1,000/100ml	Found consistently	>8 mg/l	<50 cm

An overall classification, considering both *living environment* and *human health,* is then produced whereby all minimum standards for all categories must be met[638].

Management Approaches

Japan does not perform sampling of recreational waters during the bathing season, instead taking weekly samples over the 3-month period from April to June prior to start of the bathing season (typically 12-13 samples), to assess a waterbodies overall performance. If, during this period, the site fails to achieve the minimum standards the beach will be closed for the duration of the bathing season[639].

The sampling is conducted by local governments while the reporting of beach performance is through the Ministry of the Environment. Where a bathing water area is found to have 'unsatisfactory' water

[635] Primary contact describes full immersion activities such as bathing, this is in comparison with secondary contact activities like paddleboarding or kayaking which are done on top of the water.
[636] Water Quality Criteria for Bathing Beaches | Water / Soil / Ground Environment | Ministry of the Environment, Government of Japan
[637] Stantec and CREH have been unable to confirm the exact meaning of *colon bacillus* and if it responds to specific microbiological tests recognised by the UK, EU, US or WHO. It is perhaps most likely to translate as 'Faecal Coliform', a subset of Total Coliforms which includes *E.coli*.
[638] Environmental Quality Standards for Water Pollution
[639] Results of the Reiwa 4th Water Quality Survey at the Bathing Area (before Opening) | Press Releases | Ministry of the Environment

quality (classed below C) it is closed for the rest of the season[640]. An investigation of remediation methods is performed where beaches that are class B or C are found to have at least one measurement of *colon bacillus* as >400 MPN/100ml, or where oil films are detected on the water's surface.

Annual ranking of the best recreational waters is published by the Ministry of the environment, including a ranking of the top 100 cleanest bathing waters, to improve public awareness of water quality protection[641]. National recreational water performance is reported and published to the public by the Ministry of the Environment on their website, for the public to find out which sites are open for the season and their most recent water quality performance[642].

There are no systems in place within the guidance to warn the public of short term variations in water quality.

Number of Recreational Waters

The number of official recreational waters can vary year on year, based on pre-season sampling, usage, past performance, and monitoring availability. In 2018, 823 sites were monitored and classified including both inland and coastal beaches. All data are publicly accessible on website of the Ministry of Environment[643].

Access and Use

Japan's coastlines, rivers and lakesides are popular for recreation and leisure, with sites such as Lake Biwa receiving 37.5 million visitors a year. Many of Japan's reservoirs are also designated swimming sites during the bathing season[644].

The bathing season is relatively short, typically starting on Umi no hi "Sea Day" which is on the third Monday of July and running until the end of August. While beaches and other recreational water sites remain open and accessible to the public year-round, life guarding is typically only present during the bathing season, and it is customary not to engage in contact recreation outside of the season. However, many coastal sites are popular for surfing outside of the season as surfing on designated beaches is typically banned or restricted during the bathing season.

Alongside traditional recreational waters many urban areas also have increasingly popular *Shinsui* ("Water Play") parks which feature shallow streams with vegetation and features to facilitate play, thereby providing public access to recreational waters even in urban areas[645]. Many of these parks are created either through re-naturalising urban waterways or piping in water from rivers to create

[640] Results of the Reiwa 4th Water Quality Survey at the Bathing Area (before Opening) | Press Releases | Ministry of the Environment
[641] RIETI - Japan's Environmental Policy
[642] Water Environment Information Site
[643] Water Environment Information Site
[644] Water Resources in JAPAN (mlit.go.jp)
[645] 親水緑道パンフ・表.ai (gotokyo.org)

artificial streams. An example *Shinsui* park in shown in Figure 31. These parks are subject to the same recreational water classifications detailed previously.

Figure 31 – Arima River Shinsui Park, Kobe, Japan [source: Playing with Water – Hidden Hydrology]

Dogs are generally allowed on beaches, though many sites ban or restrict dogs during the bathing season.

Performance

Over the last several years (excluding 2020 and 2021, where beaches across the country were closed for Covid-19) the number of Japanese recreational waters achieving 'Good' has remained ~ 80%, with AA class sites representing 63% of all bathing water sites in 2022. Throughout the last several years no monitored sites have failed to meet minimum Environmental Quality standards for Human Health and Environment, and therefore we can assume that no beaches have been closed due to water quality risks, outside of occasional temporary closures due to heavy rainfall events in catchments that have been identified as sensitive to this.

Table 30 – Performance of recreational waters across Japan between 2017 and 2022, [source: Results of the Reiwa 4th Water Quality Survey at the Bathing Area (before Opening) | Press Releases | Ministry of the Environment, Results of the Water Quality Survey of the Bathing Area (before the Opening) in the First Year of Reiwa | Press Releases | Ministry of the Environment, About the results of the water quality survey of the bathing place (before opening) | Press Releases | Ministry of the Environment]

Classification of water quality		2022		2019		2018		2017	
		Number of bathing areas	%	Number of bathing areas	%	Number of bathing areas	%	Number of bathing areas	%
Good	AA	474	63	586	72	499	61	510	62
	A	122	16	105	13	188	23	172	21
Satisfactory	B	159	21	128	16	133	16	132	16
	C	1	0.1	0	0	3	0.4	3	0.4
Unsatisfactory		0	0	0	0	0	0	0	0
Sum		756	100	819	100	823	100	817	100

Assuming *colon bacillus* is approximately equivalent to faecal coliforms, 63% of bathing beaches exhibiting an average of <2 MPN/100ml demonstrates an exemplar global standard for microbial water quality.

This performance is credited by the authorities as due to wholistic approaches to encouraging traditional and sustainable agricultural practices allied with significant investment in foul and combined sewerage infrastructure and nature based solutions [646].

The agricultural practices are perhaps specific to a Japanese context, and not easily comparable with the UK other than to say that significantly increasing 'wetted' areas (for example, rice paddies and wetland areas) has made a big improvement.

Investment in sewerage infrastructure is perhaps more contextually relevant. Japan has heavily invested in upgrading the old jōkasō wastewater systems as well as upgrades to storm overflows, including the segregation of stormwater and wastewater, primary treatment of storm overflows and the creation of stormwater retention tanks[647] (see Figure 32). For example, Tokyo boasts one of the largest underground stormwater tank systems in the world; the G-Cans is built to manage 200-year floods capable of draining 200 tonnes of segregated water per second into the Edogawa River[648]. Japan's approach to modernizing its sewer network has been focused on "decentralization" though the installation of small primary treatment facilities for stormwater overflows (see Figure 32) and modern '*Gappei-shori Johkasou*' systems[649] (see Figure 33) allow Japan to target point sources in rural and remote mountain communities as well as its big cities.

[646] River and Wetland Restoration: Lessons from Japan | BioScience | Oxford Academic (oup.com) and HYPERLINK "https://www.mlit.go.jp/river/basic_info/english/river.html"II.River Improvement Measures Taken by the MLIT

[647] untitled (jswa.jp)

[648] G-Cans Project, Kasukabe, Saitama, Greater Tokyo Area - Water Technology (water-technology.net)

[649] Traditional jōkasō plants which only offered primary treatment replaced by modern gappei-shori johkasou package treatment plants with anaerobic filters, aeration tanks, sedimentation tanks and tertiary disinfection.

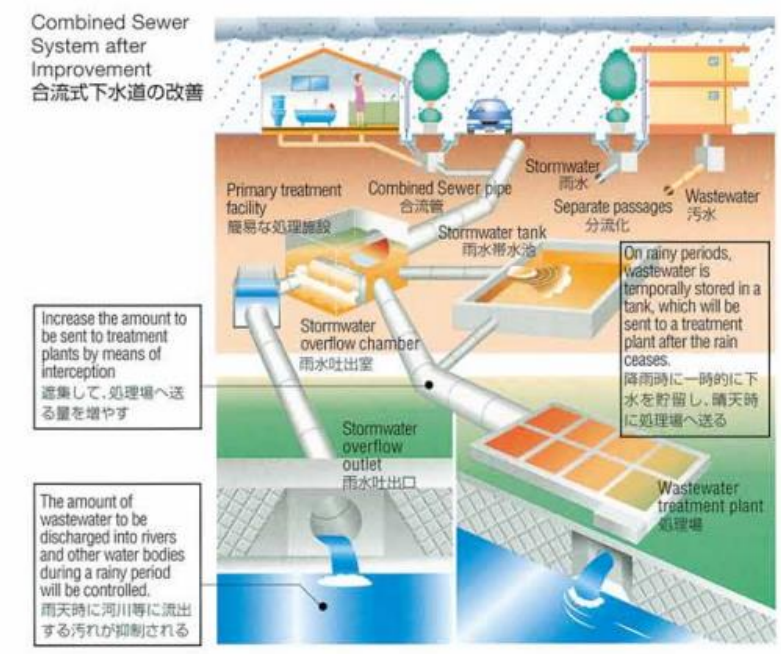


Figure 32 – Illustration showing features of combined sewer improvement in Japan [source: untitled (jswa.jp)]

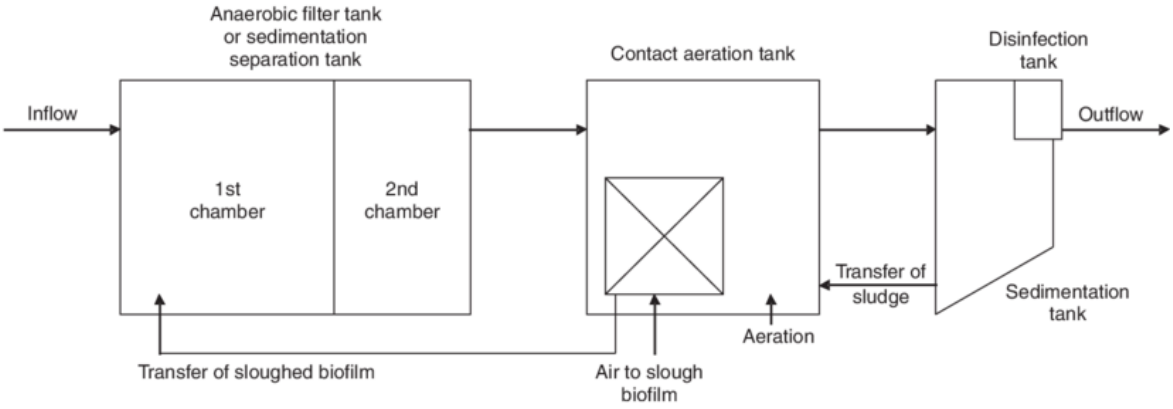


Figure 33 – Schematic of a typical process flow for a household gappei-shori johkasou (source: https://www.researchgate.net/publication/245409140_On-site_wastewater_treatment_and_reuses_in_Japan)

6.6 Lessons Learned

These case studies demonstrate the varied global approach to recreational water management and have sought to highlight areas which England and Northern Ireland could consider with regards to future bathing water regulations following the UK's exit from the EU.

Australia (Tasmania)

Tasmania has not proven to be the best example of the implementation of Australian guidelines, in that it hasn't updated state legislation since the release of the latest guidelines. The Australian national guidelines however offer an interesting example of some of the changes that could be made to UK regulations to address some of the evolving trends discussed previously.

By covering a much wider range of factors that can impact human health the guidelines are much better placed to communicate to the public whether a recreational water is a good and safe place for people to enjoy. The alert level approach and longer-term classifications also provide a simple method of communication which can be easily understood and acted upon by the public.

The risk-based framework approach for assessing overall quality has many benefits, especially in its ability to offer elements of preventative risk reduction as supposed to the more retrospective UK classification system. It does, however, add a considerable degree of complexity for those responsible for managing the recreational water which is perhaps one of the reasons why Tasmania has been reticent to update its state legislation in line with latest national guidelines.

Due to the additional factors being considered and the wider scope of the guidelines to all recreational water users, Australian guidelines, like those of New Zealand, the US and Japan, do not offer many useful comparisons with regards to the identification or un-classification of recreational waters when considered against a UK context.

There is no reason why UK bathing water Regulation should be limited to risks associated with contracting gastro-intestinal illness and as such Stantec and CREH recommend that additional factors, such as those covered by the Australian guidelines, be considered in any future revision of UK Bathing Water Regulations.

New Zealand

Whilst New Zealand guidelines are similar to Australia they are not as far reaching, focusing solely on microbiological water quality. The more simplified risk-based framework used in New Zealand is perhaps also more understandable to the recreational water managers.

New Zealand, along with Tasmania and Connecticut, acknowledges recreational water management to primarily be a human health issue. In practice, this means that recreational water management is the responsibility of national and local public health authorities rather than the environmental regulator as is the case in the UK.

Many of the differences between New Zealand and UK approaches, such as the New Zealand requirements for mandatory weekly sampling, regular sanitary inspections and an inability to disregard or discount high samples, can be attributed to this increased focus on public health. These factors also help explain why recreational water quality in New Zealand appears poorer than the UK.

United States (Connecticut)

The US RWQC represent an alternative approach to UK bathing water Regulation. The two tier assessment system, based on number of days of beach closures and long term water quality, has both advantages and disadvantages when compared to the UK. For example, the requirement for sanitary inspections following exceedances to the BAVs or 30-day rolling geometric mean and STV should help identify causes of the pollution earlier but is heavily reliant on taking regular samples and would not necessarily help prevent exposure to pollution following, for example, rainfall, unless preceding samples were already high.

Within Connecticut, the concept of tiered protection based on 'primary' or 'secondary contact' recreational water uses within Connecticut is something which could be considered within future changes to England and Northern Ireland regulations.

In addition to the RWQC, *'Swimming Advisories for Cyanotoxins'* sets out a framework or protocol which could be built upon for the complex cyanobacteria problem. The geographic and climatic differences between the US and UK, however, mean that whilst the protocol is informative the UK will need to develop its own standards and approaches.

The differences in context and guidelines do mean that the US and UK standards are not interchangeable, and complications have arisen when aspects of the RWQC have tried to be incorporated into England's legislation. The use of viral pathogen reductions in English Environmental Permitting Regulations for example has been discussed in section 2.4.

Japan

Japan offers a somewhat unique approach to environmental water quality management and an example of how to meet extremely high standards. Whilst certain approaches and parameters can be questioned or may not be suitable for a UK context, the integration of environmental and recreational water regulations shows what could be possible if the UK were to fully integrate the Water Framework and Bathing Water regulations post Brexit.

In Japan the wholistic approaches to encouraging traditional and sustainable agricultural practices allied with significant investment in foul and combined sewerage infrastructure can also be seen to have made a real and tangible improvement to longer term water quality trends.

Looking specifically at the key aspect of the Japanese system, where water quality is determined prior to the bathing season, Stantec and CREH don't believe this would work in a UK context for many reasons including:

- UK bathing water quality is shown to decrease on average throughout the bathing seasons so pre-season assessments are not reflective of bathing season quality.
- Full closure of a beach for an entire bathing season, including removing provision of lifeguards is unlikely to be deemed acceptable by the UK public.
- Whilst Japan operates on a combined sewerage network, the significant improvements to sewerage infrastructure, provision for stormwater treatment and declining agricultural inputs mean Japan's recreational waters are not as susceptible to rainfall driven pollution (outside the monsoon season) as the UK. This is perhaps why so many of their beaches meet the highest AA rating, exhibiting an average of <2 MPN/100ml *colon bacillus*.

Finally, whilst not directly rated to bathing water regulations, the concept of *Shinsui* or 'urban water parks' as designated recreational water spaces are a great example of integrated approaches to wellbeing, environment, flooding mitigation and biodiversity.

Stantec and CREH recommend that consideration of a minimum standard for IE and *E.coli* within Water Framework Regulations, akin to the Japanese approach, would help align key environmental water quality and human health related regulations on the water environment.

Chapter 7: Conclusions and Recommendations

This report has sought to review the current legal provisions for bathing waters in England and Northern Ireland, assess their implementation and effectiveness, and compare these provisions against the rest of the UK and selected EU and Worldwide jurisdictions.

The report demonstrates that while the England and Northern Ireland authorities are implementing the requirements of the current Regulations reasonably well, the effectiveness of the Regulations could be improved in certain areas:

- Closure of legal gaps in Northern Ireland around misconnections and diffuse bacterial pollution from agriculture.
- Better alignment with other related legislation and water industry AMP cycles.
- Within England, public consultation could be improved around changes to bathing water guidance and regulations; examples include the recent changes to the eligibility criteria for identification, and the current review of bathing water Regulations.
- Consideration of additional factors which can influence water quality when designing the microbiological sampling and monitoring programmes.
- Developing protocols for addressing and communicating risks around cyanobacterial proliferations.
- Predictive water quality forecasting should play a greater role in bathing water management approaches, with more robust modelling approaches and real time communication of risks via electronic signage boards at the bathing waters.

Overall bathing water performance could also be improved, a factor most clearly demonstrated by comparing the percentage of sites achieving the target 'Excellent' classifications in England and Northern Ireland against EU and non-EU countries which report against the EU Bathing Water Directive. Some of these nations offer positive lessons on how to achieve better outcomes, including measures which could be taken now by the main authorities or incorporated into future reviews of the bathing water Regulations:

- A structured pre-identification process, such as used in Germany, offers a mechanism to be able to align regulations with the water industry AMP cycles and ensure a minimum standard of water quality is achieved prior to formal identification.
- Greater emphasis on the requirement for tertiary UV disinfection, or similar, on wastewater treatment discharges to freshwaters.

Further afield, other recreational water guidelines and approaches have been considered which can offer lessons which could be incorporated in the current or future reviews to bathing water regulations. The report highlights several key aspects, all of which can be traced back to a primacy of public health considerations in decision making:

- Extending the scope of regulations to include all recreational water users[650].

[650] This will likely require new epidemiology to define the risk.

- Extending the scope of regulations to include other additional factors which can impact the human health of recreational water users.

A record of the recommendations contained within this report is shown below in Table 31.

Table 31 – Record of Recommendations

Topic	By Whom	Applies To	Recommendation
Overarching Aspects	Stantec & CREH	England & Northern Ireland	It is recommended that the definition of 'bather' and the potential to extend to include other recreational water users be considered as part of future reviews or updates to UK Bathing Water Regulations (Chapter 3.8).
			The length of the bathing season should be influenced by the recreational water usage. If high usage can be evidenced at particular sites outside the traditional bathing season there should be consideration for extending the bathing season to cover all periods of high usage (Chapter 3.8).
			UK bathing water regulations has a basis in human health but there is a wide range of factors which can impact the human health of recreational water users which are not covered. It is recommended that additional factors, such as those outlined in Australian Guidelines, be considered in any future revision of UK Bathing Water Regulations, all of which should feed into a single classification on suitability for use (Chapter 6.6).
			A defined and structured pre-application process, such as seen in Germany, would allow opportunities to align with the WINEP and Water Industry Price Review / Price Control timeframes, whilst also allowing potential issues to be addressed prior to formal identification. This approach of 'investigate first, then decide on status' is also preferential with regards to reducing public health risks (Chapter 3.4 & 5.6).
Regulation Alignment	Stantec & CREH	England & Northern Ireland	Better alignment could be achieved between Water Framework and Bathing Water regulations by allocating the bathing water sample point as an additional WFD sampling and compliance location. This would allow WFD nutrient and chemical parameter data, which may have a direct or indirect influence on human health (for example nutrient data which could be used to predict cyanobacteria proliferations or concentrations of specific chemicals such as PFOS), to be used for multiple purposes. (Chapter 3.7)
			Consideration of a minimum standard for IE and *E. coli* within the Water Framework Regulations, as seen in Japanese legislation (Chapter 6.6), would also help to better align the key environmental and human health related regulations on the water environment.
			UK Bathing Water Regulations should consider how to best align with Water Industry AMP cycles and Price Reviews / Price Controls. This could be in the form of a structured pre-identification process such as used in Germany (Chapter 3.7).
		England	If the Water Industry is to be incentivized for delivering the target standard of 'Excellent' bathing waters, OFWAT Performance Commitments should be aligned to standards set out in the Regulations (Chapter 3.7).
			Environmental Permitting Regulations guidance on enteroviruses in bathing waters should be aligned with UK Bathing Water Regulations rather than the United States Recreational Water Quality Criteria to allow innovative technologies to be developed (Chapter 3.7)
			Environment Act requirements on storm overflows (as set out by the Storm Overflow Discharge Reduction Plan) within given distances of bathing waters should have a basis in scientific evidence. Allowances

Topic	By Whom	Applies To	Recommendation
			should also be made for continuous sewage discharges and pollution from agriculture (Chapter 3.7).
		Northern Ireland	Closing the legislative gaps around faecal pollution from agriculture and addressing misconnected properties would help Northern Ireland to improve bathing water quality at non-Excellent sites (Chapter 3.7)
Identification Processes		England	When undertaking the review of English Bathing Water Regulations, it is recommended that DEFRA undertake public consultation around the minimum eligibility criteria for identification, as well as understanding public concerns around many of the new and evolving trends. DEFRA should look at the DAERA formal review as an example of best practice (Chapter 3.4).
			Better dissemination of information around reasons for rejected bathing water applications is needed to increase transparency within the process (Chapter 3.4)
Parameters & Thresholds	WHO	England & Northern Ireland	With regards to micro-biological assessment, *E. coli* and intestinal enterococci as well as the four levels within the current classification system ('Excellent', 'Good', 'Sufficient', and 'Poor') should be retained (Chapter 3.5).
			It is recommended that the threshold classification system is solely based on 95 percentile values instead of a mixture of 95 and 90 percentile standards as the current system is deemed by the WHO to be "too confusing and unjustifiable" (Chapter 3.5).
			No change is needed to the current method used… for macro-algae and / or marine phytoplankton, i.e., their consideration as part of the bathing water profile (Chapter 3.5).
			Ongoing research on the issue of microplastics that falls within the scope of the EU Marine Strategy Framework Directive should reveal in the short to medium term whether it is relevant also for consideration within bathing water Regulations (Chapter 3.5)
	Stantec & CREH	England & Northern Ireland	England and Northern Ireland need to develop protocols for cyanobacteria proliferations. The German 'Alert Levels' are an example of initial best practice in this area (Chapter 3.5).
			Where cases of 'Swimmers Itch' are identified, this information should be included in the bathing water profile (Chapter 3.5).
			Where cases of 'wound infection' are identified, this information should be included in the bathing water profile (Chapter 3.5).
			Further research into the transmission of, and surveillance methods for, antimicrobial resistant microorganisms are required before becoming part of bathing water Regulations (Chapter 3.5).
Monitoring & Assessment	Stantec & CREH	England	Bathing Water Regulations should be amended to allow for the monitoring location to be situated in the area with the highest risk of pollution as defined by the bathing water profile. This would bring England in line with the rest of the UK and EU and prevent issues such as those seen at the Wharfe at Cromwheel, Ilkley (Chapter 3.5).
		England & Northern Ireland	Bathing water monitoring should be forced by Regulations or Best Practice Guidelines to consider the impact of within-day variability when developing sampling and monitoring calendars (Chapter 3.5).
			Bathing water monitoring should be forced by Regulations or Best Practice Guidelines to consider the impact of seasonal water quality trends and bathing water usage with regards to sampling frequencies (Chapter 3.5).
	WHO	England & Northern Ireland	At least 100 samples should be used to estimate the upper percentile values if significant misclassification of bathing waters is not to occur. More pragmatically, a minimum of 20 samples per year to reduce the risk of misclassification (Chapter 3.5).

Topic	By Whom	Applies To	Recommendation
			Data from bathing water sites with at least 80 samples should be tested for log10 normality (using the Shapiro-Wilk test). If log10 normality is demonstrated, the [current calculation] can be used for percentile calculation. Where the data are not shown to be normally distributed, the Hazen calculation method should be used. This measure will reduce misclassification of sites. (Chapter 3.5)
	Stantec & CREH	England & Northern Ireland	Whilst existing min / max values can be retained for calculation of classification, decreasing the lower limit of detection below 10 cfu/100ml is recommended. This would need to be justified on a cost-benefit basis (Chapter 3.5).
Prediction & Forecasting	Stantec & CREH	England & Northern Ireland	Internal EA guidelines around minimum acceptability for BW model confidences in predicting explained variance and other appropriate metrics for short term pollution risk forecasting should be extended to Northern Ireland and be applied as a target to all bathing water modelling activities (Chapter 3.6).
			All short-term pollution forecasting models could be improved through links with the Urban Wastewater real time event duration monitoring data from storm overflows (if the assets are shown to impact bathing water quality). Into the future, forthcoming Environment Act continuous water quality monitoring data should also be used to improve model predictions (Chapter 3.6).
		Northern Ireland	The multi-parameter statistical model approach used by England (refer to Section 3.6) would improve upon the system currently in use in Northern Ireland which is very limited by the quality of the modelled input data. This would provide more accurate pollution risk forecasting ensuring the public are better informed of the risks before bathing. (Chapter 4.5)
Public Comms	Stantec & CREH	England & Northern Ireland	Results of the predictive water quality models be displayed on electronic bathing water signage for English and Northern Ireland bathing waters which are prone to significant variance in water quality (Chapter 3.7)
			Provisions for multiple (ideally electronic) signs covering all key beach access points be considered for the advice against bathing as part of any future review or update to UK Bathing Water Regulations (Chapter 3.7)
			Increased and more regular information concerning works being done improve 'Poor' bathing waters should be communicated to the public (Chapter 3.3)