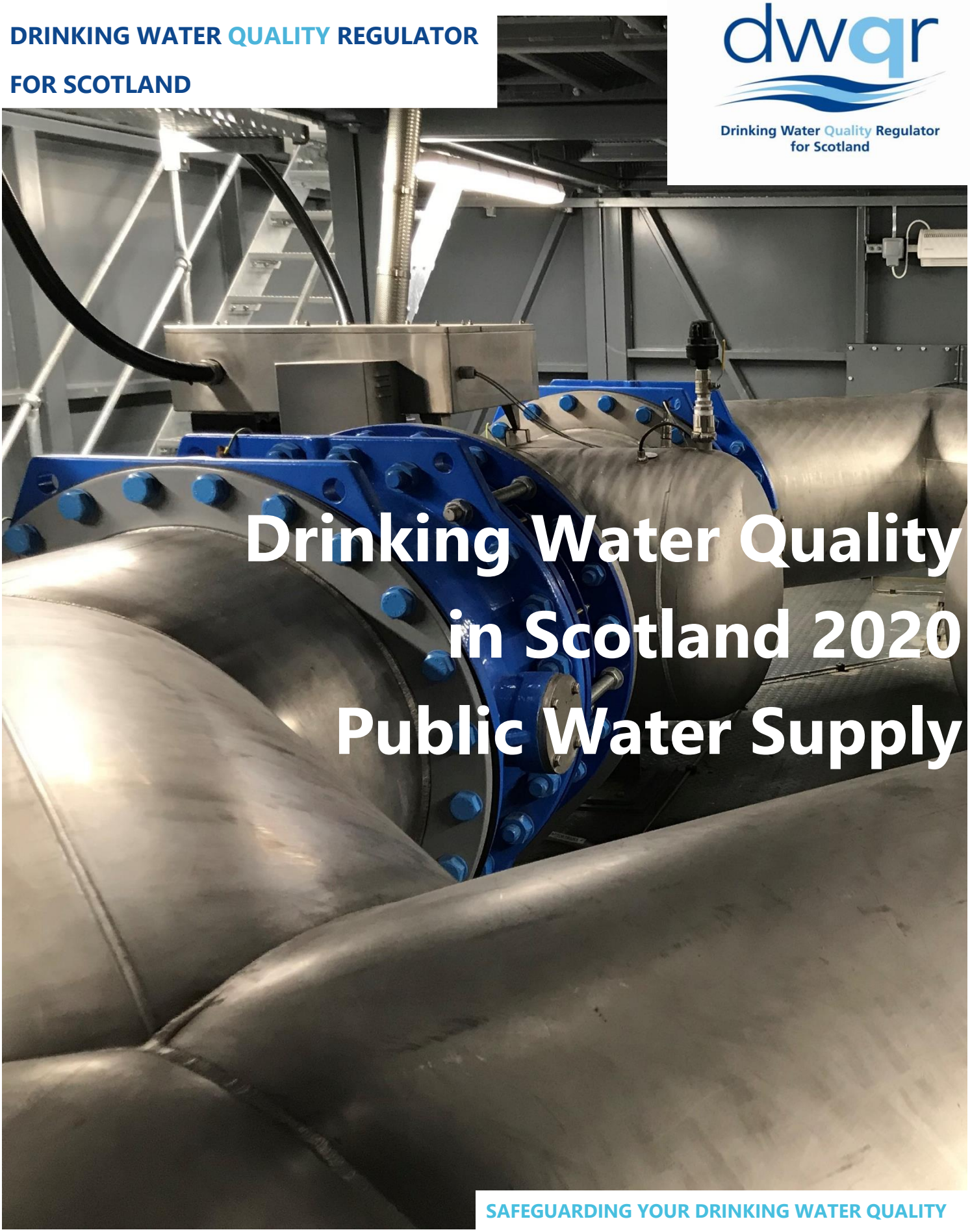
DRINKING WATER QUALITY REGULATOR

FOR SCOTLAND

dwqr

Drinking Water Quality Regulator for Scotland



Drinking Water Quality in Scotland 2020

Public Water Supply

SAFEGUARDING YOUR DRINKING WATER QUALITY

Contents

i. FOREWORD

This is the nineteenth report from the Drinking Water Quality Regulator for Scotland (DWQR). The report provides a summary of the quality of Scotland's public water supplies for 2020. My report also describes our work during the calendar year 2020 in scrutinising the quality of drinking water provided by Scottish Water.

The quality of our drinking water is vital for our health and wellbeing and never has that been more important than during the COVID-19 pandemic when all but essential workers were asked to stay at home. The quality and safety of our drinking water is verified by Scottish Water through sampling at multiple locations which include treatment works, storage tanks and at consumers' taps. In the very early stages of the pandemic it was apparent that changes would need to be made to sampling arrangements to continue to provide verification of water quality in a way that did not compromise the safety of consumers in their homes and protected sampling staff during the pandemic. DWQR staff met frequently with Scottish Water to discuss and agree pragmatic alternative arrangements to ensure continuity of sampling and analysis.

A direct comparison in quality data between years is difficult due to the changes described above, however, I can say that the microbiological quality of water leaving treatment works and storage tanks has improved. Due to the pandemic, sampling from consumers' taps was only possible for part of the year and for the remainder samples were taken from Scottish Water's storage tanks, by agreement with DWQR. Scottish Water met their regulatory commitments regarding water sampling and this data shows a continued high level of compliance with standards.

It was necessary to amend our approach to auditing due to the pandemic. Due to restrictions and the need to protect essential services, it was not possible to visit as many Scottish Water sites as we would in a normal year. Instead, other innovative means of auditing were used, such as video calls, photographic and written evidence to undertake our scrutiny activities. An area of focus was on distribution activities and some of the audits raised significant findings around hygiene, working practices and the cleanliness of maintenance vans. This is an area that must be improved upon and will continue to be a focus in 2021.

2020 presented Scottish Water with many challenges, which included significant increases in water usage and changes in demand patterns for water; staff absence through illness or self-isolation and changes in working patterns to protect staff. However, through exemplary pandemic contingency planning and incident response, the provision of verified high quality of drinking water and continuity of services for consumers was maintained, for which Scottish Water should be commended.

I hope you find this report informative and that it enables you to share the confidence I have in Scotland's public water supply.

Sue Petch

Sue Petch

Drinking Water Quality Regulator for Scotland

ii. EXECUTIVE SUMMARY

In Scotland the public water supply is provided by Scottish Water. All other supplies are known as private water supplies, managed by owners and/or users. The Drinking Water Quality Regulator for Scotland (DWQR) regulates the quality of water supplied by Scottish Water, ensuring that drinking water supplies meet the requirements of The Public Water Supplies (Scotland) Regulations 2014 ("the Regulations"). This report describes the quality of the public supply provided by Scottish Water and the regulatory actions that DWQR has undertaken in 2020. DWQR publishes a separate report on private water supplies which you can view on our website at https://dwqr.scot/information/annual-report/.

Scottish Water takes and analyses its own samples to demonstrate that the water supplied complies with regulatory requirements. Samples are taken from water as it leaves treatment works, service reservoirs (also referred to as storage points) and from randomly selected consumers taps. This sampling and analysis is independently accredited and is consistent with water industry practice in the rest of the UK. DWQR assesses Scottish Water's monitoring programme and results. When the pandemic began, DWQR worked closely with Scottish Water to ensure continuity of sampling and analysis. This meant that water quality could be verified in a way that did not compromise the safety of consumers in their homes and protected sampling staff. For example, when sampling from consumers' taps was not possible for part of the year, samples were taken from Scottish Water's service reservoirs.

In 2020, Scottish Water carried out a total of 304,006 regulatory tests on Scotland's drinking water for which there is a numerical standard and many more for operational reasons such as following a burst main. Of the 137,681 tests taken to represent water at consumers taps 99.95% complied with the standards. While the data is not directly comparable to 2019, in 2020 Scottish Water met their regulatory commitments regarding water sampling and the data contained in this report shows a continued high level of compliance with standards. A further 67,373 tests were carried out on water supplied from treatment works and all but 30 of these tests met the required standards which is an improvement on previous year's performance. 98,952 tests were also taken from service reservoirs and compliance at this point of the supply chain was also improved.

As well as reporting water quality test results Scottish Water also report the numbers of contacts received from consumers about the quality of their drinking water. There were 18,142 such contacts during 2020 and the greatest proportion (81%) of these related to the appearance of the water. DWQR also carries out formal complaint investigations if consumers are not satisfied with Scottish Water's own investigation. We carried out two investigations during 2020 related to the taste of the water and illness concerns. Whilst neither case was upheld we did make three recommendations to Scottish Water. Further information on Scottish Water's monitoring programme, results and consumer contacts can be found in Section 1 of this report.

Very occasionally things go wrong and Scottish Water is required to tell DWQR about all events that could affect water quality or cause consumer concerns. The number of water quality events reported in 2020 was 650 this is lower than in 2019, but those that were of a more serious nature and were

categorised as water quality incidents was 29, the same as in 2019. DWQR's 2019 report highlighted concerns about the number of incidents were human error was a causal factor and this concern remains. There were 7 incidents in 2020 were poor communication was found to be a cause or compounding factor. Lack of escalation, assumptions and poor communication between field teams and the Intelligent Control Centre (ICC) were highlighted in our incident reports. It is essential that improvements are made to this crucial aspect of event response to minimise their duration if incidents are to be avoided. In response to these findings DWQR staff carried out an audit of Scottish Water's competent operator training and made a number of recommendations for improvement. Section 2 of this report gives more details on some of the incidents that we investigated during 2020/21.

Audit and inspection is a key part of DWQR's role and we inspect a range of Scottish Water activities and assets that could affect the quality of drinking water every year, auditing against regulatory requirements and industry best practice. Sites are selected for inspection using a risk based process that takes into account sample failures and water quality events and incidents. We had to amend our approach to auditing during the pandemic, to minimise the number of site visits, and used alternative approaches such as video calls, taking written evidence as alternatives. During 2020, five incident investigation visits took place at water treatment works and nine distribution and storage points were audited. An audit of all four of Scottish Water's area public health teams was also concluded in 2020. 48 recommendations were made following audits in 2020. Further information on our audit and inspection work is given in Section 3 of this report.

Image 1 Watch Water Reservoir.

2020 in review
Public Water Supplies in Scotland

233 Water Treatment Works

967 Water Storage Tanks

282 Water Supply Zones

Drinking water sources

There are 30,287 miles of drinking water distribution pipes in Scotland

We assessed:

304,006 tests were taken by Scottish Water

137,681 tests were taken at consumers' taps

99.95% of tests to represent consumers' taps passed

We reviewed 650 drinking water related events

We declared 29 incidents

We assess **every** fail | We review **every** event
We investigate **every** incident

1. PUBLIC DRINKING WATER SUPPLIES IN SCOTLAND 2020

1.1 Water Treatment Works

Scottish Water has 233 water treatment works (WTW) that treat water to ensure it is safe to drink and complies with the standards set out in the Regulations. Treatment works in Scotland range from large supplies serving whole cities to very small works that supply small communities consisting of a few properties. Regardless of size, DWQR expects Scottish Water to ensure that its WTW are capable of treating the range of raw water quality which is found in source waters.

Overall, 67,373 tests were undertaken on samples collected at treatment works, and of these, 30 (0.04%) failed to meet the required standard.

1.1.1 Microbiological Quality at Water Treatment Works

Coliforms and *E. coli* are two variables (known as parameters) measured in water leaving treatment works in order to check that disinfection has been successful. Coliforms are a group of bacteria widely found in the environment and *E. coli* is an indicator of faecal contamination. If either are detected it shows that disinfection hasn't been effective at killing potentially harmful bacteria. The standard is for none to be present and all failures must be fully investigated by Scottish Water and reported to DWQR, the local NHS board and relevant local authority.

When investigating sample failures at treatment works, Scottish Water consider a number of factors, such as changes in the quality of the incoming raw water; issues or unexpected changes in the treatment process; the circumstances of sampling, including the condition of the sample line and sample tap; and evidence from samples taken downstream in the distribution system. They should also consider taking additional samples, including between stages of the treatment process, to establish whether there is a genuine problem and where this might be. Data from on-line monitoring can also yield very useful information on quality around the time of the failure. Scottish Water routinely carries out root cause analysis of investigations of sample failures. This is beneficial in understanding and resolving the causes underlying many failures.

Microbiological quality at WTW improved significantly in the first decade of this century, however compliance has since plateaued and 2019's results represented a deterioration in that trend. Results for 2020 have improved and DWQR expects Scottish Water's focus on disinfection as a key driver for investment to continue, with a corresponding increase in disinfection performance.

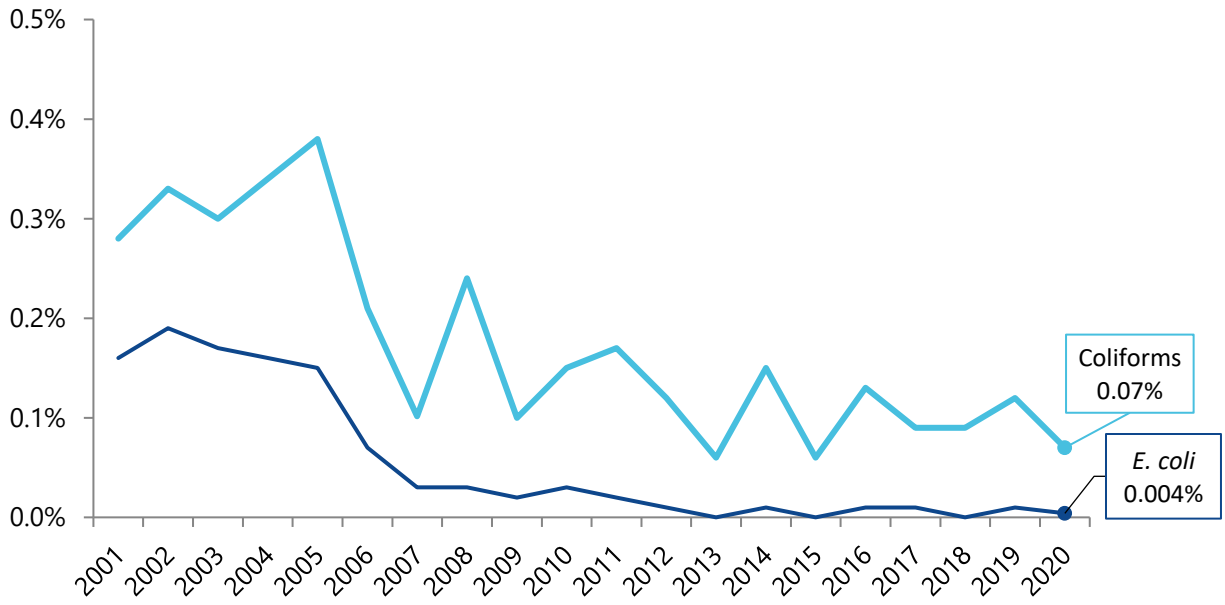


Figure 1 Microbiological Failure Rate at Water Treatment Works

1.1.2 *Cryptosporidium* at Water Treatment Works

Cryptosporidium is a microscopic protozoan parasite that can live in the gut of humans and other animals. *Cryptosporidium* oocysts can enter a water supply if faecal material is washed into the source (raw) water and oocysts are not removed by the treatment process. *Cryptosporidium* is not killed by chlorine and requires the water treatment process to be well optimised and monitored in order to ensure that it is physically removed. Scottish Water tests water supplies for *Cryptosporidium* in order to verify that these processes are effective. Ultra-violet (UV) light can be effective at inactivating oocysts and Scottish Water uses this process at a small number of sites where physical removal of oocysts by the original treatment process is not consistently achieved.

In 2020, 46 samples contained *Cryptosporidium* oocysts, however all but six of these detections received a UV dose adequate to inactivate the oocyst. All failures must be fully investigated by Scottish Water and reported to DWQR, the local NHS board and local authority.

Table 1 *Cryptosporidium* Detections at Water Treatment Works

Cryptosporidium	**2020**	**2019**	**2018**	**2017**	**2016**
No. of tests	5,213	9,101	8,764	9,087	9,737
No. of samples containing *Cryptosporidium* oocysts	46	38	35	44	87
% of samples containing *Cryptosporidium* oocysts	0.88	0.40	0.40	0.48	0.89
No. of WTW sampled for *Cryptosporidium*	229	230	238	234	238
No. of WTW with one or more samples containing oocysts	8	11	23	20	28
% of WTW with one or more samples containing oocysts	0.15	4.78	9.66	8.55	11.76

Image 2 UV filters like this one inactivate *Cryptosporidium* oocysts which may be present in source waters.

1.1.3 Chemical Quality at Water Treatment Works

Water is tested for two chemical parameters, nitrite and turbidity, in samples taken from treatment works. Nitrite is a compound of nitrogen that can occur in supplies where ammonia is added to chlorine in a process called chloramination. This process needs to be tightly managed and the presence of nitrite in significant quantities can indicate that it is not controlled as it should be. There were no exceedances of the nitrite standard at treatment works during 2020.

Table 2 Nitrite Failures at Water Treatment Works

Nitrite	2020	2019	2018	2017	2016
Number of tests	3,282	3,250	2,980	2,853	2,801
Number of tests exceeding standard	0	0	0	0	3
Percentage of tests exceeding standard	0.00	0.00	0.00	0.00	0.11
No. of WTW not meeting regulatory requirements	0	0	0	0	1
% of WTW not meeting regulatory requirements	0.00	0.00	0.00	0.00	0.41

Turbidity is a measure of the extent to which particulate matter in the water scatters light – effectively how cloudy the water appears. Turbid waters cannot be properly disinfected, hence a treatment standard of 1.0 nephelometric turbidity units (NTU) has been set in the Regulations. Five exceedances of the turbidity standard occurred in 2020.

Table 3 Turbidity Failures at Water Treatment Works

Turbidity	2020	2019	2018	2017	2016
Number of tests	7,139	7,026	6,859	7,060	7,127
Number of tests exceeding standard	5	8	9	10	10
Percentage of tests exceeding standard	0.07	0.11	0.13	0.14	0.14
No. of WTW not meeting regulatory requirements	3	6	9	9	9
% of WTW not meeting regulatory requirements	1.28	2.56	3.78	3.78	3.73

All were investigated by Scottish Water. Two WTW recorded two failures each: Turriff WTW in Aberdeenshire and Aviemore WTW in Highlands, which were reported to DWQR and fully evaluated. The Aviemore failures were attributed to sediment from the lime batching plant (for pH control) entering the sampling pipework. At Turriff the failures were also attributed to capability issues with the lime batching plant. DWQR considered the need for enforcement action and Scottish Water has given a letter of commitment for the replacement of the lime dosing with caustic soda. Ringford WTW also recorded one failure which was attributed to heavy rainfall in the catchment and ongoing groundworks near the boreholes. This event was assessed by DWQR as an incident due to the duration of the failure, the details of which are available on the DWQR website https://dwqr.scot/regulator-activity/water-quality-incidents/.

Image 3 An online turbidity monitor at Poolewe WTW.

1.2 Service Reservoirs

Service reservoirs (also referred to as storage points) are located at points in the distribution system to store water for hydraulic reasons and to meet the demand for water from consumers through the day. If these service reservoirs are not maintained they can be prone to inward leakage from contaminated surface water. This needs to be controlled through inspection and maintenance. We inspect a selection of structures each year in order to ensure that they are being maintained and operated in a manner that minimises risk of contamination of the water. Coliform and *E. coli* samples are taken regularly from service reservoirs to check that disinfection is effective within the distribution system and to identify any instances where the water may have become contaminated. All *E. coli* and coliform failures must be fully investigated by Scottish Water and reported to DWQR, the local NHS board and local authority.

In 2020, 54 samples taken from service reservoirs contained coliforms with six of these also containing *E. coli* from the same sample. Figure 2 shows annual performance since 2007.

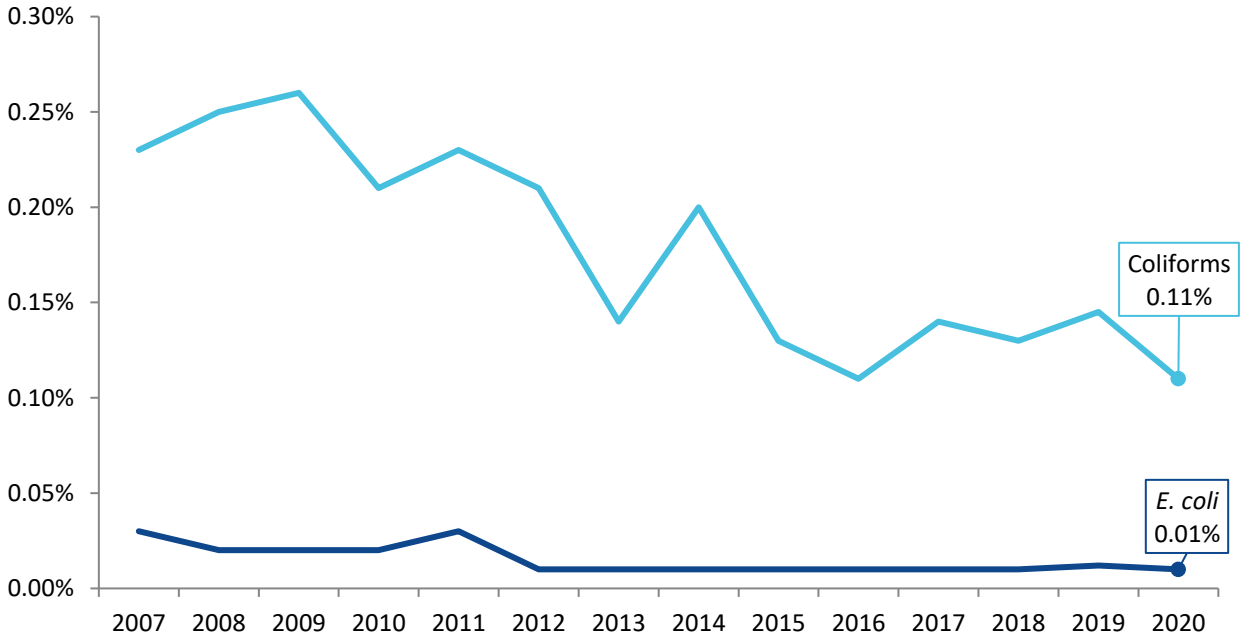


Figure 2 Microbiological Failure Rate at Service Reservoirs

The service reservoirs that reported samples containing *E. coli* were Brankanentham (Turriff); Caolis & Hynish (Tiree); Gourdon (Inverbervie); Moy (Tomatin) and South Staneyhill (Lerwick).

At Moy the failure was most likely due to the exposure of the sample point to wind and weather conditions, causing environmental contamination. Brankanentham service reservoir was immediately taken out of service - the failure was attributed to poor tank condition which is being addressed. At South Staneyhill Scottish Water's investigation concluded that the failure was due to the condition of the sample point with asset integrity of the tank being a contributory factor.

The Caolis and Hynish failures from a contaminated sample resulted in a Boil Water Notice for the whole of Tiree and prompted a DWQR water quality incident investigation. The actions put in place to

prevent this happening again included the re-siting of the sample tap and cleaning and refurbishment of the service reservoirs and clear water tank. At Gourdon the failure also resulted in a DWQR water quality incident investigation due to the structural integrity of the tank which has since been removed from service. Detailed reports of these investigations can be found on the DWQR website https://dwqr.scot/regulator-activity/water-quality-incidents/.

Scottish Water have committed to replacing all non-compliant service reservoir sample points within the next two years to improve performance. The Regulations require that no sample from service reservoirs should contain *E. coli* and at least 95% of samples do not contain coliforms. No service reservoirs failed to meet the 95% requirement.

Image 4 Recently refurbished Torphins Cockardie SR, showing renewed joint seals, surface coating and peripheral drainage to prevent ingress of surface water. Service Reservoirs need to be maintained regularly to reduce risk of contamination.

1.3 Water Quality at Consumers' Taps

Scottish Water's supply area is divided into 282 water supply zones serving up to 100,000 people. Water is tested for 70 variables known as parameters, with sampling frequencies determined by the size of the population in the water supply zone. In March 2020, due to the pandemic, it was agreed that the usual approach of sampling at randomly selected consumers' properties was no longer appropriate and all zonal sampling took place at Scottish Water's storage points. As restrictions lifted for a time later in the year, some sampling took place at Scottish Water and DWQR staff volunteers' properties, but as restrictions were reimposed towards the end of the year this ceased and sampling reverted to storage points.

DWQR met fortnightly with Scottish Water during the period to discuss issues with sampling and review the approach taken. In particular, changes to island flight times and other logistical issues with the transport of samples made it difficult at times for Scottish Water to get samples to the laboratory within specified time limits. Through the regular meetings, DWQR was able to ensure that everything possible was being done to minimise disruption to the sampling programme, with the verification of the safety of drinking water being a priority.

This necessary change in sampling approach means that, although the correct numbers of samples have been taken from supply zones, the circumstances around their collection is different. Sampling at storage points means the quality of water, and consequently the data from the sampling, will be slightly altered. For example, sampling at fixed points means that the usual variation in taps and distribution system locations does not occur. This can affect parameters such as iron, microbiology and plumbing metals in particular, such as lead and nickel where domestic plumbing can greatly affect the quality of water after it has entered properties. Consequently, in reviewing the 2020 data, DWQR will avoid drawing significant conclusions from year-on-year trends.

In 2020, 137,681 tests were carried out on samples taken to represent water quality at consumers' taps, although as discussed above the samples were not always taken from consumers' taps. Of these, 73 failed to meet the standard set out in the Regulations. This means that 99.95% of tests on samples intended to represent water at consumers' taps complied with the standards. The equivalent figures for 2019 were 114 failing samples and 99.92% compliance, although the data are not directly comparable – it is likely that much of this apparent improvement is attributable to the more controlled circumstances associated with sampling from dedicated sample taps owned by Scottish Water. 52 supply zones failed to meet one or more of the standards.

Table 4 below shows the failing test results of samples taken to represent water at consumers' taps. Compliance for a number of key parameters is then discussed in more detail. The number of samples taken for each parameter that Scottish Water is required to test for is shown in the Performance Tables which accompany this report and can be found on our website. In addition to these regulatory samples, Scottish Water also take samples for further investigation where the consumer reports an issue. This continued throughout the pandemic, with Scottish Water working to ensure issues were properly investigated while minimising the need to enter consumers' properties.

Table 4 Summary of Failing Tests on Regulatory Samples From Consumers' Taps in 2020

Parameter	Total No. of Samples	No. Failed Samples	No. Zones with Failures	% Compliance in 2020
Bacteria				
Coliform Bacteria	14,832	20	18	99.87
E. coli	14,832	2	2	99.99
Clostridium perfringens	5,185	0	0	100.00
Total bacteria	34,849	22	18	99.94
Metals				
Aluminium	5,213	2	2	99.96
Iron	5,213	21	16	99.60
Lead	772	2	2	99.74
Manganese	5,213	15	13	99.71
Nickel	772	7	7	99.09
Total metals	17,183	47	35	99.73
Others				
Benzo 3,4 Pyrene	1,500	0	0	100.00
Hydrogen ion (pH)	5,248	1	1	99.98
Nitrite	2,752	0	0	100.00
Odour	5,247	0	0	100.00
Radon	3,106	0	0	100.00
Taste	5,243	0	0	100.00
Total Trihalomethanes	1,478	1	1	99.93
Turbidity	5,249	1	1	99.98
Total others	52,088	4	3	99.99
Scotland total (incl. other parameters)**	**137,681**	**73**	**52***	**99.95**

* A supply zone can fail for more than one parameter. This means that the total number of zones that failed for *at least* one parameter is less than the sum of the 'No. Zones with Failures' column.

** Including other parameters not shown here. You can see the full list of parameters in the Water Quality Performance Tables.

1.3.1 Microbiological Quality at Consumers' Taps

Coliform Bacteria

Coliform Bacteria represent a group of bacteria of which *E. coli* is one species. They are common in the environment and do not necessarily indicate faecal contamination. However, they should not be present in the water supply as they are readily deactivated by chlorine, which is added in controlled amounts to all of Scottish Water's supplies.

Coliforms were detected in 20 samples in 2020, with two zones reporting more than one failure.

Multiple failures were detected in Clatto West B and Mannofield South supply zones. In 2020, DWQR required Scottish Water to carry out a review of microbiological performance across the Clatto supply system. Although there was no single or main cause found for the failures, a range of mitigation measures were identified. These involve treatment process optimisation, improved stability of disinfection levels and storage point cleanliness and integrity.

When coliform failures occur, Scottish Water takes further samples from the premises and also from neighbours' taps to determine if there is a local property issue or a wider supply system concern. Scottish Water notifies the consumer of the findings and provides the appropriate advice in each case. During much of 2020, it has been harder for Scottish Water to collect samples from consumers' premises, however failures were still investigated thoroughly.

E. coli

E. coli is an extremely important parameter because it is an indicator of faecal contamination and the microbiological safety of the water. The detection of *E. coli* in a water sample may be an indication that either the supply in that area or the tap from which the sample was taken has become contaminated. Scottish Water must investigate each failure thoroughly to try to determine the cause and respond appropriately.

Compliance for this parameter is relatively stable with only a few failures occurring each year. Two samples failed singly in separate zones in 2020.

Clostridium perfringens

Clostridium perfringens is a secondary indicator of faecal pollution. Clostridial spores can survive in water much longer than organisms of the coliform group and will resist disinfection by chlorine. Their presence in disinfected waters may indicate deficiencies in treatment. In distribution systems and at consumer taps, they can be an indicator of some historic contamination having occurred.

No failures of this standard occurred in 2020.

1.3.2 Chemical Quality at Consumers' Taps

Iron

Iron occurs naturally in some water supplies but should be predominantly removed by the treatment process. It is used as an alternative flocculant to aluminium at a few treatment works in Scotland. The most common cause of failures of the iron standard at consumers' taps is corroding cast iron water mains which can cause sediment to build up in distribution systems. High concentrations of iron can cause discoloured water supplies, greatly inconveniencing consumers.

Scottish Water continues with a programme of renovation and cleaning of the water mains that cause the most significant water quality issues. This should have the effect of reducing the number of complaints about discoloured water in the future.

As many samples during 2020 were collected at Scottish Water's storage points, it was expected that iron compliance would have improved this year, because these samples should be less vulnerable to local disturbances in water mains. This proved to be the case, with 21 samples containing iron at concentrations above the standard, compared with 37 in 2019. Four supply zones had multiple failures, indicating the role that storage points in these zones may have in acting as a repository for iron.

Manganese

Manganese occurs naturally in some raw waters, especially in the West of Scotland. If it is not removed effectively by the treatment process it can accumulate as fine black sediment in distribution system pipework and cause severely discoloured water supplies and great inconvenience for consumers. Even a relatively low concentration of manganese in the water from the treatment works can build up in pipes and cause problems in distribution pipework. Fifteen samples failed for manganese, a somewhat surprising increase on the ten that occurred in 2019. This has been attributed to manganese settling out in storage points and warrants further investigation by Scottish Water, with a view to informing the storage point cleaning programme. Lintrathen Zone, supplying parts of Angus, recorded three of the failures, triggering discussions with Scottish Water as to the cause. The zone and treatment process are being investigated to see if intervention is required to prevent an emerging issue.

Lead

In Scotland, lead does not occur naturally in significant concentrations in our water supplies. The problem arises when drinking water comes into contact with lead supply pipes, lead tanks, and lead solder joints on copper pipes, or inferior quality brass fittings and taps, particularly for longer periods (e.g. overnight/weekends/holiday periods). This can result in high lead levels in the drinking water supply. Although the majority of lead piping is privately owned and therefore outside Scottish Water's direct control, it does have a responsibility under the Regulations to minimise the risk from dissolved lead.

The Scottish Government is reviewing the policy in relation to the reduction of exposure to lead in drinking water, especially in light of the recast Drinking Water Directive. The project aims to raise awareness of consumers to the concerns about lead in drinking water and to promote the removal of lead service pipes and plumbing. Within this, DWQR has commissioned Scottish Water to carry out a surveillance programme for lead within independent schools and nurseries. Scottish Water is also undertaking work to explore the lead issue as part of its lead strategy. This includes work to assess the practical issues encountered in replacing lead pipework in people's homes and gardens.

In 2020, two lead failures were detected. Both of these were collected from consumers' taps in spite of the pandemic. One was attributed to lead on the part of the service pipe owned by Scottish Water. This was subsequently replaced.

Total Trihalomethanes (THM)

THM is a group of disinfection by-products that can form when organic substances combine with chlorine used to disinfect water. As Scotland's upland waters are naturally rich in these organic compounds, management of THM formation presents a challenge for Scottish Water. Scottish Water has devoted much effort to reducing the formation of THM in its water supplies and has made significant progress on this issue.

A single exceedance of the THM standard occurred in 2020, an improving trend on previous years, although with a high proportion of samples collected from storage points, and fewer samples collected from the end of long distribution systems, this might be expected.

In addition to meeting the standard for total THM, Scottish Water is also required to minimise the production of all disinfection by-products. DWQR has required Scottish Water to carry out additional operational monitoring for other disinfection by-products to demonstrate that they are minimising across a range of substances, not just THMs. The recast Drinking Water Directive will introduce a new standard for the sum of 5 halo-acetic acids. Operational sampling by Scottish Water indicates that some investment will be required in order to achieve full compliance with the new standard.

Nitrite

Nitrite forms when nitrifying bacteria react with the ammonia that is added to chlorine in a process known as chloramination. If the process is not carefully controlled and nitrifying bacteria are allowed to persist in the distribution system due to water lying in pipes for long periods (due to the length of the system and/or the amount of water being used by consumers), especially in warmer weather, nitrite can build up and cause failures in the standard. In 2020 there were no failures of this parameter. This is not unexpected as during the summer most samples were collected from storage points rather than at the end of long distribution systems.

Nickel

Nickel is not found in high concentrations in Scotland's waters. Nickel is, however, used for many different applications but mainly in the production of stainless steel and other metal products. Its presence in drinking water generally arises from contact with plumbing fittings, such as nickel or chromium-plated taps or certain types of kettles.

Seven nickel failures occurred in 2020, compared with only a single failure during 2019. This is extremely surprising due to the high proportion of samples collected from Scottish Water's own taps due to the pandemic. Where failures have occurred, the taps have been replaced. Nickel analysis is not usually undertaken on samples from storage points, but this finding could indicate the need for a dedicated survey to identify further taps containing high concentrations of nickel.

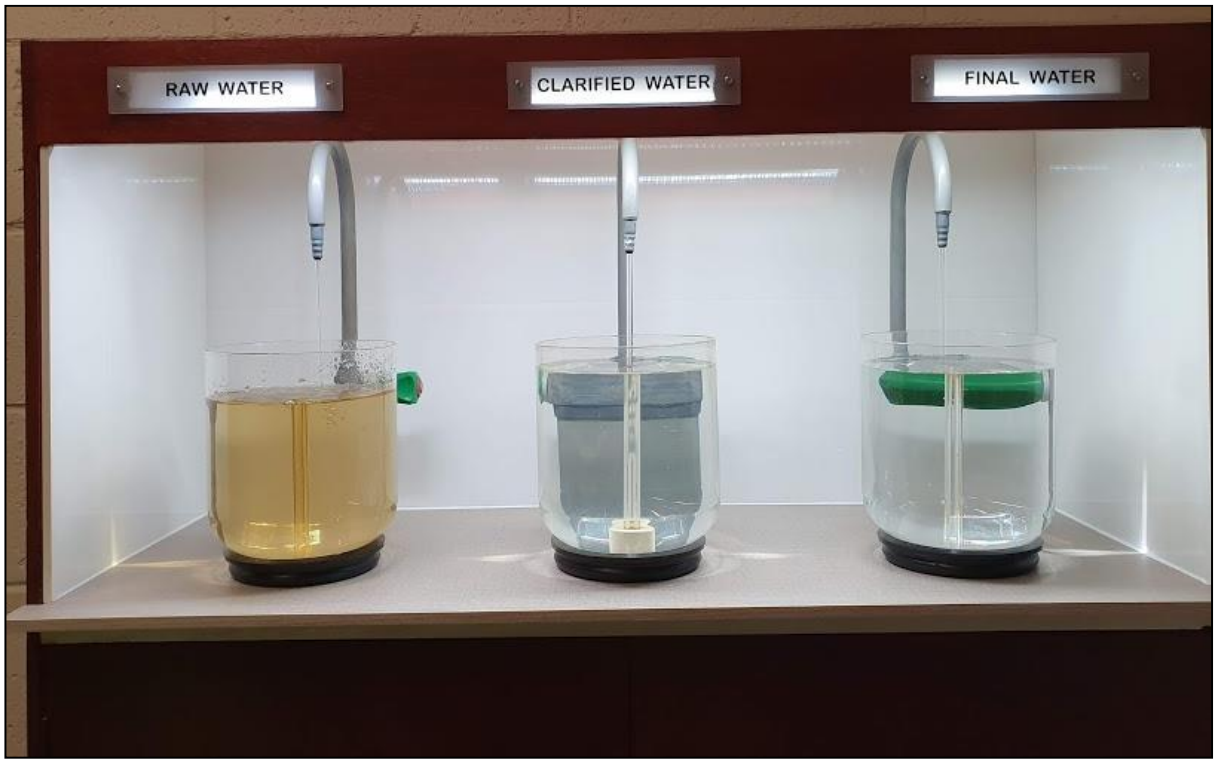


Image 5 Water needs to be treated to remove unwanted substances and then disinfected to ensure it is safe to drink.

Taste and Odour

There were no failures of the standard for taste and odour in 2020.

Turbidity

Turbidity in water is caused by suspended particles or colloidal matter that obstructs light transmission through it, making it appear cloudy. The standard is primarily an aesthetic one, but high turbidities need to be investigated, especially in water leaving the treatment works, as they could indicate a problem with the treatment process and may mean that the effectiveness of disinfection has been compromised. Failures can occur at consumers' taps for a number of reasons, but the most

common cause is the disturbance of sediment in the bottom of corroding iron water mains. A single turbidity failure was recorded in 2020. This was in Glenfarg Kinnesswood Borehole A Supply Zone.

Hydrogen Ion (pH)

The pH of a substance is the measure of how many hydrogen ions it contains, with large numbers of hydrogen ions making it more acidic. Most waters in Scotland are naturally soft and have a low pH. Such water can be corrosive to metals used in plumbing, therefore Scottish Water needs to correct this to bring the pH into the required range. High pH values can sometimes occur where water is in prolonged contact with some water mains containing cement. Waters with a very high pH can have a taste that some consumers find unpleasant. A single sample failed the standard for pH in 2020. This was taken at Yarrowfeus WTW in lieu of a zonal sample and showed a marginally high pH that was attributed to fluctuations in the pH correction dosing at the treatment works. Such fluctuations would normally be evened out in the distribution system.

1.4 Consumer Contacts

When a consumer calls Scottish Water regarding the quality of their water supply, the contact is recorded and classified according to the nature of the issue. Scottish Water received 18,142 consumer contacts relating to water quality in 2020, equating to a contact rate of 33.8 per 10,000 population served. In 2019, there were 10,658 and the overall contact rate was 19.9 per 10,000. Scottish Water has introduced a new consumer contact management system which is better able to record and categorise consumer contacts, including those received through social media. The new system addressed concerns DWQR had of the lack of visibility of some water quality complaints and this is the first full year where the system and the reporting provide the single source for contact figures. The number of recorded contacts is therefore significantly increased over those reported last year. It is disappointing to note however that in the data, Scottish Water were unable to attribute a supply zone to 2,338 contacts to their records and this is an aspect of their recording that must be improved.

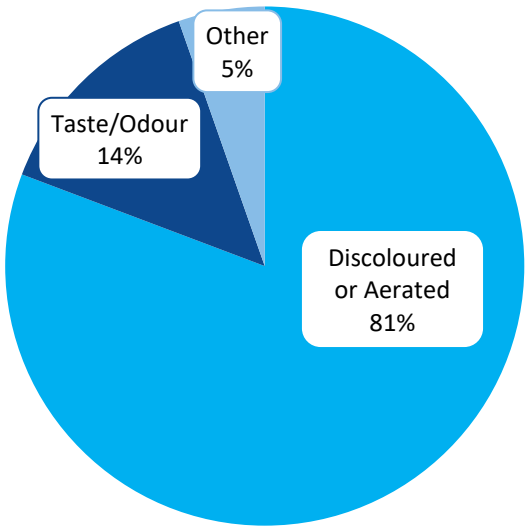


Figure 3 Breakdown of Consumer Contacts by Type 2020

Figure 3 shows 81% of calls were received in response to discoloured water and aerated (or milky) water. These two categories reflect problems with the condition of the water supply network and problems caused by operational activity where flow changes within the water mains are caused by the operation of valves or by burst mains. The chart also shows 14% of contacts relate to the taste or smell of the water supply causing concern to consumers.

Whilst it is acknowledged that the proportions of categories will shift as the overall numbers change, Figure 4 further illustrates the point in terms of the trends in key contact types. The main driver for consumer contacts remains discoloured water but all categories reflect the step change in recording and reporting made possible this year.

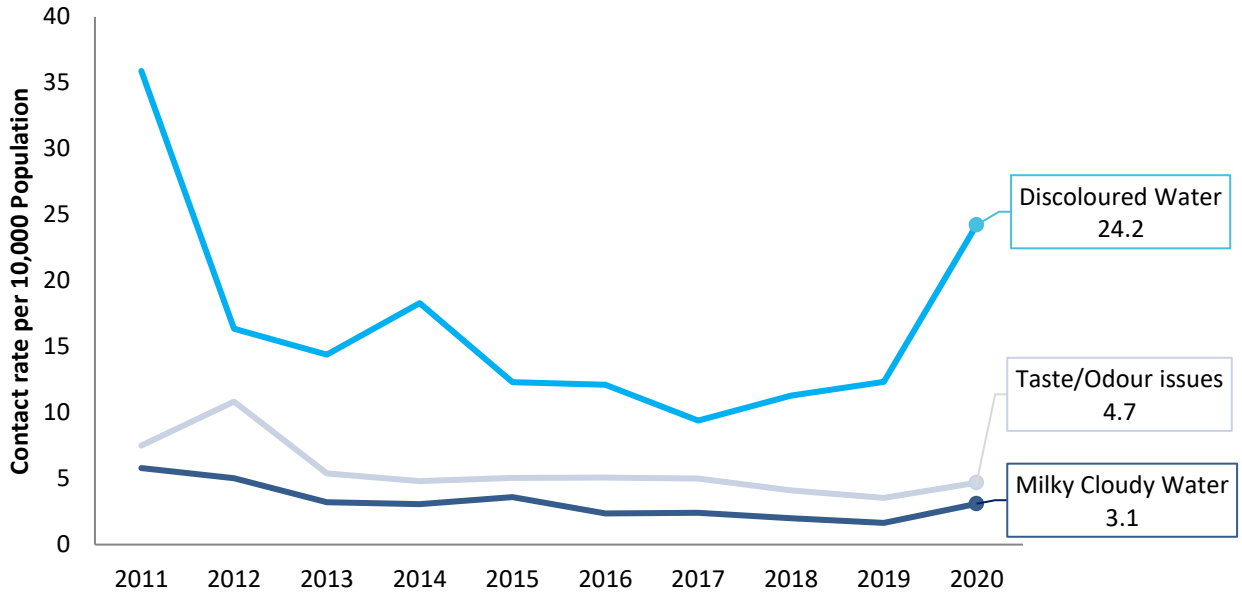


Figure 4 Trend in Key Contact Categories

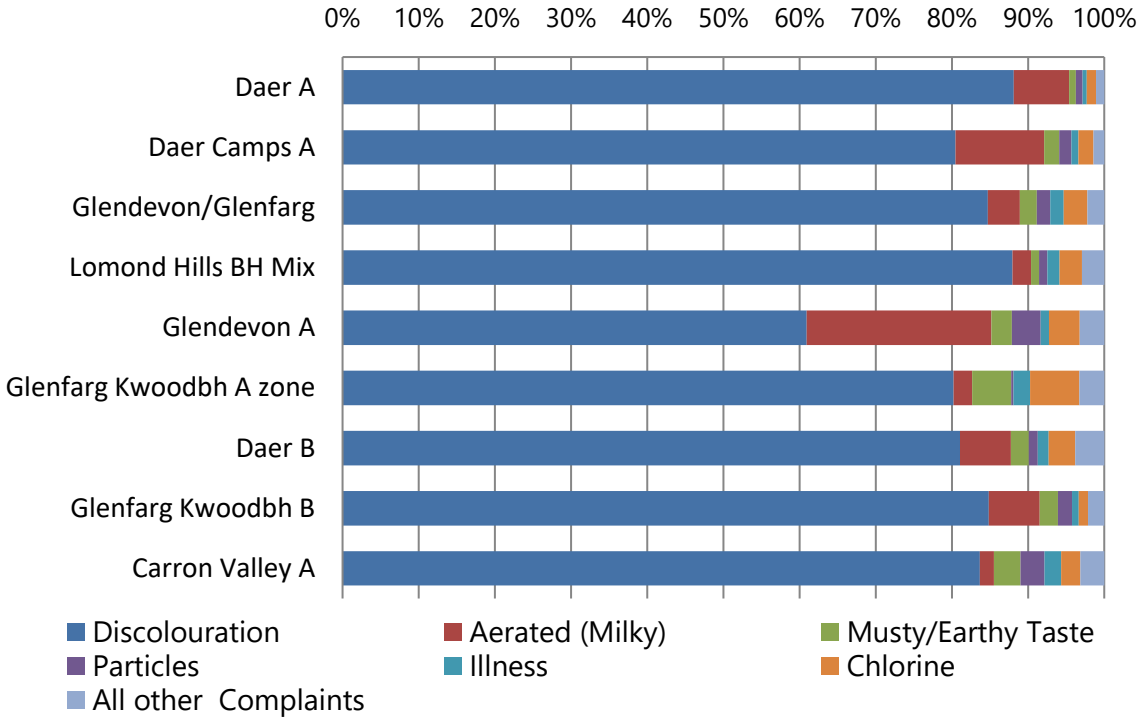


Figure 5 Water Supply Zones with Most Water Quality Complaints 2020

In geographic terms, the areas where most issues were raised by consumers are shown in Figure 5. There are nine zones where more than 300 contacts were received. The chart shows the supply zones ranked by contact rate with most being received from consumers in the Daer A zone. Water quality incidents causing significant consumer concern, which are discussed in Section 3, are undoubtedly a driver for a significant proportion of the discoloured and aerated water complaints. Last year, the nine zones contained in the comparable chart were those with 200 contacts or more, again illustrating the better capture and reporting of complaints this year.

1.5 Consumer Contacts to DWQR

Scottish Water has a responsibility to investigate water quality complaints and supply issues. We guide consumers to report any concerns to Scottish Water in the first instance to enable their investigation and resolution. Where consumers are dissatisfied with Scottish Water's response and have pursued and completed a formal complaint with Scottish Water, DWQR can carry out an investigation of the issues.

As well as dealing with formal complaints about Scottish Water, DWQR receives contacts from consumers and other organisations about water quality matters. We are able to offer impartial advice and assistance in many cases and a summary of these is shown below in Table 5.

Table 5 Consumer Contacts Received by DWQR 2020

Contact Category	Number of Contacts				
	2020	2019	2018	2017	2016
Appearance					
Discoloured Water	5	4	2	4	12
Aerated (Milky) Water	0	0	0	0	2
Particles in Water	1	1	1	2	1
Organisms in Water	2	0	1	1	0
Taste and Odour					
Chlorine	11	5	2	5	4
Metallic	1	0	0	0	0
Solvent/Fuel	0	0	0	0	0
Musty/Earthy	0	2	0	1	2
TCP/Chemical	0	2	0	0	0
Other contact about Water Quality					
Illness due to Water	5	3	2	5	4
Other Contact	5	17	21	7	4
Total Public Water Supply Water Quality contacts	**30**	**34**	**29**	**25**	**29**
Public water supply requests for information	10	6	3	35	21
Private water supply issues	66	64	96	59	29
General Enquiries to DWQR	25	19	15	5	36
Total Consumer Contacts to DWQR	**131**	**123**	**143**	**124**	**115**

Tier Two Investigations of SW Consumer Complaints

We carried out formal investigations of two complaints against Scottish Water in 2020. One concerned the chlorine content of the water and illness. The other taste, odour and illness. We have summarised them below and the full determinations of both cases are available on the DWQR website https://dwqr.scot/regulator-activity/consumer-complaint-investigations/dwqr-determinations/

Case 1

The consumer made several requests for information to Scottish Water from February 2019 when they reported illness that they attributed to high levels of chlorine in the supply. Despite Scottish Water taking a sample for analysis and explaining the reasons for the particular levels of chlorine found and

further communications between the consumer and Scottish Water, the consumer remained dissatisfied with the response. A formal complaint was made to Scottish Water on 13 January 2020 identifying the particular concerns; that Scottish Water was not providing complete information regarding the supply and not fully answering the questions posed.

During the course of correspondence, the consumer also contacted Scottish Water with a Freedom of Information (FOI) request regarding the treatment chemicals used at the WTW and the quantity of chlorine used in the water supply. Scottish Water responded with the information requested. DWQR was content that the water quality information provided was factual and accurate, as required by FOI legislation, although it was disappointing that given the history of contact and knowledge of their concerns, there was no context provided in which the consumer could interpret it.

The WTW providing the supply had recently been rebuilt and we were satisfied that the quality of the water produced was significantly improved. The amount of residual chlorine leaving the WTW was lower than that of the old WTW and more consistent. The consumer made further requests for information regarding the health effects noticed since the WTW was upgraded. Scottish Water replied within reasonable timescales to these requests providing information to a standard which DWQR finds acceptable.

DWQR is satisfied that the drinking water supply meets the regulatory requirements, was safe to drink and the amount of chlorine in the supply was being maintained at a suitable level. DWQR did not uphold the complaint, though one recommendation was made.

Case 2

The consumer contacted DWQR in May 2020 to complain about the smell of the drinking water and to advise that they believed it was causing illness. The consumer was also seeking advice for water treatment within their property and expressed concern that the supply was being chloraminated, which they felt could be causing health problems. The consumer had contacted Scottish Water in December 2019, to report the taste and odour of the drinking water supply to their home and later advised that the supply was reportedly causing a variety of health problems and had a bleach-like smell.

Scottish Water took a number of water samples from the consumer's property in response to requests and the results showed that the samples complied with Regulations. The test report for samples taken on 10th December, however, did not include a record of chlorine measurements. Given the consumer had contacted Scottish Water with concerns over a bleach-like odour, this omission is inappropriate as this type of contact is most likely to be due to concerns about chlorine levels.

The consumer moved home, to another property within the same Water Supply Zone as their previous property. They again contacted Scottish Water with concerns about the drinking water and its impact on their health. Scottish Water would not take a sample from this property, on the grounds that the supplies to the two properties were in the same Water Supply Zone. However, water supply networks and internal plumbing within properties can affect water quality, so DWQR advised Scottish Water to

rectify this and take a sample from the consumer's current property. This sample was taken and was compliant with the requirements of Regulations.

DWQR's records from previous audits of the supplying treatment, and the analytical data confirmed that the supply is not chloraminated. Analytical data from samples taken across the Water Supply Zone over the past two years, however, show that chlorine levels have been increasing over this time period. Scottish Water has reported that a decision was taken in March 2019 to increase the residual chlorine target at its service reservoir storage tanks in a number of its supply systems, in order to ensure microbiologically safe water at consumers' taps. This included this consumer's supply.

It is possible that this increase in chlorine concentrations caused the consumer to object to the taste and odour of the water supply. While there is no maximum allowable standard for chlorine in the Regulations, the values recorded in all samples were well under the World Health Organisation's guideline value of a maximum of 5 mg/l. However, the Regulations do place a duty on Scottish Water to ensure that the taste and odour standards are 'acceptable to consumers and no abnormal change'. DWQR concluded that while the increases in chlorine dosing have not been abnormal, and have been made to reduce the risk to the microbiological safety of the supply, which must always take priority, Scottish Water must also take into account the aesthetic properties of the supply and the potential for water being unpalatable to consumers.

There is a statutory duty on Scottish Water to maintain individual risk assessments on all of its supplies. The next scheduled review for the risk assessment of the drinking water supply system feeding the consumer's property was November 2020 and this particular water supply system is extensive and complex. As such, DWQR recommended that Scottish Water carry out an assessment of chlorine levels, microbiological compliance and consumer contacts for taste and odour across the supply system for the previous two years during the November 2020 review, in order to determine whether the increase in chlorine across the system was appropriate.

DWQR is satisfied that the water quality at the consumer's former and current homes complied with the standards required by the Regulations and was safe to drink. However, the increased residual chlorine levels across the supply zones which fed the consumer's properties may have been the cause of the perceived bleach odour of the supply. Whilst Scottish Water did not act reasonably in initially declining to take a sample from the consumer's current property, this has been rectified.

DWQR did not uphold the complaint, but two recommendations were made.

2. WATER QUALITY EVENTS AND INCIDENTS

Scottish Water is required to tell DWQR about all events that have affected or could affect water quality or cause concern to consumers. This includes all regulatory sample failures; operational sample failures that are significant or unexpected; any failure of a treatment process; significant numbers of consumer contacts; and issues which attract significant media interest.

Each event is reviewed and classified into one of five categories: not significant, minor, significant, serious or major. Those events categorised into one of the latter three categories are classed as incidents requiring further detailed investigation by DWQR. Where further information is required, a full report may be requested from Scottish Water. It should be noted that where a full report is not requested, this does not suggest in any way that the incident is less serious.

Incidents are fully investigated by DWQR Drinking Water Specialists who produce a written assessment and make recommendations where appropriate. As part of the investigation, DWQR staff often visit Scottish Water sites to talk to Scottish Water employees and examine equipment failures. A short summary of the incident assessment is published on the DWQR website. For the most serious incidents, enforcement action or prosecution are considered and can be taken. In 2020, two incidents resulted in enforcement action being taken.

There were 650 events reported to DWQR during 2020, the majority of which were not significant. Table 6 shows the numbers of events and the Scottish Water operating areas where they occurred. A summary of incidents is available on the DWQR website https://dwqr.scot/regulator-activity/water-quality-incidents/

Table 6 Drinking Water Quality Events and Incidents in 2020

	Not Significant	Minor	Significant	Serious	Major
EAST	173	35	6	4	0
NORTH	65	19	4	3	0
SOUTH	120	61	5	1	0
WEST	131	17	3	2	0
SCOTLAND	**489**	**132**	**18**	**11**	**0**

Twenty-nine of these events were classified by DWQR as incidents, which is the same as the number declared in 2019. The reasons why events were classified as incidents in 2020 are illustrated in the chart in Figure 6.

Thirteen incidents were declared due to the necessity to issue alternative water supplies or the events were causing consumers concerns about their drinking water. Some of the concerns report discoloured water, milky/white water or taste and odours. In certain cases, planned interventions within the water mains network cause these issues and in others, it arises from the need to manage supplies due to burst water mains. Common factors in the DWQR assessments of the incidents are the actions taken by Scottish Water to introduce supplies from adjacent areas or tankers, which generate

changes in flow direction or velocity in water mains, some of which is a result of inadequate preparation or risk assessment of planned work.

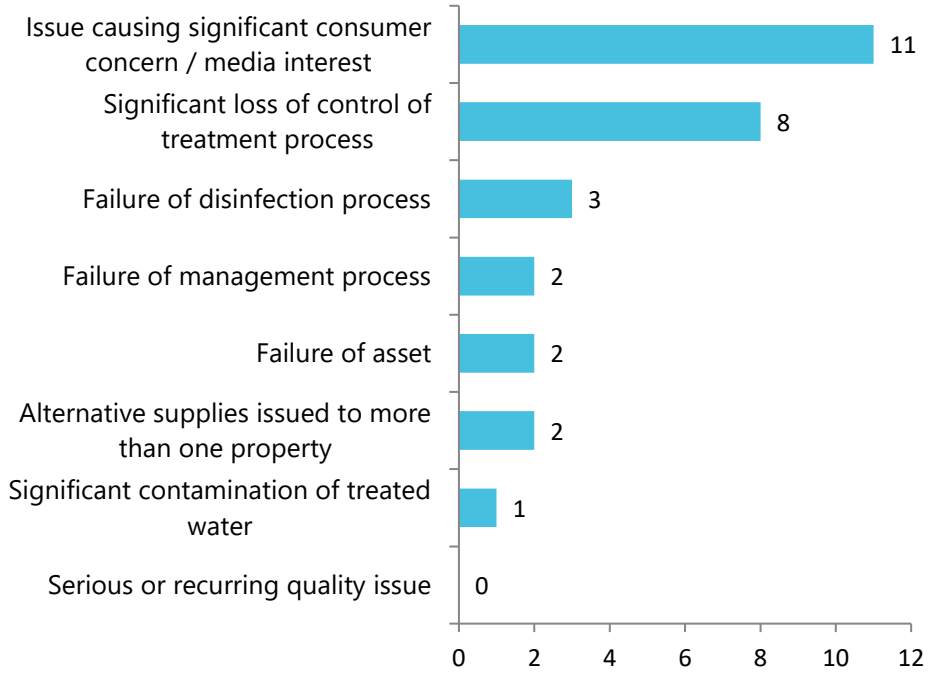


Figure 6 Reasons for Declaration of an Incident in 2020

DWQR is especially concerned about the number of incidents where a causal factor was poor communication. This was found to be either the cause or a compounding factor in seven incidents. Failures in communications within Operations teams and with specialist support teams feature in incident assessments and there continues to be evidence of assumptions being made around the cause of treatment issues rather than step cause investigations being carried out. The most prevalent, however, have been found to occur in communications between the Intelligent Control Centre and Operations teams in the field. It is essential that improvements are made to this crucial aspect of event response to minimise their duration if incidents are to be avoided.

DWQR requires that Scottish Water provide information and a conclusion of their investigation on all events within 30 days of the event occurring. Scottish Water often fall short of this timescale with many event outcomes and incident investigations taking considerably longer than 30 days. DWQR is extremely concerned about the frequent lateness of outcome information, and has issued Information Letter 2/2020 to ensure compliance and consistency. This Information Letter can be viewed on our website at https://dwqr.scot/regulator-activity/information-letters/public-2020/

Each Incident Assessment can be viewed on the DWQR website at https://dwqr.scot/regulator-activity/water-quality-incidents/2020-incidents/. A number of these are worth highlighting as they illustrate significant consumer issues or present important learning points for Scottish Water. These are set out below.

Afton WTW – August 2020 and December 2020 to January 2021

Afton WTW, near New Cumnock, had two incidents within the space of four months in 2020. The first involved poor communication between the standby Operator and the Intelligent Control Centre (ICC), following alarms from the site for failure of the coagulant aid dosing system. The delay in response led to a loss of control of the coagulation and filtration processes, and severely impacted the disinfection system. There was a complete lack of awareness of the risk from *Cryptosporidium* during the incident, and the monitoring of the supply and the sampling response was inadequate. DWQR is of the opinion that there were six breaches of the Regulations; Scottish Water committed to five actions, and DWQR made sixteen further recommendations.

The second incident was caused by a failure of orthophosphoric acid dosing for sixteen days. Orthophosphoric acid is added to reduce the solubility of lead from remaining lead communication or supply pipes in the network. The incident was caused by a series of issues; the initial fault with the dosing system was not repaired, there was a faulty flow switch which did not alarm, there was poor communication at the site, there was no online phosphate monitor at the site, there was a complete lack of manual samples taken for phosphate at the site, samples taken by the laboratory in the network to assess the effectiveness of the orthophosphoric acid dosing clearly showed that there was an issue but this was not escalated, and the site was understaffed over the festive period. There was evidence from the lead test rig in the network that the break in dosing may have allowed an increase in lead concentrations in supplies to properties with lead pipes. Scottish Water made a commitment to nine actions, and DWQR made a further seven recommendations.

Given the severity of these two incidents, DWQR has taken enforcement action. A notice was served on 14th May 2021, under Regulation 17 of the Network and Information Systems Regulations 2018, in relation to the first incident. A further notice was served on Scottish Water under the Water Industry (Scotland) Act 2002 on 8th June 2021. This can be viewed on DWQR's website at https://dwqr.scot/regulator-activity/enforcement/. DWQR will be paying close attention to Scottish Water's progress with the requirements of the Enforcement Notices.

Central and East Fife Supply Zones – May 2020

Consumer demand increased significantly in several supply systems across Fife at the end of May and the beginning of June 2020 due to very warm weather and increased consumer demand. This affected storage tank levels and water mains pressures and led to an incident team being formed, with elements of Scottish Water's drought plan being triggered. Water was transferred between different Water Supply Zones, and Scottish Water was able to maintain supplies at all times.

However, the activation of the contingency plans increased the volume and velocity of the supply, causing the disturbance of sediment in water mains and discolouration of the supply. More than 1,200 consumers contacted Scottish Water to report discoloured water or request bottled water supplies. While DWQR accepted that the time afforded to Scottish Water to respond to such situations may be limited, it is important that Scottish Water maintains its water networks in a suitable condition for expected higher flows. Scottish Water responded appropriately to the developing situation, and a

number of learning points were made to improve its future response. Scottish Water identified seven actions from this incident, and DWQR made one recommendation.

Loch Calder WTW – November 2020

A power failure at Loch Calder WTW caused air locking in the chlorine dosing pumps and led to a period of 45 minutes without any chlorine dosing. A second power failure several hours later again caused an airlock in the chlorine dosing system, this time dropping chlorine dosing to low levels for 15 minutes. While samples were taken to check water quality, no attempt was made to boost chlorine levels by emergency dosing of the system. This was due to poor communication between the Operators and the Public Health Team and neither the process scientist nor the Team Leader was available to support the Operators. Investigations showed that the wrong de-gassing heads had been installed on the chlorine dosing equipment, and alarms were not generated as flow switches had been installed with incorrect settings. DWQR was critical of the commissioning of this new equipment and of the communication between teams in Scottish Water as well as inconsistent naming convention at the site.

Scottish Water identified eight actions, and DWQR made a further two recommendations.

Manse Street WTW – July 2020

Turbidity alarms from Manse Street WTW were received by the ICC over a number of hours, until all four primary filters were in alarm. The ICC did not advise the standby operator of issues at the site for several hours, and when they were notified, the operator was only told that one filter was in alarm mode. The operator did not attend the site as there had been issues with the turbidity monitor the previous day, and it was assumed that this was the cause of the alarms. The ICC later advised that the combined filtrate aluminium monitor was in alarm, and that all four filters were affected, and at this stage the operator attended the site. The colour of the raw water had significantly increased, so the coagulant dose was increased to optimise the dose. However, the coagulant dosing pumps were unable to meet this increase, and the automatic shutdown of the plant was not triggered despite the low coagulant dose meeting the threshold for shutdown. The operational staff made changes to the dosing point of coagulant in order to keep the treatment works running, but this adjustment later failed. This sent an alarm to the ICC, who did not report the alarm to operational colleagues since the operator was onsite. However, the operator did not have sight of this alarm and the coagulant flow failure was only picked up when the team leader remotely checked the telemetry for the site.

Poor communication from the ICC to the operator along with inadequate online water quality monitoring at the site meant that the situation became a significant incident. A lack of cleaning of coagulant dosing lines, a basic scheduled maintenance task, was found to have been the cause of the problems with coagulant flow. Scottish Water identified seven areas for improvement, and DWQR made one recommendation.

Port Charlotte – August 2020

During investigations into issues with erratic chlorine control, the Process Scientist measured manganese levels and found that they were more than six times higher than the permitted concentration. Previous sample results were checked, and a number were also found to be well in excess of the standard. Manganese levels continued to increase, and manganese in the final water reached a maximum of almost sixteen times the standard. There is a manganese removal process at the site, but all three manganese filters were having issues, and backwash water had to be imported from another WTW. Soda lines were found to be blocked, and there had been issues with pumps. There was no online manganese monitor at the works, manual samples were not being taken due to ongoing health and safety issues, and because they were dealing with ongoing disinfection issues. An IT issue meant that a failing laboratory sample was not flagged as being out of specification and the low pH alarm generated at the site to alert staff to issues with manganese removal treatment was lost among a large volume of other alarms.

It is estimated that manganese levels from the treatment works breached standards for a total of 16 days, and for 20 days in the network. DWQR was critical of the lack of manganese sampling. Scottish Water committed to five actions for improvement as a result of this incident.

Redcraigs Distribution Service Reservoir – October 2020

A burst on the inlet of the tank threatened the supply of water to 90,000 consumers in the Dunfermline and Dalgety Bay areas. Half of the tank was out of service for cleaning, and the burst was on a specially cast fitting, a replacement for which could not be supplied quickly. The inlet pipework was modified to allow full flow through the out of service cell; this cell had recently been filled and had had its water quality tested, so authorisation was needed before it was returned to service, which happened in the early hours of the morning. There was an airlock on the inlet valve which further delayed the tank being returned to service. There was no incoming water to the tanks, and the distribution was drawn down, so water that was stored in the tank was quickly depleted. Supply was maintained by activating back feeds from adjacent supply zones in two locations, along with a fleet of tankers to inject water at key points within the distribution system. The ball valve was repaired, allowing the inlet flow to be restored to the service reservoir, and the distribution system gradually recovered. Tankering continued through the night and into the following afternoon. Scottish Water made enormous efforts to minimise loss of supply to consumers in a complex recovery operation; the service reservoir supplies 90,000 consumers, and the number of consumers affected by loss of supply was reduced to just over 23,000 as a result of staff efforts. Many experienced discoloured water, and Scottish Water received 41 consumer contacts on the matter.

DWQR expressed concern at the management of the tankering operations. Direct injection of water into mains brings a risk of contamination, but records were not kept of the exact location of the 60 direct injects into the system during this incident, meaning that thorough investigation of any contamination or mains disturbance would not have been possible. DWQR also criticised the poor sampling response to the incident and advised that Scottish Water must improve this aspect of their

response plans to ensure the impact on water quality at consumer taps is representative of the supply throughout the areas affected, particularly for downstream monitoring of tanker injects.

Scottish Water identified one action from this incident, and DWQR made three additional recommendations.

Image 6 Scottish Water sometimes uses tankers like this one to supply customers when water quality events affect the normal supply.

Turriff WTW – October 2020

Following a shutdown of Turriff WTW for site maintenance, a loss of control of final water pH was experienced when a control fault on restart caused continual batching in the duty lime tank. This led to a high concentration of lime being dosed, which triggered a high pH alarm at the ICC. Poor communication between the Operator and the ICC meant that there was a significant delay in Scottish Water's response, and samples from the downstream service reservoir showed that pH exceeded regulatory standards. A very similar failure of the lime dosing system occurred again in November 2020, and there had previously been a series of pH or turbidity events at Turriff WTW. The treatment works had been inspected by DWQR in September 2020, when concern had been expressed around the performance and reliability of lime batching and dosing, but Scottish Water's progress in dealing with this was disappointingly slow. Turriff WTW is already subject to an Enforcement Notice for improvements to the rapid gravity filters and DWQR sought additional assurance that the reliability of the final pH dosing would be addressed. A letter of commitment to that effect was obtained from Scottish Water in May this year. Scottish Water identified four actions for improvement.

3. AUDIT AND INSPECTION

3.1 Water Treatment Works and Service Reservoirs

An important part of DWQR's scrutiny role is to audit and inspect activities undertaken by Scottish Water. We can choose to inspect any aspect of Scottish Water's activities that could affect water quality. Inspections commonly undertaken include WTW, storage points, distribution system activities, response to consumer water quality issues and analytical services. We audit against the requirements of the Regulations, as well as water industry best practice. We also audit the completion of investment projects.

The inspection process provides a number of benefits:

- It enables DWQR to verify that Scottish Water is complying with regulatory requirements at sites across Scotland;
- It allows DWQR to see new initiatives and areas of best practice;
- It is an opportunity for DWQR staff to meet site-based Scottish Water staff and discuss water quality issues with them;
- It raises awareness of DWQR and the regulations amongst Scottish Water staff;
- It enables verification of the delivery of investment work;
- It enables DWQR to build an awareness of common trends, risks or deficiencies across Scotland and use these to inform future policy and guidance.

We select sites for inspection using a risk based process that takes into account sample failures and water quality events and incidents. DWQR may also choose to inspect sites randomly or directly following incidents. Other types of inspection may be undertaken in response to a particular issue or concern.

To make sure we are consistent, all our inspectors use standardised inspection templates and the audit process is subject to an ISO accredited procedure. DWQR also participates in benchmarking audits with other regulators in the UK and beyond to drive consistency and to spread best practice.

Where issues are noted during an inspection, these are recorded as recommendations that are tracked and followed up. If common themes are identified, these are progressed centrally with senior Scottish Water staff. Elements of best practice are also highlighted. Scottish Water has an opportunity to comment on draft inspection reports and co-operates fully during the technical inspection process.

Once an inspection report has been finalised, the completed report is sent to Scottish Water and a summary placed on the DWQR website. You can view the DWQR audit and inspections reports on our website at https://dwqr.scot/regulator-activity/audit-and-inspection/

Our audit activities during 2020 were greatly affected by the pandemic. Due to restrictions and the need to protect essential services, it was not possible to visit as many Scottish Water sites as we would in a normal year. Instead, we found other ways of auditing, using video calls and written evidence to undertake our scrutiny activities.

Water Treatment Works

In 2020 no full technical DWQR audits were undertaken at WTW due to the pandemic. Five incident investigation visits did take place, however, to discuss specific issues, and these are shown in Table 7. Additional conversations were held via video call with treatment staff as required in order to investigate specific events.

Table 7 DWQR Site Visits for Event and Incident Investigations in 2020

Site	Date
Turret WTW	March
Bonnycraig WTW (enforcement notice)	May
Turriff WTW	September
Bradan WTW	September
Manse St WTW	November

Distribution Systems

We audited nine distribution systems and storage reservoirs (SRs) in 2020. Our recommendations included preventing ingress of contamination, valve protection and quality of information. Some of these audits, especially the one at Invercannie, raised significant findings around hygiene, working practices and the cleanliness of maintenance vans. These aspects will be the topic of follow-up audits in 2021.

Table 8 Distribution System Audits in 2020

Location	Date	Reason for Audit	No. of Recommendations
Edinburgh Distribution System	February	Risk Based	0
Edzell Mains Rehabilitation	July	Risk Based	3
Turriff Distribution System	September	Risk Based	0
Maunderlea SR	September	Risk Based	1
Fisherford SR	September	Risk Based	0
Invercannie Distribution System	September	Risk Based	9
Broomhill Banchory SR	September	Risk Based	0
Burncrooks Pipe Laying	September	Risk Based	4
Edinburgh Top up Taps	December	Risk Based	2
Blackburn Mains Repair	December	Risk Based	1

3.2 Services and Benchmarking

Services

Scottish Water's Public Health Team is responsible for managing the company's handling of water quality events and incidents, providing scientific advice for their resolution and reporting and liaising with DWQR and other external stakeholders such as NHS boards and local authorities. Following a desire to improve the timeliness of event reporting and to better understand the barriers to this, DWQR audited all four area (North, East, South, and West) public health teams and their approach to event management. This audit was concluded in 2020. Eighteen recommendations were made in total, around a range of issues specific to each area, but the need for other parts of Scottish Water to respond quickly to requests for information by the Public Health team was a common finding.

During the year DWQR audited Scottish Water's Competent Operator training, by which the company ensures that the people who run its treatment works have the necessary skills. DWQR looked at the comprehensive training programme provided by Scottish Water via its Skills Academy, and spoke to a number of operators across Scotland to understand their experience of their training. We concluded that the training delivered was of very high quality, although the method of assessment was sometimes lacking consistency. There were 10 recommendations made in total.

Table 9 Audit of Services

Location	Date	No. of Recommendations
Drinking Water Events Reporting	Concluded May 2020	18
Competent Operator Training	October 2020	10

Benchmarking

DWQR retains close contact with the other water quality regulators in the UK and Europe to share knowledge, learning and best practice. These are excellent benchmarking opportunities: both to ensure DWQR inspectors are auditing to a high standard; and to make sure Scottish Water's standards for operations and procedures are of the same quality (or better) than other water providers. There were no opportunities for benchmarking audits during 2020. However, it is intended that these shall be continued in future and DWQR has extended the invitation to colleagues in England and Northern Ireland to accompany DWQR on benchmarking opportunities in Scotland.

4. NETWORK INFRASTRUCTURE SECURITY DIRECTIVE

The Network Information Systems (NIS) Directive was introduced to improve the levels of cyber security and resilience of essential services across the EU. It provided the basis of NIS Regulations that were introduced in 2018, which you can view at https://www.legislation.gov.uk/uksi/2018/506/made

These regulations have identified Scottish Water as an 'Operator of Essential Services' and designated the DWQR for Scotland as the relevant Competent Authority in Scotland. They require there to be a national framework to manage cyber security incidents and maintain and improve cyber resilience. Further information on these regulations may be found from the UK Government Department for Digital, Culture, Media & Sport at https://www.gov.uk/government/collections/nis-directive-and-nis-regulations-2018 and the National Cyber Security Centre at https://www.ncsc.gov.uk/collection/caf/nis-introduction

During 2020, Scottish Water submitted to DWQR its assessment of compliance with the Regulations as assessed using the Cyber Assessment Framework (CAF). Following further discussion of the CAF an improvement plan was submitted by Scottish Water to DWQR and this forms the basis of ongoing discussion and monitoring of progress.

5. ANNEXES

5.1 Information Letters issued during 2020

There were two Information Letters issued during 2020.

2020-1: Sampling And Other Activities During A Covid 19 Outbreak

2020-2: DWQR Requirements For The Reporting Of Water Quality Events

Information Letters are published on the DWQR website which you can view here:
https://dwqr.scot/regulator-activity/information-letters/

5.2 Current Letters of Commitment and Enforcement Notices

When DWQR has evidence that Scottish Water has contravened a drinking water quality duty and the contravention is likely to recur and Scottish Water does not appear willing to take timely steps to rectify the situation, DWQR may serve an Enforcement Notice on Scottish Water under Section 10 of the Water Industry (Scotland) Act 2002. Such an Enforcement Notice must set out specific actions to be taken by Scottish Water within specified timescales. Failure to complete such actions by the due date is a criminal offence under Section 12 (5) of the Act.

In 2020, there were three active Enforcement Notices:

Bonnycraig WTW	*Cryptosporidium*
Turriff WTW	*Cryptosporidium*
Scotland wide	*Improvements to risk assessment process*

Enforcement Notices are published on the DWQR website which you can view here:
https://dwqr.scot/regulator-activity/enforcement/

Scottish Water may give assurances, termed 'Letters of Commitment' to Scottish Ministers that they will carry out specified work to resolve a recurring water quality failure by a particular date. Progress to deliver the work specified in the Letter of Commitment is tracked by DWQR. Scottish Water gave DWQR five Letters of Commitment which were active during 2020 and beyond in respect of five WTW:

Glenfarg WTW
Herricks WTW
Rosebery WTW
Carron Valley WTW
Black Esk WTW

Letters of Commitment are published on the DWQR website which you can view here:
https://dwqr.scot/regulator-activity/letters-of-commitment/

5.3 Abbreviations and Glossary

BH	Borehole
Bq/l	Becquerels per litre, a measure of radioactivity
CAF	Cyber Assessment Framework
CWT	Clear Water Tank
DCMS	Department for Digital, Culture, Media and Sport
DOMS	Distribution Operation and Maintenance Strategy
DWSP	Drinking Water Safety Plan
DWQR	Drinking Water Quality Regulator for Scotland
EAL	Emergency Action Levels
IAF	Impact assessment Form
ISO	International Standards Organisation
mg/l	milligrammes per litre
NCSC	National Cyber Security Centre
NHS	National Health Service
NIS	Network Infrastructure Security
NRV	Non-Return Valve
NSO	Network Service Operator
NTU	Nephelometric Turbidity Unit
PAC	Powdered Activated Carbon
PCV	Prescribed Concentration or Value
PHT	Scottish Water's Public Health Team
PLC	Programmable Logic Controller
RSZ	Regulated Supply Zone
SCADA	Supervisory Control and Data Acquisition
SEPA	Scottish Environment Protection Agency
SR	Service Reservoir
THM	Trihalomethanes
TL	Team Leader
TOMS	Treatment Operation and Maintenance Strategy
TWS	Treated Water Storage
µg/l	microgrammes per litre
UV	Ultraviolet Light
WTW	Water Treatment Works

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