1. BACKGROUND

Members will remember that we briefed them on the Drinking Water Inspectorate's (DWI's) Compliance Risk Index (CRI) scoring system at the 1 November 2017 meeting. This was followed by Milo Purcell, Deputy Chief Inspector of DWI, attending the 19 March 2018 Water Forum (WF) meeting to present on drinking water quality.

In his presentation Milo Purcell said that with regard to general drinking water performance the Company was doing reasonably well and in particular on network management. However, he noted that there were some issues which DWI was looking at more closely, specifically water treatment incidents. He said that the Company had made an increased number of notifications to DWI, which he speculated could be because of under investment in treatment or operations, or due to improved Company reporting. Milo also said that he was aware of the Company's PR19 submission to DWI however; he felt it did not reflect or address any of the risks around water treatment.

In response to Milo's comments, WF members asked us to provide a paper to show our responsive actions for the short and medium-term, with a more detailed analysis of the items that may require additional investment in the future and the degree to which these need to be included in PR19 or undertakings.

2. PURPOSE OF THIS PAPER

The objective of this paper is to update the WF on our water quality performance, and give an understanding of the impact of water treatment incidents on customers (Section 3).

We give a summary of the current investment activities being delivered to achieve leading water quality performance across NWL (Section 4).

We will also contextualise these activities in relation to our commitments and proposals for PR19 across the various water quality measures (Section 5).

We have also taken the opportunity to set out an indicative 25 year strategy for water quality, in advance of the submission to DWI which is due by end of May 2018. The ambitions stated within our long-term strategy are due to go before the Executive Leadership Team in mid-May for support and sign-off (attached Appendix).

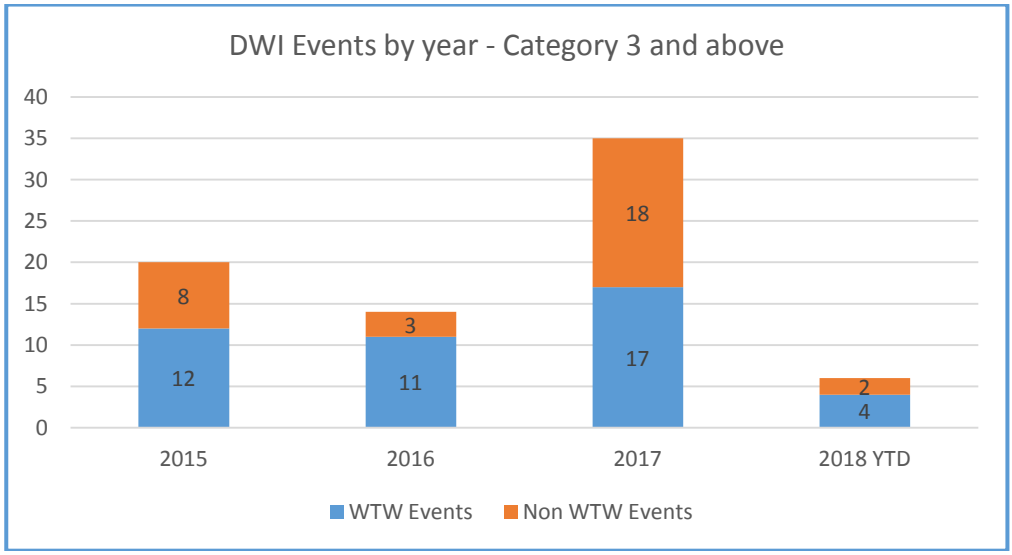
3. WATER TREATMENT INCIDENTS

When a drinking water event is notified to DWI, the Inspectorate will make an assessment on the nature of the issue reported and the actions taken by the Company to prevent a reoccurrence. The DWI will then categorise the event on based on the following scale:

1 – Insignificant
2 – Minor
3 – Significant
4 – Serious
5 – Major

The focus for DWI is on those events which are category 3 (significant) and above.

The graph below illustrates the number of significant events allocated to NW and ESW combined from 2015 which demonstrates the trend that Milo Purcell described.



Further analysis of treatment related events (table below) highlights the criteria for notification and hence the root cause of the issue notified:

Type of event	**Number**
Chemical Dosing	10
Media	1
Cryptosporidium	4
Process Malfunction	1
Discolouration	1
TOTAL	17

Out of the seventeen events at water treatment works in 2017, only two had an impact on customers. This is due to reporting guidelines as DWI rightly take a precautionary approach to process risk and hence minor deteriorations in say chemical dosing or inter-stage performance will be notified irrespective of the impact seen in treated water.

Eighteen of the events reported in 2017 were network or customer related. Five of these were due to changes in local network flows which resulted in supplies being temporarily discoloured. A total of eight events were in connection to the issue of precautionary advice to single properties. In these instances, the primary cause was generally the customer's own plumbing.

Section 4 below describes the short-term investment plan for water treatment. At least eight of the WTW events listed above will be directly managed through this work as will other compliance measures.

4. WATER QUALITY INVESTMENT 2018-20

A high level of scrutiny has been applied to years four and five (2018-20) of the current capital plan to ensure the right priorities are being addressed within the funding envelope. The requirement to manage down water quality risk and improve outcomes around drinking water incident numbers, DWI technical audits and regulatory feedback is a critical component of the plan.

These schemes are examples of the work we are doing to address the water supply process risks we observed during drinking water events in 2016/17, whilst in some cases, removing the risk altogether due to asset replacement. It also directly confronts the risk turbidity in treated ground-waters, a major influence on CRI scores in NW during 2016, a point emphasised by Marcus Rink, Chief Inspector of DWI.

- Horsley WTW, one of two strategic works supplying water to Tyneside, is currently being rebuilt. The new 150 million litres per day (Mld) process will meet both supply and quality demands for the next 25 years.
- The rural treatment sites at Byrness, Rochester and Otterburn are to be fully replaced with new treatment units pre-built off-site. This will increase their operability and reliability.
- Mosswood WTW will undergo full filter media replacement as part of asset maintenance to ensure adequate cryptosporidium log removal is achieved at all times. Mosswood supplies up to 140Mld to customers in Durham, Sunderland and South Tyneside.
- Filter units will be installed at Sunderland groundwater stations to mitigate final (treated) water turbidity risk from borehole particulates, improving compliance supplies in East Durham and Sunderland.
- A run-to-waste feasibility study is being delivered to identify and prioritise options for water containment during any unplanned events on water treatment sites in the north. This applies mainly to sites which supply water via gravity and where outages are difficult to manage.
- The works at Murton (and Fowberry) are being replaced as the existing processes supporting the various boreholes in the Berwick region are no longer fit for purpose. This scheme will mitigate the issues experienced in three incidents alone in 2017, as well recommendations from a DWI technical audit.

The water treatment programme for 2018-20 will directly mitigate the risk of non-compliance at a number of treatment works as well as the root cause from incidents. The work will benefit supplies to around 75% of northern customers. Importantly, delivery of the above schemes will positively influence the new CRI measure which will become an ODI in 2020.

5. PR19 DWI QUALITY SUBMISSIONS

Four schemes were submitted to DWI in December 2017 as part of the PR19 process, and we expect to receive feedback by June 2018. If accepted, DWI will confirm regulatory support to Ofwat for inclusion in the base plan for NWL.

The schemes were chosen based on a number of factors, and principally because of their maturity in detail and costs, and their continuity with previous AMP submissions. The schemes are focused mainly on strategic and distribution networks:

- Our lead strategy will focus on public health, compliance and availability of natural resources. We aim to replace the communication and supply pipes (the full service pipe) for all identified vulnerable customers, targeting public buildings frequented by children as this is the age group most susceptible to the ingestion of lead. We also intend to replace all lead in six discrete rural supplies in Northumberland to allow phosphate dosing to be removed at the supplying works. These are two elements of a wider lead strategy and combined costs have been determined to be in the region of £14m. Feedback from DWI has indicated our strategy is one of the leading approaches in the industry.
- Our discolouration strategy in conjunction with Sheffield University will oversee the installation of flow monitoring and control at key locations on the strategic network to allow flow conditioning of mains to be carried out across 90% of the northern network. The £24m programme should minimise discolouration during unplanned outages or when carrying out sensitive planned activities. We estimate this will reduce discolouration contacts by a further 10-15%.
- As part of a commitment made to DWI in 2014 to investigate discolouration management in Teesside, we commissioned a Tees Zonal Study to understand system capacity, asset operability, water quality risk, demand balance and resilience. As a result of this work, we intend to lay 37km of new trunk main from Lartington to Longnewton to replace aged dual trunk mains which carry a significant operability and discolouration risk (£38m). This would be the primary activity of a 25 year plan for Teesside. The work will enable a link to be made between Tees and Central area as part of the resilience plan (£16m).
- A new service reservoir is planned for construction in the Central area at Springwell to improve resilience, water quality compliance whilst reducing risk of customer interruptions. The 62Ml storage tank will bridge storage deficits in the area and will be sited on the Washington leg from Mosswood WTW. The £17m project will also provide opportunity to link supplies from Carr Hill on the Tyneside system to further increase resilience.

- In addition, DWI has been supplied with a statement on our catchment management plans for AMP7. This is to signpost and support any transitional arrangements for legal instruments in early 2018 covering pesticides and wider catchment based approach in advance of further guidance from the Inspectorate. The catchment approach targets a replacement of pesti-wise in ESW with a grant scheme to generate funding for alternative measures used for pesticide management. We will also continue to work on peatland restoration for colour and carbon removal, plus tackle nitrates in the Berwick system.

The broader water quality plan for AMP7 does incorporate water treatment improvements as part of our business as usual approach to operational and asset management. These are within our base costs and do not require a legal instrument to be agreed with DWI.

6. ADDITIONAL PR19 WATER QUALITY PROPOSALS

We expect delivery of our PR19 plan will help us achieve 100% water quality compliance at both water treatment works and service reservoirs by 2025. This will help the combined NW and ESW score to achieve upper quartile whilst also having a significant impact on the proposed Events Risk Index (ERI) which is likely to be tracked as a bespoke measure. Examples of schemes within the plan include:

- A critical part of the water quality plan will be to deliver the outputs from the run-to-waste feasibility study. This will be delivered as part of a phased programme of work to ensure we operate resiliently and with the principle that only compliant water will ever leave a water treatment works.
- The plan will also improve water chemistry in water leaving treatment works, making the water more stable and non-aggressive to distribution mains. This work will mitigate the risk to consumers from parameters such as lead and nickel.
- We will extend the manganese removal strategy across northern sites and Suffolk, and also aim to accelerate the iron mains replacement programme beyond reactive compliance issues to ensure deterioration of unlined cast-iron is adequately targeted.
- On water quality resilience in Essex, we have observed an increased risk from algae in Abberton impounding reservoir which can impact on the output from the receiving Layer WTW. In response, we intend to install additional treatment to condition the raw water at Layer WTW and so improve treatability. We also aim to lay a new raw water pipeline from Abberton to Hanningfield impounding reservoirs to increase raw water flexibility and supply management.
- In Suffolk, we are mid-way through the implementation of a zonal strategy to boost resilience and create a more integrated network. Whilst connectivity schemes have already been delivered as part of this strategy, in AMP7 we will be building a new service reservoir at Barsham to support the wider transfer of water between Barsham, Lound and Ormesby WTWs to minimise the impact of unplanned outages and water quality risks for customers in Suffolk.

Long-term Water Quality Strategy

As part of PR19, the DWI has requested that all companies submit a long-term water quality summary paper by May 2018, which signals their strategic intent from source to tap and also identifies likely one-off or 'lumpy' replacement schemes for water treatment or storage facilities as part of asset management. DWI quotes in their guidance document:

"Although current periodic reviews span just a 5 year period, DWI expects that companies will need to take clear long term strategic views on their planning needs to ensure that their risk management strategies are coherent, effective, efficient and sustainable."

The May deadline requires a summary document to be produced which highlights current long-term planning and targets, however the DWI expect this to be a followed up in March 2020 with a more detailed breakdown of the 25. Our strategy will aim to sustainably achieve 100% compliance on all aspects of CRI whilst aligning to equivalent ambitions around ERI, consumer acceptability of water, interruptions to supply, unplanned outages and resilience. It will demonstrate continuity with current AMP6 and AMP7 plans and where necessary, influence current pace of activity. A summary of the plan is provided in the attached Appendix.

7. SUMMARY

Our plans for water quality cover all aspects of the water service and aim to protect consumer health, demonstrate ambition, and also recognise asset needs in-line with customer and regulatory expectation. The plan confronts each of the key measures around CRI, events and consumer acceptability, and aims to ensure that NWL is seen as a trusted, innovative and high-performing company.

Ceri Jones and Richard Warneford met with Milo Purcell of the DWI on 3 May to discuss the Company's water quality strategy. The Company shared more detail on its short, medium and long-term approach to improving water quality. This includes a significant investment programme between now and 2020 with further investment and initiatives in AMP7 as the first part of a longer-term strategy currently being finalised for submission to DWI. The water quality related activity is mainly part of business as usual and much wider than the few schemes for which specific DWI support has been sought as part of the PR19 process due to the requirement for legal instruments to be put in place. We also noted the strong link with resilience as greater network connectivity helped to address concerns about treatment works that were too critical to fail by creating the ability for supplies to be maintained by moving water around.

Milo commented that the paper we shared and the discussion had been really helpful in providing the context of our broader water quality strategy and he had found this very re-assuring.

ALAN BROWN
Scientific Support Manager

4 May 2018

LONG-TERM WATER QUALITY STRATEGY

- We need to enhance our upstream monitoring capability to be better informed and prepared in terms of raw water knowledge and decision making. We will invest in instrumentation to monitor our source waters in real time for water quality parameters, inflows, mixing zones and mass balances to create an intelligent abstraction management process on medium to high risk waters.
- There is a need to replicate the Tees Zonal Study across Central, Northumberland and Tyne. This will allow decisions to be made on treatment rationalisation and/or upgrade and ensure networks are designed to be integrated and resilient. It would be inappropriate to look at individual regions in isolation as this would generate a different set of answers to the same questions. We believe this work is critical to the development of a water quality/asset planning strategy and we would be looking for support to commission these studies with immediate effect. The outputs from these will form a key part of the content within the 2020 report to DWI and will signpost the number and locations of required treatment works in association with opportunities for strategic network re-design to make them fit for the future. It will also likely set the water service investment programme over at least five future AMP periods. This is where 'lumpy' schemes will be highlighted.
- The aim of the above studies is to help create a flexible network that can cope with future incident scenarios. It is recognised in this ambition that Essex has largely achieved this already and that a similar study in north Suffolk has already been completed and the programme is a good way through implementation. It is also noted from a quantity perspective that sustainable water resources (North and South) exist apart from Hartismere zone in Suffolk. It is therefore likely that investment will be required in this area.
- Once rationalised, optimised and streamlined, we would want strategic networks to be managed via a smart network of data capture and intelligent real time control. This work would be affiliated with adequate resource to data manage the information such technologies would provide.
- The group recognise that our current rate of replacement for service reservoirs is inadequate and that the current age profile of these assets is predominately 80+ years. There is a need to create more informed tendency tree analyses to determine the service reservoir inspection frequency rate, and where engineering assessments signal significant asset deterioration within a five to ten year period, we would plan to replace or abandon. Other principles which form part of the strategy include:
  - All fill and draw tanks will be re-engineered to remove this type of operation.
  - All brick-lined tanks will be removed from service and replaced.
  - Age profile will be considered within the tendency tree assessment, with an option of a cut-off point agreed (120 years+?) dependent on construction material.
  - Age of water from source to customer to be assessed across a system and not just isolated to design residency in single tanks.
- Water quality compliance in NWL has been significantly affected over many years by the rate of iron failures. At present, non-strategic mains rehabilitation and replacement on unlined cast-iron is at a very low rate due to decisions made in PR14 and current reprioritisation of the capital plan. Unlined cast-iron will continue to be a significant risk until a step change is created. The long-term strategy will therefore look to replace all unlined cast-iron non-strategic mains by 2050. This equates to approximately 60km per year from 2020.
- The section 19 programme of non-strategic mains relining and renewal is now almost 20 years old in places and where lining techniques were applied, this material is coming to the end of its asset life. The long-term strategy would therefore include the re-introduction of pre and post rehabilitation assessments to determine (alongside unlined cast-iron mains) the areas of greatest risk to non-compliance and iron pick up and so help to prioritise a forward programme of works.
- In-operable or poorly maintained air valves have often been a cause of customer issues or drinking water events. We would therefore aim to replace all non-standard air-valves on the network by 2045.
- In-line with Water UK and DWI ambition, NWL's forward-looking programme for lead is moving towards more widespread removal of lead in customer services whilst recognising that phosphate is a limited resource. We will aim to be lead free in customer communication and supply pipes by 2050.
- There was a strong view that NWL needs to adopt asset design standards aligned to industry best practice which ensures when we refurbish or rebuild our assets they are able to deliver leading levels of performance and service. They would not aim to stifle innovation, and indeed the group are confident that project scope and timelines can be made more efficient be use of such standards as well as create robust assets to manage water quality.

- To support the above, we will continue to make people competency a key strategic objective and tools and techniques for continuous improvement will be allowed to evolve in-line with best practice taken from across various industry sectors.