1. WATER QUALITY UPDATE

The purpose of this paper is to update the Water Forum on water quality performance both past and present. This overview highlights performance as measured by the Drinking Water Inspectorate (DWI) and by customers through research, contact and perception measures. It also provides insight into areas that need focus for PR19 and the 2020-24 period. The document content has been prepared to enable dialogue.

Members are asked to note that:

- our performance is improving year on year; and
- we are planning to improve further.

2. OUR CUSTOMERS' VIEWS

This section summarises the high level findings from recent customer engagement related to our water quality policies and plans. The summary draws upon research conducted in relation to specific aspects of water quality, eg taste and odour, discolouration and lead. It also draws on some of our broader research which explored water quality in the context of other services such as 'defining the conversation' and our research into trust and value. Water Forums members can find all of the final reports for this engagement in the 'research and engagement information' section of Sharepoint.

Our customers' views on drinking water quality have remained very consistent over time. This means that we can be confident in making the following statements:

- Satisfaction with drinking water quality has remained consistently high over time.
- Customers see the delivery of clean, clear drinking water that tastes good as one of our core responsibilities and trust us to maintain this service.
- The majority of customers and stakeholders perceive their drinking water to be of high quality and take this for granted.
- Most customers have a limited understanding of water treatment and don't care to know more.

CCWater's most recent tracking research 'Water Matters' (2016) places Northumbrian Water at the top of the industry, with the highest levels of satisfaction for colour and appearance of tap water (97%), satisfaction with taste and smell (94%) and satisfaction with safety (95%). Essex & Suffolk Water (ESW) scored above average for satisfaction with colour and appearance of tap water and satisfaction with taste and smell with scores of 96% and 90% respectively. ESW's satisfaction score for safety was two percentage points below the industry average (89%) at 87%.

3. OVERALL DRINKING WATER QUALITY COMPLIANCE

The DWI is currently changing the measure of compliance from the Overall Drinking Water Quality (ODWQ) compliance measure to the Compliance Risk Index (CRI) measure. The old measure largely considered compliance against the regulated standards at the customer tap. The new CRI measure is more representative of the supply chain as it utilises compliance data from water treatment works, the strategic network and customer taps. Regulatory sampling data is the underlying data source, this has not changed, it is being utilised and presented in a more complete way to highlight risk. The attached Appendix includes details of the calculation.

3.1 Performance with ODWQ compliance 2006 to 2016

Performance has been stable over time, varying between 99.88% and 99.96%. We have been unable to achieve an upper quartile level of service with this measure. The measure is an average of zonal samples taken from randomly selected customer taps. Impacts are reported through the Annual Performance Report and barriers to upper quartile performance have included pesticides, and degradation/corrosion products from network and plumbing materials.

Performance in 2009, 2012 and 2013 was significantly hampered by the pesticide metaldehyde, the active ingredient in slug pellets. This plant protection product is very soluble, stable and persistent in the water environment so it can move from field to source water used for treatment and then stay

there for months. As part of our continual improvement approach, a review was undertaken in 2013, the output of which is that metaldehyde has been successfully controlled with abstraction management. Our plan for PR19 includes additional catchment management activity and strengthening our partnership working to deliver multiple benefits enhancing our natural capital. Our plan also includes treatment solutions at key sites as in drier years we will be unable to practice abstraction management (effectively rejecting water as unsuitable for treatment).

Chart 1: Overall drinking water quality 2006 to 2016 NWG and industry average.

3.2 Performance with CRI 2016

Compliance risk index is a new measure introduced for 2016; ODWQ will cease to be used by DWI from 2020. The charts presented by DWI at the Annual Report launch are replicated below to show how NW and ESW perform and where current risks lie.

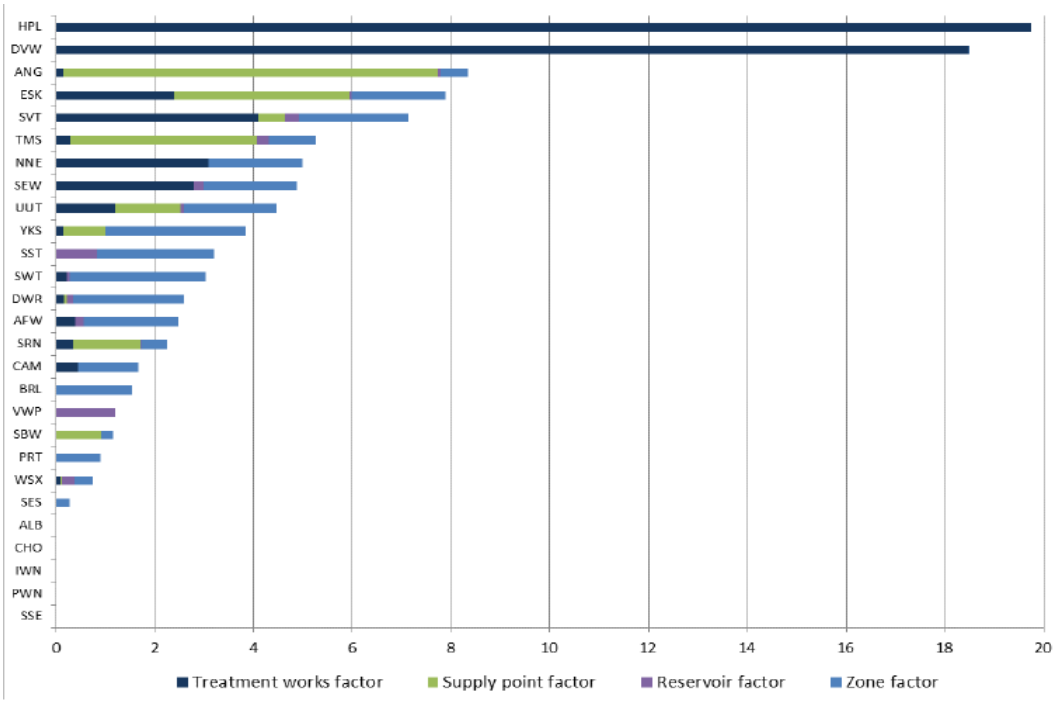

Figure 1: Compliance risk index 2016 NWG are ESK and NNE, industry average was 5.

The risk score is total risk from four compliance monitoring points these are; water treatment works (dark blue); supply points (green), service reservoirs (purple) and customer taps (pale blue). Each failure is processed to become a risk score through a specific process which includes a DWI inspector assessment and the amount of water supplied or population served, the type of failure is weighted for those tests relating to water safety or health. Company performance can be normalised by volume or population and comparative information produced (Figure 1 above).

The chart above shows how the industry is performing with risk management. It can be seen that there is considerable variation in score and risk area. ESW (ESK) is in fourth place and NW (NNE) is in seventh.

Figure 2 below illustrates how the risk score is composed for NW and ESW. The pie charts show turbidity at treatment works (red sector) as a major component, in NW this is equivalent to nine failures and in ESW one failure. For ESW the other major components are the pink (1.9 Bentazone) and pale blue (1.8 metaldehyde) sectors. These risk sectors account for three failures of the pesticide standard from supply points.

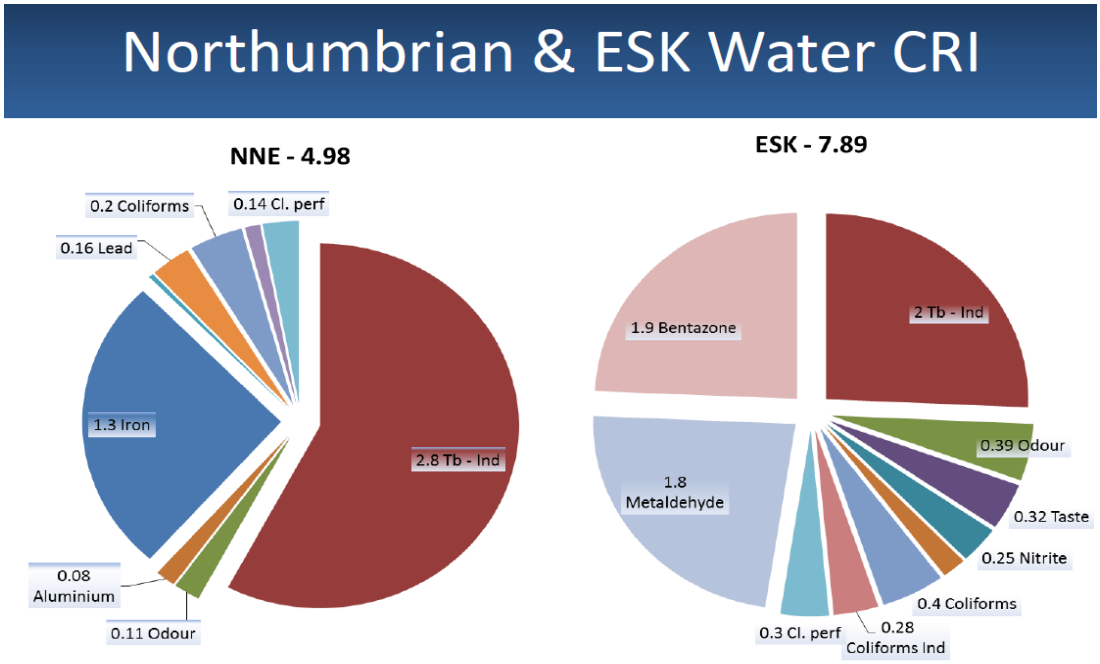

Figure 2: NW and ESW compliance risk index breakdown for 2016

Analysis of the turbidity failures in NW has identified a number of contributing sites and a number of projects that will deliver significant turbidity benefit are in plan for delivery. This will improve the turbidity risk from key contributing assets by 2019, the Company scores are anticipated to improve from 4.98 to 2 for NW and 7.89 to 5 for ESW in response. We also have longer term plans to improve the filtration facilities at a small number of water treatment works through PR19 to manage this in the medium term.

The water that we supply is the most important product that our customers buy and ensuring that it is always the best that it can be is not just about capital investment. We have introduced a number of continual improvement techniques onto our treatment works in 2017 with the aims of; engaging all employees in continuous improvement, standardising our operations and reposition our treatment works as ‘food factories’.

The water supply chain was not visible through the ODWQ measure as this was focused on the customer tap. The new CRI measure highlights risk from the component parts of the supply chain. The chart below shows the numbers of failures from relevant points, the grey, orange and blue sections being Company controlled assets, the yellow representing customer taps. Excepting 2009, 2012 and 2013 when metaldehyde played a significant part in the numbers of failures, the trend is one of improvement.

The blue band represents service reservoirs where water is stored at key locations in the network, ready for customer use. The numbers of failures from these assets is around a quarter of what it was. This has been as a result of a sustained focus from 2011 to now; the increased expenditure on these assets has benefited performance. We are using the innovative flow cytometry technique (that counts cells in water) to understand more about water quality in these assets and have derived a bespoke risk scoring measure. This additional information combined with our existing focus should allow us to manage risk to water quality better than ever before.

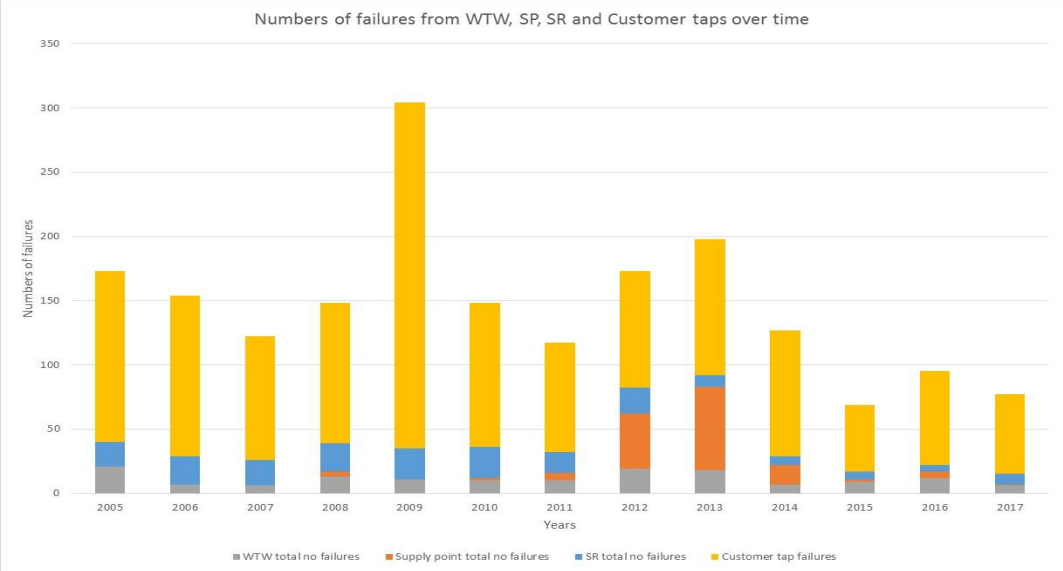

Chart 2: Numbers of failures from treatment works, supply points, service reservoirs and customer taps 2005 to 2017 (part year).

4. WATER QUALITY CONTACTS

Our service has improved over time, this is clear from customer contacts about water quality. The contact categories that form part of our annual return to the DWI have reduced from 22,036 in 2005 to 8,056 in 2016. The contacts recorded are from customer reports, the contacts are not validated or assessed in any way other than to categorise them correctly.

Improvements have been seen primarily in the appearance category as work on discoloured water has been delivered and with taste and odour contacts due to the cumulative and iterative improvements made through asset maintenance over the period.

4.1 Performance with Discoloured water 2007 to 2017

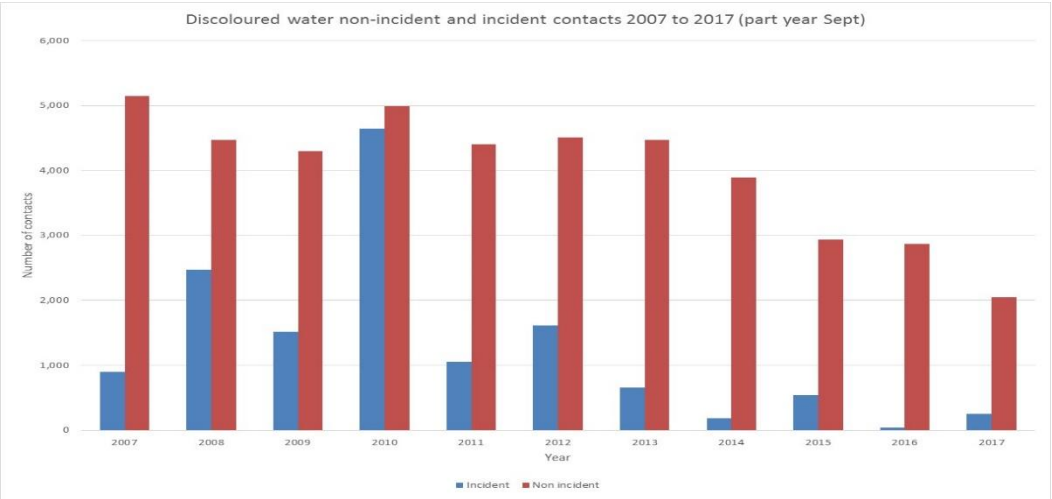

Chart 3: Discoloured water contacts, background and event, 2007 to 2017 (part year).

Improvement in water quality is a long-term ambition, it is not easy to effect a significant change as water quality is a culmination of all asset maintenance and operational activity on the water supply system.

We have been working to improve water quality for a long time, our Business Plans for PR04 and PR09 included schemes to clean trunk mains to remove the legacy of accumulated discolouration material from the strategic network. In 2010-15 we reviewed our discolouration approach and created a source to tap strategy. Our 2015-2020 work includes additional treatment processes to reduce the release of discolouration material into the network reducing the rate of accumulation further. It includes the efficient and innovative automation of proactive network management which maintains quality and reduces the need for expensive conventional cleaning. The work also includes flushing local networks, this with the other systematic activity ensures customer benefits.

The discoloured water chart shows that all of this work has improved the customer experience of our water quality in day to day situations (red bars). The network cleaning and active management combined with the flushing programme have also enhanced the service resilience of the supply system and discolouration events (blue bars) are also significantly reduced.

4.2 Performance with taste and odour 2005 to 2017

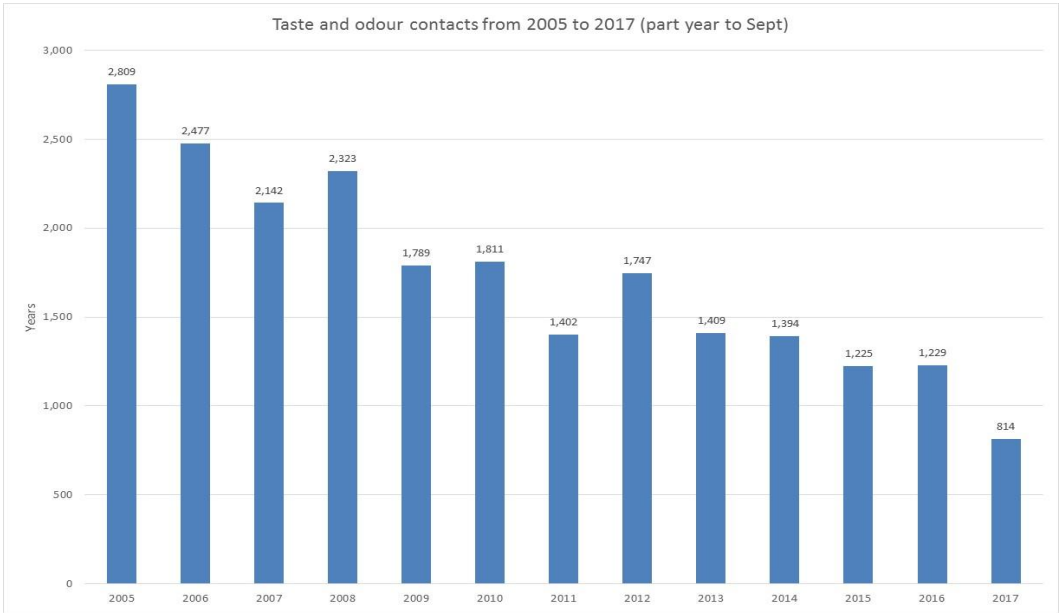

Chart 4: Taste and odour contacts 2005 to 2017 (part year)

The contacts of taste and odour have improved from 2,809 in 2005 to 1,229 in 2016. Our 2017 forecast is 1,100 which is upper quartile performance. However, due to our stringent ODI we are in penalty position with this measure.

The improvement in taste and odour contacts has been achieved through asset maintenance and operational activity across the water service over time. In 2015, we carried out taste and odour research to better understand customers' views. This gave us the confidence that our plans to improve performance further were the right ones.

To improve we have changed our maintenance approach for our water treatment works processes. We manage the level of chlorine in the supply system very carefully, more carefully than ever before. We have improved the quality of advice on our website, with our field teams and customer contact teams, this has also improved consistency of the customer experience. We are also undertaking a study to understand if changing our northern network from chlorine to chloramine would give customers a higher level of acceptability.

5. SUMMARY

Water quality performance, whether measured through compliance and regulated standards, or through customer experience measures, has improved. We want to improve further, and alongside our continual improvement work, our plans for PR19 include activity to protect raw water resources through stronger partnerships, enhance treatment capacity to protect against pesticides and turbidity, and manage risk and demand effectively in the supply chain.

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Technical Policy Manager

17 October 2017

COMPLIANCE RISK INDEX CALCULATION

Compliance Risk Index (CRI) is a new measure developed by the DWI in consultation with water companies. CRI will replace the current Mean Zonal Compliance (MZC) index to accommodate upcoming drinking water quality regulations amendments, and to adopt a risk based monitoring methodology to assess compliance. These regulatory amendments are currently being consulted on (close 24 October).

CRI is calculated by taking into account the significance of the parameter failing the standards in the Regulations, the cause of the failure, the Company's response to the failure, and the location of the failure within the water supply system. It does this by taking into account the proportion of the Company's customers who are affected.

The calculation can be summarised as follows:

$$CRI = \underbrace{\frac{\Sigma SCV}{\text{Total volume } m^3/day}}_{\text{At water treatment works}} + \underbrace{\frac{\Sigma SCV}{\text{Total volume } m^3/day}}_{\text{At supply points}} + \underbrace{\frac{\Sigma SCR}{\text{Total SR capacity } m^3}}_{\text{At service reservoirs}} + \underbrace{\frac{\Sigma SCP}{\text{Total company population}}}_{\text{At water supply zones}}$$

Where:
S = Parameter score
C = Assessment score
P = Population affected - for compliance failures in water supply zones
V = Volume affected - for compliance failures at treatment works or designated supply point
R = Service Reservoir capacity affected - for compliance failures at service reservoirs

The parameter score is risk based and weighted to health parameters are follows:

Basis for score	**Score**
Health Risk	5
Health Risk Indicator	4
Aesthetic	3
Regulatory Impact	2
Non Health Risk Indicator	1

The assessment score is chosen by the DWI Inspector based on the following:

DWI Inspector assessment	**Score**
Enforce	5
Covered by legal instrument	4
Enforcement considered	4
Recommendations made	3
Suggestions made	2
Satisfactory investigation did not identify cause	1
Trivial	1
Unlikely to recur	1
Incorrect data	0
Outside operational limits	0

The methodology allows comparisons to be made between companies and/or asset groups.