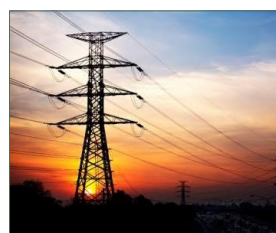


Water & Sewerage Services Price Control 2015-21

Draft Determination – Annex G
Asset Serviceability
July 2014



Contents page

Water and Sewerage Services

Price Control 2015-21

Draft Determination Annex G

Asset Serviceability

1.0	Introduction.....	1
2.0	Selection of Serviceability Indicators.....	3
3.0	The Assessment of Serviceability	7
4.0	Regulatory Action in Respect of Serviceability.....	10
5.0	Sub-service Area Assessments	11
5.1.	Sub-service assessment approach	11
5.2.	Water infrastructure sub-service	11
5.3.	Water non-infrastructure sub-service	12
5.4.	Sewerage infrastructure sub-service.....	13
5.5.	Sewerage non-infrastructure sub-service.....	14
5.6.	Overall service assessment using primary indicators.....	15
6.0	Assessment of Individual Indicators	16
6.1.	Assessment of water infrastructure indicators.....	16
6.2.	Assessment of water non-infrastructure indicators.....	22
6.3.	Assessment of sewerage infrastructure indicators	26
6.4.	Assessment of sewerage non-infrastructure indicator.....	33
6.5.	Summary of reference levels and control limits.....	37

1.0 Introduction

- 1.1.1 This Annex to the PC15 draft determination sets out the Utility Regulator's assessment of asset serviceability which contributes to our determination of future capital maintenance investment and allows us to establish 'control limits' which will be used to assess future performance.
- 1.1.2 In the final determination for PC13, we set out our intention to develop serviceability assessments to monitor delivery of the PC13 determination and provide the basis for a more robust serviceability assessment for PC15. During PC13 we engaged with the Principal Stakeholders, including NI Water, to develop a suite of indicators which could be used to assess serviceability. This first assessment is based on those indicators. We remain open to adopting alternative indicators which NI Water might propose to better represent serviceability and drive the right outcomes for its consumers.
- 1.1.3 Serviceability is the capability of an asset to provide a service. It is a broad measure based a mix of service indicators, asset performance indicators and sub-threshold indicators which balance consumer experience and the underlying performance of the assets. Focusing asset maintenance planning on serviceability, rather than the condition or performance of the assets, will ensure that investment targets consumer outcomes in the short term and the right level of capital maintenance investment is maintained in the medium and long term.
- 1.1.4 In practice, serviceability is monitored by trending a series of defined asset performance indicators (such as the frequency of pipe bursts) and service indicators (such as the frequency of interruption to supply). Data trends are used to determine whether asset serviceability is improving, stable, marginal or deteriorating.
- 1.1.5 As well as monitoring what has been delivered, serviceability indicators provide a basis for planning asset maintenance investment to maintain a reference level of service to consumers and the environment now and into the future.
- 1.1.6 Serviceability can be assessed for the asset base as a whole, by individual service areas, by individual assets or groups of assets, or by individual service metrics. While we present information for the individual serviceability indicators, we have assessed serviceability collectively for four sub-service areas of infrastructure and non-infrastructure assets in the water and sewerage service areas.
- 1.1.7 Our overall conclusion from this assessment is that serviceability is stable in all four sub-service areas.

1.1.8 The remainder of this annex sets out our approach and assessment in the following sections:

- Section 2 Selection of serviceability indicators;
- Section 3 The assessment of serviceability;
- Section 4 Regulatory action in respect of serviceability;
- Section 5 Sub-service area assessments; and
- Section 6 Assessment of Individual Indicators.

2.0 Selection of Serviceability Indicators

2.1.1 This section describes how we selected serviceability indicators and sets out the indicators used in this assessment.

2.1.2 The serviceability indicators used in this assessment are set out in Table 2.1.

Table 2.1 – Serviceability indicators

Service	Indicator
Water Infra	Mains bursts per 1,000km
	Interruptions to supply greater than 3 hours resulting from equipment failure
	DG3 percentage of properties affected by interruptions greater than 12 hrs (unplanned & unwarned)
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV
	Customer contacts per 1,000 population (Discoloured water)
	Distribution losses
Water Non-infra	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV
	Events at WTW resulting from treatment difficulties or ineffective treatments categorised as 'significant' or higher
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV
Sewerage Infra	Sewer collapses per 1,000km
	Sewer blockages per 1,000km
	Number of H, M and L pollution incidents from the sewer network (CSOs, rising mains and foul sewers)
	Properties flooded in the year (other causes)
	Total number of equipment failures repaired
Sewerage Non-infra	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value
	Percentage of WwTW discharges not compliant with numeric consents
	Percentage of total population equivalent served by WwTWs not compliant with numeric consents

- 2.1.3 For each service area a primary indicator is shown first in bold. Particular weight is given to the primary indicators when assessing serviceability.
- 2.1.4 Serviceability is a relative measure which assesses the performance of a company relative to its historical performance. While the proposed approach is based on a methodology previously used in England and Wales, it was not essential to use the same basket of indicators. The choice of indicators has taken account of established monitoring practices by the quality regulators (Drinking Water Inspectorate DWI and Northern Ireland Environment Agency NIEA) and the indicators which NI Water uses to monitor its assets and inform asset maintenance investment.
- 2.1.5 The number of indicators used to assess serviceability is a matter of judgement. Too few indicators could lead to an ill informed assessment. Too many, and the assessment becomes unduly complex. Experience suggests that the order of six indicators is sufficient to judge serviceability in an individual service area.
- 2.1.6 When developing our approach to serviceability we concluded that the following benchmarks were useful when assessing and selecting suitable serviceability indicators:

Primary criteria

- Is it appropriate for assessing asset performance linked to serviceability?

Secondary criteria

- Is it meaningful, practical, measurable and relevant to the company?
 - Is it used by the company to monitor, assess and inform asset maintenance requirements?
 - Is performance for the indicator within the company's control?
 - Does it provide robust 'stable' data?
 - Is it currently reported or externally verifiable?
 - Is it used or recognised by external stakeholders, in particular the quality regulators?
 - Is an historical data trend available or can a reasonable period of historical data be back-cast?
- 2.1.7 A mix of three types of indicators has been adopted to assess serviceability:
- Service indicators. These measure the service as experienced by consumers and are based on the service targets used to measure NI Water's performance. For example service targets for interruption to water supplies;
 - Asset performance indicators. These measure the performance in terms of

asset failure which becomes the root cause of service failures. For example the frequency at which bursts occur on water mains; and

- Sub-threshold indicators. These have been introduced to monitor serviceability before a recognised service or asset performance failure level is reached. They allow deterioration of assets to be identified before the asset fails. For example, a water treatment works ‘fails’ if turbidity reaches the prescribed concentration value (PCV) of 1.0 NTU – a sub-threshold indicator of the number of samples above 0.8 NTU has been used. Sub-threshold indicators reduce the risk that management action to maintain service targets or asset performance targets masks an underlying deterioration of serviceability.

2.1.8 Based on the above criteria we reviewed the serviceability indicators used in England and Wales and identified other indicators for consideration. In addition to established service and performance indicators we considered:

- Consumption indicators such as power usage or chemical consumption. We concluded that changes in this type of indicator were influenced more by changes in need and operational practice than by the performance of the assets; and
- Indicators which link asset failure and service consequence – for example sewage pump failure which results in an overflow. Some indicators of this type were included and we will consider additional indicators of this type in the future.

2.1.9 The serviceability indicators we use are the type of indicator the company should use to target investment and monitor the effectiveness of asset maintenance. The relative merits of each indicator were assessed and then reviewed with NI Water. As part of this process, NI Water was asked to propose other indicators which might better reflect serviceability and take account of the company’s developing asset management systems. The company did not offer alternative measures. We believe that there is a need for indicators that represent non-infrastructure serviceability based on unplanned maintenance indicator(s) and we have asked the company to draw up a specification for this type of measure. The company did not have a specific measure in place and has developed a specification. However, it will be some time before a data trend is available to allow this to be effective.

2.1.10 A ‘primary’ serviceability indicator is identified in each service area. This is listed first and highlighted in bold text. Particular reliance will be placed on the performance of these indicators in reaching an overall assessment for the service area.

2.1.11 While the assessment depends on the collection of long term data, the basket of serviceability indicators is not fixed. The Utility Regulator remains open to considering alternative indicators which would enhance the assessment. We would welcome suggestions from stakeholders for indicators that might provide a better indication of serviceability. In particular, we would encourage NI Water to

continue to identify and propose alternative serviceability indicators as its asset management systems and processes develop.

- 2.1.12 Serviceability indicators will be reviewed from time to time to ensure that they remain appropriate and effective. As compliance improves towards 100%, some of the statutory compliance measures will become less useful and greater reliance might be placed on sub-threshold indicators. Where experience shows that the selected basket of indicators does not address a particular service issue, we will consider introducing alternative targeted indicators.
- 2.1.13 The serviceability indicators and serviceability assessment do not replace regulatory targets or provide a performance measure for quality compliance. Their sole purpose is to assess asset maintenance and monitor the effective delivery of asset maintenance. Issues relating to quality compliance and regulatory targets will be addressed through existing statutory and regulatory processes.
- 2.1.14 Effective assessment depends on reliable data which has been collected over the medium to long term using a consistent methodology. The poor quality of some historical data could compromise the assessment in the short term. We have recognised this in the selection of initial indicators and the quality of historical data will influence how we use serviceability assessments until robust data trends can be established.

3.0 The Assessment of Serviceability

- 3.1.1 This section describes how we will carry out an annual assessment of serviceability to determine whether serviceability is improving, stable, marginal or deteriorating.
- 3.1.2 The assessment of serviceability is based on the trend in performance for each individual indicator. This leads to an assessment of the serviceability for the service area as a whole which identifies whether serviceability is:
- Improving;
 - Stable;
 - Marginal; or
 - Deteriorating.

Establishing serviceability control limits

- 3.1.3 The trend of each indicator is assessed against a **reference level of service** and upper and lower **control limits**.
- 3.1.4 We will have more regard to the upper control limit in our analysis. The lower control limit will act as a trigger for a review of the control limits. It should not be seen as a barrier to improved performance and it should not be taken as the Utility Regulator's view of an acceptable limit of performance which the company is not expected to out-perform. This is of particular importance where there are continued opportunities for management action and improved asset management techniques to continue to improve service at relatively low cost.
- 3.1.5 The reference level of service reflects the best historic level of performance unless this is demonstrably atypical or sub-optimal. In the first instance, it is based on the average performance over two consecutive years during a period when the data is considered to be of acceptable quality. This aims to identify a challenging but realistic reference level.
- 3.1.6 Upper and lower control limits allow for variability of performance around the reference level of service. It allows the company flexibility to manage asset maintenance and allows for the natural variability in performance due to external drivers such as weather. In the first instance, these limits are established by considering the variation between the two data points used to determine the reference level and are calculated using the following formulae:

$$\text{Upper control limit} = \text{Reference level} + \left[A \times \frac{1}{2} (\text{difference between the two data points in the reference period}) \right]$$

$$\text{Lower control limit} = \text{Reference level} - \left[A \times \frac{1}{2} (\text{difference between the two data points in the reference period}) \right]$$

- 3.1.7 The default value for the coefficient 'A' is normally taken as 3.

- 3.1.8 However, we do not adopt a prescriptive approach to the determination of reference levels and control limits. Where appropriate we will also consider:
- Longer trends and variability of historical data. Where we develop confidence limits based on longer term data trends, we will normally set the reference level at the mean and control limits at 2 standard deviations from the mean; and
 - The inherent variability caused when limited random sampling is used to assess performance. When we do this, we will normally set control limits at 2 standard deviations from the mean using a standard deviation determined from the binomial distribution approximation to random sampling from a population.
- 3.1.9 Where an indicator is a measure of customer service or a statutory quality compliance measure, we have tended to adopt a more challenging upper control limit. The use of these measures to monitor serviceability should not be seen as a reason for declining consumer service or quality compliance. Over time, we would wish to adopt serviceability indicators which relate more to the performance of the assets and move away from those which are based on consumer service or statutory compliance.
- 3.1.10 We recognise that some of the indicators can be materially affected by extreme events, often occurring over a short period. Where it is possible for the company to identify the impact of a short duration extreme event, we will consider adjusting the assessment to reflect the underlying serviceability of the assets. However, we will do so with caution as performance during extreme events may be a key signal for the need to improve the resilience of the asset base to maintain or improve the overall level of service provided.
- 3.1.11 We will take account of other factors such as changes in methods of measurement and past and future investment.
- 3.1.12 This is the first time we have determined serviceability indicators, reference levels and control limits. For many of the indicators the useful data trend is relatively short either because past data was of doubtful quality or because significant quality investment over the last decade has resulted in a stepped change in performance. In view of this, we will review the reference levels and control limits at the mid-term review to take account of further changes in data quality, changes in methodology and improvements which quality investment will deliver. This will also give the company time to propose alternative indicators of serviceability and develop its asset management processes to better inform future serviceability trends.
- 3.1.13 The reference level does not need to be a constant level. Where the company has been funded to deliver service improvements, including improved quality compliance, these may be reflected in an improving reference level over the period of the relevant plan.

Assessing serviceability against the control limits

- 3.1.14 NI Water is expected to monitor performance for each indicator and to manage and maintain its assets so that all indicator values remain well within the upper control limit.
- 3.1.15 The performance against the serviceability indicators will be assessed using four categories:
- Improving: Improved performance sustained over a number of years;
 - Stable: Performance broadly stable around the reference level and within control limits;
 - Marginal: Shorter term deterioration or improvement that indicates a stepped change from the level of service; and
 - Deteriorating: A reduction in performance sustained over a number of years that suggests that a reduction in the reference level of service has occurred.
- 3.1.16 Because the serviceability indicators can be influenced by external factors and sampling variance, a change in one year is not sufficient to determine a change in performance. A change in performance needs to be demonstrable over a number of years before re-categorisation occurs. For example:
- Two successive increases that together show a significant step up from the reference level of service would be considered a marginal trend irrespective of whether the upper control limit had been exceeded; or
 - Three successive increases, representing a significant cumulative change from the reference level, would be considered a deteriorating trend.
- 3.1.17 Persistent performance at or around the upper control limit could also result in a 'deteriorating' assessment irrespective of whether the upper control limit has been exceeded or not. This will ensure that the company operates within a range around the reference level rather than operating close to the upper limit.
- 3.1.18 The requirement for a sustained trend to be demonstrated before performance is categorised as deteriorating or marginal provides the opportunity for corrective action to be taken by the company to consider and address any deterioration in performance.

Overall service area assessment

- 3.1.19 Stable serviceability is expected to be maintained for all of the company's assets and so the serviceability assessment concludes with an evaluation of whether the overall performance in each service area is improving, stable, marginal or deteriorating.
- 3.1.20 The individual performance assessment for each indicator in the basket is used to determine an overall balanced service area assessment. Particular reliance will be placed on the primary indicator in each area in coming to the overall assessment. No formal weighting is employed and a degree of judgment is applied to determine the overall outcome.

4.0 Regulatory Action in Respect of Serviceability

- 4.1.1 This section sets out our requirement for the submission of serviceability data and assessments by NI Water and the action we would take if serviceability is marginal or deteriorating.
- 4.1.2 NI Water shall provide an annual serviceability submission and an assessment of whether serviceability is improving, stable, marginal or deteriorating.
- 4.1.3 Where serviceability is declining but marginal, the company should set out its assessment of the cause of the decline in serviceability and the steps it will take to restore stable serviceability.
- 4.1.4 Where serviceability has been confirmed as deteriorating, the company should set out a detailed action plan to arrest the deterioration and restore stable serviceability. We would monitor delivery of the action plan on a regular basis.
- 4.1.5 If we considered the company's action plan to arrest deteriorating serviceability to be inadequate, or it did not deliver the action plan, or delivery of the action plan did not restore stable serviceability, we would consider taking enforcement action under Article 30 of the Water and Sewerage Services (Northern Ireland) Order 2006.
- 4.1.6 If we considered the company's action plan to arrest deteriorating serviceability to be inadequate, or it did not deliver the action plan, or delivery of the action plan did not restore stable serviceability, we would consider logging down the cost of work necessary to restore serviceability whether we proceed to take enforcement action or not.
- 4.1.7 Many of the serviceability indicators draw on quality compliance data used by the quality regulators (DWI and NIEA) to monitor compliance with statutory standards and consents. The work of these regulators and the action they take to enforce compliance means that a sustained deterioration in performance against a quality compliance measure is unlikely. If we conclude the performance against these indicators has deteriorated, we would first consult the relevant quality regulator before we consider taking enforcement action in respect of serviceability.
- 4.1.8 We recognise that the serviceability assessment is based on a selected basket of indicators chosen to be representative of the main assets and services provided. If there is evidence that there is a decline in other service indicators or sub-groups of assets, we will take the following action:
- We will ask the company to assess the cause of the decline and identify the steps it will take to restore stable serviceability; and
 - Consider whether it is appropriate to add the particular indicator to the basket of serviceability indicators and include it in future serviceability assessments.

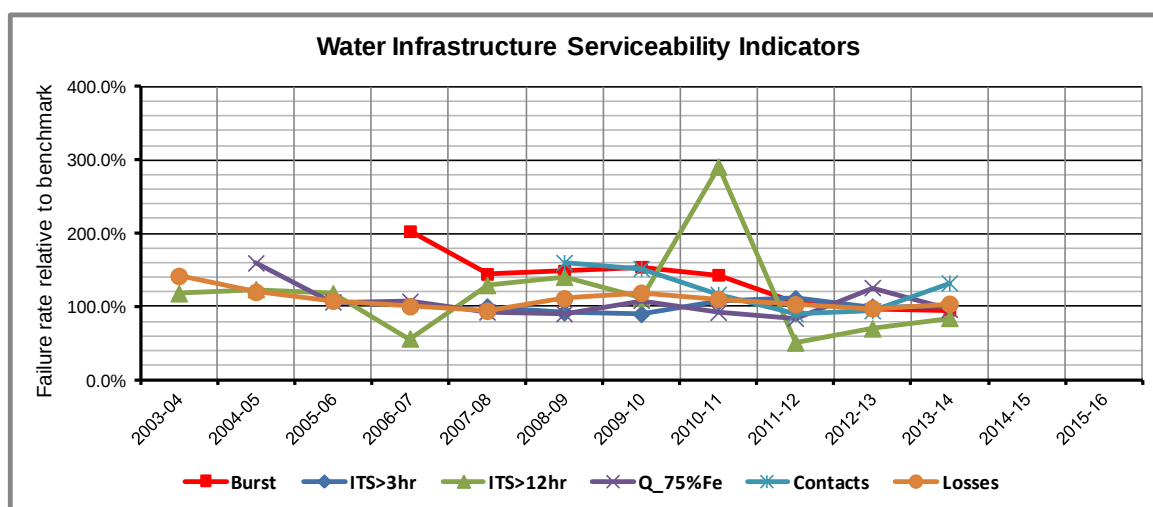
5.0 Sub-service Area Assessments

5.1. Sub-service assessment approach

- 5.1.1 This section summarises our assessment of serviceability by sub-service.
- 5.1.2 Sub-service serviceability is assessed using trends in performance relative to the selected reference level chosen for each indicator. This standardises data for different indicators allowing them to be plotted and compared on a common scale.
- 5.1.3 The assessment is a matter of judgement which follows the general principles outlined in Section 0. We give particular weight to the 'primary' indicator but consider the range of indicators used. We provide a brief explanation of our assessment highlighting any concerns with individual indicators. A more detailed assessment of the individual indicators is given in Section 6.0.

5.2. Water infrastructure sub-service

Figure 5.1 – Water infrastructure service serviceability indicators

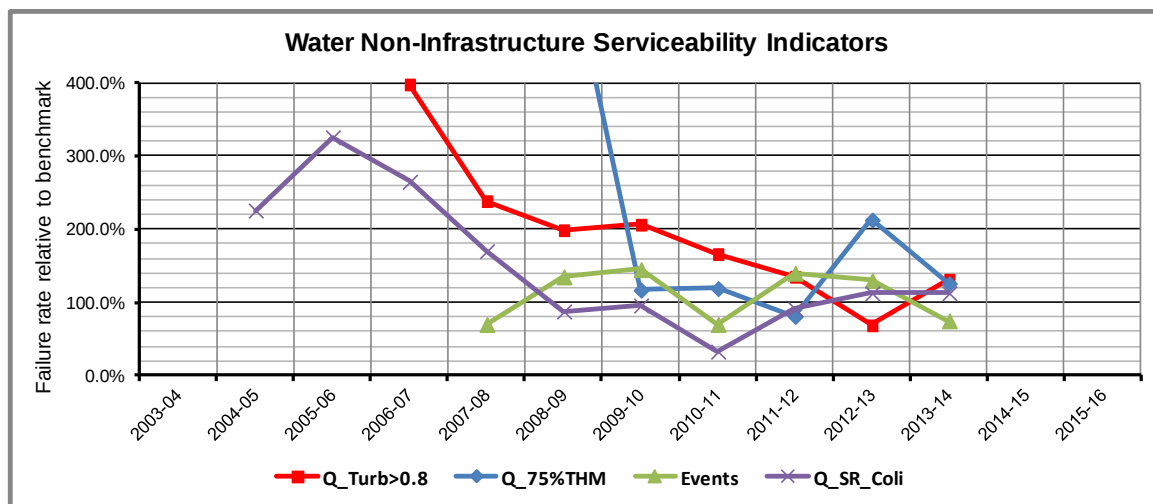


- 5.2.1 Our overall assessment of water infrastructure serviceability is stable.
- 5.2.2 The primary indicator (water mains bursts per 1, 000km) reduced significantly in 2011-12 and is now stable at levels comparable to the best performing systems in England & Wales. This is consistent with the relatively young age profile of water mains operated by NI Water. The spike in interruption to supply greater than 12 hours in 2010-11 is attributable to a major incident where it took some time to restore supplies.
- 5.2.3 We are aware of the significant increase in discoloured water complaints in 2013-14. This is an issue for the company to consider and address. We will

review the impact on serviceability if this continues to a marginal or deteriorating trend in future years.

5.3. Water non-infrastructure sub-service

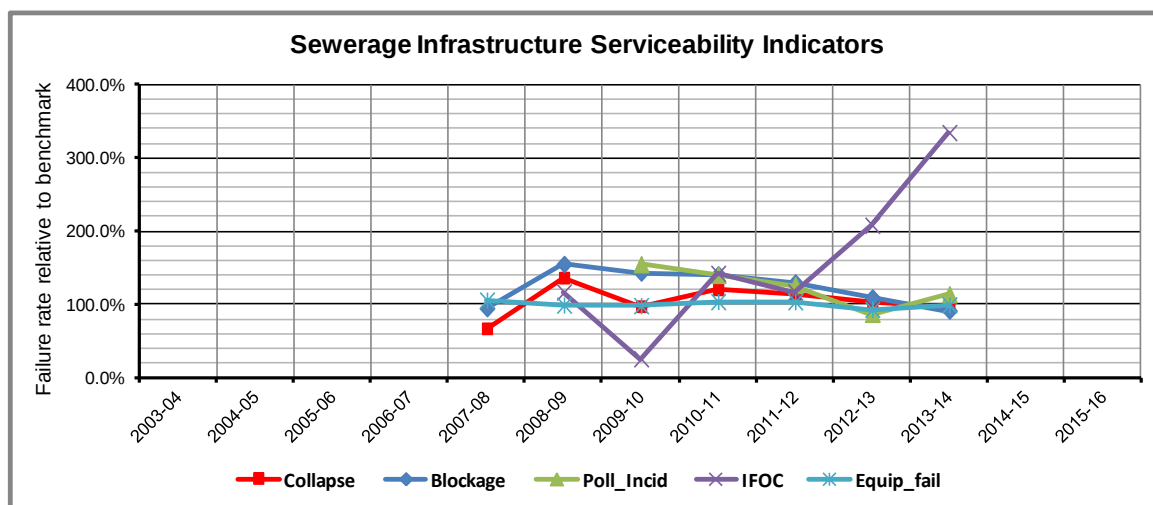
Figure 5.2 – Water non-infrastructure sub-service serviceability indicators



- 5.3.1 Our overall assessment of water non-infrastructure serviceability is stable.
- 5.3.2 Water treatment performance improved significantly over the period 2004-10 due to major investment in water treatment and service reservoir rehabilitation to secure compliance with drinking water quality standards. Serviceability has stabilised at a new improved level.
- 5.3.3 The primary indicator (percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU) has followed the general trend described above, but increased in 2013-14. This increase is an issue for the company to consider and address. We will review the impact on serviceability if this continues to a marginal or deteriorating trend in future years.
- 5.3.4 We are aware of the increase in service reservoir coliform bacteria over three years following a low figure in 2010-11. This occurred at a time when investment in service reservoir rehabilitation reduced because of delays to the procurement of a new framework contract. As part of its PC15 submission, the company has described work to develop the prioritisation of service reservoir rehabilitation which aims to address this trend.
- 5.3.5 We believe that there is a need for indicators for non-infrastructure serviceability based on unplanned maintenance indicator(s) and we have asked the company to draw up a specification for this type of measure. The company did not have specific measures in place and has developed a specification. However, it will be some time before a data trend is available to allow this to be effective.

5.4. Sewerage infrastructure sub-service

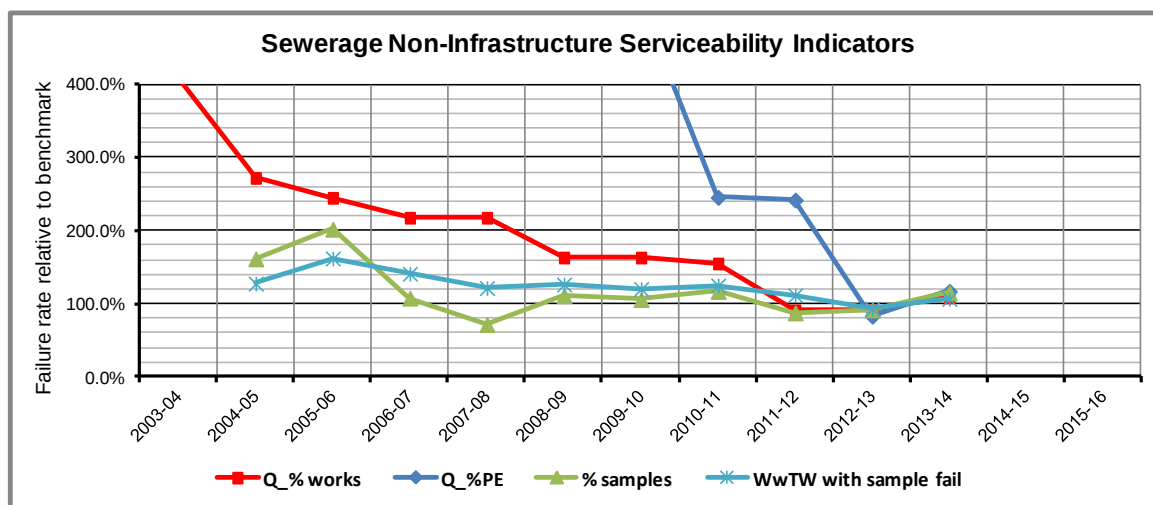
Figure 5.3 – Sewerage infrastructure sub-service serviceability indicators



- 5.4.1 Our overall assessment of sewerage infrastructure serviceability is stable.
- 5.4.2 The number of sewer collapses has remained stable since 2008-09 following improvement in data recording with some indication of a marginal improvement.
- 5.4.3 There has been a sustained improvement in the number of sewer blockage and pollution incidents. However, we believe that this is attributable to proactive management action to prevent repeat blockages and pollution incidents occurring rather than any change in the asset.
- 5.4.4 The level of sewer collapse and sewer blockage in Northern Ireland remains high when compared to England & Wales. It is possible that there is further action that management could take to target blockage hot spots and reduce the level of repeat blockage. Until this has been explored, we do not have confidence in the use of sewer blockage as a robust indicator of serviceability.
- 5.4.5 We note the increase in internal flooding caused by blockage or equipment failure (IFOC) in 2012-13 and 2013-14. We are aware that this indicator is affected by weather conditions and is a weak indicator of the underlying assets. However, flooding can have both major short and long term impacts on the people affected and the increase is an area for the company to consider and address.

5.5. Sewerage non-infrastructure sub-service

Figure 5.4 – Sewerage non-infrastructure sub-service serviceability indicators



- 5.5.1 Our overall assessment of sewerage infrastructure serviceability is stable.
- 5.5.2 The serviceability indicators used for sewerage non-infrastructure are based on the analysis of regulatory samples taken to monitor compliance with numeric consent standards.
- 5.5.3 Two indicators are based on standard of compliance using the percentage of works failing to meet their consent standard and the percentage population equivalent of works failing to meet their consent standard. With significant investment in wastewater treatment to meet new consents over the last decade, there has been significant improvement in these indicators, and further improvement might be expected as this quality investment continues.
- 5.5.4 Two sub-threshold indicators have also been included based on the number of individual samples which fail to meet the numeric consent value. These have remained stable over the last eight years suggesting the serviceability is stable. This assessment may be superficial as the introduction of more onerous standards over this period requires a much higher performance to deliver the same score. As the drive for tighter discharge standards comes to an end, these indicators will provide a better measure of serviceability trends.

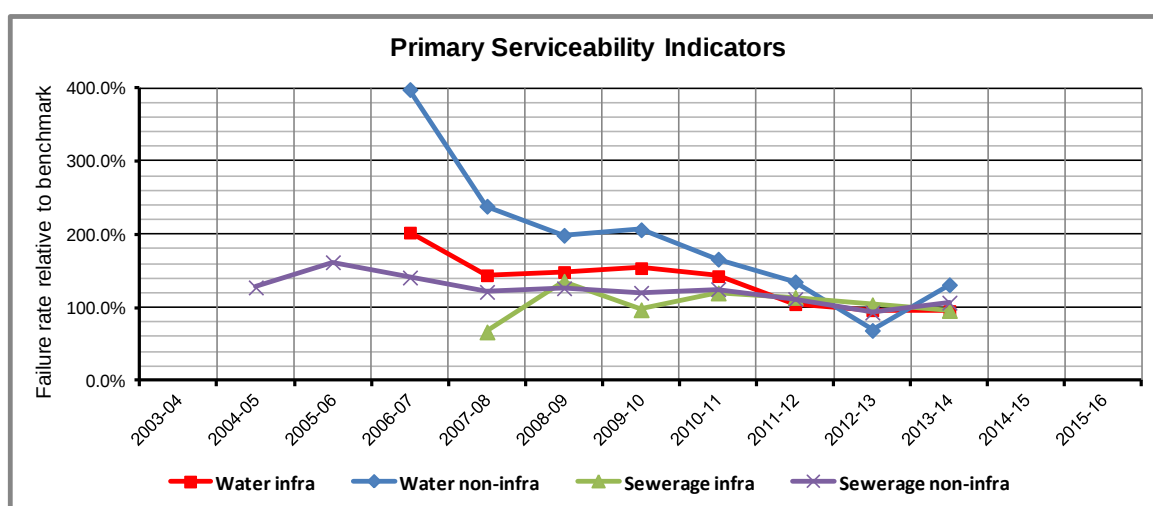
5.6. Overall service assessment using primary indicators

5.6.1 While we use a basket of indicators to assess serviceability, we give particular weight to a primary indicator in each sub-service area. These primary indicators are shown in Table 5.1 and their trend relative to reference levels are shown on Figure 5.5

Table 5.1 – Primary serviceability indicators

Service	
Water Infra	Mains bursts per 1,000km
Water Non-infra	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU
Sewerage Infra	Sewer collapses per 1,000km
Sewerage Non-infra	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value

Figure 5.5 – Primary serviceability indicators



5.6.2 The trends in the primary indicators show that the overall serviceability is stable, confirming the individual assessments for each sub-service area.

6.0 Assessment of Individual Indicators

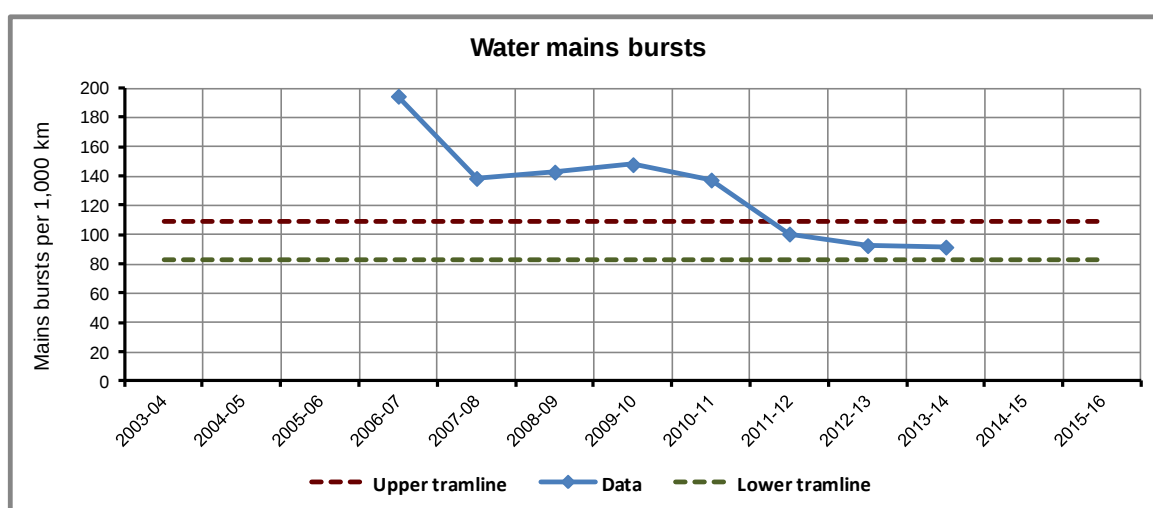
6.1. Assessment of water infrastructure indicators

6.1.1 This section provides more detailed information and assessment of the individual serviceability indicators.

Water mains bursts

6.1.2 Water mains bursts are assessed as the number of bursts per 1,000km of water mains.

Figure 6.1 – Water infra – water mains bursts



Reference level	96.1	Upper control limit	109.5	Lower control limit	82.7
-----------------	------	---------------------	-------	---------------------	------

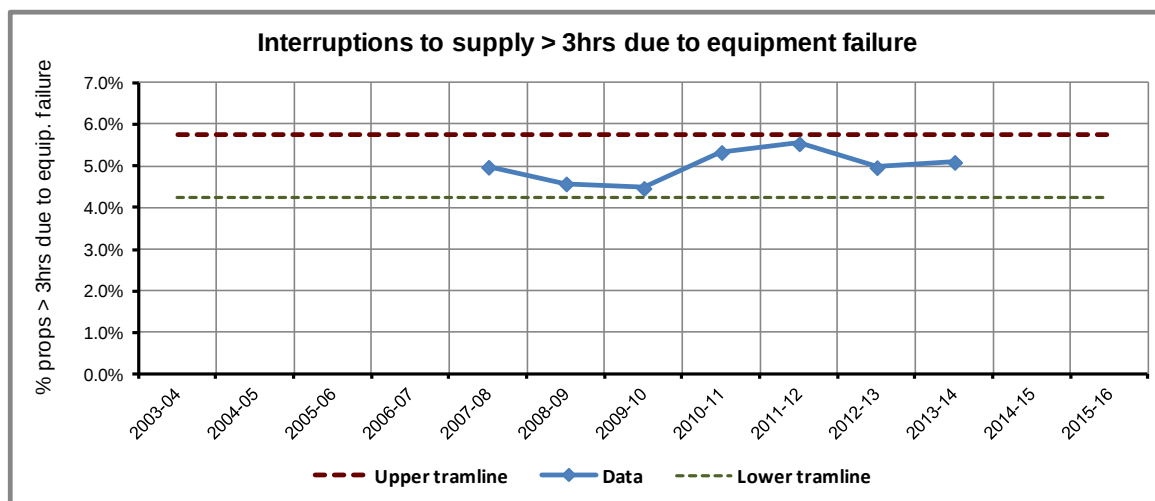
6.1.3 The reference level has been established on the average of performance in 2011-12 and 2013-14 with upper and lower control limits set 3 times the difference from the reference level for the selected years.

6.1.4 The trend is stable following a marked reduction in burst rate in 2011-12. Current levels of performance are comparable to the best performing water service providers in England & Wales, consistent with the relatively young age profile of water mains in Northern Ireland.

Interruption to supply caused by equipment failure

- 6.1.5 Interruptions to supply caused by equipment failure are assessed as the percentage of properties affected by an interruption to supply lasting greater than three hours caused by equipment failure.

Figure 6.2 – Water infra - interruption to supply caused by equipment failure



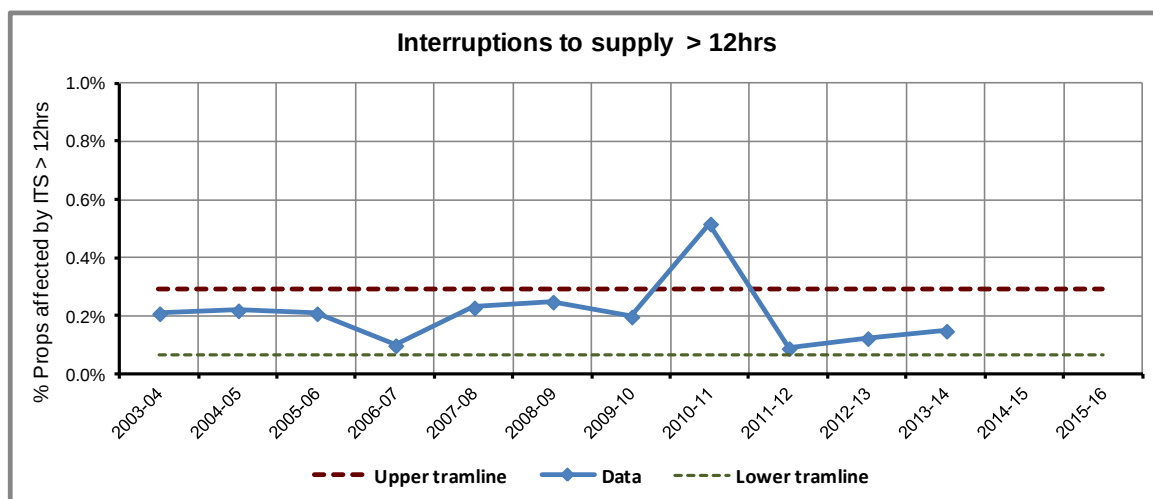
Reference level	5.00%	Upper control limit	5.76%	Lower control limit	4.24%
-----------------	-------	---------------------	-------	---------------------	-------

- 6.1.6 The reference level has been established as the average of the seven years of data available with upper and lower control limits based on 2 times the standard deviation of the data from the reference level.
- 6.1.7 The trend is stable.
- 6.1.8 The data has been adjusted to exclude the extreme level of interruption to supply which occurred in the 2010-11 freeze thaw demand exceeded the NI Water's ability to produce and distributes water.
- 6.1.9 Given that water mains burst is a key cause of interruptions to supply, we note that the stable trend does not reflect the stepped reduction in water mains bursts which occurred in 2011-12. The ability to analyse and understand this type of relationship would allow the company to identify and prioritise interventions which could be taken to reduce equipment failure with a view to reducing interruptions to supply.

Interruptions to supply greater than twelve hours

6.1.10 Interruptions to supply greater than twelve hours are assessed using the DG3 measure for unplanned and un-warned interruptions to supply reported as the percentage of properties affected by an interruption to supply greater than twelve hours.

Figure 6.3 – Water infra - Interruptions to supply greater than 12 hours



Reference level	0.18%	Upper control limit	0.29%	Lower control limit	0.06%
-----------------	-------	---------------------	-------	---------------------	-------

6.1.11 The reference level has been established as the average of the data (excluding the peak in 2010-11) with upper and lower control limits based on 2 times the standard deviation of the data from the reference level.

6.1.12 The trend is stable.

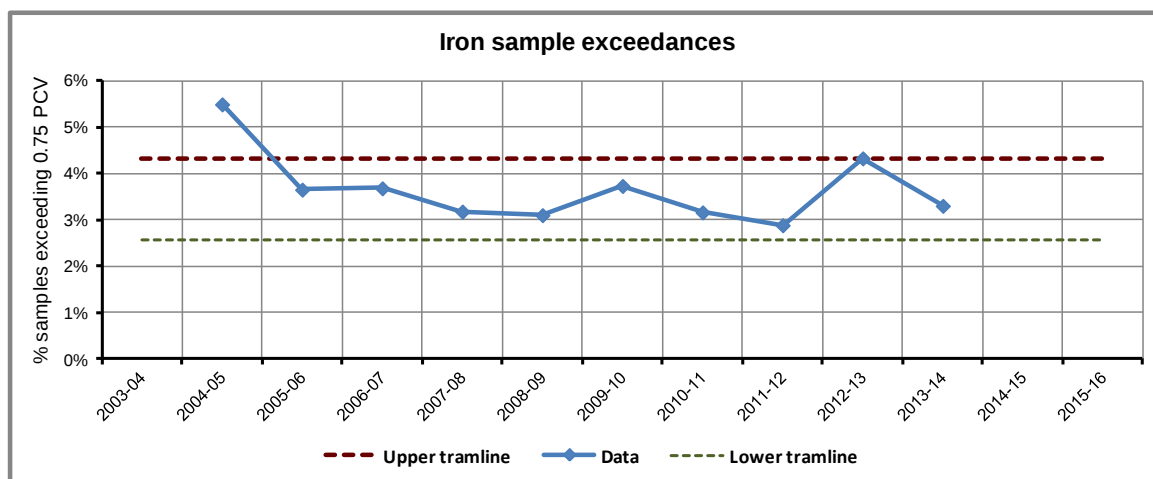
6.1.13 The data has been adjusted to exclude the extreme level of interruption to supply which occurred in the 2010-11 freeze thaw where demand exceeded NI Water's ability to produce and distribute water.

6.1.14 The spike in interruptions to supply greater than twelve hours in 2010-11 is attributable to a major incident in Kilkeel where it took some time to restore supplies and remove airlocks. This highlights a key weakness in this indicator. It normally runs at a low level with the company making every effort to prevent interruptions to supply running for long durations. It is therefore susceptible to single events (such as a main which is difficult to access and repair) which can make the results unstable. We will therefore give a low weight to this indicator when judging overall serviceability. However, because of its high impact, we will retain it as an indicator and monitor performance against it. We expect the company to undertake root cause analysis of these events to learn lessons and minimise the risk of reoccurrence.

Water quality – iron

6.1.15 Water quality iron is assessed as the percentage of regulatory water quality samples taken at consumers' taps where the iron concentration exceeds 75% of the PCV. It offers an indication of how water quality is impacted in distribution by corrosion products from water mains.

Figure 6.4 – Water infra – water quality - iron



Reference level	3.45%	Upper control limit	4.32%	Lower control limit	2.58%
-----------------	-------	---------------------	-------	---------------------	-------

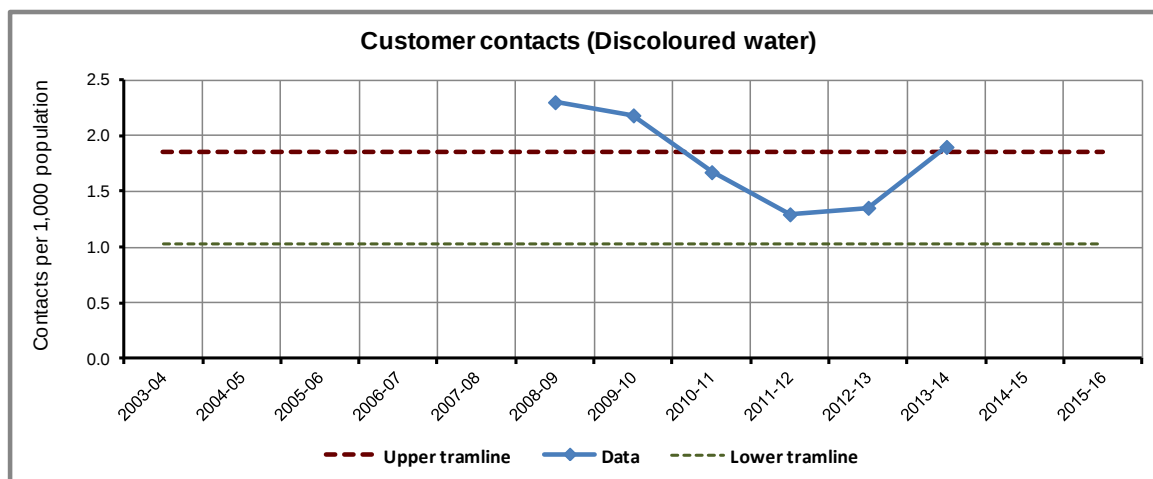
6.1.16 The reference level has been established as the average performance from 2005-06. The control limits are 2 standard deviations from the reference level with the standard deviation determined assuming a binomial distribution of failures to reflect the random sampling regime used to assess statutory water quality compliance.

6.1.17 The trend is stable. As yet, there is no strong indication that the work on mains rehabilitation has done more than keep pace with the deterioration of the system.

Consumer contact regarding discoloured water

6.1.18 Consumer contact regarding discoloured water is assessed as the number of contacts per 1,000 population. The indicator provides a measure of the aesthetic quality of water delivered as perceived by consumers.

Figure 6.5 – Water infra - consumer contact regarding discoloured water



Reference level	1.44	Upper control limit	1.85	Lower control limit	1.03
-----------------	------	---------------------	------	---------------------	------

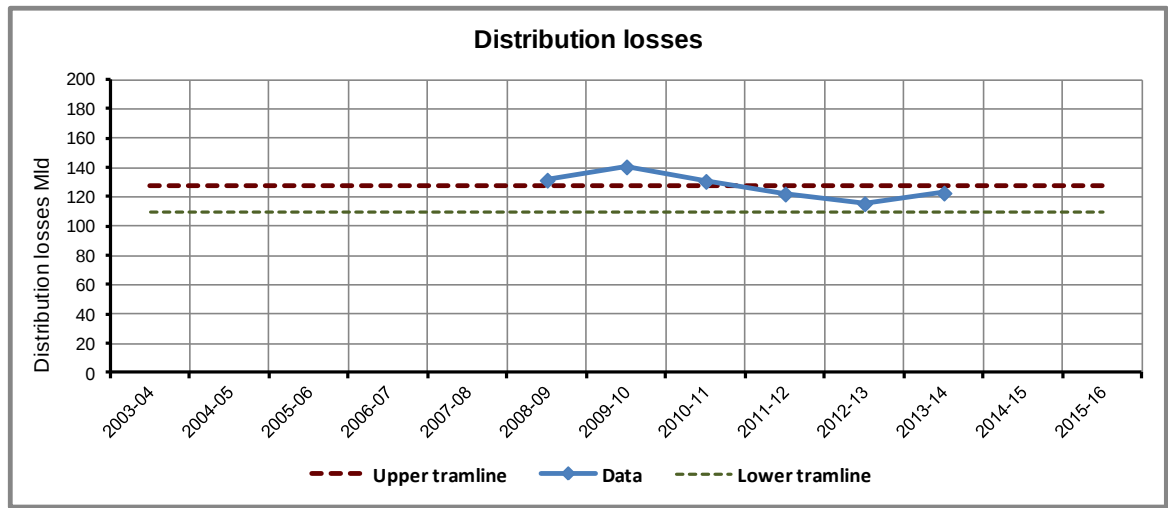
6.1.19 The reference level has been established as the average of three years data from 2010-11 with the upper and lower control limits based on 2 times the standard deviation of the data from the reference level.

6.1.20 The trend shows performance reducing over the last two years becoming marginal. There has been an increase in complaints of 50% from 2011-12. It is this type of increase that we would expect the company to investigate and explain the steps it will take to reverse the trend. This is an issue for the company to consider and address as it improves its understanding between asset performance and consumer service.

Distribution losses

6.1.21 Distribution losses are assessed as the loss of water from the distribution system in mega litres per day (Mld) excluding estimated losses from consumer supply pipes.

Figure 6.6 – Water infra – distribution losses



Reference level	119	Upper control limit	128	Lower control limit	110
-----------------	-----	---------------------	-----	---------------------	-----

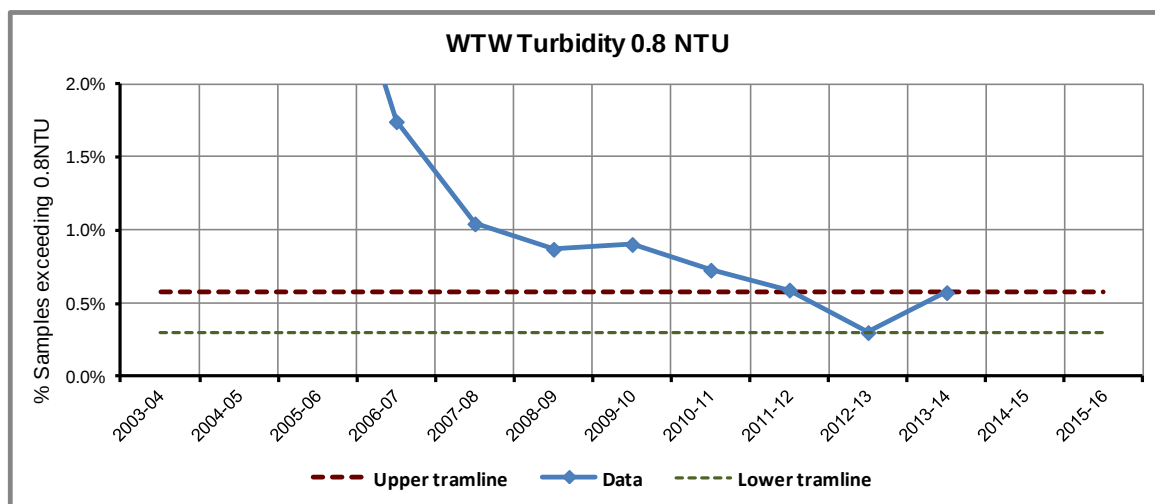
- 6.1.22 The reference level has been established on the average of performance in 2011-12 and 2012-13 with upper and lower control limits set at 3 times the difference from the reference level for the selected years. The trend is stable.
- 6.1.23 The methodology used to calculate distribution losses was revised and improved from 2007-08 and data prior to this has not been plotted. A further change in methodology introduced in 2013-14 resulted in an increase of 2 Mld in reported leakage. Continuing investment to reduce leakage should result in a gradual reduction in distribution losses through PC15, allowing the company to work within the reference levels and control limits set out above.

6.2. Assessment of water non-infrastructure indicators

Water treatment turbidity

- 6.2.1 Water quality turbidity is assessed as the percentage of regulatory water quality samples taken at treatment works where the turbidity exceeds 0.8 NTU which is 80% of the PCV for water entering into supply.

Figure 6.7 – Water non-infra - water treatment turbidity



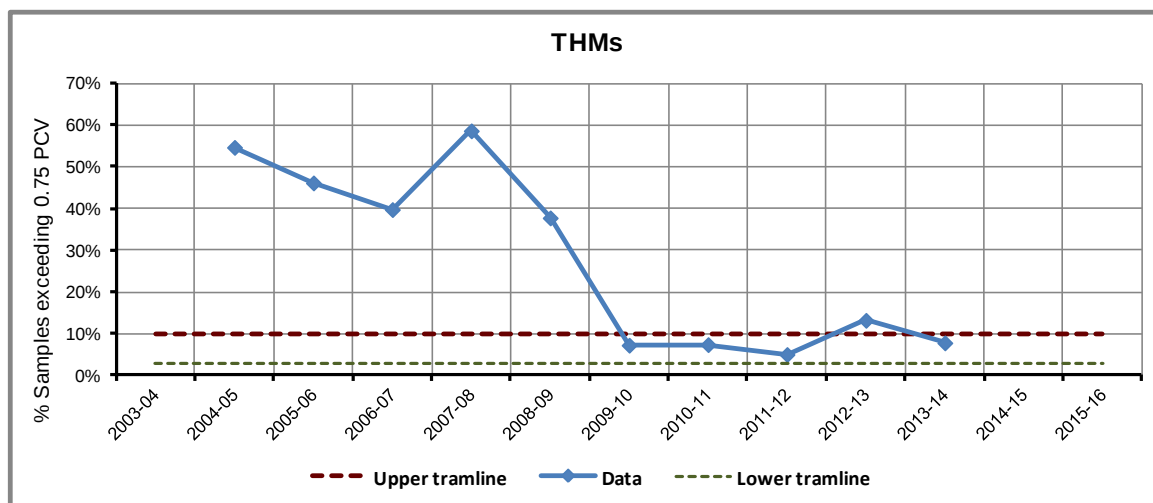
Reference level	0.44%	Upper control limit	0.57%	Lower control limit	0.30%
-----------------	-------	---------------------	-------	---------------------	-------

- 6.2.2 The trend in this indicator reflects the major investment in water treatment quality improvements up to 2010-11, in particular the major investment delivered through the PPP concession. A stepped improvement occurred prior to 2008-09 and further improvements continued to 2012-13.
- 6.2.3 There is marked increase in the indicator in 2013-14. This is reflected in an increase in samples exceeding 1.0 NTU which is the PCV for turbidity. The company should consider the steps it can take to prevent this indicator moving to marginal or deteriorating.
- 6.2.4 The reference level has been established on the average of performance in 2012-13 and 2013-14. Because there was a substantial increase in failure rate in 2013-14 following a sustained period of improvement supported by investment, the upper and lower control limits are set at 1 times the difference from the reference level for the selected years. The trend is stable.

Water quality – trihalomethane (THM)

6.2.5 Water quality trihalomethane (THM) is assessed as the percentage of regulatory water quality samples taken at consumers' taps where the concentration of THMs exceeds 75% of the PCV.

Figure 6.8 – Water non-infra - water quality – trihalomethane (THM)



Reference level	6.22%	Upper control limit	9.78%	Lower control limit	2.66%
-----------------	-------	---------------------	-------	---------------------	-------

6.2.6 The trend in this indicator reflects the major investment in water treatment quality improvements up to 2010-11, in particular the major investment delivered through the PPP concession.

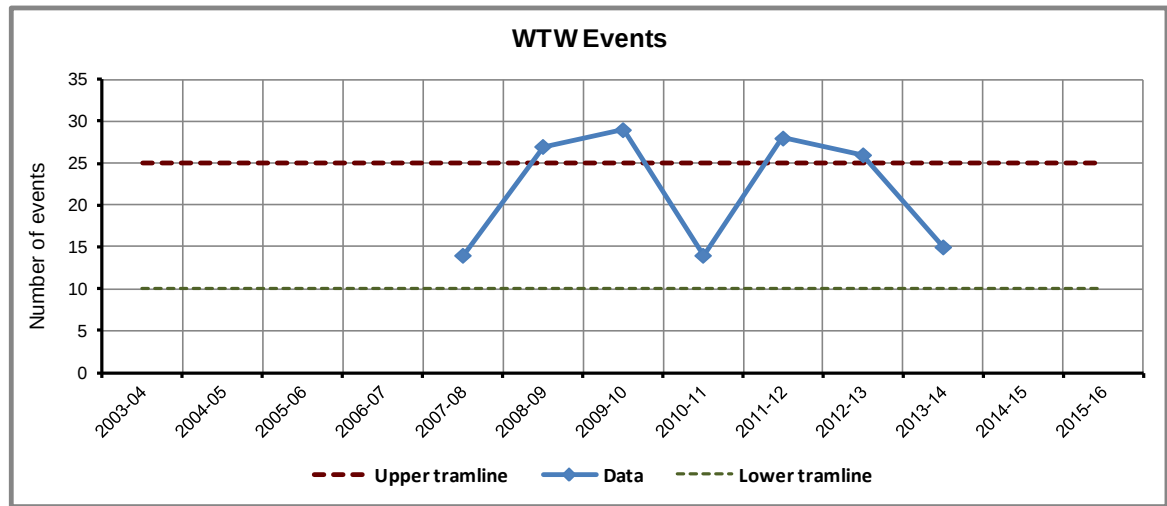
6.2.7 The reference level has been established on the average of performance in 2010-11 and 2011-12 with upper and lower control limits set at 3 times the difference from the reference level for the selected years. The trend is stable.

6.2.8 We note the peak in 2012-13 which exceeded the upper control limit. This is reflected in an increase in samples exceeding the PCV for THMs. It is this type of increase that we would expect the company to investigate and explain the steps it will take to reverse the trend.

Water treatment works events

6.2.9 Water treatment works events are assessed as the number of events at WTW resulting from treatment difficulties or ineffective treatment which are categorised as ‘significant’ or higher, as defined by the DWI in its annual Drinking Water Quality Report.

Figure 6.9 - Water non-infra - water treatment works events



Reference level	20	Upper control limit	25	Lower control limit	10
-----------------	----	---------------------	----	---------------------	----

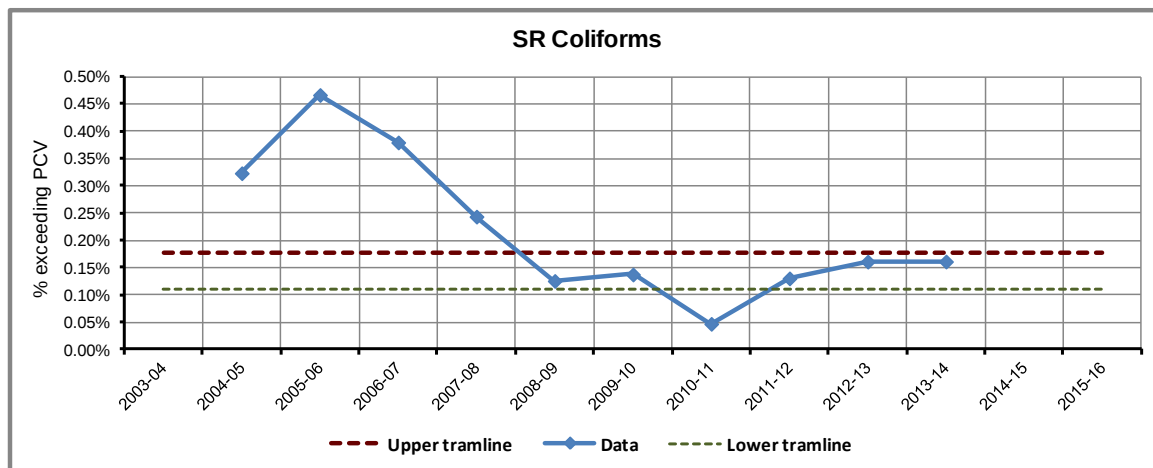
6.2.10 While the trend in the data is stable, the number of events reported move from an upper range to a lower range. Any analysis of two consecutive years of data or any statistical analysis of the data would provide unacceptably wide control limits. As a result we have made a subjective assessment of the reference level and control limits. The reference level has been set at 20, just below the average of 22. The upper limit has been set at 25, just below the historical peaks. The trend is stable but erratic.

6.2.11 We only plan to use this as a weak indicator of serviceability to inform our overall assessment. Events are reported to DWI which has the necessary enforcement powers to address any specific or general issues arising. Therefore we would not consider ‘events’ when deciding whether to take action in respect of capital maintenance investment and serviceability.

Service reservoir quality - coliform

6.2.12 Service reservoir quality - coliform is assessed as the percentage of regulatory samples taken for coliform bacteria at Service Reservoirs which exceed PCV.

Figure 6.10 – Water non-infra - service reservoir quality - coliform



Reference level	0.14%	Upper control limit	0.18%	Lower control limit	0.11%
-----------------	-------	---------------------	-------	---------------------	-------

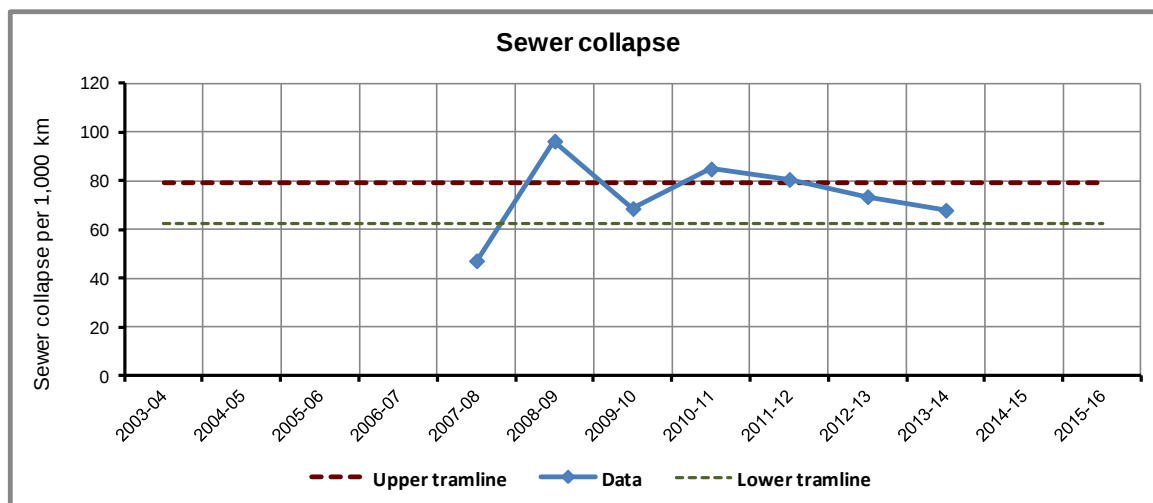
- 6.2.13 The percentage of samples taken at service reservoirs with coliform failures reduced to a low level in 2010-11 but has increased over the last three years. This increase occurred at a time when investment in service reservoir rehabilitation reduced because of delays to the procurement of a new framework contract. As part of its PC15 submission, the company has described work to develop its prioritisation of service reservoir rehabilitation which aims to address this trend.
- 6.2.14 The reference level has been established as the average performance from 2008-09, excluding 2010-11. The control limits are 2 standard deviations from the reference level for the same data. The current trend is marginal.
- 6.2.15 NI Water has attributed a large proportion of coliform failures at service reservoirs to unrepresentative samples. It has included investment in PC15 to improve and secure sample taps to address this. As a result, there may be a further stepped change in performance. We will consider this and review the reference levels and control limits as this investment is delivered and new trends established.

6.3. Assessment of sewerage infrastructure indicators

Sewer collapse

6.3.1 Sewer collapse is assessed as the number of sewer collapses per 1,000km of main sewer.

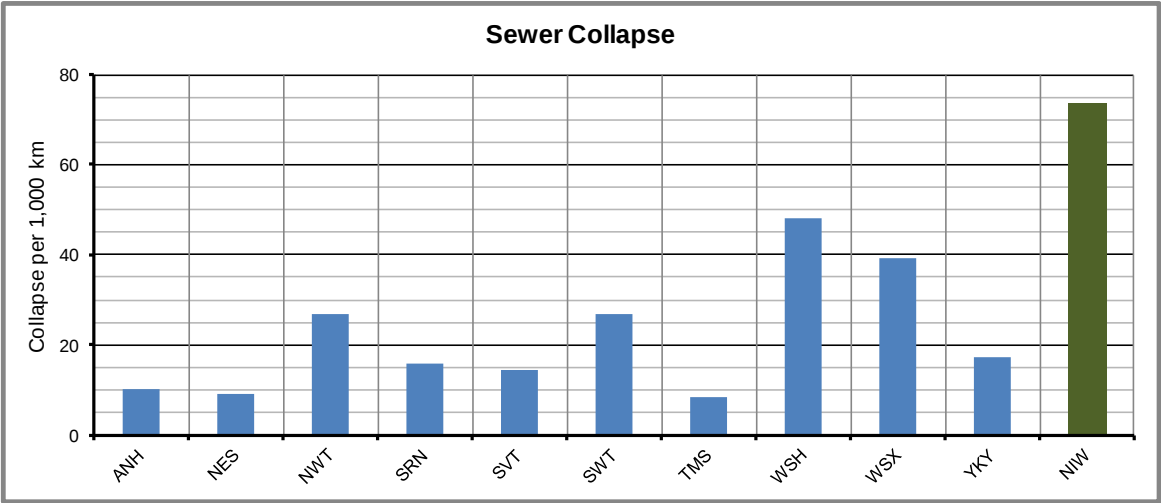
Figure 6.11 – Sewerage infra – sewer collapse



Reference level	71	Upper control limit	79	Lower control limit	62
-----------------	----	---------------------	----	---------------------	----

- 6.3.2 The reference level has been established on the average of performance in 2012-13 and 2013-14 with upper and lower control limits set at 3 times the difference from the reference level for the selected years. The trend is stable although there has been a consistent reduction for three years.
- 6.3.3 The number of sewer collapses reported by NI Water per 1,000km main sewer is significantly greater than that reported by sewerage companies in England & Wales (see Figure 6.12). This comparison includes collapse on private drains and laterals recently adopted by water companies in England & Wales. The data is standardised for the length of main sewer excluding laterals.
- 6.3.4 The level of sewerage collapse in Northern Ireland is high compared to England & Wales. It is possible that there is further action management can take to reduce the collapse rate and the reduction seen in the last three years will continue. We will consider longer term trends when we review the reference level and control limits at the mid-term review.

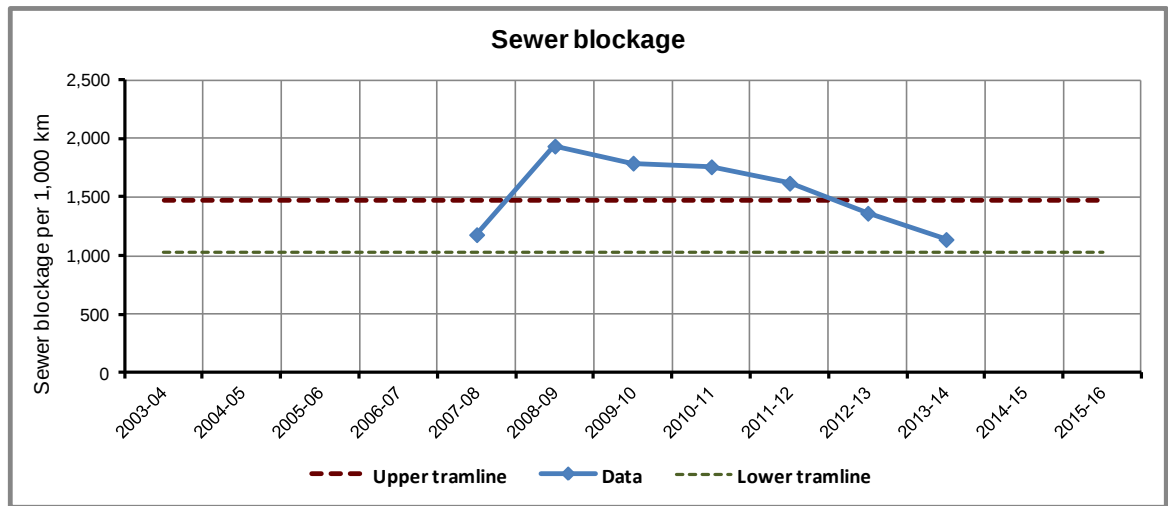
Figure 6.12 – Sewer collapse rates



Sewer blockage

6.3.5 Sewer blockage is assessed as the number of sewer blockages per 1,000km of main sewer.

Figure 6.13 – Sewerage infra – sewer blockage

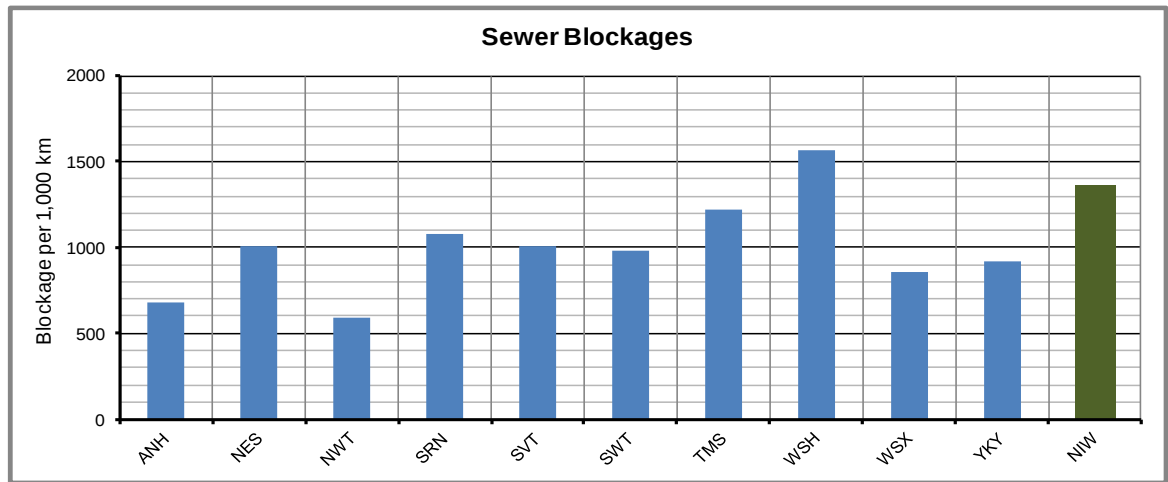


Reference level	1,252	Upper control limit	1,475	Lower control limit	1,028
-----------------	-------	---------------------	-------	---------------------	-------

6.3.6 The reference level has been established on the average of performance in 2012-13 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years. The trend is improving with a reduction in blockages in the last five years.

6.3.7 The number of sewer blockages reported by NI Water per 1,000km main sewer is significantly greater than the average reported by sewerage companies in England & Wales (see Figure 6.14). This comparison includes collapse on private drains and laterals recently adopted by water companies in England & Wales. The data is standardised for the length of main sewer excluding laterals.

Figure 6.14 – Sewer blockage rates

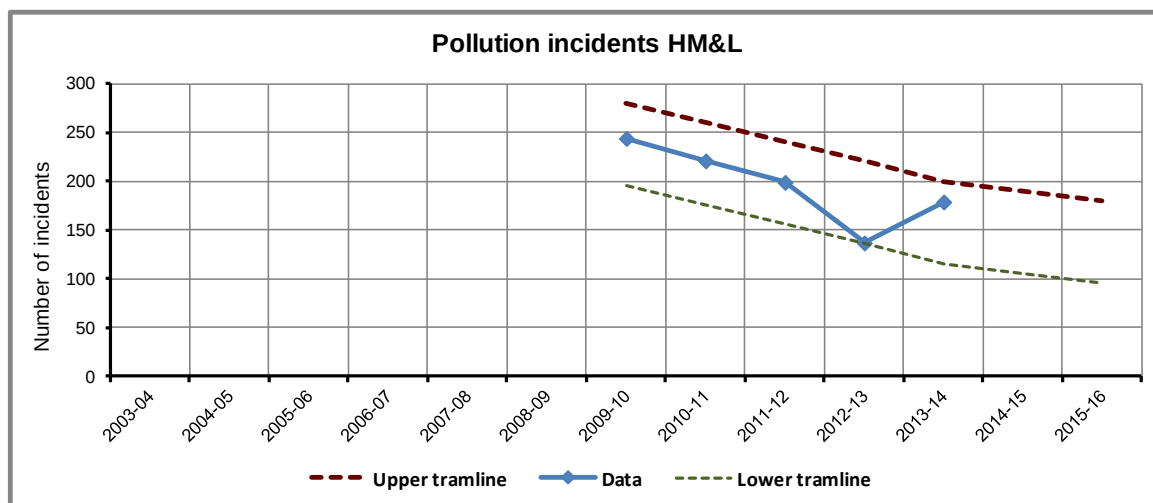


- 6.3.8 The level of sewerage blockage in Northern Ireland is high compared to the average in England & Wales. It is possible that there is further action management can take to reduce the blockage rate by targeting areas with high blockage rates and prevent repeat blockages occurring. Until this is explored, we do not have confidence in sewer blockage as a robust measure of serviceability.
- 6.3.9 The reported figures for sewer collapse and sewer blockage include those on the main sewerage system and those on laterals and drains connecting properties to the main sewerage system. To date, NI Water has not been able to report data for the main sewers and laterals separately. Since these are distinct asset types, and different interventions may be appropriate, we will consider monitoring the serviceability for the mains sewers and laterals/drains separately once NI Water can report a robust trend of data.

Pollution incidents

6.3.10 Pollution incidents are assessed as the number of High, Medium and Low pollution incidents caused by the sewer network (CSOs, rising mains and foul sewers)

Figure 6.15 – Sewerage infra –pollution incidents



Reference level	158	Upper control limit	200	Lower control limit	116
-----------------	-----	---------------------	-----	---------------------	-----

6.3.11 The reference level has been established on the average of performance in 2012-13 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years.

6.3.12 The trend is improving.

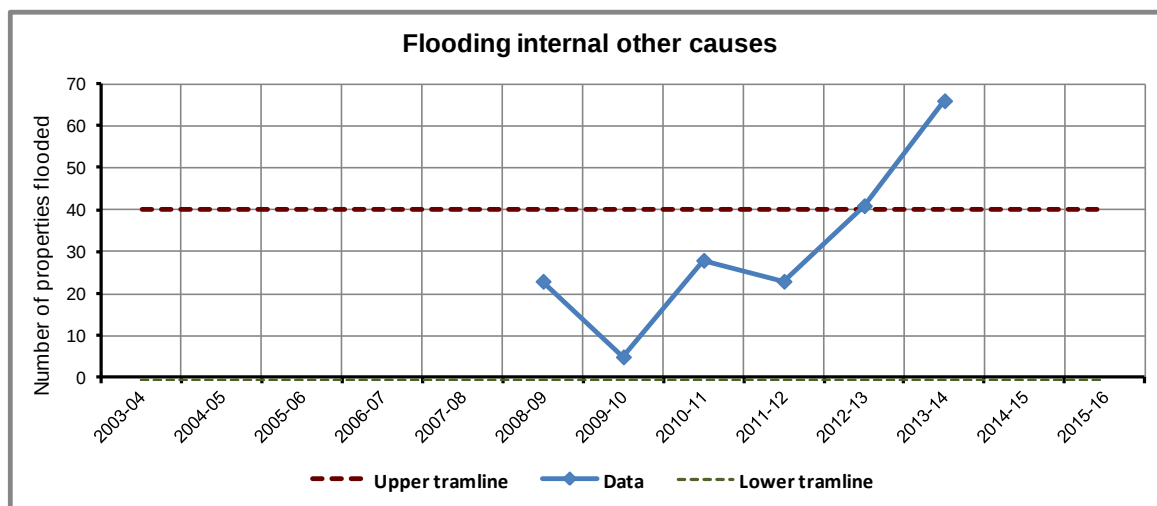
6.3.13 The trend shows sustained improvement with significant variations in individual years which the company attributes to advantageous weather conditions. The general improving trend has been attributed to management action in ensuring earlier responses to pollution incidents and learning lessons from past incidents which are then incorporated into operational procedures.

6.3.14 The level of incidents remains high compared with sewerage companies in England & Wales. Therefore we have assumed that the trend in improvements will continue and we have assumed that the reference level and control limits should reduce by 10 per annum from 2013-14. We will review performance and control limits at the mid-term review.

Properties flooded (other causes)

6.3.15 This indicator is assessed as the number of properties flooded in the year due to causes other than hydraulic incapacity (typically sewer collapse, sewer blockage or pumping station failure).

Figure 6.16 – Sewerage infra –properties flooded (other causes)



Reference level	20	Upper control limit	40	Lower control limit	0
-----------------	----	---------------------	----	---------------------	---

6.3.16 Any property flooding remains unacceptable. However, some flooding of properties due to other causes such as blockage or equipment failure remains an inevitable consequence of managing a sewerage system. We have excluded data prior to 2008-09 because of concerns over data quality.

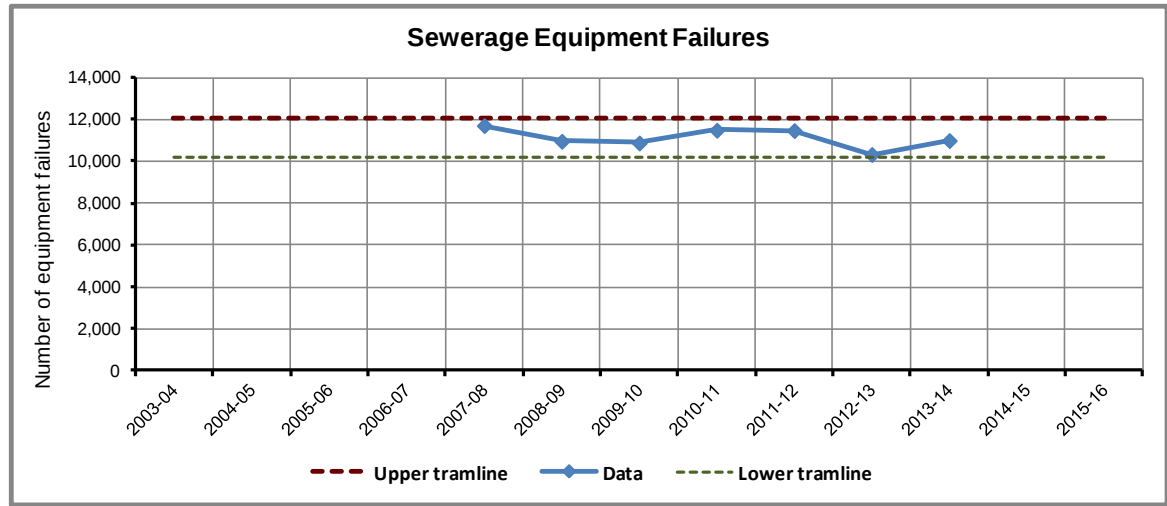
6.3.17 The level of incidents is lower in Northern Ireland than England & Wales. Because the level of incidents is relatively low and because weather is a key cause of the number of incidents occurring, it is doubtful that a meaningful serviceability trend can be established.

6.3.18 The reference level has been established as the average performance for the four years 2008-09 to 2011-12. The control limits are 2 standard deviations from the reference level. However, we remain concerned by the impact which weather can have on this indicator and we propose to monitor performance rather than incorporate this indicator in the serviceability assessment. We would expect the company to comment on its understanding of the increase in 2013-14 in its Annual Information Return.

Equipment failures

6.3.19 Equipment failure for sewerage infrastructure is assessed as the number of equipment failures on the sewerage system including those occurring on pumping stations and intermittent discharges.

Figure 6.17 – Sewerage infra – equipment failures



Reference level	11,123	Upper control limit	12,066	Lower control limit	10,180
-----------------	--------	---------------------	--------	---------------------	--------

6.3.20 The reference level has been established as the average performance for the seven years of available data. The control limits are 2 standard deviations from the reference level. The trend is stable.

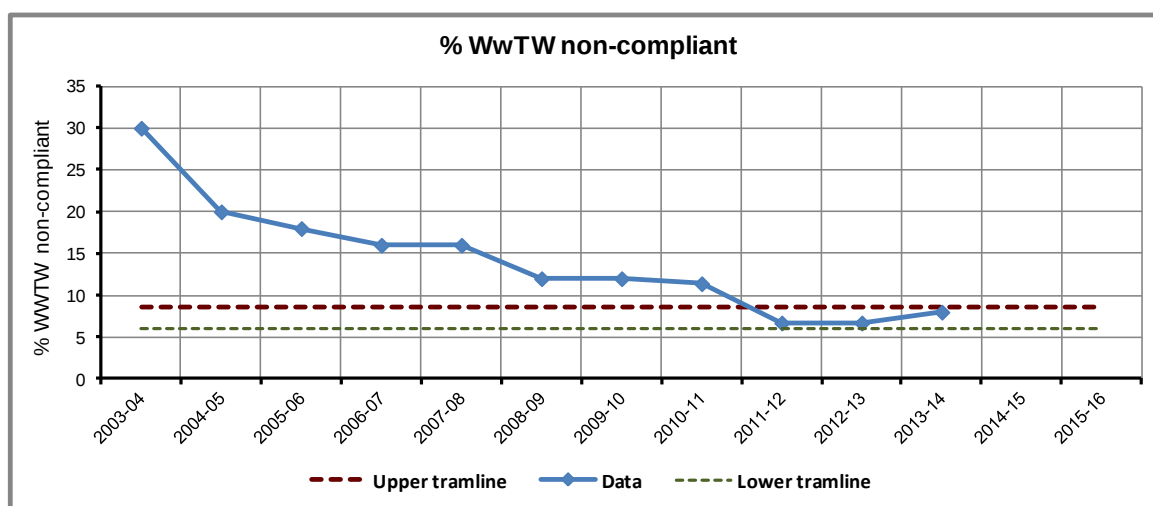
6.4. Assessment of sewerage non-infrastructure indicators

- 6.4.1 All the serviceability indicators for sewerage non-infrastructure are based on the reported compliance at wastewater treatment works. We have asked the company to draw up a specification for unplanned maintenance indicator(s) which would show trends in serviceability. The company has not monitored this type of indicator to assess trends in asset performance and serviceability. The company has developed a specification but it will be some time before trends can be established. In the absence of this type of information, we will continue to rely on wastewater treatment works compliance data to assess serviceability.

WwTW compliance – percentage of works

- 6.4.2 WwTW compliance, percentage of works, is assessed as the percentage of WwTW discharges not compliant with their numeric consent.

Figure 6.18 – Sewerage non-infra - WwTW compliance – percentage of works



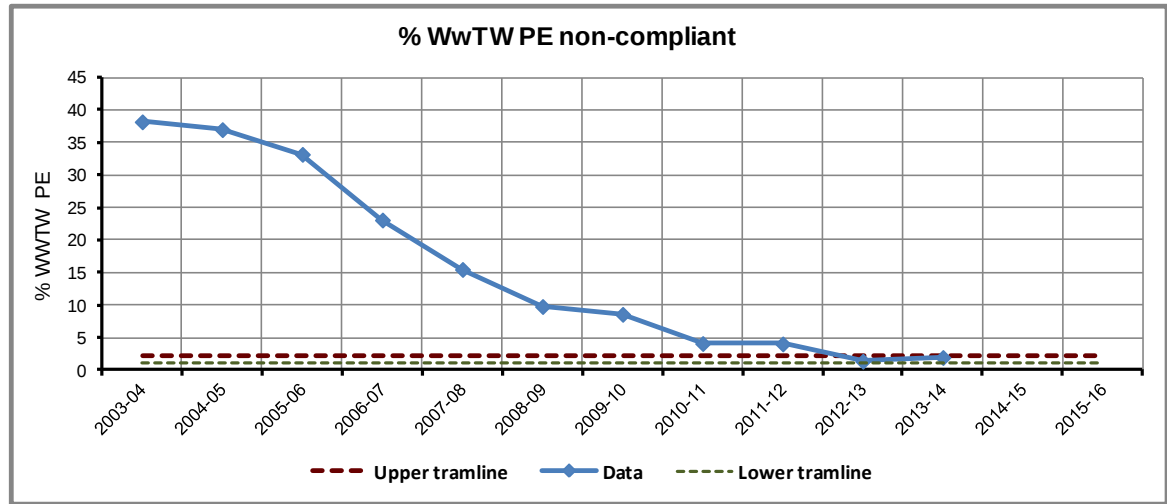
Reference level	7.4	Upper control limit	8.7	Lower control limit	6.1
-----------------	-----	---------------------	-----	---------------------	-----

- 6.4.3 The reference level has been established on the average of performance in 2011-12 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years. The range reflects the understanding that 2013-14 was a poor year due to adverse weather and that continuous investment in quality improvement will drive further improvement in quality compliance. We set targets for compliance which will reflect investment to improve compliance.

WwTW compliance – population equivalent

6.4.4 WwTW compliance, population equivalent, is assessed as the percentage population equivalent for WwTW discharges not compliant with their numeric consent.

Figure 6.19 – Sewerage non-infra - WwTW compliance – population equivalent



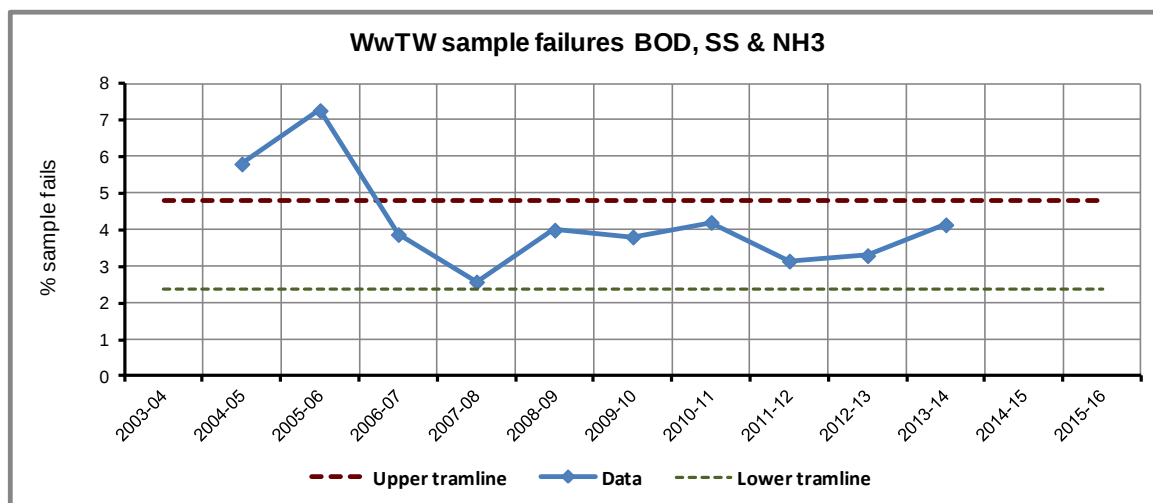
Reference level	1.68	Upper control limit	2.25	Lower control limit	1.11
-----------------	------	---------------------	------	---------------------	------

6.4.5 The reference level has been established on the average of performance in 2012-13 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years. The range reflects the understanding that 2013-14 was a poor year due to adverse weather and that continuous investment in quality improvement will drive further improvement in quality compliance. We set targets for compliance which will reflect investment to improve compliance.

WwTW compliance – samples

6.4.6 WwTW compliance samples is assessed as the percentage of regulatory samples at WwTW for BOD, suspended solids or ammonia which exceeded their numeric consent value

Figure 6.20 – Sewerage non-infra - WwTW compliance – samples



Reference level	3.60	Upper control limit	4.81	Lower control limit	2.38
-----------------	------	---------------------	------	---------------------	------

6.4.7 WwTWs with numeric consents are allowed a small number of sample failures before the works is deemed to have failed its consent. We have adopted the number of samples which exceed the numeric consent value as a sub-threshold indication of asset serviceability.

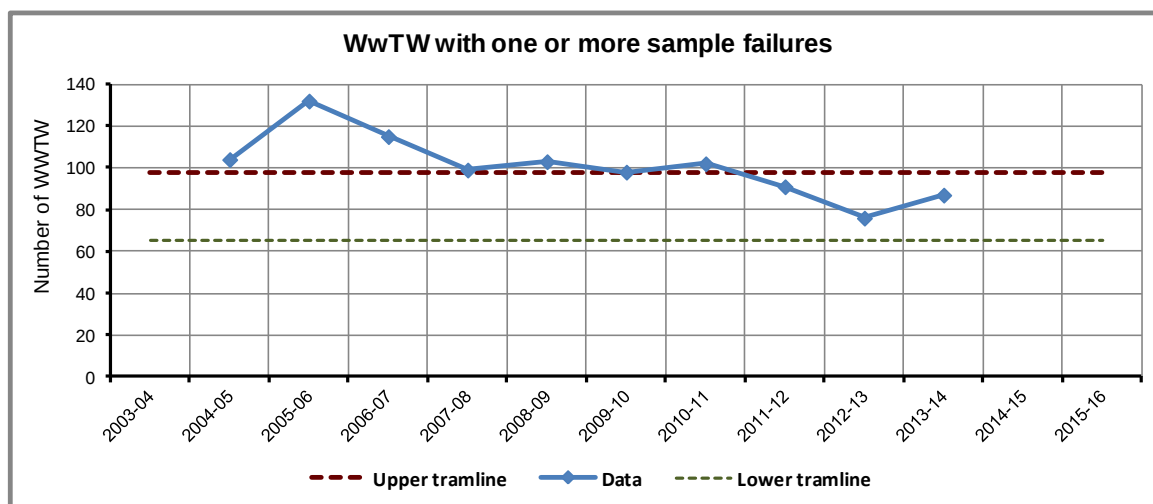
6.4.8 However, we recognise that performance against this indicator has been affected by a progressive tightening of consents over the last decade. To some extent, the benefit of investment in treatment works to improve performance is countered by the increased risk that more works will have small numbers of sample failures against the more onerous consents. As a result, the use of historic data trends could be deceptive until a relatively stable level of consent is reached.

6.4.9 The reference levels and control limits set out above make use of the long term trends in the data. As this could be deceptive, we will use this indicator with caution until a performance trend is established on a relatively stable set of consents.

WwTW compliance – works with one or more sample failure

6.4.10 WwTWs with one or more sample failure are assessed as the number of works where one or more regulatory sample for BOD, suspended solids or ammonia exceeds the numeric consent value.

Figure 6.21 – Sewerage non-infra - WwTW compliance – works with one or more sample failures



Reference level	82	Upper control limit	98	Lower control limit	65
-----------------	----	---------------------	----	---------------------	----

6.4.11 The reference level has been established on the average of performance in the last two years, 2012-13 and 2013-14 with upper and lower control limits set at 3 times the difference from the reference level for the selected years.

6.4.12 This indicator is affected by the issue of judging performance against progressively tightening consent standards referred to above. The use of recent data to establish control limits provides confidence that that they reflect current consents which are more onerous than those applied in the past.

6.5. Summary of reference levels and control limits

Table 6.1 – Serviceability reference levels and control limits

Service	Indicator	Ref. level	Upper limit	Lower limit
Water Infra	Mains bursts per 1,000km	96.1	109.5	82.7
	Interruptions to supply greater than 3 hours resulting from equipment failure	5.00%	5.76%	4.24%
	DG3 Percentage properties affected by interruptions greater than 12 hrs (unplanned & unwarned)	0.18%	0.29%	0.06%
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV	3.45%	4.32%	2.58%
	Customer contacts per 1,000 population (Discoloured water)	1.44	1.85	1.03
	Distribution losses	119	128	110
Water Non-infra	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU	0.44%	0.57%	0.30%
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV	6.22%	9.78%	2.66%
	Events at WTW resulting from treatment difficulties or ineffective treatment categorised as 'significant' or higher	20	25	10
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV	0.14%	0.18%	0.11%
Sewerage Infra	Sewer collapses per 1,000km	71	79	62
	Sewer blockages per 1,000km	1,252	1,475	1,028
	Number of H, M and L pollution incidents from sewer network (CSOs, rising mains and foul sewers)	158	200	116
	Properties flooded in the year (other causes)	20	40	0
	Total number of equipment failures repaired	11,123	12,066	10,180
Sewerage Non-infra	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value	81.5	98	65
	Percentage of WwTW discharges not compliant with numeric consents	7.4	8.7	6.1
	Percentage of total p.e. served by WwTWs not compliant with numeric consents	1.68	2.25	1.11
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value	3.60	4.81	2.38