

# Chapter 11a

## Non financial measures

### Water service serviceability indicators

Covering:  
Water treatment works – turbidity

# Non financial measures

## Chapter 11a

### Water service serviceability indicators

This table has one block, block A and 4 lines.

This information is required to enable NIAUR to identify trends, which may indicate declining asset condition at treatment works. This adds to the basket of indicators that will together inform an assessment of serviceability to customers.

#### Guidance

##### Water treatment works turbidity

One table has been provided, for NI Water data only. The total and PPP data tables have been removed. Equivalent data for PPP works is to be reported in Table 42

Block A in this table covers:

Water treatment works – turbidity

Reporting is for the calendar year to align with DWI reporting. The company is required to analyse turbidity results for each operational water treatment works that produced water for drinking purposes in the calendar year and determine 95 percentile values. The company should identify and report the number of works and their aggregated output (Ml/d) over the calendar year where the 95 percentile is greater than or equal to 0.5 Nephelometric Turbidity Unit (NTU) in line 1 and less than 0.5 NTU in line 2. This requires an off-line calculation and the procedure is set out in Appendix A to this chapter (methodology and calculations). It is expected that turbidity will be monitored at least weekly.

We have a line for reporting where there are works with insufficient sampling for turbidity to determine 95 percentile values, however we expect the company to try to continue to report on this measure for all works. The expectation is that for those works that are sampled for turbidity, data is available on at least one sample per week.

If continuous monitoring of turbidity has been introduced and is not producing results consistent with regular sampling, and vice versa, the company should work to resolve this issue. For the time being, NIAUR will keep using results of routine regular sampling.

The company is required to note that the methodology requires the exclusion of works where there are long gaps in the data, the removal of 'non-routine' samples and samples extra to the regular sampling interval. For some works, this may mean that there is insufficient data to calculate a 95 percentile figure (refer Appendix A). We recognise that some works may be fully operational but not in supply for part of the year, creating long gaps in turbidity data. To avoid excluding these works, data gaps due to a works not being in supply should be ignored.

Report in line 3 works where turbidity is not recorded or cannot be reported, and their aggregate output.

The 0.5 NTU threshold is not a surrogate for a Prescribed Concentration or Value (PCV). The company is to provide an assessment of the results and its expectations, above and below 0.5NTU based on the type and quality of source waters, treatment processes and recording procedures.

**Deletion**

## Company commentary

### Water treatment works turbidity

The company should:

- explain the reasons for the figure in line 3; in particular where works are operated for less than the whole year and whether this has affected the figures in lines 1 or 2 significantly;
- when appropriate, comment on performance on the calendar year to date, to further inform trend assessment; and,
- include the following information for works that have transferred to the PPP concessionaire during the year, but whose information has been reported in the table by merit of the fact that the works was operated by the company for the majority of the year:
  - the WTWs that fall into this category.
  - the period of time attributable to NI Water / PPP 'ownership' for each of the works.
  - whether performance has changed significantly between 'ownership' periods (quantified where possible).

The company is encouraged to make similar analyses of performance in relation to other key determinants to aid demonstration of performance of works in this group and describe any such progress in its commentary.

## Guidance to Reporters

### Water treatment works turbidity

The reporter is asked to review the calculations undertaken by the company. The review should include adherence to the methodology, assumptions made and calculations produced. The reporter is asked to confirm or otherwise whether the results produced are realistic and justifiable.

The reporter should:

- identify which works did not produce water throughout the year and check that these results are appropriately included;
- check the company's exclusion of non-routine samples and review the exclusion of works on the basis of insufficient data or gaps in the data, to ensure that the criteria have been correctly applied;
- confirm that the company has correctly accounted for works that transferred to the PPP concessionaire during the year;
- challenge data that is included or excluded, and comment on whether the procedure for exclusion of samples has had a material effect on the results; and,
- comment on company proposals regarding any other performance indicators for this group of assets.

# TABLE 11a

## APPENDIX A

### Methodology and calculations

#### Water treatment works – turbidity

##### Introduction

The company is required to report the number of treatment works whose 95 percentile turbidity values exceed a 0.5NTU threshold in the reporting year. This information is required to enable us to identify trends which may indicate declining asset condition at treatment works. For consistency, the company should adopt the following procedures for selecting data and calculating the 95 percentile for each works.

##### 1. Select data

The company must analyse turbidity results for the reporting year for each operational works. It is expected that turbidity will be monitored at least weekly and, in most cases, at least twice a week.

##### 2. Calculate 95 percentile values for each treatment works

##### Methodology:

- 1) Assemble data for the relevant treatment works and calendar year being reported.
- 2) Order by date and time.
  - Recording of time is not mandatory but, if available, times should be included.
  - If date and time are not available continue at step 6.
- 3) Calculate the time interval between one sample and the previous one to the nearest day.
  - For the first sample, the time interval should be the time elapsed since the year start.
  - For the last sample, the time interval should be the time to the year end.
- 4) Check for long gaps in the data.
  - Identify periods when the works was not in supply, and the time (weeks) not in supply.
  - If the maximum time interval is less than or equal to 28 days, proceed.
  - If the maximum time interval exceeds 28 days, check whether this corresponds to a period when the works was not in supply. If it does not so correspond, stop. Report "Gap in data too long".
  - If the works was in supply for eleven months or less, check whether the maximum time interval is less than or equal to 28 days less one per four weeks not in supply. If it does exceed this adjustment to the maximum interval, stop. Report "Gap in data too long".
  - Exclude works where the maximum time interval exceeds 28 days, except where this corresponds to when the works was not in supply and the adjusted maximum time interval is not exceeded.
- 5) Remove 'non-routine' samples
  - 'Non-routine' samples are those carried out as part of special investigations.
  - If 'non-routine' samples are not known they must be removed from the data in the following way:
  - Define the frequency of sampling (weekly, twice weekly periods etc). This may be known or estimated by dividing the total number of samples by 52 and rounding to the nearest integer greater or equal to 1.
  - Define 'weeks' (periods) from the start of the year in appropriate blocks (seven days for period = week) as shown below, with the 31<sup>st</sup> December being included in the preceding week. (The 'week' referred to here is the average interval between samples. This period may be a week, a half-week, a day, etc., depending on the sampling frequency).

Week number	Dates (inclusive)
1	1 <sup>st</sup> to 7 <sup>th</sup> January
2	8 <sup>th</sup> to 14 <sup>th</sup> January
...	...
9	26 <sup>th</sup> February to 4 <sup>th</sup> March (Inc. 29 <sup>th</sup> February if appropriate)
...	...
21	21 <sup>st</sup> to 27 <sup>th</sup> May
...	...
52	24 <sup>th</sup> to 31 <sup>st</sup> December

- Assign the appropriate week (period) number to each sample
- Discard the samples extra to the regular sampling interval (in this case a week) from each week (period), latest first, so that the maximum number of samples in any week (period) is the sampling frequency.

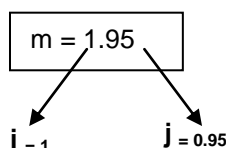
6) Check for an adequate number of data points.

- If the number of samples is less than 29, stop and report: "Not enough samples at works".

7) Calculate 95 percentiles for works with sufficient numbers of samples and no long data gaps.

- Put the data in descending order:  $V_1$  (max),  $V_2$ ,  $V_3$  etc.
- Calculate  $m = 0.05 * (\text{number of samples} + 1)$
- Split  $m$ :  $m = i + j$  where  $i$  is an integer and  $0 \leq j < 1$

$$95\%ile = \{(1-j) * V_i\} + \{j * V_{i+1}\}$$



### 3. Worked example

Consider the data for a works outlined in table A.1. The works was in supply for the whole year. Applying the methodology shows that the maximum time difference between samples is 27 days, which is just acceptable. The total number of samples is 53, which suggests a weekly sampling regime. To get one sample per week remove the samples in bold in table A.1 from the data set. Assigning weeks to each of the samples does this.

**Table A.1 Example works turbidity data**

Date	Values (NTU)	Time interval between samples	Week number
02/01/99	0.3	2	1
<b>03/01/99</b>	<b>&lt;0.2</b>	<b>1</b>	<b>1</b>
<b>05/01/99</b>	<b>&lt;0.2</b>	<b>2</b>	<b>1</b>
10/01/99	<0.2	5	2
18/01/99	0.4	8	3
25/01/99	0.4	7	4
08/02/99	0.2	14	6
15/02/99	<0.2	7	7
22/02/99	0.2	7	8
15/03/99	<0.2	21	11
22/03/99	<0.2	7	12
29/03/99	0.3	7	13
<b>01/04/99</b>	<b>0.3</b>	<b>3</b>	<b>13</b>
04/04/99	<0.2	3	14
<b>08/04/99</b>	<b>0.3</b>	<b>4</b>	<b>14</b>
19/04/99	<0.2	11	16
26/04/99	<0.2	7	17
07/05/99	0.3	11	19
17/05/99	0.2	10	20
24/05/99	<0.2	7	21
<b>27/05/99</b>	<b>&lt;0.2</b>	<b>3</b>	<b>21</b>
29/05/99	<0.2	2	22
09/06/99	0.3	11	23
14/06/99	0.3	5	24
21/06/99	0.3	7	25
28/06/99	0.3	7	26
<b>30/06/99</b>	<b>0.3</b>	<b>2</b>	<b>26</b>
06/07/99	<0.2	6	27
09/07/99	0.3	3	28
<b>13/07/99</b>	<b>0.4</b>	<b>4</b>	<b>28</b>
19/07/99	0.3	6	29
<b>20/07/99</b>	<b>0.4</b>	<b>1</b>	<b>29</b>
26/07/99	0.4	6	30
<b>27/07/99</b>	<b>0.3</b>	<b>1</b>	<b>30</b>
02/08/99	<0.2	6	31
<b>03/08/99</b>	<b>&lt;0.2</b>	<b>1</b>	<b>31</b>
07/08/99	0.2	4	32
16/08/99	0.3	9	33
<b>17/08/99</b>	<b>0.4</b>	<b>1</b>	<b>33</b>

Date	Values (NTU)	Time interval between samples	Week number
23/08/99	<0.2	6	34
<b>25/08/99</b>	<b>0.2</b>	<b>2</b>	<b>34</b>
29/08/99	0.4	4	35
08/09/99	0.3	10	36
13/09/99	0.3	5	37
17/09/99	0.3	4	38
<b>21/09/99</b>	<b>0.2</b>	<b>4</b>	<b>38</b>
<b>22/09/99</b>	<b>0.3</b>	<b>1</b>	<b>38</b>
27/09/99	0.2	5	39
05/10/99	<0.2	8	40
01/11/99	0.4	27	44
08/11/99	0.2	7	45
04/12/99	<0.2	26	49
<b>07/12/99</b>	<b>0.4</b>	<b>24</b>	<b>49</b>

The remaining 38 data points are shown in descending order in table A.2. Since there are more than 29 samples the percentile can be calculated:

- Data in descending order and labelled  $V_1$  (max),  $V_2$ ,  $V_3$  etc is shown in table A.2
- $m = 0.05 * (\text{number of samples} + 1) = 0.05 * (38 + 1) = 1.95$
- Splitting  $m$ :  $m = i + j$  where  $i$  is an integer and  $0 \leq j < 1$   
is achieved by setting  $i = 1$  and  $j = 0.95$
- So the 95%ile is  $\{(1 - j) * V_1\} + \{j * V_{i+1}\} = \{(1 - 0.95) * 0.4\} + \{0.95 * 0.4\} = 0.4$

**Table A.2 Example turbidity data, after processing and sorted in descending order**

Date	Value (NTU)	$V_i$
18/01/99	0.4	$V_1$
25/01/99	0.4	$V_2$
26/07/99	0.4	$V_3$
29/08/99	0.4	$V_4$
01/11/99	0.4	$V_5$
02/01/99	0.3	$V_6$
29/03/99	0.3	$V_7$
07/05/99	0.3	$V_8$
09/06/99	0.3	$V_9$
14/06/99	0.3	$V_{10}$
21/06/99	0.3	$V_{11}$
28/06/99	0.3	$V_{12}$
09/07/99	0.3	$V_{13}$
19/07/99	0.3	$V_{14}$
16/08/99	0.3	$V_{15}$

$$V_i = V_1$$

$$V_{i+1} = V_2$$

Date	Value (NTU)	V <sub>I</sub>
08/09/99	0.3	V <sub>16</sub>
13/09/99	0.3	V <sub>17</sub>
17/09/99	0.3	V <sub>18</sub>
08/02/99	0.2	V <sub>19</sub>
22/02/99	0.2	V <sub>20</sub>
17/05/99	0.2	V <sub>21</sub>
07/08/99	0.2	V <sub>22</sub>
27/09/99	0.2	V <sub>23</sub>
08/11/99	0.2	V <sub>24</sub>
10/01/99	<0.2	V <sub>25</sub>
15/02/99	<0.2	V <sub>26</sub>
15/03/99	<0.2	V <sub>27</sub>
22/03/99	<0.2	V <sub>28</sub>
04/04/99	<0.2	V <sub>29</sub>
19/04/99	<0.2	V <sub>30</sub>
26/04/99	<0.2	V <sub>31</sub>
24/05/99	<0.2	V <sub>32</sub>
29/05/99	<0.2	V <sub>33</sub>
06/07/99	<0.2	V <sub>34</sub>
02/08/99	<0.2	V <sub>35</sub>
23/08/99	<0.2	V <sub>36</sub>
05/10/99	<0.2	V <sub>37</sub>
04/12/99	<0.2	V <sub>38</sub>

#### 4. Aggregate results at company level

Allocate works into the relevant category for lines 1 to 3. Report numbers of works and their aggregated output for each of lines 1 to 3. Line 4 is the summation of lines 1 to 3.



## Table 11a line definitions

### A WATER TREATMENT WORKS - TURBIDITY

<b>1</b>	95%ile greater than or equal to 0.5NTU [column 1 – number of water treatment works]	nr	0dp
<b>Definition</b>	<p>The number of operational potable water treatment works and sources whose turbidity 95 percentile equals or exceeds a 0.5 NTU threshold. Calculate 95 percentile value using all data from regular routine sampling of final water from sources for the calendar year.</p> <p>Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply.</p> <p>The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.</p>		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>1</b>	95%ile greater than or equal to 0.5NTU [column 2 – output volume]	MI/d	2dp
<b>Definition</b>	<p>The sum of the output volume for the calendar year for operational potable water treatment works and sources whose turbidity 95 percentile equals or exceeds a 0.5 NTU threshold. Calculate 95 percentile value using all data from regular routine sampling of final water from sources for the calendar year.</p> <p>Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply.</p> <p>The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.</p>		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>2</b>	95%ile less than 0.5NTU [column 1 – number of water treatment works]	nr	0dp
<b>Definition</b>	<p>The number of operational potable water treatment works and sources whose turbidity 95 percentile is less than a 0.5 NTU threshold. Calculate percentile value using all data from regular routine sampling of final water at water treatment works for the calendar year.</p> <p>Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply.</p> <p>The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.</p>		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>2</b>	95%ile less than 0.5NTU [column 2 – output volume]	MI/d	2dp
<b>Definition</b>	<p>The sum of the output volume for the calendar year for operational potable water treatment works and sources whose turbidity 95 percentile is less than a 0.5 NTU threshold. Calculate percentile value using all data from routine regular sampling of final water at water treatment works for the calendar year</p> <p>Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply.</p> <p>The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.</p>		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>3</b>	Turbidity not recorded [column 1 – number of water treatment works]	nr	0dp
<b>Definition</b>	Number of operational water treatment works or sources for which turbidity is not recorded or where there are insufficient samples or where the time interval between samples is longer than the required minimum (see line 1 and 2 definitions).		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service.		
<b>Processing rules</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>3</b>	Turbidity not recorded [column 2 – output volume]	MI/d	2dp
<b>Definition</b>	The sum of output volume for the calendar year for operational works in this category, expressed in megalitres per day.		
<b>Primary purpose</b>	Confirming delivery of key outputs and service.		
<b>Processing rules</b>	Input		
<b>Responsibility</b>	Network Regulation Team		

<b>4</b>	Total [column 1 – number of water treatment works]	nr	0dp
<b>Definition</b>	The total number of operational water treatment works.		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Calculated: sum of lines 1, 2, and 3		
<b>Responsibility</b>	Network Regulation Team		

<b>4</b>	Total [column 2 – output from water treatment works]	MI/d	2dp
<b>Definition</b>	The total output from operational water treatment works for the calendar year.		
<b>Primary Purpose</b>	Confirming delivery of key outputs and service		
<b>Processing rule</b>	Calculated: sum of lines 1, 2 and 3		
<b>Responsibility</b>	Network Regulation Team		

## CHANGE CONTROL SHEET

### CHAPTER 11a

2008/1.0	First issue of chapter for the SBP period.
2009/1.0	Second issue of chapter for the SBP period. <ul style="list-style-type: none"> <li>– Notification of potential future reporting on water service non-infrastructure added</li> <li>– Tables amended to provide PPP only and NIW+PPP reporting</li> </ul>
2010/1.0	Third issue of chapter for the SBP period. <ul style="list-style-type: none"> <li>– Non-infrastructure unplanned maintenance section removed</li> <li>– PPP and Total table removed leaving NIW Only table.</li> <li>– Clarification on treatment of works transferring to PPP added.</li> </ul>
2011/1.0	First issue of chapter for the PC10 period. <ul style="list-style-type: none"> <li>– No changes</li> </ul>
2012/1.0	Second issue of chapter for the PC10 period. <ul style="list-style-type: none"> <li>– No changes</li> </ul>
2013/1.0	Third issue of chapter for the PC10 period <ul style="list-style-type: none"> <li>- Text referring to works transferring to PPP removed.</li> </ul>