



Water Use

CAS Guidance (CAS-G-004)

Flow Recording and Reporting at Sewage Treatment Works and on the Sewer Network

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Update Summary

Version	Description
v1.0	First issue for Water Use reference using approved content in the following document: <i>CAS_Flow_Recording_and_Reporting_Guidance_v11.doc</i>
v1.1	s2.5, para 1: Added '80%ile' & ref to DWF calculation method
v2	Removal of para re flow monitoring compliance (s2.1), simplify DWF assessment (s2.5), Annex 2 inserted, 5 & 6 updated.

Notes:

References: Linked references to other documents have been disabled in this web version of the document. See the References section for details of all referenced documents.

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Always refer to the online document for accurate and up-to-date information.

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1. Introduction

The purpose of this document is to provide SEPA officers with guidance for assessing compliance with recording and reporting of flows at sewage treatment works (STWs) and on the sewer network. The guidance may be used for other operators.

The guidance is only for use in SEPA's compliance assessment scheme. It does not affect SEPA's enforcement policies/guidance or any enforcement action against any licence.

Flow monitoring at STWs and on the sewer network consists of two types – measurement of flows and recording of storm overflow events.

The recording and reporting of flows and overflow events provides an important source of information for SEPA. (The rationale for requiring flow monitoring and event recording is available in section 2.1 of *WAT-SG-13: Municipal Sewage Treatment Works* and section 4.5 of *WAT-RM-07: Regulation of Sewer Overflows*.)

Two other CAS guidance documents relating to flow monitoring are available:

- *CAS-G-002: Calibration of monitoring and measurement equipment at STWs*
- *CAS-G-003: Flow Event Monitoring at Scottish Water STWs*

2. Guidance

2.1 Provision of Monitoring at STWs and on the Sewer Network

Flow and event monitoring at new or substantially modified assets shall be provided in accordance with the requirements of Table 1 of *WAT-SG-13: Municipal Sewage Treatment Works* in relation to STWs and Figure 6 of *WAT-RM-07: Regulation of Sewer Overflows* in relation to sewer network overflows.

Guidance on assessment of compliance with flow/event monitor provision is available in *CAS-G-003: Flow Event Monitoring at Scottish Water STWs*.

New flow measurement and recording systems should be installed to good engineering practice or if appropriate, in accordance with the relevant British Standards. Existing measurement and recording systems should have been installed to the standards applicable at the time of installation.

The type of flow meter installation (whether ultrasonic, flume, electromagnetic meter etc) shall be suitable for the conditions where it is installed.

The location of the flow meter shall ensure representative measurements of the flow and shall cover the full range of flow conditions. Any suitable location can be used but the location should take account of returned liquors, recirculation etc.

In particular, the flow to full treatment flows at a STW should be able to be assessed without the contribution of any returned liquors, recirculates etc., to avoid double counting.

Staff should be aware that it may not always be practicable to retrofit flow monitors for existing STWs in order to be compliant with Table 1 of *WAT-SG-13*. A pragmatic approach may be required, for instance by allowing flows to be determined by an alternative means.

If the flow monitor fails, the operator should take all practicable steps to ensure it is fully functioning as soon as possible.

Technical Guidance on methods of flow measurement is available in *WAT-SG-54: Technical Guide to Flow Measurement*.

2.2 Recording and Storage of Data

There are certain STWs and sewer networks where licences require recording of flows and overflow events but there is no requirement to report these to SEPA. This category generally includes STWs between 2000 and 15000pe (see *WAT-SG-13*, section 2).

Flow monitors shall record the instantaneous or the 15 minute integrated flow rate every 15 minutes and shall meet the licensed requirements.

Licences normally require flow statistics to be kept for 5 years and provided to a SEPA officer on request.

Table 1 of *WAT-SG-13* requires the keeping of summary statistics and the continuous flow to full treatment flow records for 5 years.

Some licences may require storing of data on site for one year. Data should be available on request as it is unlikely data will be held at site level for this period of time.

Where the licence requires an event recorder to 'record the frequency and duration of overflow events', this requires the start and finish date and time of each overflow event to be kept by the operator. (An example is provided in Annex 3).

2.3 Routine Reporting

SEPA expects that a data sense check will have been carried out by the Operator before submission and investigations are carried out if required. If data is clearly not representative, it will not be accepted. The data will be placed on the *Wastewater* page of the SEPA intranet, where a Local Operations team member will check against CAS at a later date.

STWs serving >15000pe are generally required by the licence to report flow data.

In addition, certain STWs serving <15000pe may be required to report flow data based on environmental need.

Certain existing overflows on the sewer network are required to routinely report flow data. New overflows on the sewer network shall be required to report by including a condition in the sewer network licence (but reporting is only required if there is an environmental need, such as high risk or low dilution).

Flow data returns shall be emailed centrally to SEPA in Excel spreadsheet format by the licence due date of 31 January for the previous calendar year.

If required, the reason for Dry Weather Flow (DWF) exceedance and any proposed action should also be provided to SEPA by 28 February (section 2.5). (NB Emailing to SEPA centrally is deemed compliant, even though some STW licences may specify reporting to the local SEPA office).

If a licence condition requires reporting '*as agreed with SEPA*' or '*as agreed in writing*' and there is no evidence that anything has been agreed, then this is taken to be that no reporting is required. However if there is a requirement in the Reporting table at the front of the licence, then this is to be taken that reporting is required. Where there is an environmental need for reporting, SEPA will write to the operator requesting this and if reporting is required for a temporary period, SEPA will specify the timescales over which reporting is required.

If a licence condition requires reporting '*in a format as agreed with SEPA*', this is generally taken to be that reporting is required. The requirement for reporting should be specified in Table 2 of the licence.

If reporting is required, then the format agreed with SEPA is by default taken to be the Excel spreadsheet format given in Annexes 1 and 2.

The inspection of the STW or the sewer network licence (SNL) may be a trigger to review whether to require reporting or alternatively to discontinue reporting as no useful information is being obtained.

If a licence requires annual reporting of flow statistics, but there is no licence requirement for the provision of flow monitoring equipment, the reporting condition

should not be assessed and CAS-G-003 should be referred to in order to determine whether flow monitoring is appropriate. If flow monitoring is not required, the reporting condition should be removed from the licence.

2.3.1 Flow data returns

Format: An example flow data return is provided in Annex 1.

If the Mean Daily Flow is not based on all 365 days of the year, then the number of days in the year used to calculate the mean shall be provided in the Comments column. If the flow submission is non-standard in some other way (for example if the submitted flow is based on adding flows together), this should also be described in the Comments column.

2.3.2 Overflow data returns

Format: An example data return is provided in Annex 3.

If the submission is non-standard (for example if the event recorder was not operating correctly for part of the year), then details should be described in the Comments column.

Where the licence requires an estimate of the volume discharged, this should be entered into the relevant column in Annex 3. If required, this estimate is made from heights over weir etc and does not require a flow monitor.

2.4 Assessment of Recording and Reporting of Flows under the Compliance Assessment Scheme

The Compliance Assessment Scheme (CAS) differentiates licence conditions between Environmental Limit Conditions (ELCs) and Environmental Management Condition (EMCs). The provision of flow monitors and the submission of reports to SEPA required under licence conditions are both EMCs.

The assessment of EMCs is subjective but Annex 5 of the *Compliance Assessment Scheme Manual* provides guidance on how they should be assessed. When assessing compliance with EMCs, the SEPA Officer must consider proportionality and risk.

For example, consider a licence for a STW discharging to a water course with very limited dilution which has a flow monitor recording flows passing forward to full treatment. If this meter is out of operation for a considerable period, it is likely that this would be assessed as a major non-compliance.

Conversely if another STW licence requires a number of flow monitors at different locations, and the one monitor that is out of operation relates to flow at the inlet of the works, this may be assessed as a minor non-compliance. However this would depend on the length of time it is out of operation or even overall compliance if there is an alternative method of assessing the flow.

EMCs are assessed by attribute – not by individual licence condition or by individual asset - and assessed on the operator's annual performance. Therefore

how the operator responds to the problem and the steps they take to mitigate any impacts is critical.

It is also important that the assessment of the flow monitoring and report submission attributes does not lead to 'double counting' -

- The operator should inform SEPA at the time (via local Operations Notifications) if a flow monitor has broken down. Assessment in Annex 5 of the *Compliance Assessment Scheme* is then under the 'Provision and operation of monitoring equipment' attribute and NOT under 'Reports to SEPA required under licence'.
- If SEPA has not been informed that the flow meter has broken down, then assessment is made under 'Reports to SEPA required under licence'. This assessment should be proportionate, relating to, for example, the number of days used in the data return and importantly, the resultant environmental risk i.e. missing data may be less important for large dilution coastal discharges that do not have any nearby Bathing Waters that could be impacted.

In summary:

- All assessments are subjective and should consider risk and proportionality
- If the flow monitor fails, the operator should take all practicable steps to ensure it is fully functioning as soon as possible.
- Non-operation of a flow monitor should be assessed under the 'Provision and operation of monitoring equipment' attribute and NOT under 'Reports to SEPA required under licence' or Record Keeping'.
- If the non-submission of a flow monitoring report is for a reason other than failure of a flow monitor (or if SEPA is not informed of flow meter failure) then it should be assessed under 'Reports to SEPA required under licence'.

2.5 DWF Compliance

2.5.1 DWF Compliance Assessment

Dry Weather Flow (DWF) data returns are to be submitted by the operator by calculating the total daily flow value that is exceeded by 90% of the measured total daily flows in any period of 12 months and matching this value against the permitted daily DWF limit (80%ile). Section 3.2.4 in *WAT-SG-13: Municipal Sewage Treatment Works (STW)* explains the reasons for this approach.

The method to be followed for this calculation is detailed in Annex 4. This is to be undertaken by the operator and submitted to SEPA with the annual flow data returns by 31 January of the following year. Failure to submit the annual return on time is a Minor Breach of the reporting condition.

Where a licence requires DWF reporting for the influent and effluent, it has been agreed with Scottish Water that only the influent DWF requires to be reported in the annual flow data return.

SW should endeavour to ensure that DWF licence limits are not breached. This can be achieved by working with the local authority planning function and SEPA to manage network and STW capacity.

The 90th percentile approach to calculating DWF was introduced for data collected during calendar year 2013 and submitted 31 January 2014 for Scottish Water sites (and implemented a year later for PFI sites). DWF compliance assessment is set out in a flowchart (Annex 5).

DWF and mean daily flow are summary statistics calculated from daily flows obtained throughout the year. The quality of these figures clearly relates to the underlying dataset. If DWF and mean daily flow are based on less than the full year's data set, then this should be assessed according to the relevant number of days as set out in Annex 5 of the *Compliance Assessment Scheme Manual* (Compliance is ≤ 36 days of missing data (but no more than 14 consecutive days), with a minor breach where 37-108 days of data is missing and a major breach occurs where >108 days data is missing (Annex 5).

Where the measured Q_{90} flow exceeds the DWF licence limit, this should be investigated by the operator and the reason and proposed action provided to SEPA. Examples are given in Table 1 below.

The underlying approach is that if the discharger is breaching the DWF limit they will not be marked down as non-compliant as long as they provide an appropriate mitigating reason/action, as outlined below.

In some cases the cause of the exceedance may not be able to be identified. However SEPA would expect at least the causes in Table 1 to be investigated and reported by 28 February.

The exceedance of the DWF limit can be short term and may be limited to a single year. For example a reason such as high rainfall or inaccurate flow measurement should not be consistently repeated year on year.

The discharger may consider that the reason for DWF exceedance is due to missing days of data leading to the DWF being determined on an unrepresentative dataset, eg missing data is disproportionately over a dry period leading to an unrepresentatively high DWF being reported.

If no satisfactory reason and action is given for DWF exceedance by 28 February, then this is a licence breach. Failure to submit the reason for exceedance or undertake a satisfactory action is a non-compliance of the DWF limit condition i.e. Scope ELC Minor Breach.

In some circumstances, the exceedance may be longer term and has established a pattern over a number of years. Whether the measured Q_{90} flow consistently exceeds the DWF limit can be assessed by examining Q_{90} flows from historical daily flow data. *CAS Scottish Water STW Flow Returns Data* allows easy checking of trends in DWF.

If the measured Q_{90} flow exceeds the DWF limit for 3 consecutive years or greater then this can be assumed to be an established trend and further investigation is warranted as described in section 2.5.2 and Annex 6 below.

Example reasons and suggested follow up actions are given in Table 1 below.

Table 1 Possible Reasons of DWF Exceedance and Actions Required

Cause of exceedance of DWF	Likely follow up actions by the operator	Type of exceedance
High rainfall	None - evidence of this may be shown by submission of rainfall records etc	Out of norm / short term
Problems with flow data: <ul style="list-style-type: none"> • Flow meter inaccurate • Flow meter in inappropriate location • Maintenance issue – eg silt in inlet channel • Data transfer issue • Missing data during a dry period 	Take action to prevent this happening in the future e.g. removal of silt from inlet flow channel, address inlet screen causing backing up of flow. May need to use a temporary flow meter	Out of norm / short term
Increased trade discharge	Agree a reduction in the trade discharge with the trader or apply for higher flow limit (see below)	Out of norm / short term or Step change/ permanent
Population growth, increased trade discharge	NB This reason for exceedance should be exceptional as it should be avoided by working with the planning system. If necessary, then apply for a variation for a higher DWF limit. SEPA modelling will then determine whether this can be conditioned or permitted and whether other licence conditions such as discharge standards may need to change. The timescale of any required investment needs to be agreed with SEPA.	Step change/ permanent
Increased infiltration	Reduce infiltration or apply for higher flow limit (see above). CSO settings may require alteration to reduce risk of excessive spills.	Step change/ permanent

2.5.2 Assessing Applications to increase licensed DWF

If the measured Q_{90} flow exceeds the DWF limit for 3 years or greater then this can be assumed to be an established trend and further investigation is warranted as described below. This investigation would not be expected to take place within the CAS assessment period immediately following a year's submission, but over an agreed timescale. A flowchart is provided in Annex 6.

If the current DWF is consistently greater than the licence or STW design DWF, then more DWF is arriving at the STW than was originally envisaged when the STW was designed. A STW designed to treat 3DWF may effectively only be treating say 2 or 2.5DWF due to the increase in DWF. There is therefore a potential increase in spill events.

The acceptability of a higher licence DWF can be determined by following the procedure set out below. Refer to Annex 6.

For further information on DWF calculations, refer to WAT-RM-07 and WAT-SG-13.

In order to identify the severity of the DWF exceedance, we will need to compare the current FFT against the licence or STW design FFT.

Calculate current Flow to Full Treatment (FFT)

FFT capacity should be adequate to treat the diurnal variations in DWF, for example for small to medium sized works $FFT = 3DWF$

STW FFT settings other than 3DWF can be assessed and compared against the relevant calculated current FFT to determine acceptability of an increased DWF.

Where $3DWF = 3PG + I_{max} + 3E$

P = population served, G is water consumption per head, E is trade effluent flow

I_{max} is the maximum infiltration rate

Since FFT needs to be appropriate throughout the year, it is important to use the maximum possible infiltration rate I_{max} . I_{max} should be calculated using the maximum calculated flow on each dry day.

- If the licensed or existing STW FFT setting is greater than the calculated current FFT, then the existing situation would normally be acceptable, since the incoming flows do not exceed the STW's design.

We would therefore accept an increase in licensed DWF, as long as this does not exceed the existing STW FFT setting or any other overflow setting e.g. 6DWF or Formula A.

- If the licensed or existing STW FFT setting is less than the calculated current FFT, then incoming flows exceed the STW's design. The discharger then needs to provide evidence of the environmental impact of the discharge and increased overflow spills based on the Urban Pollution Manual (UPM) methodology. (Refer to the Urban Pollution Manual and section 4 of WAT-RM-07).
 - If the proposal is environmentally satisfactory, then a licence application to increase the DWF would normally be acceptable.
 - If the proposal is environmentally unacceptable, then the STW will need to be upgraded via a Q&S project. This would be a Scope ELC Significant Breach since the discharger has exceeded the DWF limit and caused an environmental impact.

The adequacy of any storm storage may need to be reassessed in terms of the standard requirement of 68l/head or 2 hours at 3DWF FFT.

Where the DWF is being increased the following summary data must be provided for all WwTW over 2,000pe and for the current and proposed DWF figures: -

- the FFT

- the typical annual volumes entering the WwTW
- the typical annual volumes discharging to the water environment after full treatment
- the typical annual volumes discharging to the water environment without full treatment
- the percentage of incoming flows receiving full treatment
- spill frequency from the CSO inlets and storm tanks

Failure to undertake the study to determine environmental acceptability within the agreed timescale would be a Scope ELC Significant Breach since the discharger has exceeded the DWF limit without undertaking appropriate mitigating actions. This may be followed up with appropriate enforcement action.

Annex 1: Format for Flow Data Returns

Figure 1 Example flow data return

A	B	C	D	E	F	G	H
Year	2016						
Licence Number	Site Name	SEPA Measurement Point Description	Mean daily flow (m3/d)	Standard Deviation	DWF (m3/d)	DWF > Licence (Y/N)	Comments

Annex 2: Format for Reason for Exceedance

Figure 2 Example reason for exceedance

Year	2016						
Site Name	SEPA Measurement Point Description	Licence DWF (m3/d)	DWF (m3/d)	DWF > Licence (Y/N)	Number of consecutive years of exceeded	Exceedance Cause	Comments

Annex 3: Format for Overflow Event Data Returns

Figure 3 Example Overflow Event Data Return

	A	B	C	D	E	F	G	H	I
	Licence Number	Site Name	SEPA Measurement Point Description	Max flow m3/hr	Start of Overflow Event	End of Overflow Event	Duration of Overflow Event	Volume discharged m3	Comments
1									
2	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW max PFF at CSO weir to FT new	1,800.00					
3	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW max PFF at SSSO weir to FT new	1,440.00					
4	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		25/01/2013 19:15	26/01/2013 02:00	00:06:45:00		
5	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		22/02/2013 05:30	22/02/2013 17:30	00:12:00:00		
6	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		13/05/2013 17:15	14/05/2013 00:34	00:07:19:00		
7	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		01/06/2013 13:45	04/06/2013 09:45	02:20:00:00		
8	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		23/06/2013 04:19	23/06/2013 14:45	00:10:26:00		
9	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		29/06/2013 08:45	30/06/2013 02:30	00:17:45:00		
10	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		07/07/2013 06:45	07/07/2013 18:00	00:11:15:00		
11	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		18/07/2013 04:00	18/07/2013 11:15	00:07:15:00		
12	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		23/07/2013 15:45	23/07/2013 23:06	00:07:21:00		
13	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		17/08/2013 06:15	17/08/2013 11:30	00:05:15:00		
14	CAR/L/1003328	ALLERS WWTW 1964 NS662561	Allers WWTW storm event at CSO new		29/08/2013 15:45	29/08/2013 21:00	00:05:15:00		

Annex 4: DWF Calculation Method

Compliance assessment where there is a full dataset

The individual values of measured Total Daily Volume (TDV) must be ranked from the lowest to the highest. If there are either 365 or 366 total daily volume (TDV) values then compliance with the consent is achieved if the 36th value from the low end is at or below the consented limit.

Compliance if there are missing TDV values

If there are missing values from any 12-month dataset then the value that is exceeded by 90% of the available measured TDV values will still be determined and compliance assessed. The nth value ranked from the low end is used to determine compliance, where $n = \text{Integer}(0.1N)$ and N is the number of good measurements of TDV in the year.

For example, if $N=332$, then $n=\text{Integer}(0.1 \times 332) = \text{Integer}(33.2) = 33$. In this case, if the 33rd ranked value of TDV is no more than the permitted DWF, then compliance is achieved.

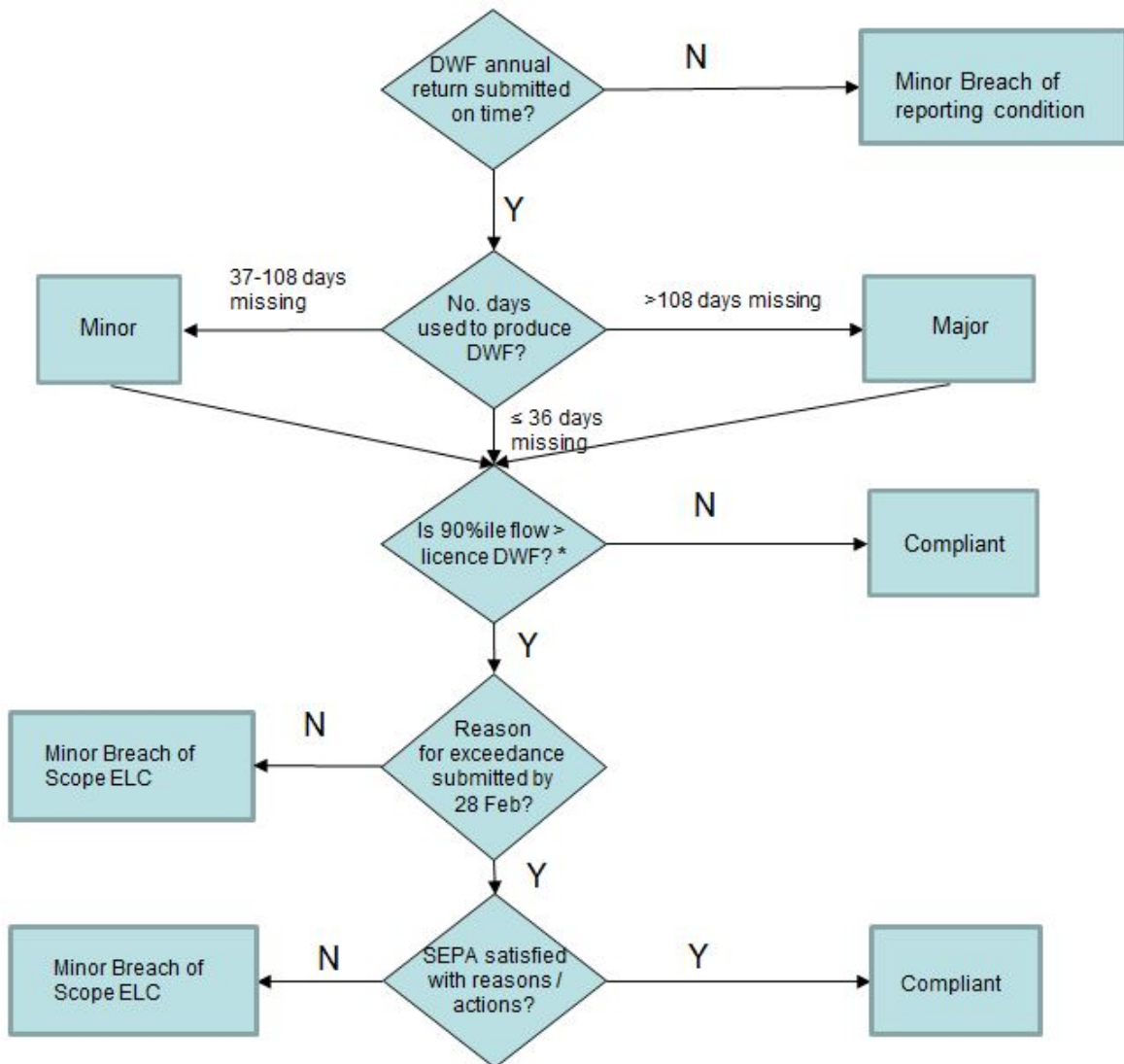
However, where there are missing data, the confidence with which we can state whether the flow has exceeded the consent limit may be reduced. The degree of confidence in any compliance assessment will depend on a combination of several factors:

1. The season of the year from which the values are missing
2. The number of missing values
3. The extent to which the measured Q_{90} is above or below the consented limit
4. The degree of knowledge available about the normal annual flow distribution and range within the year

A study of the effect of missing TDV data on measured Q_{90} showed that the effect varies appreciably between works, but for most, the effect is relatively small even when the consent holder has missed several weeks of the lowest TDVs.

Because of the variability between sites and the effect of the factors noted above, we cannot devise any simple rules to allow for the effect of missing values on compliance. We will therefore assess compliance for all sites using the measured Q_{90} of all available good TDV values, without any allowance for missing data.

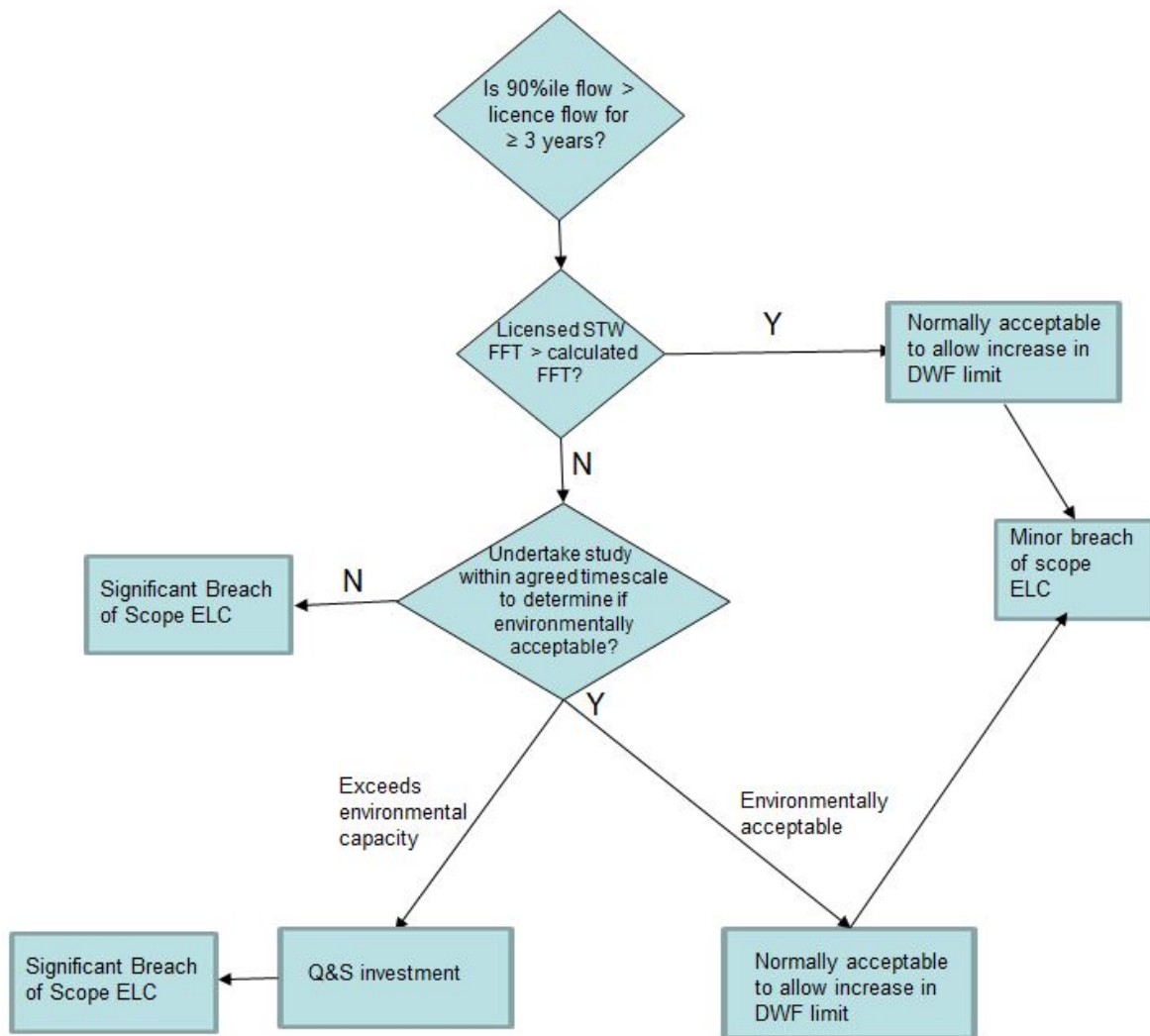
Annex 5: DWF Interim Compliance Assessment



Note:

* If 90%ile flow > licence DWF for > 3 years, also refer to Annex 6

Annex 6: Assessment if DWF limit for ≥ 3 years



References

NOTE: Linked references to other documents have been disabled in this web version of the document See the Water >Guidance pages of the SEPA website for Guidance and other documentation (<http://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/>). All references to external documents are listed on this page along with an indicative URL to help locate the document. The full path is not provided as SEPA can not guarantee its future location.

SEPA Documents

- *WAT-RM-07: Regulation of Sewer Overflows*
- *WAT-SG-13: Municipal Sewage Treatment Works (STW)*
- *WAT-SG-54: Technical Guide to Flow Measurement*
- *CAS-G-002: Calibration of monitoring and measurement equipment at STWs*
- *CAS-G-003: Flow Event Monitoring at Scottish Water STWs*
- *CAS Scottish Water STW Flow Returns Data (Spotfire Tool)*
- *Compliance Assessment Scheme Manual* including Annex 5 (www.sepa.org.uk)
- *Urban Wastewater Treatment Regulations Guidance Note* February 1998 (SEPA intranet)
- *Wastewater* page (SEPA intranet)

- End of Document -