Water Use

Regulatory Method (WAT-RM-07)

Sewer Overflows

Version: v3.1

Released: Feb 2014

Copyright and Legal Information

Update Summary

Version	Description
v1.0	First issue for Water Use reference using approved content from the following documents: *Intermittent_Sewage_Discharges_HT4.doc* *RM_07_PS_SewerOverflowsV3.doc*
v1.1	Revisions detailed in *WAT-RM-07_PS_Sewer_Overflows_v2.doc* Doc WAT-SG-01 now deleted, all references removed Other doc references updated to include *WAT-* prefix WAT-TEMP-21 reference added
v2.0	New base template applied, links to docs revised for new SEPA website
v3.0	Expired CMS links reviewed and updated. Formula A revised, Storm Tank/Screening/Flow monitor/Sewer Network Licence info added.
v3.1	Fig 3 corrected (Special case options), outfall is dependent activity, doc includes modifications and removal of assets

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.

Printing the Document: This document is uncontrolled if printed and is only intended to be viewed online.

If you do need to print the document, the best results are achieved using Booklet printing or else double-sided, Duplex (2-on-1) A4 printing (both four pages per A4 sheet).

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

Table of Contents

1. Key Points

The guidance applies to the following types of intermittent discharges:

- Combined sewer overflows (CSOs) at sewage treatment works (STWs) and on the sewer network.
- Storm tank overflows at STWs and on the sewer network.
- Emergency overflows (EOs) from pumping stations.

Scottish Water network CSOs and EOs are authorised by sewer network licences.

Existing discharges should be licensed to address any unsatisfactory criteria.

A new discharge should be designed to satisfy the *Urban Waste Water Treatment (Scotland) Regulations 1994* (UWWTR) with reference to two key external documents:

- *Urban Pollution Management Manual*
- *Urban Waste Water Treatment Regulations Guidance Note*

2. Introduction

Intermittent discharges may occur at a STW or from a sewerage system (or network). Such discharges consist of combined sewer overflows, storm tank overflows and emergency overflows. Emergency overflows may be present where there are pumps or other equipment at risk from mechanical/electrical failure.

2.1 Types of Overflow

2.1.1 Combined Sewer Overflows (CSOs)

CSOs are a feature of most existing sewerage systems where surface water i.e. rainwater from roofs, yards and roads and foul (sewage & trade) effluent flows are combined in one single pipe With increasing rainfall, the combined sewer reaches its hydraulic capacity and a release mechanism is required in order to prevent flooding or inundation of areas (including domestic property and commercial premises) with dilute sewage. As such, there are very good reasons for having CSOs. By their very nature, CSOs should operate intermittently and only in response to rainfall events. They may discharge to inland, coastal or transitional (i.e. estuarine) waters.

When rainfall occurs in an area, the rain runs off from permeable surfaces, i.e. grassland and natural ground, more slowly than from impermeable or developed areas such as roofs, roads and pavements. As a consequence, flows in the combined sewer increase more rapidly than in the receiving watercourse. It is therefore necessary to retain these initial storm flows in the sewer until the watercourse flow has increased sufficiently to cope with a discharge of dilute sewage when the CSO overflows. Retention is provided by the sewers downstream of CSOs being adequately sized or by the provision of storage capacity in the CSO chamber, upstream sewer or in storm settlement tanks at the sewage treatment works or in the sewer network.

By reducing surface water and groundwater inflows to sewers, the need for new CSOs can be kept to the absolute minimum (see section 3.5.1).

2.1.2 Storm Tanks

Storm tanks at inland sewage treatment works are normally required to deal primarily with the polluting "first flush" of storm sewage at a time when flows in the receiving watercourse will not have responded to rainfall as quickly as the impermeable areas served by the combined sewer.

In coastal and transitional waters, some form of storm water retention system may also be required to deal with these "first flush" scenarios, especially where the microbiological quality of receiving waters is an issue.

The sizing of storm water retention systems, if they are necessary (e.g. to reduce spill frequency from the sewer network), is normally based on sewer hydraulic modelling and modelling of the receiving waters.

2.1.3 Emergency Overflows

Emergency Overflows (EOs) are designed to cater for mechanical and/or electrical failure, rising main failure or blockage in the downstream sewer.. Such equipment may be mechanically-raked screens or pumps or flow control devices. EOs are not CSOs as they are not designed to operate in response to rainfall. They may be present on separate sewerage systems as well as combined sewerage systems.

Emergency overflows of sewage, although they should be very infrequent, can have a more severe effect on watercourses than CSO discharges as there may be no dilution effect from any rainfall. The sewage discharge may be stronger and the flow in the watercourse may be low. For small, separately sewered catchments (i.e. where there are separate pipes for surface water and foul sewage) it should be possible to 'design out' the need for an EO by utilising storage in the pump wet well and upstream sewers, by use of telemetry to warn of pump failure and/or high level, and agreeing an appropriate response time. In such situations, there would be a presumption against providing an EO. Should an EO be deemed essential, which must be justified, then it must be licensed subject to conditions to ensure that measures such as telemetry alarms (refer to *WAT-SG-13: Municipal Sewage Treatment Works*), are taken to minimise the frequency, duration and impact of any discharge.

2.1.4 Sewage Pumping Stations with Storm Overflows

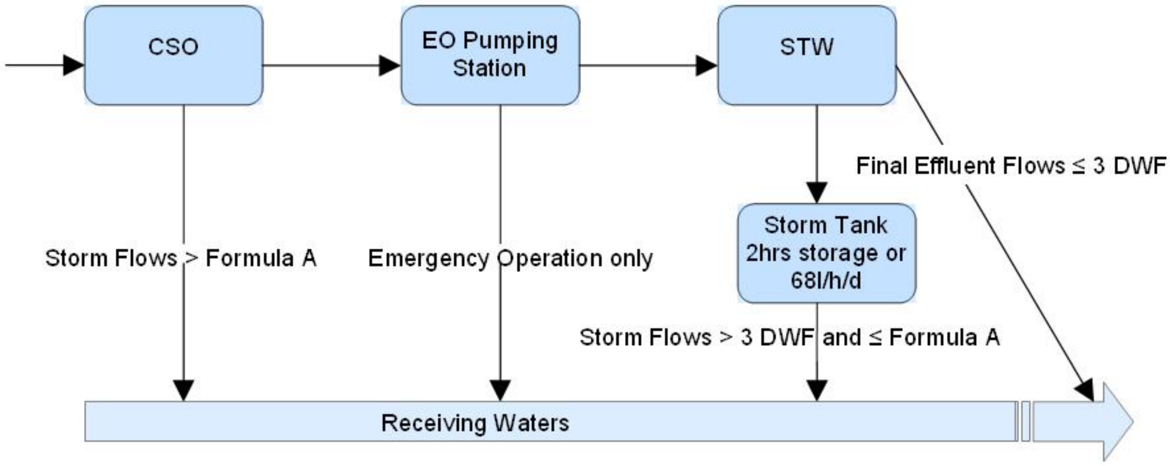
Pumping stations on a combined sewer often have both a CSO and an EO. It is important to distinguish between the 2 types of overflow, since these have different conditions applying to them even though they may discharge to the environment through the same outfall pipe.

See 4.5.3 for further details.

2.2 Sewerage Flow Distribution

The following diagram shows flow distribution for a typical sewerage network, illustrating the phased operation of discharges. Please note that many sewerage networks will differ from this considerably, further details are provided in the following sections.

Figure 1 Sewerage flow distribution



For example, during normal dry weather conditions the only discharge should be the final effluent from the sewage treatment works. If the flows into the works increases past the hydraulic capacity of the STW, i.e. during intense rain, some of the sewage is diverted to storm tanks. If the event is prolonged, and the storm tanks fill to capacity, they will start to discharge settled storm sewage. During higher intensity or prolonged rainfall events, the CSOs upstream of the storm tanks start to operate. The EO should only discharge if there is a malfunction at the pumping station, such as a choked rising main stopping any flows being passed forward to the STW or pump failure.

2.3 Design Flows for Discharges

2.3.1 CSO Design Flows

CSOs can be located anywhere on the sewerage network: on a branch sewer remote from the STW; at a sewage pumping station; or on an inlet sewer to the STW. It is usually preferable to base the design of a CSO on the output of sewer hydraulic and water quality impact models. However for some situations the cost of data collection for model construction or calibration may render this approach disproportionately expensive and incur significant delays in construction. In such cases it is accepted practice to require flows up to the equivalent to "Formula A" to be passed forward to the treatment works and flows in excess of this can discharge to the watercourse.

Formula A

Formula A is calculated according to the type of sewer catchment.

Fully Combined System

Formula A = DWF + 1360P + 2E

Fully Separate System

Formula A = 3DWF = 3PG + I + 3E

(The multiple of 3 for domestic and trade effluents allows for normal variations of these flows throughout the day, whereas infiltration does not vary significantly during the day).

Where:

- Dry Weather Flow (DWF) = P G + I + E
- P = Population served
- G = Water consumption / head / day (typically 150 litres)
- I = Infiltration *
- E = Trade Effluent Flow (litres)

*Infiltration should be measured where possible using measured night time flows at the sewage works. For smaller catchments infiltration may have to be estimated. Measurement is particularly important where SEPA is aware of significant infiltration (e.g. in an ageing sewer network where river inflow or saline intrusion may be occurring), this should be measured. Where groundwater levels are high, measured infiltration flows in winter are necessary.

Part Combined/Part Separate System

If there is a significant proportion of the catchment draining to a separate system use:

Formula A = DWF + 1360Pc + 2PsG + 2Et

Where:

- Pc = population served by combined sewer
- Ps = population served by separate foul sewer
- Et = trade flows from the total area

And

DWF = Pt G + It + Et

Where

- Pt = total population
- It = total infiltration

The definition of ‘significant’ immediately above is somewhat subjective, but it is suggested that, in catchments where less than 20% drains to separate sewers, the simpler combined formula should be used.

Formula A normally equates to approximately seven times the value of the Dry Weather Flow. Retention of flows (by for example, including a storm tank at the network CSO) in excess of Formula A may be required, depending on the available dilution. This is outlined later in this guidance (see section 4.2). In dry weather, instantaneous flows can increase substantially due to diurnal variation during peak periods, e.g. early morning and evening. However, peak flows may not arrive at the STW until several hours later depending on the size of the sewerage network, pumping station operation etc.

2.3.2 Storm Tank Design Flows

Storm tanks may be located on the sewer network or at various locations at a STW.

Storm tanks at the inlet to sewage treatment works will provide settlement for flows that exceed the design flow to full treatment (FFT). The industry design standard FFT is 3DWF (i.e. 3PG + I + 3E) and storm tanks should be capable of providing either 2 hours storage at FFT, or a storage volume equivalent to 68 litres per head, for flows in excess of 3DWF up to Formula A as detailed in Appendix H1 of the *UWWTR Guidance Note* or by sewer hydraulic and quality impact modelling. Once inlet flows have reduced below FFT, the contents of the storm tank should be returned to the head of the works to receive full treatment. This return can be made manually by operating a valve, or preferably automatically, when the inlet flow falls below a preset level.

If required, the capacity of storm tanks in the network, i.e. at pumping stations, will need to be based on environmental quality modelling. For example some pumping stations that pump direct to the STW pump FFT flows and have adequate storage based on 68l/h or 2hours at 3DWF or 2 hours at Formula 'A' – FFT. This is similar to what would happen at the treatment works but this reduces pumping requirements to the STW.

It should be noted that in addition to the above storm tanks, further storage capacity may have to be provided at the STW for CSOs on the inlet sewer depending on the available dilution (see section 4.2).

SEPA must be satisfied that the proposed capacity will meet the necessary water quality standards. Modelling is likely to be required for more significant discharges in accordance with Table 1 (section 4.2).

The modelling requirements will be the same for a CSO at a STW as a CSO on a network (see Table 1 for details).

2.3.3 Storm Tank Configuration

Why do we need Storm Tanks?

Storm tanks protect water quality by

- Reducing the frequency and strength of discharges.
- Delaying any discharge until rainfall increases receiving stream flows.

- Delaying the discharge until it is weak enough to have minimal impact.
- Increasing the total amount of sewage retained for pass forward or treatment.

Frequently the 68l/hd (or equivalent) storage requirement at STWs has been incorporated into the primary tanks by increasing their size. This arrangement, however, has the disadvantage that it does not capture the stronger first flush of sewage, but merely displaces the existing sewage in the primary tanks. Furthermore it does not delay the onset of a storm discharge and does not increase the amount of sewage passed forward for full treatment.

A more satisfactory arrangement consists of a storm tank of 68litres/head (or equivalent) provided as an entirely separate tank for the capture and treatment of storm sewage. Flows between FFT and Formula A are discharged to this tank which should be empty at the start of a storm and is emptied as soon as possible afterwards. Such an arrangement should therefore be considered where there is a water quality impact and a works comes to an appropriate stage in its lifetime for such a review.

The relative advantages of 'blind' versus 'flow through' storm tanks should be considered. In low dilution situations where multiple storm tanks may be provided, it may be preferable to have the first storm tank 'blind', since it stores the initial more highly polluting 'first flush'. In this case the first storm tank has no outlet and simply stores the "first flush" which is later pumped back through the treatment works. Should the storm conditions continue, the other storm tanks, which are ‘flow through’ will start to fill. However, by the time they overflow to the watercourse, the river flow should have risen to accommodate storm water flows. The advantage of 'flow through' tanks is that they allow at least partial settlement of the incoming sewage before overflow. Flow through storm tanks are the accepted practice at most STWs with storm tanks.

2.3.4 Pumping Station Emergency Design Flows

As described in Emergency Overflows (2.1.3), it is possible for new pumping stations on separate systems to be designed such that an emergency overflow is not required. Where the installation of an EO can be justified, then to minimise the risk of a discharge, the *UWWTR Guidance Note* advises a minimum storage capacity equivalent to 1-2 hours storage at 3DWF (3PG + I + 3E). However, overflows at sensitive locations may warrant significantly greater storage times.

Where operation of the EO would result in partially treated, secondary or tertiary treated effluent being discharged, precautions such as storage tanks may not be justified.

Should a CSO be required at the same location as a pumping station with an EO, there is a risk that if the pumps fail during a CSO overflow event, the result will be the EO operating i.e. the whole sewer volume discharging to the watercourse. The storage volume requirement at such a site should be assessed on a case by case basis as each discharge location will present different risks. In certain high risk situations the discharger should be asked to model the scenario of the CSO and the EO operating at the same time against 99%ile river standards to gauge the likely short-term effect on the river. This should demonstrate whether or not a storage requirement over and above the usual EO requirement will be necessary. See also section 4.3 in *WAT-SG-13*.

3. Licensing

It is desirable to have had pre application discussions with the applicant at the earliest possible stage. This will allow discussion of the options available, the required standards to be achieved and ensure adequate modelling/monitoring data collection is carried out.

Any network improvements must be agreed and delivered via the Quality and Standards (Q & S) investment process.

3.1 Sewer Network Licences Background

Scottish Water CSOs and EOs on sewer networks have been brought together into sewer network licences. These reflect the wider scope of CAR which can regulate activities such as sewage collection, as well as actual discharges of sewage.

Network licences change the focus from managing individual overflows to managing whole sewer networks. This links SEPA's approach to the output from drainage area studies undertaken by Scottish Water.

Network licences focus on the management and upgrading of sewer networks, therefore providing the most effective means of controlling the risks of pollution. For example, they allow SEPA to inspect against and for Scottish Water to demonstrate their compliance in relation to the management conditions, within the SNL.

Network licences allow SEPA to be more proactive in requiring flow data collection and specifying how sewers should be modelled.

The Scottish Water (Q&S) investment process typically involves the development of drainage area studies which provide the basis upon which SEPA's and Scottish Water's understanding of networks is progressed. The licensed network sectors are based upon the sectors used by these drainage area studies i.e. the network served by a particular STW. Network licences may lead to Q&S investment in strategic solutions to networks which are classified as unsatisfactory but individual asset improvements (eg screening) needs to be agreed between SW and SEPA.

The concept of network licences is consistent with the practice of licensing multiple activities in one document, such as for drinking water supply and hydropower schemes.

3.2 Licence Requirements

Licence conditions for intermittent sewage discharges define the structures required rather than the quality of discharge to be achieved. Although the application of numeric microbiological limits is possible, it is not practical to apply numeric standards in the majority of cases.

Licences should define:

- The acceptable spill setting which determines the storm water storage capacity and size of the downstream sewer
- The level of treatment required which determines the level of screening, settlement etc. to be provided prior to discharge
- The requirements for recording of intermittent discharge events and in-sewer flow monitoring
- The descriptive conditions which cover environmental standards such as "deposition of solids"

3.3 Licence Templates

3.3.1 Licence Templates

The following licence templates should be used as appropriate:

- *WAT-TEMP-06: Municipal Sewage Treatment Works Licence Template*
- *WAT-TEMP-07: Combined Sewer Overflow Licence Template (CSO)*
- *WAT-TEMP-08: Emergency Overflow Licence Template (EO)*
- *WAT-TEMP-67: Sewer Network Licence Template*

The sewer network licence template should be used for all network overflows licensed to Scottish Water, even if these only consist of a single overflow. Private (including PFI operated) overflows should be licensed using the CSO and EO templates. When private overflows are subsequently adopted by Scottish Water (for example a pumping station EO) then an application to include the overflow in the relevant network licence should be submitted to SEPA.

Sewer network licences authorise all Scottish Water overflows on the sewer network whether previously unauthorised or whether authorised by deemed registrations (previously COPA consents) or CAR licences.

NB Overflows within the boundary of a STW should normally be included within the STW licence and not the sewer network licence.

3.4 Licensing Existing CSOs or EOs

3.4.1 Background

In order to comply with the requirements of the UWWTR in relation to existing intermittent discharges, the *UWWTR Guidance Note* identifies unsatisfactory discharges (otherwise known as unsatisfactory intermittent discharges or UIDs) on the basis of six failure criteria:

- Causes significant visual or aesthetic impact due to solids or fungus or has a history of justified public complaint

- Causes or makes a significant contribution to a deterioration in chemical or biological status
- Causes or makes a significant contribution to a failure to comply with Bathing Water Quality Standards for identified bathing waters and/or Shellfish Waters
- Operates in dry weather conditions
- Operates in breach of licence conditions provided that they are still appropriate, and/or
- Causes a breach of water quality standards (EQS) or other EC Directive requirements.

An existing discharge which meets one or more of the above criteria is classed unsatisfactory and will require improvement to address the failing criteria only. For example, if the discharge is deemed unsatisfactory due to the presence of sewage solids in the watercourse, screening to the required standard will be the only substantial change when reviewing the licence.

3.4.2 Licensing Procedure

Existing overflows should be licensed ‘as is’ until investment is agreed by SW/SEPA via the Q & S process.

The first SEPA inspection focuses on checking of licence conditions and is a verification audit. Any consequent corrections to licence conditions should be achieved by a SEPA initiated variation.

However any subsequent changes that Scottish Water wish to make to the licence will be via an operator initiated variation. This would require an administrative variation fee if there is no increase in the environmental impact.

On the other hand, if there is the potential to increase the environmental impact (i.e. a reduced pass forward flow), then this would require a technical variation fee (refer to the CAR Charging Scheme guidance).

Guidance on undertaking sewer network licence inspections is provided in *WAT-SG-87: Compliance Monitoring for Sewer Network Licences*.

3.5 Licensing New CSOs or EOs

3.5.1 Applications for new CSOs to deal with sewer flooding

Sewer flooding risks are expected to increase as a consequence of climate change. These risks can be minimised by the progressive reduction of sources of surface water runoff into the combined sewer and reduction in groundwater infiltration into sewers.

As well as alleviating flood risk, reducing inflows to sewers has other benefits. These include freeing up sewer capacity for future development, reducing pollution from CSOs, reducing the power consumed by pumping and treating the excess inflows and recharging groundwater supplies. By reducing surface water inflows to sewers, the need for new CSOs should therefore be kept to the absolute minimum.

New or increased CSO discharges on an existing sewerage system are not normally an acceptable long term solution to inadequate sewer capacity or maintenance. However, a new CSO may be the best overall option as long as there is no unacceptable water quality impact.

3.5.2 Applications for new EOs

Refer to section 2.1.3.

3.5.3 Licensing Procedure

When a new Scottish Water overflow is constructed, an application should be submitted to include it in the relevant network licence (unless it is within the boundary of a STW). This will be achieved by an operator initiated variation and a technical variation fee. N.B. A variation fee applies to each overflow added (refer to the CAR Charging Scheme guidance).

The construction, modification or removal of an outfall at an overflow is considered as a dependent controlled activity that requires authorisation. The SNL template has a condition requiring the design and method statement for the outfall to be submitted and agreed by SEPA. This means that an engineering licence variation will not be required when an outfall is constructed/modified/removed.

Further information in relation to the modification of a SNL is held in the Regulatory Method *WAT-RM-09: Modifications to CAR Authorisations*.

4. Assessment of Receiving Waters / Determination of CSO Licence Conditions

4.1 Overview

The guidance below reflects developments in modelling techniques and SEPA's Environmental Policies, subsequent to issue of the UWWTR Guidance Note, and represent useful tools in determining the level of investigation required. The tables are based upon the principle of using minimum data requirements where appropriate, and are considered to be conservative approaches.

The *UWWTR Guidance Note* and the *Urban Pollution Management Manual* (UPM) advocate a graduated assessment of the level of investigation required to determine the impact of a CSO discharge on the receiving waters.

Any network improvements must be agreed and delivered via the Quality and Standards (Q & S) investment process.

4.2 Inland Waters

The first step in licensing a CSO is to consider the potential impact of the CSO discharge on the receiving water; this will determine the level of assessment required (see Table 1 below).

The UPM Manual and the UWWTR Guidance Note recognise that the costs of carrying out detailed sewer hydraulic modelling may outweigh any benefits in deriving precise storage requirements, particularly in simple situations of low sewer flow and high dilution (see Table 1). In such cases the required methodology is a step wise approach that applies Formula A standards for the most simple situation.

As dilution decreases and significance increases, progressively more detailed catchment modelling and water quality impact assessment is required. These methods may also be required for the more complex drainage situations. Modelling is carried out using either Fundamental Intermittent Standards (FIS) or 99%ile standards.

The assumption in Table 1 is that simple models and standards produce conservative (or protective) solutions. Therefore Formula A produces a more protective solution than 99%iles using simple modelling, and similarly 99%iles result in a more protective solution than FIS standards using complex modelling. However this assumption may not be valid in all circumstances (contact SEPA's Environmental Modellers for advice).

FIS have been developed for dissolved oxygen (DO) and un-ionised ammonia. These standards are expressed in terms of concentration/duration thresholds for a range of return periods. If a river meets these standards with the proposed intermittent discharge then the aquatic life in the river should have adequate protection against the effects of short term exposure to storm sewage discharges.

- 99%ile standards are used when mass balance calculations form the basis of the modelling. Repeated mass balance calculations are carried out to estimate a frequency distribution of the determinand for the river downstream of the CSO discharge. The 99%ile value from this distribution can then be checked against the standard.

The approach to be adopted should be ascertained from reference to Table 1 below and agreed with the applicant at pre-application discussion stage. Refer to the UPM for more details of use of 99%iles and FIS.

Modelling may produce a range of solutions such as additional storm storage, increased sewer capacity downstream (pass forward flows), relocation of discharge to less sensitive location and removal of surface water inflows.

Table 1 Indicative impact assessment criteria: Discharge to freshwater

Low Significance Discharges

- Dilution greater than 8:1 (foul DWF @ 5% low river flows), and
- There is no interaction with other discharges

Both criteria should apply, if not compare against Medium significance criteria.

SEPA will accept minimum data methods (e.g. simple mass balance calculations) for low significance discharges. Minimum pass forward flow at overflows based on Formula A will be adequate for the majority of cases meeting the above criteria. This assumes that available dilution will be sufficient to protect the river quality class. Where an environmental problem is known more detailed modelling may be required.

Medium Significance Discharges

- Dilution less than 8:1, and
- There is no interaction or limited interaction with other discharges, and
- The population equivalent is less than 10,000

Where all the above criteria apply, SEPA will accept the schemes demonstrated in accordance with the 99 percentile quality standards for the designated river class. Where all the above criteria apply, SEPA will accept the schemes demonstrated in accordance with the Scottish Development Department (SDD) methodology (Table 2) provided that they demonstrate compliance with the 99 percentile quality standards for the designated river class. Simple stochastic river impact modelling, applied in association with sewer hydraulic models, should be adequate for the majority of medium significance discharges.

FIS is generally the best option. This will be acceptable to SEPA provided that, where there is a risk of deterioration in river quality, the sewerage authorities can demonstrate that the proposed scheme allows the appropriate 99 percentile river class standards to be met. In all other cases, it will be sufficient to demonstrate that the proposed scheme will achieve the relevant 90 and 95 percentile river class standards.

High Significance Discharges

- Dilution is less than 2:1
- Interaction with other discharges
- population equivalent is greater than 10,000

Where any of the above criteria apply, SEPA may require the demonstration of compliance with appropriate FIS. Detailed flow and quality modelling should be applied to appropriate wastewater system and receiving water components to generate river quality results for comparison with the FIS.

For FIS schemes that improve river quality, it will be sufficient to demonstrate that the proposed scheme will achieve the relevant 90 (or 10) and 95 percentile river class standards and that the cost of meeting the 99 percentile class standards is disproportionate to the benefit of meeting the 99 percentiles.

Where there is a risk of deterioration in river quality, FIS solutions will only be acceptable provided that the sewerage authorities can demonstrate that the proposed scheme allows the relevant river class 99-percentile quality standards to be met.

Where dilution is less than 8 fold, higher pass-forward flows or storm water storage facilities will be required to protect the receiving water. The storage capacity will be dictated by the output from a modelling exercise carried out by the Water Authority. This may involve adoption of the Scottish Development Department Method, detailed in Table 2 below.

Table 2 Scottish Development Department Method (SDD Method)

Dilution Available	Percentage Spill	Overflow Arrangement
8	100	Formula A
4	50	Formula A + 40 l/hd storage
2	25	Formula A + 80 l/hd storage
1	12	Formula A + 120 l/hd storage

Early consultation with colleagues, especially Environmental Modellers (Environmental Assessment Unit - EAU) and Hydrologists, is advised since there are a wide range of river and sewer modelling techniques, with any combination of simple and complex models.

The 99%ile and FIS standards can be found in the UPM Manual and are related to typology. The typology for the receiving watercourse can be obtained from GIS

SEPA modellers should verify the output from models used by the Water Authorities or agents. Separate guidance on modelling is included in the following

- *WAT-RM-28: Modelling for Water Use Activities*
- *WAT-SG-02: Modelling Continuous Discharges to Rivers*
- *WAT-RM-37: Regulation of Discharges to Freshwater Lochs*
- *WAT-SG-11: Modelling Coastal and Transitional Discharges*

Microbiological standards are discussed in section 4.3 on Coastal and Transitional Waters but it should be noted that some inland waters may also be designated as Bathing Waters. In this case the same standards would apply. It is particularly important that new discharges of intermittent sewage to standing waters (freshwater lochs) and discharges which may affect drinking water sources (including rivers) are avoided where possible.

4.3 Coastal and Transitional Waters

The water quality standards that must be met by intermittent discharges to coastal and transitional waters are detailed in *WAT-RM-13: Regulation of Microbiological Discharges*.

4.3.1 Modelling Requirements

The criteria for determining modelling requirements for CSOs discharging to coastal and transitional waters is provided in Table 3 below, reproduced from Annex H of the *UWWTR Guidance Note*.

Table 3 Indicative impact assessment criteria: Coastal and transitional discharges

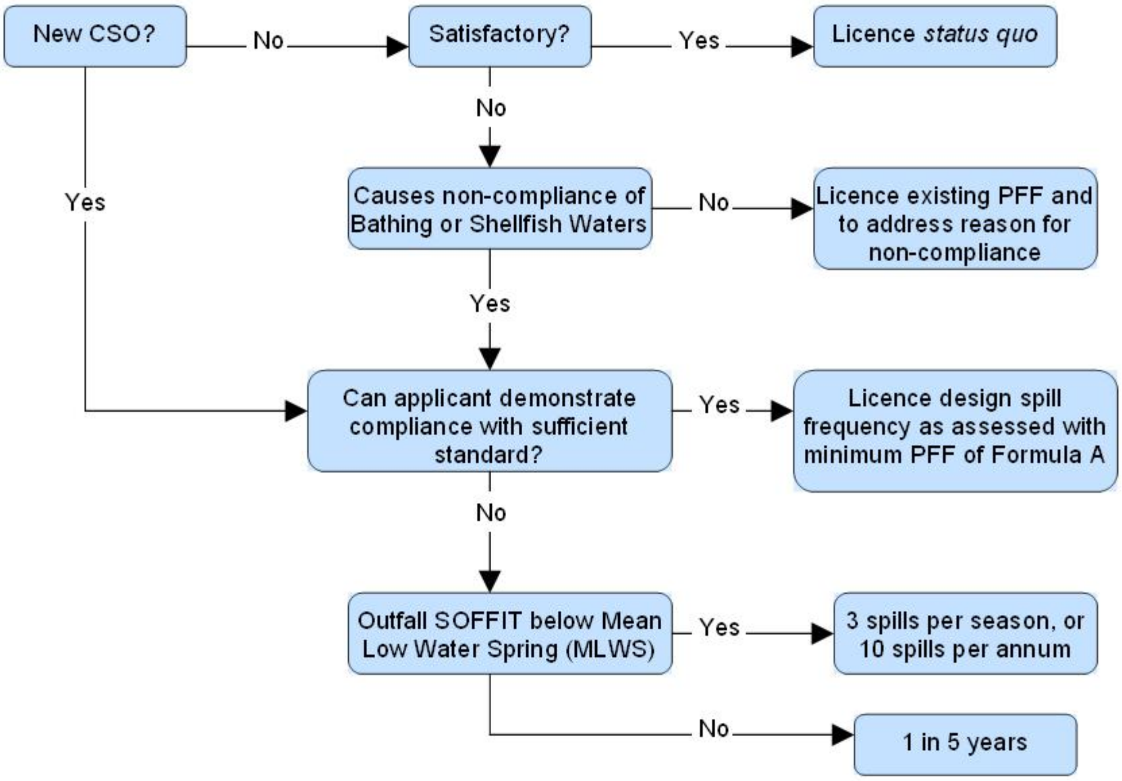
Low Significance
Minimum data methods (e.g. "Formula A") • No EC identified Bathing or Shellfish Waters • No interaction with other discharges
Medium Significance
Simple Models (sewer hydraulic model with frequency assessment of overflow spill) • Population Equivalent 2,000 - 10,000 • Affects identified Bathing or Shellfish Waters This approach is likely to be required only if both criteria apply.
High Significance
Complex models (sewer hydraulic model with frequency assessment of overflow spill and an option for coastal dispersion model and impact assessment) • Population Equivalent >10,000 • Affects identified Bathing or Shellfish Waters This approach is likely to be required only if both criteria apply.

4.3.2 Spill Frequency

New intermittent sewage discharges to sites designated as Bathing Waters or classified as Shellfish Waters should be avoided where possible. However, where unavoidable and justification is agreed with the applicant, the minimum design criteria should be such that spills do not exceed 3 significant spill events per bathing season into bathing waters or 10 significant spill events per annum into shellfish waters, unless the applicant demonstrates compliance with water quality standards through modelling. A spill of >50m3 will be deemed significant. Where there are multiple, intermittent discharges to the same identified water then these will be assessed on aggregate.

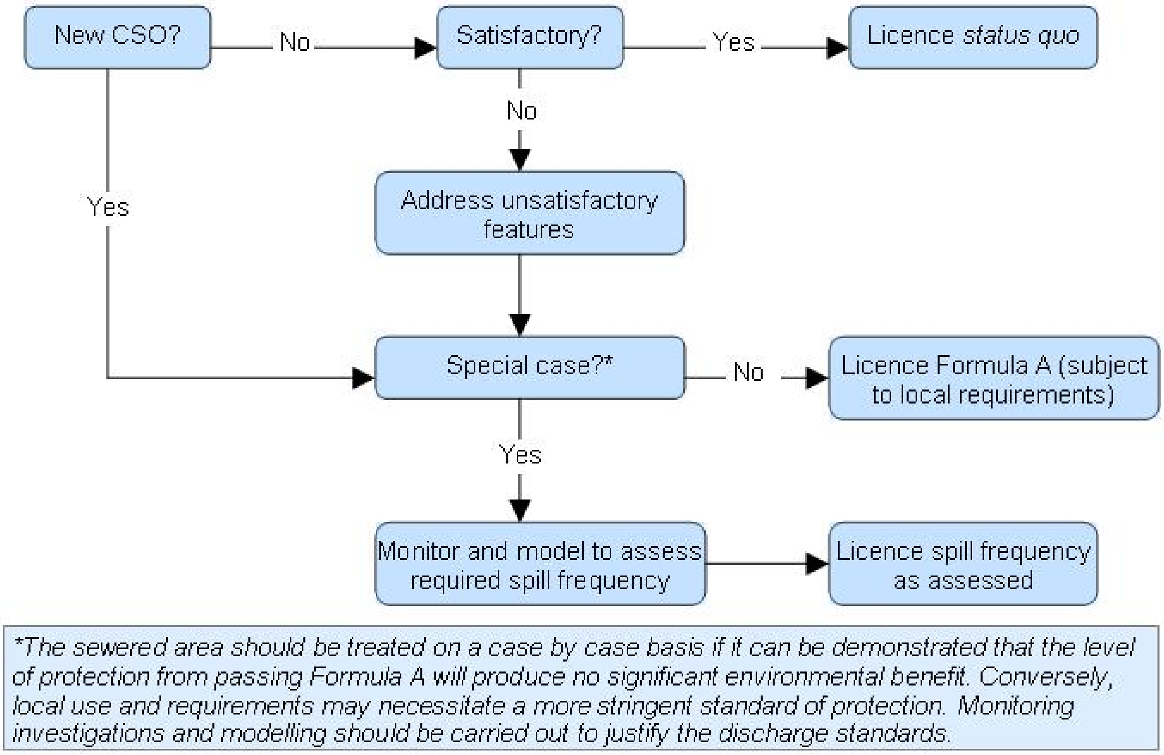
The following figures summarise the licence criteria for intermittent discharges to waters in relation to the required microbiological quality standards to be achieved in the receiving waters.

Figure 2 Summary of CSO Design Criteria (for discharges in waters where Microbiological Quality Standards apply: Bathing Waters, Shellfish Waters)



**For discharges to identified Bathing Waters or Shellfish Harvesting Waters demonstration of design to achieve compliance with Good Standards as a 95%ile is required in addition to compliance with Sufficient Standards as a 90%ile.*

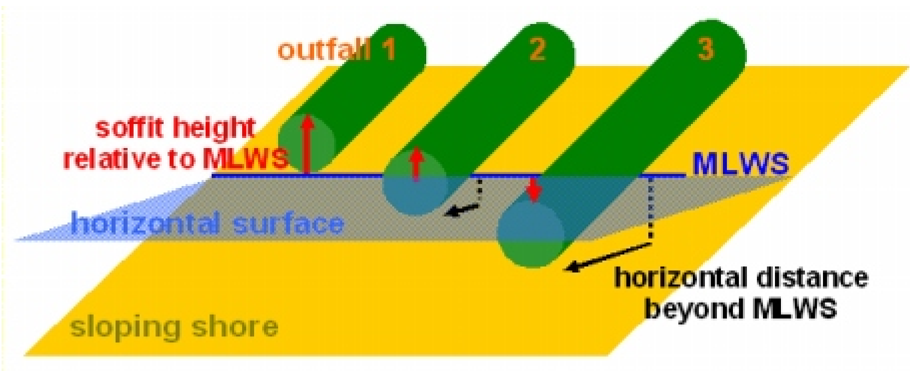
Figure 3 Summary of CSO licence requirements (for discharges in waters where no Microbiological Quality Standards apply)



4.3.3 Outfall Location

All new CSO outfalls discharging to coastal and transitional waters should have the top of the pipe (soffit) to below the level of Mean Low Water Spring (as shown in Outfall 3, Figure 4 below) unless exceptional circumstances apply. Further guidance on exceptional circumstances is provided in the *UWWTR Guidance Note*.

Figure 4 Outfalls discharging at, beyond and below MLWS



- Outfall #1 discharges at MLWS, and its soffit is above MLWS
- Outfall #2 discharges beyond MLWS, and its soffit is above MLWS
- Outfall #3 discharges beyond MLWS and its soffit is below MLWS

4.4 Screening and Maintenance Requirements

Treatment requirements for CSOs will almost exclusively relate to the level of screening required to control aesthetic impacts arising from the discharge of solid materials. In very specific cases, treatment may extend to settlement facilities (e.g. storm tanks). The level of screening required is determined on the basis of the receiving water amenity use (see Table 4 and Figure 5).

New discharges of intermittent sewage to classified shellfish waters, designated bathing waters, freshwater lochs and discharges which may affect drinking water sources should be avoided where possible, unless unavoidable and justification is agreed with SEPA. For existing unsatisfactory discharges, the level of screening specified in Figure 5 below should be provided.

4.4.1 Minimum Screening Requirements for CSOs

Table 4 and Figure 5 below represent SEPA's minimum requirements for screening. However, Scottish Water may choose to put in two dimensional 6mm screens at CSOs predicted to overflow more frequently than 1 in 5 years. For those predicted to discharge less frequently than 1 in 5 years, no screening is required unless there is a particular environmental need.

Screens normally have a bypass to prevent flooding if the screen becomes blinded. The screen should be designed so that it has sufficient hydraulic capacity to cope with events up to and including the 1 in 5 year event without becoming blinded and bypassed.

Screens can either be static or mechanically raked. Scottish Water will determine whether put in a static or manual screen. Static screens will begin to blind when the overflow operates, therefore additional screen area should be considered to account for this.

The screen must be designed to cope with the frequency and duration of spills predicted from the time series analysis.

Account should be taken of the screen cleaning regime planned. In addition screens should be oversized to cope with situations where the influent to the overflow is likely to be highly loaded with debris. An example of where this is relevant is where the sewered catchment has only partly combined drainage. Another example is where upstream sewers are laid at slack gradients. This can lead to solids settling out in dry weather and being flushed to the screens during storm.

For a given flow rate, mechanical or auto-cleaning screens are generally smaller in area than a static screen of equivalent capacity. Therefore if the raking mechanism fails the screen will blind more quickly and bypass more readily. Where mechanically raked screens are installed, telemetry is required to notify the operator in the event of screen failure.

Retrofitting screens to an existing chamber should only be undertaken where the engineer is confident the installed screen and chamber achieve the objectives for screening performance and are not bypassed. Evidence to support the design should be provided in support of licence applications. Post scheme appraisal monitoring may be required to confirm retrofitted screens are not bypassed more often than once in 5 years on average.

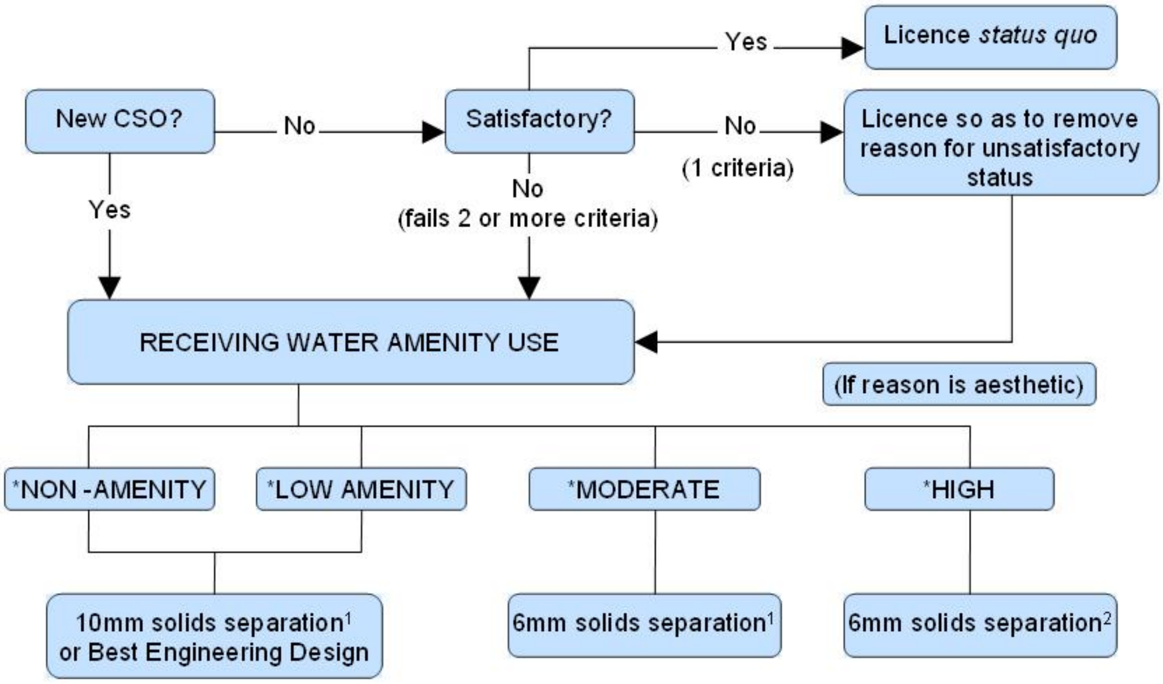
Screens and chambers must be designed not to increase flood risk. This is particularly important when retrofitting screens to existing chambers.

Screening requirements should be discussed with the operator at an early stage.

Table 4 Description of Amenity Categories

High Amenity
Influences an area: • Where bathing and water contact sport (immersion) is regularly practised (e.g. wind-surfing, sports canoeing); • Where the receiving watercourse passes through a formal public park or there is a formal picnic site; • Designated (and classified for harvesting) Shellfish waters, • Designated Freshwater Fish waters. • Waters designated under the Wild Birds and Habitats Directives that are Sensitive Areas.
Moderate Amenity
Influences an area where: • There is boating on the receiving water • There is a popular footpath adjacent to the watercourse • A watercourse passes through a housing development or frequently used town centre area (e.g. bridge, pedestrian area, shopping area) • There is recreation and water contact sport (non-immersion)
Low Amenity
Influences an area where there is: • Basic amenity use only; • Casual riverside access used on a limited or infrequent basis, such as a road bridge in a rural area, footpath adjacent to a watercourse.
Non-Amenity
Influences an area which is: • Seldom or never used for amenity purposes; • Remote or inaccessible.

Figure 5 Summary of CSO Screening Requirements



1. 0 applies to all flows up to a 1:5 year rainfall return period
2. For high amenity use, screening of flows for a return period greater than 1:5 may be required.

4.4.2 Maintenance Requirements for CSOs

Mechanically raked screens should be automatically cleaned. However static screens if not properly cleaned, can blind and the bypass can operate, resulting in the premature discharge of unscreened sewage. In order to avoid this, an appropriate screen cleaning regime should be implemented based on the requirements of the individual CSO.

Overflows that are known to operate more often may need more frequent cleaning. In order to plan efficient cleansing visits, telemetry can be used to indicate when a spill has occurred and also when the screen is bypassed (for instance due to the screen being blinded).

It would be good practice to record the degree of blinding of the screen prior to cleansing and compare this with design expectations. Repeated excess blinding may require a redesign of the screen or chamber.

CSOs can suffer from structural deterioration, for instance due to loose bricks falling out causing a partial blockage. These obstructions can quickly rag up with silt building up behind leading to a dry weather overflow. Premature overflows can also be caused by sediment build up due to slack gradients. Drainage Area Studies may provide useful information in this regard.

4.4.3 Minimum Screening Requirements for EOs

12-18mm bar screening is acceptable, however the discharger may chose to put in 10mm bar screening.

4.5 Monitoring and Telemetry

4.5.1 Screen Monitoring/Telemetry

Where mechanically raked screens are installed, telemetry must be installed to notify the operator in the event of screen failure.

Monitoring of screen operation, performance and bypass operation may be required as a licence condition and may include the requirement for telemetry to notify the operator of screen operation or bypass.

Screen monitoring may be required due to one or more of the following reasons –

- Post scheme appraisal monitoring to confirm screen not bypassed more than 1 in 5 years on average.
- Sensitive receiving water environment
- Uncertainty in capacity of proposed screen or performance of retrofitted screen
- previous poor performance
- to notify the operator of a need for a clean up of sewage debris downstream.

The operator may wish to apply additional monitoring to that required by the licence in order to identify the need for manual screen cleansing or a sewage debris clean up.

4.5.2 Overflow Monitoring/Telemetry

Modelling of CSO spill frequency is based typically upon very limited sewer flow data. The installation of event monitors or flow loggers or the provision of access facilities to install these monitors needs to be considered for all new and modified CSOs. However the installation of event recorders and particularly flow monitoring devices can constitute a significant proportion of scheme costs. For the majority of schemes, once the collection system has been brought up to UWWTR standards, or an existing intermittent discharge has been categorised satisfactory; the need for monitoring is minimal.

Flow/event monitoring requirements at STWs are detailed in Table 1 of *WAT-SG-13*.

Figure 6 summarises the requirements on the basis of environmental risk to the receiving waters.

Event Monitoring

Event monitoring provides the date and start and stop time of overflow events. Such monitoring may be required for a number of reasons:

- To validate model predictions and to ensure that sufficient data is available for future reviews
- To ensure that spill frequencies/volumes are as modelled and designed, specifically at medium or high sensitivity sites
- To investigate water quality problems which may arise from premature operation

Installation of these monitors may be temporary.

Discharges liable to impact bathing and/or shellfish waters may require the installation and use of event monitors to provide an annual record of spill frequency and to enable SEPA to audit performance against the design spill standard.

Networks serving >2000pe with <8:1 dilution require overflow event recorders for new or modified overflows.

Flow Monitoring

In-sewer flow monitoring provides more useful information than event monitoring which is dependent on rainfall events and characteristics.

Flow monitors can provide information on whether pass forward flows are being maintained or dry weather flows being exceeded and can also provide estimates of spill volumes.

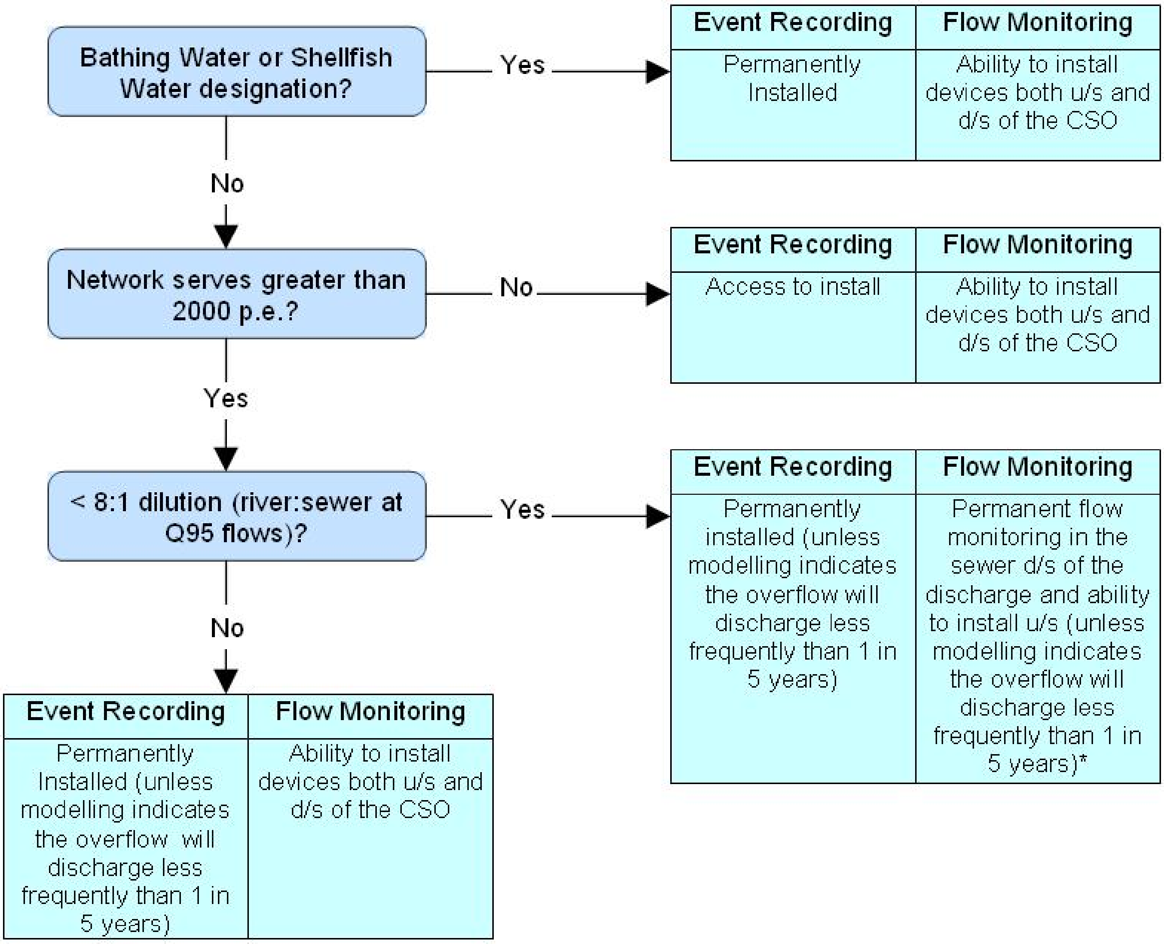
If the design spill frequency for discharges liable to impact bathing and/or shellfish waters is exceeded and/or there are impacts on water use, the installation of flow monitoring devices in the upstream and downstream sewer may be required.

In addition, for discharges >2000pe where a discharge is to a watercourse where the flow is less than 8:1 dilution (river Q95 flow :sewer DWF) then flow monitoring is required, except in the 2 situations below:

Where there is a gravity sewer downstream with an overflow which cannot be adjusted. However permanent flow monitoring is required where pass forward flows may be controlled by an adjustable penstock, weir plate, or by variations in pumping (i.e. CSOs at pumping stations).

Where the modelling indicates that the overflow will discharge less frequently than 1 in 5 years.

Figure 6 Event Recording and Flow Monitoring requirements for New and Modified CSOs on the Sewer Network



* Unless this is a gravity sewer downstream with an overflow which cannot be adjusted.

If licence says reporting or recording should be ‘as agreed in writing with SEPA’, then it should be decided whether this is required. This should be done on a risk assessed basis – i.e. reporting required for higher risk/low dilution situations.

4.5.3 Sewage Pumping Stations with Storm Overflows

These should be dealt with as for CSO structures as detailed above. However, a measurement of pump capacities can provide the pass forward flow, and a record of pump run-times may enable estimations to be made of the volumes of sewage passed forward. It should be noted however that pump rates may deteriorate over time. In high-risk locations event recorders and inlet flow structures/recorders may be justified as detailed above.

4.5.4 Recording and Reporting

The details of recording and reporting vary according to the licence.

For flow monitors this may include the pass forward flows and DWF.

For event monitors this may include the start/stop time and date of each overflow event.

Further details for STWs are provided in the Recording and Reporting sections in section 2 of *WAT-SG-13*.

For overflows on the sewer network, routine reporting should be conditioned in the licence if there is an environmental need such as low dilution.

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 (*www.sepa.org.uk/water/water_regulation/guidance.aspx*).

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-09: Modifications to CAR Authorisations*
- *WAT-RM-13: Regulation of Microbiological Discharges*
- *WAT-RM-28: Modelling for Water Use Activities*
- *WAT-RM-37: Regulation of Discharges to Freshwater Lochs*

- *WAT-SG-02: Modelling Continuous Discharges to Rivers*
- *WAT-SG-11: Modelling Coastal and Transitional Discharges*
- *WAT-SG-13: Municipal Sewage Treatment Works (STW)*
- *WAT-SG-87: Compliance Monitoring for Sewer Network Licences*

- *WAT-TEMP-06: Municipal Sewage Treatment Works Licence Template*
- *WAT-TEMP-07: Combined Sewer Overflow Licence Template (CSO)*
- *WAT-TEMP-08: Emergency Overflow Licence Template (EO)*
- *WAT-TEMP-67: Sewer Network Licence Template*

Other References

- *Urban Pollution Management Manual* Third Edition, Foundation for Water Research (www.fwr.org)
- *Urban Waste Water Treatment (Scotland) Regulations 1994* SSI No. 2842 (www.legislation.gov.uk)
- *Urban Waste Water Treatment Regulations Guidance Note* Scottish Office 1998, (http://www.sepa.org.uk/water/water_publications.aspx)

- End of Document -