How to comply with your environmental permit
Additional guidance for:

Water Discharge and Groundwater (from point source) Activity Permits

(EPR 7.01)

We are the Environment Agency. It's our job to look after your environment and make it a better place – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

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Record of changes

Version	Date	Change
1.0	April 2010	Issued for launch of EPR10
2.0	April 2011	Minor amendments and format changes. Addition of Annex 12 relating to habitat regulations assessments.
3.0	October 2012	-Minor amendments, typos & corrections. -Removal of Annex 12 relating to habitat regulation assessments which are to be carried out in house. OI been revised and reissued April12. -Section 2.7.2.4 Minimum pathogen removal requirements updated. Disinfection section Q80 error correction in section 2.3.1.2 -Clarifying text: 3.3, 3.3.1, 4.2.3, 4.2.5, 4.2.6, 4.4 - Section 4.2 clarification of differential limit permit compliance. -Annex 7 Trade operations - Fish farms updated -Annex 8 Trade operations – Cress farms updated -Standard Rules Permit 3 following Consultation 8. -Inserted new Annex 12 of existing guidance on Setting upper tier limits for sanitary discharges of BOD and ammonia.

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Introduction

This Technical Guidance Note (TGN) applies to sewage and trade effluent discharges that come under “water discharge activities” or “groundwater activities” as defined in the Environmental Permitting (England and Wales) Regulations 2010 (the Regulations) (EPR 2010).

This guidance supports overarching Environmental Permitting Regulations documentation. It provides specific guidance for permit applications and compliance where more detail is required.

The key aspects of your treatment process that you will need to manage well in order to ensure continuing compliance with your permit and to reduce risk to the environment are set out in ‘How to Comply with your Environmental Permit’ and this Technical Guidance document. Our compliance assessment effort is likely to focus on these areas.

If you have, or are considering, a small sewage effluent discharge (5 m3/d or less to surface water or 2 m3/d or less to ground), you may qualify for an exemption from the need to have a permit, in which case you **may not need** to read this technical guidance note. Return to our Internet site and select Septic tanks and small sewage treatment plants guidance which will provide you with the most up to date information in relation to this issue. This will help you decide if your discharge can qualify for an exemption. You should note that there is a difference in approach with respect to exemptions depending whether you live in England or Wales – our website explains the latest situation.

A Standard Permit may be appropriate for qualifying:

- sewage effluent discharges (5 to 20 m^3/day to surface water)
- discharges or cooling water up to 1000 cubic metres per day of water from a cooling circuit or heat exchanger, to inland freshwaters, coastal waters or relevant territorial waters

For existing small sewage treatment systems that do not qualify for an Exemption or Standard Permit, sections of this TGN will apply to you. Please see below

The Environment Agency also periodically issue Low Risk Position Statements for ativites where, if your discharge complies with the requirements set out in the relevant Low Risk Regulatory Position Statement, then you do not need a permit for that discharge.

These statements are periodically reviewed and further ones may be added, with examples being such as:

- The discharge of water from heat exchange systems used to heat or cool single domestic properties.

- Temporary water discharges from excavations.

Introduction

Introduction

Please be aware that you may require other permits and permissions to make your discharge other than your stand alone EPR water discharge or groundwater activity permit. Further guidance may be obtained in relation to other permits regulated by the Environment Agency by looking at out web pages, checking the pre application flow chart and or contacting our Nationall Customer Contact Centre on 03708 506 506.

Why and how we regulate your discharge

Why and How we regulate your discharge

What's in this section?

Clarification of terms used

Discharges to Ground - for the purposes of this TGN, effluent discharges to ground are those for which the discharge is made into some form of infiltration system such as a drainage field or drainage mound. The effluent will ultimately drain through the underlying soil and rock until it enters groundwater.

Groundwater - is all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. In other words the water below the water table.

Infiltration System - A series of infiltration pipes, placed in either single trenches or one large bed, used to discharge effluent in such a way that it percolates into the disposal area.

Domestic sewage effluent – we have recently revised our interpretation of 'domestic sewage' as that arising from normal domestic activities, wherever carried out. See Annex 6.

Trade effluent - is defined as effluent discharged from any premises carrying on a trade or industry and is taken to mean an effluent generated by a commercial enterprise where the effluent is different to that which would arise from domestic activities in a normal home. See Annex 6.

This revision in interpretation will enable small businesses the opportunity, if they qualify, to benefit from exemptions and Standard Permits under the Environmental Permitting Regulations 2010, in line with our duties and Government and Environment Agency policy. Further guidance is provided in Annex 6.

For the purposes of this TGN, **surface waters** means any inland freshwaters, coastal waters or relevant territorial waters i.e. water which is above the surface of the ground.

Why and how we regulate your discharge

Inland freshwaters, coastal waters and relevant territorial waters have the meanings given in section 104 of the Water Resources Act 1991.

For the purposes of this TGN, inland waters covers rivers above the freshwater limit and any lake or pond (natural or artificial) which discharges into another river or waterbody.

Exempt registration - Certain activities are exempt from the requirement to have an environmental permit. In order to qualify for an exemption, your discharge or activity must meet certain criteria. If you cannot meet these criteria you will need to apply for a permit. See guidance on our website for the most up to date information in relation to the Registration issue.

Regulated facility – The Regulatory Guidance Note RGN2, gives details on the scope of the regulated facility for a stand alone water discharge or groundwater activity. Essentially it includes the equipment essential to the discharge activity and the site on which the equipment sits, including the discharge pipe and the outlet point. This may not be owned by the operator of the discharge, and or they may not own the land through which it passes so additional permissions may be required outside the EPR permit. We would not normally require any detail of such agreements, but may want to see some evidence that they have been agreed. The plan attached to a stand alone water discharge or groundwater activity which identifies the extent of the regulated facility (usually in green) would include these elements.

Standard permit - Standard permits are for lower risk discharges. We don't need to make a site-specific decision about your application provided your discharge meets the standard rules. Further information on these can be found on our web site and in Annexes to this technical guidance note.

Why we regulate discharges

We regulate potentially polluting point source discharges into the water environment to protect appropriate uses of the water, to relevant quality standards.

How we regulate discharges

The Environmental Permitting Regulations 2010 change existing discharge consents which do not automatically become exempt registrations (Registrations guidance) into either an Environmental Permit for a water discharge activity (WDA) or an Environmental Permit for groundwater activity (GWA).

Low risk sewage discharges that meet qualifying criteria can be regulated via Exempt Registration or Standard Permit. Technical Guidance for Exempt Registrations is now also published on our web site.

Information on which types of discharge can be permitted by applying for a Standard Permit, is given on our website.

Why and how we regulate your discharge

There are suites of standard rules for some water discharge activities. These can be found via our website. Additional available guidance will be found in our document 'How to Comply' and under the Standard Rules annexes of this TGN.

Directives

Our approach to the permitting of water discharge and groundwater activities ensures that EPR 2010 delivers the requirements of the relevant European Directives .

Our document Regulatory Guidance Series, No EPR4 Setting Standards for Environmental Protection provides further information and guidance on how our regulatory package sets the standards of environmental protection required by the Regulations. It is not essential to read EPR4 but it will provide you with additional knowledge of the basis for our regulatory approach.

Enforcement

Details of our normal enforcement response for offences we regulate, such as permit breaches, can be found in the Guidance for the enforcement and sanctions statement and allied guidance.

Permits for Groundwater Activities

For sewage effluent discharges to ground/groundwater which do not qualify for an exemption and all trade effluent discharges, you need to apply for a bespoke permit - link to application forms page.

For guidance on how to carry out a groundwater risk assessment in support of a permit application for sewage and trade effluents to ground, follow EPR H1 Guidance - Appendix (j) Groundwater – General Guidance" and its supporting module on "Groundwater Risk Assessment for Treated Effluent Discharges to Infiltration Systems". However, note that in the case of discharges of sewage of less than 15m^3/day, we may be able to do the initial risk assessment for you.

For general information and guidance to the Agency's position statements on discharges to ground refer to the Groundwater Protection: Policy and Practice, particularly GP3 Part 4.

There is guidance below for existing discharges to ground.

Why and how we regulate your discharge

Permits for Water Discharge Activities

For effluent discharges to surface waters which do not qualify for a registered exemption or standard permit you will need to apply for a bespoke permit (follow this link to Application forms and Guidance).

For guidance on how to assess the risk of your discharge, follow link to EPR H1 Guidance – Appendix (d) for basic, precautionary, risk assessment or Appendix (e) for the complex risk assessment - in many cases you can elect for us to do this assessment for you.

Documents How to Comply with your Environmental Permit and Environmental Management Systems H6, provide guidance in addition to this TGN document. For sewage discharges up to 20 m3/d there is also a management toolkit to assist operators – see H6 Annex.

Environment Agency owned and operated sites

Discharges from sites owned by the Environment Agency are covered by the EPR 2010. These will be determined within the Environment Agency by our National Permitting Service.

Key Principles

Key principles

What's in this section?

Discharges of surface water runoff

Discharges of uncontaminated surface water do not need a permit. Wherever possible, the Environment Agency does not want surface waters to become contaminated and pollution prevention methods should be used to prevent contamination.

If you discharge surface water that could become contaminated you should refer to our Pollution Prevention Guidelines (PPGs), especially **PPG1 (General Guide)**, **PPG 2 (above ground oil storage tanks)** and **PPG3 (Use & design of oil separators)**, for advice. Other **PPGs** may also be relevant depending upon the nature of your site and the activities that take place on it.

We will only grant a permit for a discharge of contaminated surface water if stopping the contamination is unsustainable, and the contamination would not pollute the receiving water.

Discharge of surface water from public roads and parking areas is generally considered acceptable if it has passed through a well-designed and maintained oil separator or sustainable drainage (SUDS) system. Additional guidance on SUDs is covered below.

Trade effluents, such as wash water or cooling water, discharges from construction sites (see also our regulatory position statement on temporary water discharges from excavations) should be kept separate from run-off water. You do need a permit to discharge trade effluents.

Discharges in sewered areas and not using cesspools

The Environment Agency expects developments discharging domestic sewage to connect to the public foul sewer where it is reasonable to do so. We will not normally grant a water discharge or groundwater activity permit for a private sewage treatment system where it is reasonable to connect to the public foul sewer.

We also expect discharges of trade effluent to connect to the public foul sewer, where it is reasonable to do so, and subject to the sewerage undertaker granting a trade effluent consent or entering into a trade effluent agreement.

Key Principles

We will oppose the use of private sewage disposal facilities within publicly sewered areas as environmentally unacceptable and object to such proposals at the planning stage, unless the applicant can demonstrate it is either impracticable or not cost-effective to connect to sewer. Accordingly, we may not permit a discharge to inland freshwaters from a proposed private sewage treatment facility in a sewered area.

Connection to a public sewer is the preferred option in all the hierarchies of connection listed in the table below. Developers need to demonstrate to us that they have fully explored all the ways their development might connect to a public foul sewer.This table shows the hierarchy of connection to public sewer.

	Building Regulations	**DETR March 1999 / WO Circular October 1999**	**Planning Policy Wales (March 2002)**
1	Public sewer where reasonably practicable	Public sewer where feasible	Public sewer where feasible
2	Private sewer connecting to a public sewer	Package sewage treatment plant	Private system
3	Private sewage treatment plant (including septic tanks)	Septic tank	-
4	Cesspool	-	-

Where non-mains drainage is proposed in an area where it appears to be reasonable to connect to the public sewer we will, as a minimum, expect an applicant to have approached and received a formal response from the relevant sewerage undertaker regarding connection under s98 or s106 of the Water Industry Act 1991.

Lack of capacity, or any plans to improve capacity, in the sewer is not a valid reason for a sewerage undertaker to refuse connection under section 106 WIA 1991. Where a sewerage undertaker refuses to allow connection under s106 on the grounds of lack of capacity the operator may appeal to Ofwat. We may refuse to issue a water discharge activity permit in such circumstances.

Development should be matched to capacity or, where new capacity is required, put in place before a development occurs or is occupied. This approach is also supported by Planning Policy Statements 11 and 12 and Annex ‘A’ of 23 (Planning and Pollution Control) (Office of the Deputy Prime Minister 2004), Planning Policy Wales (March 2002) and case law. Our report Hidden Infrastructure clearly explains the benefits of this approach.

Key Principles

Cesspools

We do not accept the promotion or proliferation of cesspools as a viable long-term sewerage option in anything other than exceptional circumstances. The grounds for this are pollution prevention, environmental protection and sustainability. In our view, environmental, amenity and public health problems can potentially arise from the inadequate operation and maintenance of cesspools. In certain circumstances, such as existing dwellings where there is no other suitable or viable alternative option, the use of cesspools may be acceptable. The Department of the Environment Transport and the Regions (DETR) Circular 3/99 (WO 10/99), Planning Requirement in Respect of the Use of Non-Mains Sewerage Incorporating Septic Tanks in New Development, provides advice on exercising planning control and discourages using cesspools.

Small package plants design

Package plants should be designed and built to British Standards.

The maximum daily volume should be calculated using the methodology outlined in the British Water code of practice "Flows and Loads 3". This code of practice, which is endorsed by the Environment Agency, has two prime uses. Firstly, it should be used to determine the required capacity of a package plant at the design stage. Secondly, it is used to set the maximum daily volume which appears in your permit.

In your permit application, you will be asked to provide information to support the maximum daily volume for which you are applying. If this supporting information is based accurately on "Flow and Loads – 3", then this will meet the Agency's requirements, and the figure you provide for maximum daily volume will be used in the permit.

For most small package plants, the maximum daily volume will be very much less than 50 m^3/d, and only in very exceptional cases will you be required to monitor the effluent flow rate.

Calculation of effluent flow from small sewage package plants

Small package treatment plants should be designed and sized according to the advice given in Flows and Loads 3, published by British Water. Volumes for larger plants should be calculated based on expected flows arising from the development. In all cases, it is the responsibility of the permit holder to ensure that the flows discharged from the system are no greater than the permitted volume.

A treatment system for a single house with up to and including 3 bedrooms must be designed for a minimum population (P) of 5 people.

Key Principles

The size of a treatment system for a single house with more than 3 bedrooms must be designed by adding 1 P for each additional bedroom to the minimum single house value of 5 P, e.g.:

- House with 3 bedrooms = minimum 5 P system
- House with 4 bedrooms = minimum 6 P system (5+1)
- House with 6 bedrooms = minimum 8 P system (5+3)

For groups of small 1 and 2 bedroom houses or flats:

- Flat with 1 bedroom = allow 3 P
- Flat with 2 bedrooms = allow 4 P

A treatment system serving a group of houses shall be designed by adding together the P values for each house calculated independently, e.g.:

- For a group of two houses (3 and 4 bedrooms, respectively) the system shall be for a minimum of 11 P (5+6)

If the calculated total P for a group of houses exceeds 12 P then some reduction may be made to allow for the balancing effects on daily flow of a group of houses (round up not down):

- Where the total is 13-25 P multiply the total by 0.9 to give an adjusted P value, e.g. if there are four four-bedroom houses the total will be 24 P (4 x 6) and the adjusted P will be 22 P (24 x 0.9 = 21.6)
- Where the total is 26-50 P multiple the total by 0.8 to give an adjusted P value, e.g. if there are four three-bedroom houses and three four-bedroom houses the total P will be 38 P (4 x 5 and 3 x 6) and the adjusted P will be 31 P (38 x 0.8 = 30.4)

These are minimum recommended population (P) loads; they should not be modified downwards, and upward modification may be necessary because of particular characteristics of each property or groups of properties.

The above assessments of population (P) should be used for both existing and new properties.

Existing treatment systems for small sewage discharges which do not qualify for exemption or Standard Permit.

Where we identify sewage discharges to surface water or to ground that do not qualify for an exemption or do not have an existing permit, we will request the operator to apply for a permit or register an exemption if in Wales, as appropriate. We will determine permits for these existing discharges according to the table below, even if the existing disposal system does not meet current design requirements for new build.

If the Environment Agency receives a permit application for a sewage disposal system that was operating prior to 6th April 2010, we will require a declaration in the application that it operates satisfactorily, is being maintained properly and has no appreciable environmental impact.

Key Principles

We will normally require secondary treatment for discharges to surface waters. In a very few cases, more relaxed standards may apply where the Agency is satisfied that the discharge will have or is having no significant impact on the environment. For example, where there is very high dilution and no noticeable local pollution. These cases will be considered site by site. As a minimum, we will require screening to remove coarse solids and non-biodegradable plastics. If we have no evidence that an existing discharge is causing a polluting impact, then we will normally issue a permit for the existing discharge. We will not require changes to existing discharges unless we can justify the improvements against specific environmental benefits.

Where an existing discharge is operating satisfactorily with no polluting impact, we will not require design studies, such as percolation tests, nor will we require that it meets current design standards. We will determine permits for these existing discharges according to the table below, even if the existing disposal system does not meet current design requirements for new build.

If the existing system can be made satisfactory by renovation or improved maintenance, then that is our preferred option, rather than replacement.

The local Environment Officer may advise you on the priority for replacement and the timescale that we will require. This will always allow a reasonable timescale for the replacement work. In the absence of any recommendation, we will allow 12 months. You will have to notify the local Environment Management (EM) team when you have replaced the system.

Key Principles

Table: Permitting of existing small sewage discharges

Situation	Action
Existing discharge with a known unsatisfactory environmental impact:	
• System satisfactory, impact due to poor operation or maintenance	We will require improved maintenance of the existing system.
• System unsatisfactory: inadequate capacity; poor design or construction; or inappropriate treatment	We will require installation of a new septic tank and infiltration system or new package plant. We may permit as for new system, but give up to 12 months for compliance.
• System satisfactory but unsatisfactory environmental impact due to location of discharge or infiltration system	We may prohibit the activity or require additional mitigating measures
Existing discharge with no known unsatisfactory environmental impact:	
• Existing septic tank or package plant discharge to infiltration system	The discharge needs to be registered or permitted by 1st Jan 2012 unless we serve a notice to require a permit earlier
• Existing septic tank discharge to surface water	These are not eligible to register as an exemption. You will need to apply for a permit to make the discharge and if granted, we will normally require you to upgrade to a treatment plant. In a very few cases, more relaxed standards may apply where the Agency is satisfied that the discharge will have or is having no detectable impact on the environment. For example, where very high dilution is available in the receiving waterbody. We will usually allow up to 12 months to complete an upgrade, although this depends on individual circumstances.
• Existing package plant discharge to surface water	Permit existing system
• Existing crude sewage discharge to surface water	Require installation of a new package plant, septic tank and infiltration system or screen, as required by the location. Permit to give up to 12 months for compliance..

Key Principles

Situation	Action
• Existing septic tank discharge or package treatment plant to infiltration system inside a groundwater Source Protection Zone 1 (SPZ1)	Under EPR (2010) these are not eligible for an exemption and will need to be permitted from the 1st Jan 2012. Whilst SPZ 1 – represents the most sensitive groundwater area around a drinking water abstraction, we will nonetheless consider existing discharges sympathetically if we are satisfied that there is no evidence of unacceptable impact.

Crown discharges

"Crown" means an interest belonging to Her Majesty in right of the Crown or of the Royal Household, the Duchy of Lancaster, or the Duke of Cornwall or other possessor of the Duchy of Cornwall, or belonging to a government department or held in trust for Her Majesty for the purposes of a government department.

Crown discharges include:

1. Discharges personally by the Sovereign
2. Discharges by the Sovereign by right of the Duchy of Lancaster, Duchy of Cornwall, etc.
3. Discharges by the Government through any of the ministries including:
    - Ministry of Defence - army barracks, research establishments, training centres
    - Department of Transport - land owned as part of as adjacent to trunk roads and motorway
    - Home Office - prisons, borstals, etc.
    - Department for Environment, Food and Rural Affairs - experimental farms, research establishments.

For the purpose of discharge control and pollution minimisation, Crown exempt discharges will be regarded as any other discharge and where appropriate an application for a permit should be requested, together with the application fee. On determining the application an environmental permit may be issued.

Management systems

1. Managing your activities

1.1 Management systems

We expect that operators will have management systems that are appropriate to the size and nature of the permitted activity.

Water discharge activity and groundwater activity (for point source discharges) permits issued or varied since the regulations were amended on 6 April 2010 are likely to have the general management condition. What this condition requires of the operator is explained in our guidance document “How to Comply”.

For sewage discharges up to 20 m3/d, there is a management toolkit that will help smaller operators meet the management system requirements of their permits. See H6 Annexes.

Permits that predate the EPR regulations have become EPR permits but their existing conditions remain in force . These permits may also have conditions with management system requirements. For example some discharges will have requirements to have appropriate management systems to allow them to carry out Operator Self Monitoring (OSM), Urban Waste Water Treatment Directive (UWWTD) self monitoring and Flow Measurement.

Specific management system requirements for these monitoring activities are covered elsewhere in this document.

Other activities such as Ultra Violet disinfection will also require management systems to meet condition requirements to have documented maintenance programmes and carry out performance monitoring and reporting.

Where permits have the “emission of substances not covered by emission limits” condition the requirements for water discharge activity and groundwater activity (for point source discharges) permits is explained in “How to Comply”.

In some cases, we may agree management plans with operators to manage substances in their discharges without limits, for example polymer dosing or use of prophylactics at fish farms. In other cases, we might agree a management plan to prevent or minimise the impact of discharges from the activity that are not specified activities.

1.2 Emissions of substances management plan

Emissions of substances management plan

Emissions of substances not controlled by emission limits (excluding odour, noise and vibration) must not cause pollution. The operator will not be taken to have breached this requirement if they take appropriate measures to prevent or where that is not practicable, to minimise, those emissions. The appropriate measures include, but not limited to, those specified in any approved emission of substances management plan.

If the Environment Agency notifies the operator that a discharge is causing pollution, it can require the operator to review its emission of substances management plan to improve operations and mitigation measures. After approval by the Environment Agency the operator must operate to the revised plan.

The management system condition requires operators to consider what could go wrong in relation to their discharge and to plan measures to prevent or mitigate any adverse environmental effects. The emission of substances management plan is a sub-set of that overall plan and specifically addresses longer-term increases in the discharge of polluting substances or short-term acute polluting events by such substances. Amongst other reasons it provides regulation for the discharge into surface waters of dangerous and priority substances and specific pollutants and the discharge into groundwater of hazardous substances and non-hazardous pollutants. This assists in meeting the requirements of the Water Framework Directive (2000/60/EC), the Dangerous Substances Directive (2006/11/EC) and Groundwater Daughter Directive (2006/118/EC).

In the case of groundwater, the Water Framework Directive and its Groundwater Daughter Directive require that the input of hazardous substances into groundwater be prevented and the input of non-hazardous pollutants be limited to avoid pollution. Detailed requirements for the protection of groundwater and the risk assessment approach are contained in EPR H1 Annex (J).

In the case of discharges into surface waters, the Water Framework Directive and the Dangerous Substances Directive require that we control the discharge of specified polluting and toxic substances to protect the environment. Any such substance present in a discharge at a significant concentration will be controlled by an emission limit. The operator must ensure that any other substance initially present at an insignificant concentration and without an emission limit remains at that level.

Further details are provided in Sections 2.5 and 2.6.

1.3 Pumping Station Management Plan

Guidance on this is covered below.

Operating techniques and process control

2. Operations

2.1 Operating techniques and process control

What's in this section?

2.1.1 Operating techniques

"The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in schedule 1, table S1.2, unless otherwise agreed in writing by the Environment Agency."

The Operating techniques condition above allows the permit to refer to information provided in or in support of an application. It will only be used in circumstances where it is important to specify a treatment process because it is crucial to the operation of the activity and in meeting the required environmental outcome. Examples of operating techniques which may be referred to and therefore incorporated into the permit are;

- complex real time control systems at a number of combined sewer overflows on a sewerage network,
- complex diffuser arrangements at the end of a discharge outfall pipe,
- an effluent which discharges to more than one outlet depending on complex circumstances

Operating techniques in relation to sewerage system operations is covered within the section below.

Sewage operations
Sewerage system operations

2.2 Sewage operations

What's in this section?

2.2.1. Secondary Treatment and Urban Waste Water Treatment Regulations Appropriate treatment requirements

Regulation 5 (7) of the Urban Waste Water Treatment (England and Wales) Regulations 1994 requires that sewage discharges from treatment plants serving agglomerations of less than 2000 population equivalent to inland waters and 10,000 population equivalent to coastal waters must be provided with appropriate treatment. Appropriate treatment means that the relevant quality objectives of the receiving water are met.

Environmental permits granted for the above sewage treatment plant discharges have taken account of the impact of the discharge on the receiving water when imposing conditions in the permits and therefore those permits and discharges meet the appropriate treatment requirement.

We don't expect operators to tell us in detail how they propose and run their sewage treatment processes. What we do need to know is covered in How to Comply.

Package plants should be designed and built to British Standards.

2.3 Sewerage system operations

What's in this section?

Sewage operations
Sewerage system operations

2.3.1 Permitted Flow Limits

What's in this section?

2.3.1.2 Introduction

Water Company Sewage Treatment Works (STWs) and some larger private STWs (such as those operated by the MOD for example) normally receive sewage and trade effluent from catchments where at least a proportion of the sewerage network is combined. This means that the sewerage network carries rainfall run-off as well as sewage and trade effluent discharged by householders and traders, so when it rains, the volume of sewage arriving at a STW can increase significantly.

Small package plants serving just a few houses (mostly private but some are operated by Water Companies) normally receive sewage and trade effluent only, with no rainfall run-off, hence the flow does not increase in response to rainfall.

For STWs which receive influent from combined sewerage systems (the vast majority of Water Company STWs and some private STWs), we regulate flow volume discharged by limiting the Dry Weather Flow (DWF) of the discharge to a maximum value. This is important, because the impact of a discharge on the receiving water is directly linked to the volume discharged. The effluent quality limits are determined on the basis of the consented DWF. In general, as the DWF increases, the quality limits become tighter.

Whilst we are concerned that the DWF does not exceed the permitted limit, for such discharges we do not set maximum discharge rates for the treated effluent (except in certain special cases), because we do not wish to limit the amount of effluent that is treated when it rains. We do, however, set minimum rates for the amount of flow that is passed forward to treatment before we permit overflows to the storm tanks. This rate is normally specified in permits for discharges from storm tanks, and is known as the Flow to Full Treatment (FFT). It will be specified in your permit as the overflow setting.

For small package plants with no rainfall run-off, we do not consent a DWF – instead we consent a maximum daily volume. For the majority of these plants, there is no requirement for flow monitoring, and the maximum flow limit is based on per capita daily volumes for different types of premises.

2.3.1.2 Dry Weather Flow (DWF)

Definition of Dry Weather Flow

Sewerage system operations

Dry weather flow, measured as m^3/d, is defined as follows:

$$DWF = PG + I_{DWF} + E$$

Where

P = population in the catchment

G = per capita domestic sewage flow

I_{DWF} = dry weather infiltration, and

E = trade effluent flow.

It has also been found that the DWF is well-represented by the non-parametric 80%-exceeded daily flow of the discharge (known as Q80) which is in fact the 20%ile. Q80 has therefore been accepted as a simple measure of DWF, and with 365 measured values of the Total Daily Volume (TDV) in a year ranked from the lowest to the highest, the Q80 will be the 73rd value. If the data set contains less than 365 values of TDV in a year, then the nth value ranked from the low end is used to determine Q80, where n = Integer(0.2N) and N is the number of good measurements of TDV in the year. For example, if N = 332, then n = Integer(0.2 x 332) = Integer(66.4) = 66.

These two approaches to obtaining or measuring the DWF are used in different ways. DWF projections can be based on either definition. However, you should bear in mind that infiltration should be limited in accordance with BTKNEEC (Best Technical Knowledge Not Entailing Excessive Cost).

Calculating the DWF permit limit

The calculations to determine the permit limit for DWF are normally undertaken by the operator. The Agency normally takes the applied-for DWF limit at face value, although details of the calculation form part of the consent application. However, it is in the operator's own interests to apply for the correct limit, as a too-low limit may lead to consent non-compliance and a too-high limit may result in tighter quality standards than would otherwise be the case.

For new discharges, where there are no flow data available, the DWF is calculated from the formula $PG + I_{DWF} + E$. The values used should be based on predictions for the design horizon of the discharge. Where possible, the measured dry weather infiltration from nearby discharges will give a basis for estimating the likely infiltration.

For existing discharges, there are two methods which can be used to determine consent limits at the design horizon, based on the two definitions of DWF.

The simpler approach is based on extrapolation of the Q_{80} obtained from measured data. This method assumes that all points on the distribution of daily flows will be increased from the current values by the same percentage. So for a projected population increase of 20%, we assume that the mean flow, the standard deviation and the Q_{80} will all increase by 20%.

An alternative and theoretically more accurate approach is to use the formula

DWF = PG + I_{DWF} + E, but using current flow data to provide an accurate starting position. The factors P and G should be increased according to the sewerage undertaker's projections. The trade flow used for future projections should be the sum of the current consented maximum daily trade flows, unless the sewerage undertaker can demonstrate to us that the trade flows have permanently reduced to a lower value. The current dry weather infiltration should be calculated as follows:

I_{DWF} = measured Q_{80} – current PG – current E

Some allowance for increased infiltration should be made for the increased population, since even new sewers have some infiltration and the rate is likely to increase. It is suggested that the infiltration allowance for the increase in population should be at half the per capita rate of the existing sewerage system.

2.3.1.3 Flow to Full Treatment (FFT)

Introduction

Sewage Treatment Works (other than the small package plants which do not receive rainfall run-off) should be designed to treat peak flows arriving in dry weather conditions and additional flows from light rainfall. The agreed methodology for deriving the FFT is as follows:

Required FFT = 3PG + I_{MAX} + 3E

where P, G and E are as defined above. The infiltration I_{MAX} is defined below.

The multiple of 3 for the domestic and trade effluents allows for normal variations in these flows through the day, whereas infiltration does not vary significantly during the course of a day. Before flow measurement became available, infiltration was estimated, leading to considerable risk of under- or over-design in terms of treatment capacity. The recent availability of effluent flow data allows a better estimation of infiltration.

Estimating Infiltration

Current infiltration for use in calculation of FFT

For clarity, we have called the infiltration rate for use in FFT calculations I_{FFT}. The objective is for the FFT to be sufficiently high to ensure that the overflow to the storm tank does not operate in dry weather at any time of the year.

I_{MAX} is the maximum infiltration rate over the complete year, although there are circumstances when it may be necessary to consider the infiltration for summer and winter separately, see below.

To find I_{MAX}, we need to calculate infiltration for every dry day (see below).

The infiltration on any dry day can be described by the formula:

$I_{dry\ day}$ = measured total daily volume – PG – E

where P, G, and E are as defined above.

Flows measured on the first dry day following rain may include rainfall run-off flows originating from the previous day's rainfall. Therefore infiltration is not calculated for the first dry day following rainfall. All other days must be used. For this calculation, only days when rainfall exceeds 0.25 mm are classed as rainy.

In addition, days when there is known to be significant snow melt plus the following day should be excluded from the analysis.

The infiltration should be calculated for all days that are not excluded as a result of rain or snow. Ideally the analysis should use flow data over several years, but as a minimum, data from 12 consecutive months should be used. The infiltration rate required is the maximum calculated value.

The above is the standard method for calculating I_{MAX}, but the Agency may accept alternatives where exceptional circumstances make this method inappropriate.

Future infiltration for use in calculation of Flow to Full Treatment FFT

In designing treatment capacity for future population increases a judgement on an appropriate allowance for future increases in infiltration must be made. As for the calculation of future DWF, it is suggested that the infiltration allowance for the increase in population should be at half the per capita rate of the existing sewerage system.

Calculating FFT

The normal FFT requirement is 3PG + I_{MAX} + 3E. Variation from this may be permitted following assessment of cost and environmental benefit.

A higher FFT may be required for small systems, particularly where the STW has no storm tank. Additionally, there are circumstances when a higher FFT is necessary to protect the receiving water. You must justify all spills using UPM Procedure.

In some instances (e.g. for larger works with flat catchments) adequate protection may be given to the receiving water at a lower FFT, owing to the greater than normal attenuation available in the sewerage system, such that under dry weather conditions the Maximum Peak Daily Flow (MPDF) arriving at the works is significantly less than 3DWF. In these cases the Agency can accept a FFT which is lower than 3PG + I_{MAX} + 3E, subject to the following:

1. You must provide the Agency with influent flow records, or if these are not available, sewerage modelling on a catchment basis. These data must demonstrate that the

MDPF arriving or predicted to arrive at the works is significantly less than 3PG + I_{MAX} + 3E.

2. You must provide sufficient evidence to demonstrate that the treatment performance of the works in respect of its impact on the receiving water will not be significantly less effective than that which would be provided by an FFT of 3PG + I_{MAX} + 3E.

3. You must demonstrate that the proposed lower FFT would be consistent with the satisfactory performance of any intermittent discharges at the works or on the sewerage system.

The FFT must be adequate to allow the storm tanks and in-sewer storage to empty as soon as possible after rainfall.

For catchments with significant population increase in summer, then FFT needs to be calculated for both summer and winter; the required FFT is the higher of the two. The two calculations will use the relevant populations for summer and winter and also a different I_{MAX} for each of summer and winter. To find the two different infiltration rates, the available flow data for the winter and summer periods should be treated separately in the manner outlined above. Note that it may be necessary to exclude some flow data from these calculations (for example for the months May, June, September, October). This means that ideally several years' data are needed – one year's data is unlikely to be sufficient.

2.3.1.4 Consented Sewage Effluent Volumes for Private and Package STWs

For small package plants which receive no rainfall run-off, as mentioned in above, we do not consent a DWF – instead we consent a maximum daily volume. See Small package plants design section.

2.3.2 Screening

What's in this section?

2.3.2.1 Design

Storm overflows must be designed minimise the visual impact caused by the discharge. Potential impacts include gross sewage solids, paper, plastic and sewage fungus within the receiving water, or stranded on the banks of rivers, or on beaches.

Aesthetic control of some sort will be required for all new storm overflows and for existing unsatisfactory storm overflows. This can be achieved by a number of means, for example the design of the overflow structure or the provision of screens.

The degree of control required is dependant on the amenity of the location impacted by the overflow and the frequency of discharges from the overflow.

Amenity will be assigned by the Agency in accordance with the following categories.

The Amenity category will have regard for the affected receiving waters for a reasonable distance downstream as well as those in the immediate vicinity of the discharge.

High Amenity

- Influences area where bathing and water contact sport (immersion) is regularly practised (e.g. wind-surfing, sports canoeing).
- Receiving watercourse passes through formal public park.
- Formal picnic site.
- Shellfish waters

Moderate Amenity

- Boating on receiving water.
- Popular footpath adjacent to watercourse.
- Watercourse passes through housing development or frequently used town centre area (e.g. bridge, pedestrian area, shopping area).
- Recreation and contact sport (non-immersion) areas.

Low Amenity

- Basic amenity use only.
- Casual riverside access on a limited or infrequent basis, such as a road bridge in a rural area, footpath adjacent to watercourse.

Non-Amenity

- Seldom or never used for amenity purposes.
- Remote or inaccessible area.

2.3.2.2 Spill Frequency

This can be determined by running a minimum of 10 year time series of rainfall through an appropriate model of the sewer system representing the performance of the storm overflow.

The selection and preparation of time series rainfall is described in the Urban Pollution Management (UPM) manual 2nd edition section 4.2 and also in this guidance.

The sewer model must be constructed and verified in accordance with the principles set out in the WaPUG Code of Practice for the hydraulic modelling of sewer systems http://www.ciwem.org/groups/wapug/Modelling_COP_Ver_03.pdf. The model must be confirmed as fit for purpose by audit.

As a minimum you must then apply aesthetic control of storm overflows based upon the combined criteria of amenity use and spill frequency as detailed below:

High Amenity	> 1 Spill per year <=1 Spill per year	6mm solids separation 10mm solids separation
Moderate Amenity	>30 Spills per year <=30 Spills per year	6mm solids separation 10mm solids separation
Low Amenity & Non Amenity	Solids separation to be achieved through good engineering design (eg, high- sided weir, stilling pond with or without scum boards or vortex separation).	

Overflows predicted to spill less often than 1 in 5 years on average will usually not require screening.

The definition of “6mm solids separation”, “10mm solids separation”, and “good engineering design are as follows:

- 6mm solids separation:

Separation, from the effluent, of a significant quantity of persistent material and faecal/organic solids greater than 6mm in any two dimensions.

- 10mm solids separation:

Separation, from the effluent, of a significant quantity of persistent material and faecal/organic solids giving a performance equivalent to that of a 10mm bar screen.

For the above definitions “significant quantity” is further defined in terms of screen performance criteria set out in Appendix C of the Urban Pollution Management (UPM) manual 2nd edition. Alternatives means to screening can be used for separating solids, providing they meet these performance criteria as demonstrated following the test procedure set out in Appendix C of the UPM manual.

New chambers for 6mm and 10mm solids separation must be designed in accordance with the principles set out in the WaPUG Guide ‘The Design of CSO Chambers to Incorporate Screens’:

http://www.ciwem.org/groups/wapug/CSO_design_guide_version3.pdf

2.3.2.3 Good engineering design

The design of combined sewer overflow structures should be in accordance with the recommendations of FWR Report No FR0488 ‘Guide to the Design of Combined Sewer Overflow Structures’, Balmforth DJ, Saul A and Clifforde IT (1994).

As a minimum, the installation should be of a type which gives acceptable solids separation and retention (eg a properly designed high sided weir, stilling pond or vortex separator). Existing structures such as leaping weirs, low sided weirs and holes in a wall are unacceptable unless no adverse impact is noted from them.

Where screening is required it is preferred and usually cost effective to use 6mm aperture screens.

Screens usually need a bypass to prevent flooding in the event the screen becomes blinded. The screen must be designed so that it will not be bypassed more often than once in 5 years on average. This requires the screen to have sufficient hydraulic capacity to deal with high rates of flow for prolonged periods without blinding to an extent that it is bypassed.

The screen must therefore be designed to cope with all magnitude events up to and including the 1 in 5 year return period storm of duration critical to screen performance. Static screens will begin to blind when the overflow operates therefore additional screen area must be provided to fully account for this. The screen must therefore be designed to cope with the frequency and duration of the spills predicted from the time series analysis. This analysis should take account of the screen cleaning regime planned. Loading rates quoted by screening manufacturers must be confirmed by realistic field trials for prolonged and repeated use. 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.

Mechanical or auto cleansing screens should be used where they are needed to fulfil the above requirements or where they provide a more cost effective alternative to manual screen cleaning. For a given flow rate a mechanically raked screen is 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 we therefore require telemetry to notify the operator in the event of screen failure.

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

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

2.3.2.4 Monitoring and Telemetry

Where mechanically raked screens are installed telemetry must be installed to notify the operator in the event of screen failure. Screen failures must be rectified as soon as practicable.

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

Examples include:

- Post scheme appraisal monitoring to confirm screen not bypassed more often than 1 in 5 years on average.
- Sensitive receiver.
- Uncertainty in capacity of proposed screen.
- Uncertainties in model predictions.
- Uncertainties in performance of retrofitted screen due to screen or chamber design.
- Previous poor performance.
- Trial of new screening or alternatives.
- To notify the operator of need for environmental clean up.

You may wish to apply additional monitoring to that required by the permit for your own uses.

Examples include:

- Operational purposes such as identifying need for manual screen cleansing.
- Identify possible need for environmental clean up.
- Ensure continued compliance with the permit.
- Defence against reports of debris in environment.
- Assess relative performance of proprietary screens.

Monitoring screen bypass may be combined within a single device monitoring flow levels with the overflow. Overflow monitoring is described below and may be used to record spill event and duration or detect the onset of sewer blockages that may otherwise lead to dry weather discharges

2.3.2.5 Maintenance

A screen cleaning regime should be planned and adjusted in the light of experience to ensure the screen retains its required capacity for all storms. Cleansing visits may be programmed for regular visits linked to the frequency of operation of the overflow. More efficient operations may be planned by the use of telemetry to inform that a spill has occurred, or a screen bypass has occurred. Alternatively cleansing visits may be planned by analysis of rainfall recordings.

The degree of blinding of the screen should be recorded prior to cleansing and compared to design expectations. Repeated excess blinding must be addressed by a reviewing the cleansing regime and checking the aesthetic impact on the environment. Where the design proves inadequate it may be necessary redesign the screen and ultimately the chamber.

2.3.2.6 Information for application

Information requirement may include:

Evidence to confirm expected spill regime including:

Model build and verification report
Report on selection and generation of rainfall time series report
Solution report including, spill predictions for time series rainfall and 1 in 5 year critical duration storm analysis

Screen and chamber design including evidence to confirm screen and chamber are designed to handle all discharges up to and including the 1 in 5 year critical duration storm event. Proposed screen cleaning regime.

Evidence that the design will not result in an unacceptable increase in flood risk.

Sewerage system operations

2.3.3 Storm overflows

What's in this section?

2.3.3.1 Introduction

This guidance applies to storm overflows from the combined sewer system (combined sewer overflows "CSOs"") and for discharges of settled storm sewage from storm settlement and storage tanks at sewage treatment works.

Annex (E) of the H1 Environmental Risk Assessment sets out our requirements for these kinds of intermittent discharges and should be read in conjunction with this guidance.

In particular it covers our requirements for:

- existing satisfactory discharges
- existing unsatisfactory discharges
- proposed new or increased discharges

In summary it explains our requirement that all storm overflows must comply with relevant design standards water quality standards and cause no deterioration to the existing quality of the receiving water. Our no deterioration objective leads to a presumption against new storm overflows unless as part of a wider scheme delivering a net improvement in water quality.

The guidance introduces the criteria for unsatisfactory overflows:

1. causes significant visual or aesthetic impact due to solids, fungus;
2. causes or makes a significant contribution to a deterioration in river chemical or biological class;
3. causes or makes a significant contribution to a failure to comply with Bathing Water Quality Standards for identified bathing waters;
4. operates in dry weather conditions;
5. operates in breach of permit conditions provided that they are still appropriate;
6. causes a breach of water quality standards (EQS) and other EC Directives; and/or
7. causes unacceptable pollution of groundwater.

For criterion (3) Water Company assets must not cause any poor bathing waters under the revised Bathing Water Directive by 2015.

Sewerage system operations

For criterion (4) we will classify any discharge not caused by rainfall run-off and or snow melt as unsatisfactory. Discharges caused by infiltration or land drainage are unsatisfactory. Infiltration should be limited in accordance with UWWTR requirements. Land drainage should be drained separately from the combined sewerage.

For criterion (7) see section on groundwater.

A storm overflow that is not unsatisfactory may still not meet the modern standards of engineering for storm overflow structures and aesthetic control, and/or may have insufficient hydraulic capacity. We classify such overflows as sub-standard.

By sub-standard we mean that the overflow does not reach the “good engineering design” standard outlined in Annex 3 of the DETR (July 1997) UWWT Regulations guidance note ‘working document for operators and regulators’ and appropriate updates including the WaPUG Guide ‘The Design of CSO Chambers to Incorporate Screens’:

http://www.ciwem.org/groups/wapug/CSO_design_guide_version3.pdf

Annex 3 of the DETR Guidance provides guidance on the design, construction and operation of collecting systems and treatment plant.

We will not issue permits for existing unsatisfactory storm overflows. You must make sure your existing storm overflows do not become unsatisfactory. Where a storm overflow does become unsatisfactory we will take enforcement action or review your permit as appropriate. We will require you to remedy the problems as soon as reasonably practical. Requirements as result of such permit reviews should be highlighted in change protocol submissions to OFWAT. The only exception to this is where an overflow becomes unsatisfactory due to new legal requirements such as the imposition of new EU Directives or new designations under existing directives. Here we will promote the affected storm overflows within AMP planning procedures.

The evidence we usually seek to determine whether a storm overflow is unsatisfactory is set out below along with further guidance on dealing with sub-standard and unsatisfactory storm overflows.

2.3.3.2 The Urban Pollution Management procedure

The urban pollution management planning procedure should be always be followed whenever you need to assess the impact of existing storm overflows and plan work to affecting wet weather discharges from the sewer network and/or the sewage treatment works.

The principles and planning procedures are set out in the Urban Pollution Management ("UPM") Manual 2nd edition.

For unsatisfactory storm overflows the procedure must be directed at achieving the relevant environmental quality targets. Our objective of no deterioration in water quality must be met by all schemes and is particularly relevant to applications for new and increased discharges.

Where there are multiple discharges to the receiving water we require you to apply the UPM procedure to develop an integrated waste water upgrading scheme at an urban catchment level.

You should work in partnership with the Agency when following the UPM procedure. There are 3 main stages which require agreement on the outputs. These are the scope statement, the modelling plan and the agreed solution.

Scope statement

This should:

- define environmental standards, our requirements for no deterioration, emission standards, and design standards, relevant to study
- Identify the types of models needed for the modelling plan eg equations, simple models, complex models.
- Identify existing data and any new data requirements

Modelling Plan

This comprises:

- the model/s
- statements about each models purpose, its limitations and range of use, and reliability
- types of sensitivity testing required
- method for using models
- statement of fitness for purpose of the overall modelling plan.

Note: in order to assess fitness for purpose of models it may be necessary to have an initial view and agreement on type of solution thought likely. This step may need iterating if the type of solution being considered, and therefore the purpose of the models, changes. We may require you to have your sewer models independently audited to check their fitness for purpose. A proforma for defining the purposes of the sewer model and documenting the audit outcomes is available. Guidance on sewer model audits is included below.

Agreed Solution

- modelling results
- solutions investigation optimisation analysis
- solution design
- solution compliance results
- assessment of risk of non-compliance through sensitivity analysis

Where permit applications are based on the outline or conceptual design you may need to agree subsequent changes that are proposed during detailed design or seek a review of your permit if it has already been issued.

2.3.3.3 Modelling

As noted above the proposed modelling should be agreed with the Agency as part of the scope statement. This will avoid much abortive work.

Agency approved guidance on modelling the impact of all storm overflows to inland, estuarine and coastal waters, and to groundwater is covered by the UPM manual 2nd edition. The manual provides guidance on selecting the level of detail and complexity of models for particular situations. The procedure allows you to manage wet weather discharges from the sewers and sewage treatment works so as to meet the requirements of the receiving water in the most cost effective way overall.

The use of the UPM procedure will be directed at achieving relevant environmental quality targets defined by the Agency. You should pay due regard to the cost effectiveness of proposed schemes and the development of long-term sustainable solutions. In situations where there are multiple discharges to receiving waters you should apply the UPM procedure to develop integrated wastewater upgrading schemes at an urban catchment level.

In arriving at the most cost effective solution the UPM procedure takes account of the cost of data collection and modelling as well as the solution cost. The Agency considers this guidance represents ‘best technical knowledge not entailing excessive costs’ (“BTKNEEC”) in respect of improvements to storm overflows. By following its procedures to meet the standards, including no deterioration, required by the Agency you should therefore fulfil the UWWTD requirements for the limitation of pollution by storm overflows.

The following documents produced by CIWEM’s urban drainage group WaPUG provide specific guidance on modelling and data collection techniques. These supplement the UPM procedure and also contribute to BTKNEEC:

- WaPUG Code of Practice for the hydraulic modelling of sewer systems: http://www.ciwem.org/groups/wapug/Modelling_COP_Ver_03.pdf.
- WaPUG Guide to the quality modelling of sewer systems: http://www.ciwem.org/groups/wapug/Quality_Modelling_Guide_Version_1-0.pdf
- WaPUG river data collection guide: http://www.ciwem.org/groups/wapug/River_Data_Collection_Guide_Version_W01.pdf
- WaPUG River Modelling Guide: http://www.ciwem.org/groups/wapug/river_modelling_guide_version_W01.pdf
- WaPUG Integrated Urban Drainage Modelling Guide 2009: http://www.ciwem.org/groups/wapug/WaPUG_IUD_Modelling_Guide_Draft_Rev1_v28_(June_09)_v01-001.pdf%20

In all but the simplest UPM modelling studies there is a requirement for a long series of rainfall data that is representative of the study catchment. The selection and preparation of time series rainfall is described in the UPM manual 2nd edition section 4.2. Guidance on our specific requirements for long rainfall time series being used in UPM modelling is included below.

Using detailed models to simulate the impact of large numbers of rainfall events on all possible background conditions may take excessive time. This may lead to the need for the use of simplified modelling to speed the simulations. These models may be calibrated to reflect the performance of detailed models but some accuracy will inevitably be lost. Simplified models can then be used to test multiple solutions rapidly and optimise the solution and costs. The final solution in most cases must be checked by re-running the rainfall series through the original detailed models.

Simplified modelling may also be used without calibration to more detailed models. This is usually only appropriate where the sewerage catchments and receiving water processes are simple enough to lend themselves to simplified representation. Default parameter values and ranges for sensitivity analysis are set out below. It may also be used to gain a rough initial indication of the scale of the solution needed.

Section 4.8.4 of the UPM manual 2nd edition sets out the uses of simplified modelling and Appendix D of the manual describes the use of SIMPOL which is a simplified modelling system designed and available as part of the UPM Manual. Alternative and improved simplified model software are acceptable providing it is approved for use by the Agency. Unapproved software may be used for scheme optimisation where the proposed solution does not rely on the output of the simplified models.

2.3.3.4 Standards

General

The environmental and design standards which define the schemes needs, and the required design standards, should be agreed as part of the scope statement referred to above.

Sewerage system operations

The second edition of the UPM Manual is generic with respect to the control of intermittent wet weather urban wastewater discharges. It does not explicitly encapsulate all the Agency's policy that will be applied to new permit applications for intermittent discharges.

The table below sets out a summary of some of the design standards relevant to the various Directives.

Directive	**Design standard**
Revised bathing waters	3 spills per bathing season, for good and sufficient stratus, 2 spills per bathing season for excellent status, 6mm screening or equivalent aesthetics control and discharges below the mark of Mean Low Water Spring tides.
Current bathing waters	3 spills per bathing season, 6mm screening or equivalent aesthetics control and discharges below the mark of Mean Low Water Spring tides.
Shellfish waters	10 spills per annum and appropriate aesthetic control where required.
Freshwater fish	Fundamental Intermittent Standards (FIS), 99%ile standards and relevant Freshwater fish directive standards. Appropriate aesthetic control where required based on UPM2 requirements.
CRoW Act or Habitats (BOD or ammonia)	Fundamental Intermittent Standards (FIS), 99%ile standards and appropriate aesthetic control where required based on UPM2 requirements.
Urban waste water treatment	UPM standards derived using UPM2 methodology. For rivers these will include FIS and 99%iles based on the significance of the discharge. Retained flow of formula `A' (or equivalent storage) and/or appropriate aesthetic control may be appropriate for low significance discharges. For storm tank discharges the minimum capacity is 68 l/head served or storage equivalent to 2 hours at the maximum flow rate to the storm tanks.
Groundwater	Refer to requirements for groundwater in the groundwater section of this document.
WFD (BOD or ammonia)	Fundamental Intermittent Standards and appropriate aesthetic control where required.

The following considers standards for freshwaters, bathing waters, shellfish waters, and other coastal waters in more detail. You should always seek confirmation from us on the standards relevant to each storm overflow.

Sewerage system operations

Discharges to freshwaters

The following guidance is on the minimum standards required for new, improved, or altered storm overflows to freshwaters. It does not cover our requirement for no deterioration which is particularly relevant to applications for new and altered storm overflows and is outlined in Section 1 and 3 of Annex (e) of the H1 Environmental Risk Assessment .

The normal minimum pass forward flow for discharges of unsettled storm sewage from new, improved or altered storm overflows is calculated using Formula A, as specified in Section 3 of Annex (e) of the H1 Environmental Risk Assessment will apply.

Where storage is provided at a CSO and in very large sewerage systems where significant smoothing of flows occur, then this shall be taken into account in defining the performance equivalent to "Formula A" without storage.

Also where there is evidence that there are significant areas within the catchment that were designed, and remain, separately drained then an allowance for separately drained areas may be made.

The minimum pass forward flow from those populations served by separately drained areas is: 3PsG + Is + 3Es

where:

Ps = population in areas served by separate system

G = flow returned to sewer

Is = Infiltration flow from separately drained areas

Es = Trade flows within separately sewered areas

Formula A becomes:

FA (litres/day) = DWF + 2PsG + 1360 Pc + 2Et

And:

DWF (litres/day) = PtG + It + Et

Where:

Pc = population in areas served by combined and partially separate sewers

Pt = total population

It = total infiltration

Et = trade flows with total area

This is the normal minimum standard for discharges to freshwaters.

Sewerage system operations

The second edition of the UPM Manual proposes two alternative approaches to setting standards to protect inland waters from the impact of storm overflows. These are:

1. 99 percentile river quality standards for BOD, Total Ammonia and Un-ionised Ammonia based on Rivers Ecosystem class; and
2. concentration-duration-frequency standards (referred to in the UPM Manual as Fundamental Intermittent standards - FIS) for Dissolved Oxygen and Un-ionised Ammonia.

The required approach will be dependent on the characteristics of the sewerage system, the characteristics of the receiving water and the environmental problems being addressed by a particular scheme. You should contact our staff in your Region who will define the required approach for individual cases. The standards will form part of the agreed scope statement.

Choice of river quality standards

We expect you to use the 99 percentile standards or FIS criteria identified in the second edition of the UPM Manual. The choice of which type of criteria and, hence, the form of planning approach, including the use of appropriate modeling tools and commensurate data collection needs will be based on the following tables. This approach is similar to the approach identified in the DETR UWWT Regulations Guidance Note (Tables A8.1 and A8.3). Those tables defined three levels of criteria based on the significance of the discharge and the characteristics used to identify the significance of a particular discharge. The Tables were based on procedures identified in the first edition of the UPM Manual. The guidance below extends Tables A8.1 and A8.3 to take account of UPM2 and therefore supersedes all previous guidance.

Indicative assessment criteria for setting permits for storm overflows to freshwaters:

The table below is provided to guide decisions on the minimum environmental criteria to be applied and the commensurate level of sophistication required for modeling to produce environmentally protective solutions for storm overflows. It does not preclude the use of alternative methods or models where these can be shown to be equivalent.

The table operates on the assumption that simple models and standards produce conservative solutions. That is to say that Formula A calculations produces a more protective (more conservative) solution than 99%iles using simple models, which in turn produces a more protective solution than FIS standards using complex modeling.

These assumptions are not valid in all circumstances. Where we are not confident that a simpler approach is conservative we may require more complex methods to confirm.

Sewerage system operations

Level of modeling required for environmentally protective solutions

Table 1

A. Low significance discharges

- Dilution greater than 8.1 (foul DWF @ 5% low river flows), and
- there is no interaction with other discharges, and
- No environmental problems

All the above criteria should apply. The Agency may accept minimum data methods (e.g. simple mass balance calculations) for low significance discharges. Minimum pass forward flow at CSOs based on Formula A will be usually be adequate where the above criteria are met. This assumes that available dilution will be sufficient to protect the rivers uses, objectives, and target standards. Where an environmental problem is known more detailed modeling may be required. The above approach will only be acceptable where it is expected that compliance with Formula A is protective of 99%ile standards and FIS standards.

B. Medium significance discharges

- Dilution is more than 2:1(foul DWF @ 5% low river flows)
- there is no interaction or limited interaction with other discharges
- the population equivalent is less than 10,000
- Cyprinid/non-Salmonid Fishery (designated or undesignated)

Where some of the above criteria apply we may accept a design that meets the 99 percentile design standards relevant to the previous RE class designation or we may assign an RE class based on the uses and attributes of the watercourse. Simple stochastic river impact modeling, applied with validated sewer hydraulic models, should be adequate for the majority of medium significance discharges.

The above approach will only be acceptable where it is expected that 99%ile standards are protective of FIS standards. Where this is not the case we may require a FIS design.

You must also demonstrate that the scheme will be sufficient to protect the rivers uses, objectives, and target standards

Companies may wish to use FIS if this is likely to result in a more cost-effective solution. This may be acceptable to the Agency provided the appropriate sensitivity analysis demonstrates sufficient confidence in the solution.

C. High significance discharges

- Dilution is less than 2:1 (foul DWF @ 5% low river flows)
- Interaction with other discharges,
- population equivalent is greater than 10,000,
- Cyprinid/non-salmonid or Salmonid Fishery (designated or undesignated)

Sewerage system operations

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

You must also demonstrate that the scheme will be sufficient to protect the rivers uses, objectives, and target standards

In cases where FIS standards are routinely exceeded in the receiving waters due to background or natural causes we may accept 99 percentile design standards. Alternatively we may require you to assess, and limit, the increase in FIS exceedances due to storm discharges. This may be the case in slow flowing eutrophic rivers.

Similarly where unsatisfactory storm discharges do not routinely cause FIS exceedances in the receiving water we may require the use of 99 percentiles and Formula A to resolve the problem. This may be the case in fast flowing rivers.

Also, discharges may not obviously fit into a particular category within the table. In reality there exists a full spectrum of sensitivities. You might not always use simple models with 99 percentiles or use fully complex modeling for FIS.

There is also a full range of river and sewer modeling techniques. Models range from simple flow models to complex flow and quality models. In the simplest scenarios models may rely on default concentrations and parameters and at the opposite extreme may be fully calibrated and verified for flow and quality.

The sewer and river modeling appropriate to a specific situation might reflect any possible combination of simple and complex models. The modeling techniques used should be tailored to the individual situation and may be affected by the availability of existing data and models as well as the sensitivity of the discharge. Simpler models using default values with appropriate sensitivity analysis may be an acceptable alternative to more detailed modelling.

We will confirm the acceptable level of planning and modeling taking all the available information into account when agreeing the scope statement. The table is only a guide.

You may wish to employ more sophisticated modeling if you consider a more cost effective solution can be found. We will accept more cost effective solutions provided there is no risk of deterioration in river quality and the additional cost of a conservative solution out-weighs any risk of failing to achieve the uses, objectives, and target standards, of the receiving water.

In all cases, we will require you to demonstrate that the proposed scheme will allow the uses, objectives, and target standards, to be met.

Where FIS are used, the minimum environmental standards for freshwater ecosystems will be those given in the Fundamental Intermittent Standards Tables (Table 2.2 and Table 2.3) of the second edition of the UPM Manual in order to achieve an ecosystem suitable for a sustainable Cyprinid Fishery.

Sewerage system operations

The sewerage undertaker must also demonstrate that the proposed scheme will allow the receiving water to achieve the required water quality at any other percentile standards relevant to its classification or designation as well as any other relevant objectives and uses. The FIS for sustainable Salmonid Fishery ecosystem will only be applied to discharges affecting established Salmonid (designated and un-designated) Fisheries and salmonid spawning grounds.

The second edition of the UPM Manual presents an approach that is consistent with the use of both 99%iles and FIS. The simplified modeling tool that is provided with the second edition of the UPM Manual (SIMPOLv2.0) allows either approach to be used in a consistent manner. We require you to select and apply appropriate modeling tools as part of the agreed scope statement.
The validity of the models should then be approved by us when seeking approval for the modeling plan. You should then demonstrate you proposed solution compliance with the agreed design standards.

Bathing Water impacts
For storm overflows that discharge directly into or impact on designated bathing water section 3.3.4 of Annex (e) of the H1 Environmental Risk Assessment explains the requirement for 3 significant spills per bathing season (May to September inclusive) on average. This allows compliance in accordance with the revised bathing water directive 'sufficient' and 'good' status, which are current Government policy, as well as the original bathing water directive. Any future requirements for 'excellent' status would require 2 spills per bathing season.

Where more than one discharge impacts on the bathing water spills must be aggregated and there must be no more than 3 significant spills to the bathing water on average. The size of spill which qualifies as significant will depend upon a number of factors. In general, however, for design purposes a spill greater than 50 m^3 will be significant. Guidance on how to aggregate spills for frequency and volume is included below. The guidance is provided in terms of aggregating discharges to shellfish waters but is equally relevant to bathing water impacts. For coastal discharges in general the discharge should be made some distance off shore of the level of mean low water spring tides. Where this is not possible more restrictive spill frequencies may apply, see below.

Where overflows discharge some distance offshore of mean low water spring tides we have previously considered impact assessment modelling to demonstrate compliance with the original bathing water directive. This was required to consider all impacts and not just storm overflows. We are currently considering whether, and if so in what circumstances, we will accept impact assessment. If we decide to accept the impact assessment approach we will publish the new design stantards appropriate to the revised Directive.

Storm overflows requiring improvement in PR09 were costed to meet 3 spills per bathing season.

Shellfish Waters impacts

New discharges:
The discharge from any new combined sewer overflows into designated Shellfish Waters should be avoided

Existing unsatisfactory impacts:

The Government's aims in respect of shellfish waters are:

- to improve to category B under the Shellfish Hygiene Directive the quality of shellfisheries that either achieve category C, or where harvesting is prohibited, and
- to ensure that the Shellfish Hygiene classification for those shellfish beds which currently achieve category B or A does not deteriorate.

There is also a Shellfish Waters Directive guideline standards for faecal coliform concentrations in shellfish flesh and intervalvular fluids.

Therefore the purpose of assessing whether a storm overflow is unsatisfactory in terms of its impact on shellfish waters under the above criterion (vi): "causes a breach of water quality standards (EQS) and other EC Directives" we classify storm overflows as unsatisfactory where they are identified as contributing to:

- Shellfish Water not achieving category B under the Shellfish Hygiene Directive,
- Deterioration in either shellfish flesh quality as shown by the Shellfish Hygiene classification, or in water quality at the designated Shellfish Water monitoring point

Where AMP programme funds the investigations of sewerage system impacts and these investigations identify the need for improvements we will require these improvements as soon as reasonably practicable, to the design standards set out below. If the improvements are to be undertaken within the AMP period the changed obligations will be recorded on OFWAT's change protocol.

Standards:
A water quality design standard was developed to ensure shellfish flesh samples comply with category B of the Shellfish Hygene Directive

To ensure no deterioration the Agency will not permit any increase in permited load from intermittent discharges to Shellfish Waters, which are aggregated in terms of their combined impact on the Shellfish Water.

Were the need for improvements to storm discharges (including storm tanks at sewage treatment works discharging into or affecting Shellfish Waters) are identified you will be required to demonstrate that:

- The frequency of significant independent spills should be limited to 10 per annum on average (over 10 years). In general for design purposes a spill greater than 50m^3 will be significant"), (Appendix 2, paragraphs 14 to 18)

OR

- The scheme, as a whole, is designed to achieve a water quality standard of **1,500 faecal coliforms per 100ml** for at least 97% of the time in the long term. The total duration of impact of 3% applies to at <u>any</u> location within the Shellfish Water and not just the monitoring point (See Appendix 2, paragraph 24).

These design standards are consistent with achieving the water quality standards for 19 years in 20, that is with 95% confidence. A similar degree of confidence applies to achieving Category B status for the Shellfish Hygiene Directive

Where the spill frequency design standard is used, the frequency of significant independent spills may be limited to less than 10 per annum on average on a site-specific basis, if the duration of impact of the CSO is considered to be longer than 24 hours.

Where more than one storm overflow discharges to a Shellfish Water, then spills should be aggregated, by frequency and volume, so that the combined impact of the aggregated discharges does not result in any part of the shellfish water being impacted by more than:

- 10 significant spills per annum on average

OR

- 3% of the time on average.

The details of which storm overflow spills should be aggregated in a particular Shellfish Waters will need to be made on a site-by-site basis, based on an assessment of the combined impact of the CSOs on the Shellfish Water. The default position is that all spills should be aggregated, both in frequency and volume, to ensure that there is a total of no more than 10 significant spills per annum on average to the shellfish water as a whole. It may be appropriate to relax this approach if the situation clearly warrants it. For example, there may be two CSOs on opposite sides of a wide estuary, serving two separate catchments, with widely separated impact zones. See below.

The definition of significant spills can be considered on a site-specific basis, but 50 m^3 can be taken as a default volume. An example of a situation when 50 m^3 might not be appropriate would be a CSO discharging into shallow water directly into a shellfish bed (as opposed to a shellfish water) where consideration should be given to a smaller significant spill volume.

Disinfection of storm discharges is being trialled as an alternative to the spill frequency standards. The disinfection of storm discharges is covered below.

Screening requirements will apply to unsatisfactory discharges to shellfish in accordance with guidance on screening.

Impacts on other coastal waters and estuaries

Coastal waters are defined as all marine waters up to the 3 nautical mile limit, excluding estuaries.

There are currently no statutory provisions for these waters. As a minimum, Formula A, as specified in Section 3 of Annex (e) of the H1 Environmental Risk Assessment will apply.

As with storm discharges to freshwaters, where storage is provided at a CSO and in very large sewerage systems where significant smoothing of flows occur, then this shall be taken into account in defining the performance equivalent to "Formula A" without storage. Also where there is evidence that there are significant areas within the catchment that were designed, and remain, separately drained then an allowance for separately drained areas may be made. See link to HI above

If it can be demonstrated that this level of protection will produce no significant environmental benefit, then the sewered area should be treated on a case by case basis, where necessary supported by investigations and modelling exercises.

If, because of local use requirements, a more stringent standard of protection is needed, monitoring and modelling exercises are required to assess the required discharge frequency. For example for discharges impacting on Shellfish Waters and Bathing Waters.

Water quality standards appropriate to freshwaters such as FIS standards and 99 percentiles may also be relevant for protecting including the aquatic ecosystem including fish life. You should contact our Regional offices for confirmation of any relevant water quality standards.

2.3.3.5 Scheme solutions

Solutions to unsatisfactory storm overflows traditionally comprise of one or more of the following elements:

- Aesthetic controls (screens, scum boards etc)
- Additional storm storage near the overflow (on-line/off-line storage, upsized sewers etc)
- Increased sewer capacity downstream (gravity sewer or pumped sewer)
- Re-direction of upstream flows
- Raising overflow levels, or controlling flows through chamber to reduce spills.
- Reducing overflow outlet throttles.
- Preventing reverse flow from receiving water (non-return valves, relocated outfall)
- Relocating point of discharge to less sensitive location.
- Separation from combined system of sewers and drains carrying surface water flows only.
- Real time control of sewers to utilise more in sewer storage capacity

Option selection should pay due regard to sustainability and in particular to whole life CO2 implications.

Schemes solutions and the drainage system as a whole should be designed constructed and maintained comply with UWWTD requirements for best technical knowledge not entailing excessive costs. Your solution must comply with these requirements.

Climate change is predicted to put increased demand on sewer systems and increase the risk of sewer flooding. You should check your solution does not increase the risk of flooding from sewers or receiving waters.

Sewerage system operations

Sustainable drainage (SUDs)

We are promoting sustainable drainage systems ("SUDS") as a technique to manage surface and groundwater regimes sustainably.

Sustainable drainage is the practice of controlling surface water runoff as close to its origin as possible, before it is discharged to a watercourse or soaks away to ground. This involves moving away from traditional piped drainage systems to softer engineering solutions that are closer to their natural drainage regimes and help to promote wider environmental objectives. Sustainable drainage is a process for achieving integrated surface water drainage design with the objectives of:-

- reducing the flood risk from development within a river catchment;
- minimising diffuse pollution arising from surface water runoff;
- minimising the risk of pollution to groundwater;
- minimising environmental damage, eg bank erosion, and damage to habitats;
- maintaining or restoring the natural flow regime of the receiving watercourse;
- maintaining recharge to groundwater;
- achieving environmental enhancements, including improvement to wildlife habitats, amenity and landscape quality.

Our Policy objectives on SUDS are:

Primary objective: to establish Sustainable Drainage Systems (SuDS) as normal drainage practice where appropriate for all new developments in England and Wales.

Secondary objective: retrofitting SuDS on those existing surface water drainage systems which have an adverse effect on the environment.

We expect solutions to fully consider the potential for the use SUDS to keep surface water on the surface until it can soakaway or be drained to water course. You should also demonstrate you have considered and planned for the management of above ground flows when the capacity of the sewer system and SUDS are exceeded. Technical guidance on proprietary sustainable drainage systems and components has been produced by British Water in partnership with the Agency and is available via the following link:

The guide is due to be revised soon and the new guide will be available via:

www.britishwater.co.uk

We expect you will seek solutions in partnership with other bodies such as the Highways Authorities and Local Authorities where there is potential for a joint approach to preventing surface water entering the sewers.

We expect increased consideration of surface water separation where opportunities exist. Where it is not possible to solve problems by SUDS type measures alone we expect solutions will still incorporate such measures as far as is reasonably practicable.

2.3.3.6 Monitoring

General for AMP improved intermittents

We expect that improvements in CSO performance in AMP rounds will be maintained. We expect that companies will periodically check actual performance of their CSOs and sewerage systems against design horizon predictions made at the time of the permit application. We anticipate the results will be reported through the MD109 process

It is for the individual companies to decide how they will effectively monitor and review future performance against design horizon predictions. We anticipate the methods may vary depending on whether there are monitors in place and on the sensitivity of the receiving water. For example companies may report actual spill frequencies against design assumptions for bathing waters or continued compliance with population assumptions for less sensitive sites.

The industry is increasingly using software that links sewer models to the company's sewer asset database, allowing models to be more easily updated and kept live. We therefore expect that sewer models used for design purposes will be maintained in perpetuity. This may then form part of the review of CSO performance and be used to check the impact of any subsequent alterations to the sewer network on CSO performance.

Overflow monitoring

We may require spill event time and duration monitoring and recording as a condition of you permit. Where we require this we will explain the reason. Such reasons might include for example:

- The overflow has had operational problems in the past and we need to know it is operating properly now.
- The overflow has been improved and there was significant uncertainty in the predicted performance from the sewer modelling .
- The AMP improvement scheme was expensive or high profile and we need to ensure it was properly designed.

These requirements may be a temporary arrangement and we will review the need for each installation from time to time.

Where spill monitoring is required we will require data reporting to us in a specific format. A copy of the Excel spreadsheet format required for reporting purposes is included below. See Spill, event, time and duration reporting format spreadsheet accompanying this guidance.

Monitoring of spill event time and duration is often achieved by the use of level sensors when linked by telemetry this data can provide early warnings of blockages and provide time for the blockage to be cleared before a discharge occurs. Some companies therefore install such equipment regardless of whether it was required by their permit.

Sewerage system operations

We welcome the many initiatives in this area and may require this within the permit where storm overflows have caused repeated pollution incidents due to blockages.

Other monitoring

We may require other forms of monitoring such as pass forward flow monitoring on pumping stations where the pumping performance is uncertain.

For storm sewage overflows at STWs, you must check that the pass forward flow at which the storm overflow operates is as required by the permit. As a minimum, where the overflow is fixed and flows cannot be adjusted, spot checks for consent compliance may be adequate. Once confirmed they should be rechecked from time to time.

Pass forward flows may be controlled by an adjustable weir plate, a penstock, or by varying pump operation. In these cases we may require continuous recording of the pass forward flow and the operation of the storm separation device to confirm whether it meets the requirements of your permit. We may request this for overflows at sewage works and those major adjustable combined sewer overflows that could have a significant impact on receiving waters.

Any such requirements will be fully specified in your permit.

In some cases, you may be using real-time control to control flow to treatment. In these cases, you should keep flow records for 6 years, to be available to the Agency on reasonable request.

For all the above, you should check from time to time that when the storm-separating weir is operating, the FFT is being met.

Shellfish Water AMP improved discharges

Storm discharges identified for improvement in AMP and which discharge directly into or which impact on Shellfish Waters must be fitted with event/duration monitors and recording equipment. This is required to enable water companies to provide annual summaries of the operation of storm discharges to the Agency, and Local Food Authorities, and details of individual spill events to be provided on request from the Agency.

Summary reports of the frequency and duration of spills will be required from the Water Company to coincide with the annual classification under the Shellfish Hygiene Directive.

Our policy will include a requirement to monitor the operation (event/duration) of improved storm discharges, that we judge will impact on Shellfish Waters. Annual reports of the operation of intermittent discharges will be required to coincide with the annual classification of shellfisheries under the Shellfish Hygiene Directive. In addition, the Agency may request information about the operation of a monitored CSO in the event of an elevated Shellfish Waters Directive or Shellfish Hygiene Directive result.

A copy of the Excel spreadsheet format for reporting purposes is included below. See Spill, event, time and duration reporting format spreadsheet accompanying this guidance.

Bathing Water AMP improved storm discharges

The following discharges require event and duration monitoring:

- Combined Sewer Overflows (CSOs) and Storm Tanks (STs) which were improved to meet bathing water standards in AMP4 and previous AMP periods, where event and duration monitoring is not already installed;
- All CSOs and STs identified for improvements under the rB1, rB2 and B1drivers of PR09.

The monitoring requirement is that frequency and duration of a spill event is measured at the CSO or ST and recorded via telemetry. Telemetry has the advantage over a data logger at the site in that it offers a rapid response from the Water Company if information about an overflow operation is urgently required. There is no requirement to measure the volume of the spill.

2.3.3.7 Permit Applications

Applications for storm overflows should include the documented outcome of the work described below. .

In all cases you must provide the relevant information as set out in form EPB: Application for an environmental permit - part B6 water discharge activity.

Applications for existing satisfactory storm overflow

Where the application is being made simply because it is currently un-permitted we may permit it as it exists. We will need documented evidence that it is currently not un-satisfactory. We may be able to help provide your evidence and agree its status

However, where the storm discharge is recently constructed or the occurrence of storm discharges has only commenced in recent years, or the discharge is from a predominantly foul sewer system, we may refuse a permit or require the minimisation of spills.

If a new permit is to be issued for an existing satisfactory storm overflow that is not subject to change, it need only specify current conditions. These should include a statement of carry-forward flow where this information is available and should include any other facilities such as storage and screens etc, currently installed.

Sewerage system operations

Applications for improvements to existing unsatisfactory storm overflows or altered overflows

These proposals should have all followed the UPM procedure outlined above. In addition to the information required in the application form we may require documented evidence of the UPM modelling and the engineering details of the agreed solution. The outcome of the reports would ideally been prior approved by us as part of the agreed modelling plan where the partnership approach to the UPM procedure has been followed. The information and reports produced should be outlined within the application. We may request these information when we have received the application.

Where we propose to audit the modelling ourselves we may request further details. An example of the data request for auditing sewer models is set out below.

Applications for new storm overflows to deal with the risk of sewer flooding.

Sewer flooding risks are expected to increase as a consequence of climate change. Efforts to combat this should include the progressive reduction of sources of rainfall run-off and groundwater infiltration into sewers as well as the appropriate sizing and optimum use of sewer systems. The ideal design for sewer systems is where the sewers accept no more water than they can transmit. Excess surface water should be dealt with by above ground means such as designing flood channels and sacrificial flooding areas and by SUDS type approaches.

We consider sewerage undertakers to be key players in the design of systems to protect against flooding even where the responsibility for those systems might fall to others. Their intimate knowledge of their sewerage systems means they are best placed to target flow reduction measures to greatest benefit.

New or increased CSO discharges are not an acceptable long term solution to inadequate sewer design or maintenance. Nor should they be used as a substitute for innovative and sustainable solutions.

Reducing flood risks will require a sustained, widespread, and long term effort. New initiatives that may help with this process include the adoption of private sewers, controlling the right to connect surface water, and the requirement for planning permission to pave over gardens. Surface water management plans will help coordinate efforts in the worst affected areas.

The floods and water bill might help clarify roles and responsibilities for the various types of flooding and their solutions. We expect water companies and others to look beyond their usual regulatory boundaries to find creative solutions to flood risks.

As well as alleviating flood risk, reducing inflows to sewers has many consequential 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.

Sewerage system operations

Measures to reduce the immediate risks of property flooding include installing non return valves and individual property pumping stations or even tankering sewage away or pumping out the sewer into the nearest watercourse. Where an emergency discharge is made to prevent danger to health it may covered by EPR Reg 40.

Where there remains risk of property flooding then measures to improve their resilience to the effects of flooding can help limit its consequences.

By following the above principles we expect the need for new CSOs to be kept to an absolute minimum. Where a CSO application is made as part of a long term flood solution we expect the following work to be carried as well.

The required flood investigation and improvement work needed is divided up on the Source, Pathway, Receptor principle and is included below. Completion of the work may require collaboration between various stakeholders including the Agency.

Application to discharge storm sewage from an existing emergency overflow

UWWTD requires sewer systems to be designed maintained and constructed in accordance with the “best technical knowledge not entailing excessive cost” (“BTKNEEC”). This applies to all aspects of the collection including the limitation of leakage into sewers, the capacity of the sewers, the design of pumping stations, and the limitation of pollution due to storm overflows.

We would not wish to legalise storm and emergency discharges caused by some shortfall with respect to the UWWTD BTKNEEC requirements. We therefore expect these requirements be observed as a pre-requisite to granting permits for storm or emergency discharges.

The objectives of the information request below is to understand the problems that have led to the emergency overflow operating in storm and to ensure the problems are reversed in accordance with the BTKNEEC requirements.

Application for new or increased storm discharge to limit flows to treatment

Our requirement for these proposals is for no net deterioration in wet weather impacts. This is set out in Section 3 of Annex (e) of the H1 Environmental Risk Assessment. Your application must contain documented evidence that the proposals meet this objective..

Application for new or increased storm discharge as part of overall improvement scheme

The possible acceptability of such schemes is set out in Section 3 of Annex (e) of the H1 Environmental Risk Assessment. Our requirement for these proposals is for no net deterioration in wet weather impacts. We may accept locallised deterioration where these are outweighed by more significant environmental improvements elsewhere.

For these proposals the UPM procedure should show the net overall improvement as well as any locallised deterioration. You should undertake early discussions with us regarding the likely acceptability of the proposed new discharge. These discussions should form part of the agreed scope statement when following the partnership approach to UPM.

Your application must contain documented evidence that the proposals meet the above objective.

2.3.3.8 Permits

Permits will generally include conditions necessary to limit the operation and the aesthetic performance of each overflow, as appropriate to the receiving water uses.

They will include conditions such as overflow location, type, minimum pass forward flow during spill or weir setting, storage requirements, etc.

Where complex operating systems are used to optimise the performance of the sewer network and the storm overflows we may include the agreed operating system as a part of the permit.

Permits may be issued to reflect future improvements required as part of the National Environmental Programme agreed through AMP planning. In this case conditions may require a scheme a scheme to be designed to meet the agreed standards.. Once the scheme is approved we may agree to vary such consents to replace the design conditions with the more usual conditions reflecting the storage, pass forward flow, and screening, provided.

2.3.4 Emergency overflows

What's in this section

2.3.4.1 Introduction

An emergency discharge is any discharge that occurs because of one or more catastrophic failures. These failures may be electrical power, electrical control systems, mechanical or structural and may relate to pumping stations, or any other equipment involved in transmitting or treating sewage.

Where there are substances present in the effluent which are not covered by the permit. These substances are covered by the emissions of substances not covered by emission limits condition within those permits. Discharges in an emergency from sewage treatment works and sewer network overflows are not covered by the fugitive emissions condition.

We will only issue permits for emergency overflows from sewage pumping stations on the sewer network and at sewage treatment inlet works. Our purpose in permitting these is to give us regulatory control over the precautions to be taken to minimise the risk of failure, and the risk of a failure leading to a polluting discharge. We will only do this in situations where, on balance, we believe that the resulting reduced risk of a discharge outweighs the risk of legitimising a potentially polluting discharge. We will also only issue a permit where we believe an overflow is the best practical environmental option.

New developments are normally drained by separate foul and surface water systems. In these cases, the foul flow is sufficiently small and predictable to be taken away by tanker in the event of catastrophic failure of a pumping station. Therefore, we will not permit emergency overflows from these pumping stations. The developer must provide sufficient storage to allow time for the tanker to attend in an emergency. The design for these pumping stations is described in Part 2B of the WRc publication 'Sewers for Adoption 6th edition - a design and construction guide for developers' ISBN 1 898920 57 3.

2.3.4.2 Pumping station emergency overflow design

Sewage pumping stations on the sewer network often possess emergency overflows. These are designed to protect the pumping station or other property from flooding in the event of pumping station failure. Failures are usually mechanical or electrical power, or electrical control, and if flooding occurred the station could be sufficiently damaged to be taken out of service for a prolonged period rather than a few hours.

Sewerage system operations

We will permit emergency overflows on the sewer network up to and including terminal sewage pumping stations at sewage treatment works inlet works. We will limit the types of emergency covered by the permit to those caused by electrical power failure, mechanical breakdown, and rising main failure.

Because these overflows may operate in dry weather and often discharge to relatively small watercourses, their environmental impact can be larger than CSOs. You must therefore take appropriate measures to prevent such failures from causing potentially damaging discharges to the environment.

You must also make adequate arrangements for a quick and effective response to prevent and minimise the pollution from emergency overflows. The arrangements will depend on the potential impact and the characteristics of the sewerage system. You must provide facilities to reduce the risk of discharge as far as reasonably practicable.

The environmental risk posed by an emergency overflow is the product of the environmental consequences and the likelihood of a discharge occurring. The greater the environmental consequence the more that measures are needed to minimise the likelihood of a discharge occurring and the duration of any discharge that does happen. The consequence of a discharge is determined by the uses and sensitivities of the receiving water and the effect the discharge of crude sewage might have on them. An example of how the environmental consequences can be assessed is provided below.

Our minimum design requirements include:

- telemetry alarms to warn of power failure, pump failure, high levels in the wet well, and discharges from the emergency overflow,
- standby pump set that is triggered automatically in the event of failure of the duty pump and is capable of delivering dry weather flows
- tanker access where an emergency dry weather discharges could be realistically mitigated by use of sewage tankers
- some facility for standby power such as an external socket for a mobile generator as a minimum

We will normally also expect emergency storage sufficient for 6 hours at DWF or 2 hours at 3DWF where figures available and:

3DWF = 3PG + I + 3E

And:

P = population served

I = infiltration

E = trade flows

This should provide sufficient response time to mobilise a tanker or resolve most faults. The storage can be located within the wet well and upstream sewers and should be above the normal top operating level in the pumping station in dry weather and below the overflow level. The telemetry alarm system must be set up to identify as soon as the emergency storage begins filling due to pumping station failure.

Where it is not practical to have storage equivalent to 2 hours at 3DWF or this would involve excessive cost and the environmental consequences are low we may reduce the storage requirement to 1 hour at 3DWF.

Where the environmental consequences are high a reduced storage requirement might still be possible if additional measures are taken to further reduce the likelihood of a discharge. These should aim to build redundancy into critical components. Such measures might include where appropriate duplicate rising mains, a facility for over pumping, additional standby pump sets, permanent standby power generator, duplicate power supply, high priority rapid response to failures, enhance proactive maintenance of pumping station and rising main. Where pumping stations exist in series we may agree to reduced storage where you have controls in place to switch off upstream pumping stations to maximise use of available storage in an emergency. This will allow the use of tanker access facilities at upstream pumping stations and allow any unavoidable discharges to occur at the least sensitive locations.

For new or AMP improved emergency overflows impacting on shellfish waters must have a minimum storage capacity of 2 hours at 3DWF. They should also be provided with telemetry, stand-by pumps, standby power and tanker access as a minimum.

Where screens are required on emergency overflows particular regard must be paid to the flood risk consequences of screen blinding in an emergency. Where emergency overflows are also permitted as storm overflows, screening will normally be required in line with our the amenity and spill frequency guidance for screening requirements. Screens may also be required on emergency only overflows. Emergency screen bypasses should be set at such a level that they only operate if a screen is fully blinded.

2.3.4.3 Pumping Station Management Plan

Schedule 1 table S1.2 of your permit requires you to have plan setting out the emergency provisions you will provide and your response plan in the event of an emergency. This plan should include target response time within which you aim to attend for various alarms including catastrophic failures. You may request a reduced emergency storage requirement where you can demonstrate you can respond and prevent discharges within the normally required storage time. In these cases, we will need you to revise your plans if the response times are not met in practice. We expect the plan to be designed in such a way that it is live and accessible to all relevant staff so as to guide and inform the efficient running of the pumping station and the response if things do go wrong.

The plan should help you:

- optimise the performance of the pumping station
- minimise individual failures
- respond to breakdowns efficiently to minimise the consequent down time
- minimise the risk of multiple failures that would lead to total loss of pumping
- manage emergencies effectively within your target response time and restore pumping as soon as practicable.

The plan must include as a minimum the basic emergency provisions as set out above such as telemetry standby pumps etc.

Your permit only provides a defence to a discharge so long as the discharge is not due to the “act or default” of you or your agents etc. This means the pumping station should be proactively maintained and protected from damage and any failure should be remedied as soon as practicable.

Therefore we additionally expect your plan to include:

- pumping station access details e.g. keys, contact details.
- pumping station plans and technical specifications including valves and mains
- details of any long term serviceability problems e.g. rising main pressure restrictions
- asset maintenance and asset replacement schedule
- environmental permit
- telemetry response alarms and your response priorities and procedures to the various alarm states, and your target response time/s.
- supplier details for repairs, replacements, maintenance contractors, location of spares, local contractor details for temporary pumps, sewage tankers etc.
- routine checks, cleansing and maintenance plans
- Environment Agency emergency contact details
- measures to mitigate environmental impact of a discharge and clean up procedures

Pumping stations being part of the collecting system are therefore required to be designed constructed and maintained in accordance with best technical knowledge not entailing excessive costs under the UWWTD. Best technical knowledge is constantly advancing therefore your plan must reflect this.

2.3.4.4 Permit Application

Whilst we expect the plan to be a live and continually updated and improved in the light of experience or incidents we need to see your initial plan as part of your application. In the event of the pumping station causing pollution we may request an improved plan for approval in line with the condition on operating techniques in your permit.

2.3.4.5 Records

You must keep records of all routine and non-routine cleansing and maintenance of the pumping station, valves, and mains, for a minimum of 6 years. These records should be accessible to operatives to assist the efficient management of the pumping station and be available to the Environment Agency on reasonable request.

You must also keep records of all telemetry alarms, breakdowns, failures, blockages, and emergency discharges, and the actions taken to resolve those problems. These records must be kept for a minimum of 6 years and made available to the Environment Agency on reasonable request.

2.3.4.6 Reporting

General

Where routine spill event duration monitoring is required for specific reasons it should be provided using the format set out in the 'spill event time and duration reporting format' spreadsheet.

In all cases you must provide us with a written report on the operation of the emergency overflow where we request one.

Emergency overflows impacting on shellfish waters

Where we have judged a new or AMP improved emergency overflow would impact on shellfish waters you must provide both the Agency and the local food authority with an annual report on the operation of the emergency overflow. Where this is a requirement it will be specified in your permit. The annual report will be required in time to coincide with the annual classification of shellfisheries under the Shellfish Hygiene Directive. The report shall cover the 12 month period 1st April – 31st March inclusive, and shall be provided by the end of the following May. The required reporting format is set out in the 'spill event time and duration reporting format' spreadsheet. On request, you must provide us with written details of individual spill events.

The Agency will also include in your permit a requirement for you to notify both the Agency and Local Food Authority in the event of an emergency discharge (see 'Notifications' below).

2.3.4.7 Notifications

General

Any malfunction, breakdown, failure of techniques or equipment, or blockage, that is likely to cause significant pollution must reported to the Environment Agency as soon as possible.

Emergency discharges impacting on sensitive receiving waters

Your permit may require you to notify us in the event an emergency discharge occurs. This will be required where the receiving water has particular sensitivities or the discharge would cause a particularly high impact. The permit may require you to notify us in the event of failure or breakdown of the pumping station as soon as there is potential for emergency overflow to operate

These requirements will be specified where we would need to set up incident mobilisation and advise down stream users of the discharge.

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Operations Annex for Section 2.3 Sewerage System Operations

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Annex 1.1 - Unsatisfactory and sub-standard, storm discharges.

Evidence to demonstrate storm overflow is unsatisfactory

Type of information to be considered

Staff field visits	Staff visits can be used to: To confirm that the asset exists To provide evidence of sewage-derived litter (through photographic or aesthetic surveys) To provide evidence of sewage fungus Biological surveys Confirmation of dry weather operation status Note: These would ideally be contained within a completed site inspection form.

Environment Agency records	Our records include: Public complaints pollution incidents (use NIRS and NIRS2) any history of dry weather flow operation any impact on water quality class or objectives (using for example the reasons for failure or bathing waters stewardship databases).

Modelling – by us or a water company	**Riverine or marine water quality impact modelling** Assess impact on water quality class or objectives. This will be of assistance to check compliance with the appropriate water quality standards. For example those associated with freshwater fish, bathing or shellfish waters directives. **Sewerage modelling** Spill frequency, volume and duration information will assist with impact assessment. Spill frequency modelling can be used to identify those overflows that significantly contribute to bathing waters and shellfish waters standards failures. Survey data collected to build models may help identify problems with sewerage infrastructure, for example low weir setting giving rise to operation during dry weather

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Water company records	Confirm what is already installed at the discharge structure. For example, screening if available, pass forward flow, facilities in case of emergency. Event duration monitoring records if available Please note it is not expected that evidence would be provided under all the categories above, but the evidence must be robust and demonstrate the discharge is unsatisfactory against the relevant qualifying criteria. **Example** Where a discharge qualifies as unsatisfactory due to significant visual or aesthetic impact then in you would expect to have evidence in the form of: photographic evidence of sewage debris or sewage fungus; a history of public complaint; from aesthetic surveys. You would also expect field staff to have visited the site. **Using judgement** Water quality planning, regulatory specialist and field staff should use their judgement to determine whether there is sufficient evidence to justify the inclusion of a discharge for improvement works. Identified discharges may be subject to review to determine whether there is sufficient evidence to identify them as unsatisfactory.

How to classify and deal with satisfactory, unsatisfactory, and sub-standard overflows.

Situation	Permited by Agency	Unpermitted
Satisfactory Meets guidelines (not unsatisfactory in terms of environmental criteria) **And** modern standards of engineering for storm overflow structures and aesthetic control, and/or sufficient capacity in system	Correct situation Ongoing Inspection and routine maintenance by water company where required to prevent them becoming unsatisfactory	Needs to be permitted. Water Company apply for permit. Permit as is. Ongoing Inspection and routine maintenance by water company where required to prevent them becoming unsatisfactory
Sub-standard Meets guidelines (not unsatisfactory in terms of environmental criteria) **But** Not to modern standards of engineering for storm overflow structures and aesthetic control,	Requires raising to modern standards of engineering in the medium to longer-term through Capital maintenance and/or Supply Demand Balance	Requires raising to modern standards of engineering in the medium to longer-term through Capital maintenance and/or Supply Demand

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and/or insufficient hydraulic capacity	Programmes. Ongoing Inspection and routine maintenance where required to prevent them becoming unsatisfactory Included in planning for maintenance/capacity improvements in AMP planning by the Water company	Balance Programmes. Needs to be permited. Water Company apply for permit. Permit as is. Ongoing Inspection and routine maintenance where required to prevent them becoming unsatisfactory Included in planning for maintenance/capacity improvements in AMP planning by the Water company
Unsatisfactory Does not meet guidelines (unsatisfactory in terms of environmental criteria) and not to modern standards of engineering, and/or insufficient capacity	Requires improvement in line with the guidance in this document appropriate standards to be confirmed by Agency and modern standards of engineering as soon as is practical, say 2-3 years. Permit will be modified to reflect these requirements. Any required improvements should be taken through OFWAT's AMP change protocol process.	Requires improvement in line with the guidance in this document appropriate standards to be confirmed by Agency and modern standards of engineering as soon as is practical, say 2-3 years. Needs to be permitted. Water Company apply for permit. Permit will reflect these requirements. Any required improvements should be taken through OFWAT's AMP change protocol process.

Annex 1 - for section 2.3.3 Storm overflows

Evidence that an overflow is the cause of a water quality problem will need to be made available. All information/data used or produced in connection with this guidance should be filed for future reference and audit.

Un-permited Storm Overflows

If an un-permited storm overflow is assessed as being unsatisfactory. The water company apply for a permit. Subject to the permitting procedure we will issue a permit containing the requirements and timescale to improve the asset as soon as practicable, normally 2-3 years. The likely requirements are outlined below. The water company will then need to discuss funding of the improvements with Ofwat through the AMP change protocol. Once the obligation is in place through the permit this should assist the Company in their discussions with Ofwat. Such an overflow should only form part of the planning for the AMP National Environment Programme if it has become unsatisfactory due to a new quality requirement through changes in legislation, such as a new Directive or designation.

Where sub-standard or satisfactory storm overflows are unpermited then the water company should apply for a permit. Subject to the permiting process the Environment Agency will then permit 'as is'. However, outside of the permit the water company should confirm in writing that operational maintenance is in place to ensure they do not become unsatisfactory. Any further requirements are outlined in Sections 2.3 and 2.4 below.

Unsatisfactory Storm Overflows

If a permited storm overflow is assessed as being unsatisfactory we will modify the permit to a contain the requirements and timescale to improve the asset as soon as practicable, normally 2-3 years (subject to discussions with the water company). You will then need to discuss funding of the improvements with Ofwat through the AMP change protocol. Once the obligation is in place through the permit this should assist you in discussions with Ofwat.

The minimum improvements necessary to meet the requirements specified in Section 1 and 3 of Annex (e) of the H1 Environmental Risk Assessment will apply. That is:

Combined Sewer Overflows: retained flow of formula `A' (or equivalent storage) and/or appropriate aesthetic control where required.

Storm Tank Discharges: tank treatment provided by storm tank capacity of 68 l/hd or two hours retention of the maximum flow received by the storm tank, or by a process giving equivalent performance.

Any additional requirements to meet environmental standards (e.g bathing water, shellfish waters or freshwater fish) should be identified and the relevant policy requirements applied.

Such an overflow should only form part of the planning for the AMP National Environment Programme if it has become unsatisfactory due to new quality requirements through changes in legislation, such as a new Directive or designation.

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Sub-standard Storm Overflows

In relation to sub-standard Storm overflows we do not view them as forming part of the Quality programme for AMP as they are not unsatisfactory. However, there is a risk that such assets may become unsatisfactory due further deterioration of the asset and/or reduced capacity due to growth. We would therefore expect water companies to programme improvements to sub-standard assets according to the risk presented to the environment as part of their ongoing asset management planning procedures to prevent them becoming unsatisfactory. In the longer term these assets should be brought up to satisfactory status as part of the capital maintenance programme. These sites should be logged by the water company to aid in planning for maintenance or capacity improvements in AMP.

With regard to longer-term planning and management of the sewerage system, the Agency is concerned to encourage a more integrated approach to the assessment of operational maintenance, capital maintenance, Supply-Demand Balance and Quality requirements. The management of storm overflow assets should form part of this and the Companies should have systems to track the status of such assets.

We would expect the number of sub-standard storm overflows to decrease in the longer term with an associated increase in the number of satisfactory storm overflows. The number of unsatisfactory storm overflows should not only decrease but there should be no new unsatisfactory storm overflows unless there is quality requirement through changes in legislation, such as a new Directive or designation.

You should log these sites to aid in planning for maintenance or capacity improvements within AMP.

Satisfactory Storm Overflows

The Water Companies should also ensure no storm overflow discharges become unsatisfactory We expect companies to identify storm overflows discharges at risk of becoming unsatisfactory and to address these as part of their capital maintenance programmes, or by other means. We would support the case for capital maintenance expenditure in AMP that identifies specific outputs to address these risks.

This should also involve the maintenance or renewal of the sewerage infrastructure to the most modern standards to prevent surcharge of ingressed surface water and infiltration that would lead to premature or emergency discharges to controlled waters.

We see future sewerage infrastructure maintenance and development being predicated by the adoption of Sustainable Drainage Systems (SuDS) techniques to minimise the ingress of surface and groundwater into the sewerage system.

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Storm Overflows Associated with Other Parts of the AMP Programme

In relation to sub-standard overflows you should discuss with us the risk that such assets may become unsatisfactory due further deterioration of the asset and/or reduced capacity due to growth. We would therefore expect you to programme improvements to sub-standard assets according to the risk presented to the environment as part of your ongoing asset management planning procedures to prevent them becoming unsatisfactory. You should log these sites to aid in planning for maintenance or capacity improvements within AMP.

Satisfactory or sub-standard storm overflows must not become unsatisfactory. Appropriate measures should be included as part of your AMP planning.

Annex 1 - for section 2.3.3 Storm overflows

Annex 1.2 - Technical Audit of Computer Models for CSO Improvement Schemes

1.0 Introduction

The need for validated sewer hydraulic models when permiting certain categories of CSOs. The following guidance is for those undertaking audit of sewer hydraulic models for determining permits for storm overflows. It will also be relevant to those building and verifying models for the same purpose. Throughout the modelling process the methodology identified in the Wallingford Procedure, and the WaPUG Code of Practice for Hydraulic Modelling and appropriate WaPUG user notes should be followed.

NB throughout this paper the industry term verification is used, as equating to validation. In this context verification is taken to mean that the model is 'fit for purpose' rather than being strictly true to life.

Computer models of sewerage systems are invaluable design tools which are used to gain an understanding of the way in which the system works and to predict pass forward flow, spill rate, and volumes. These outputs are used to design storm overflow weir settings, storage requirements and other operational features of the system. Depending on the ultimate purpose of the model differing levels of confidence in its performance may be required.

2.0 Construction of Hydraulic Models

A verified sewer model is usually required in support a applications for storm discharges to fresh, estuarine or coastal waters. Model construction should be in line with the best practice identified in the WaPUG Code of Practice and should be fully documented for audit purposes.

A sewer model can be considered as a network of connected pipes through which flow derived from base flow and storm runoff can be routed. The flows are derived from population and trade base flows, infiltration and rainfall related runoff from impermeable and permeable areas. Additional inputs from streams and land drains may also need to be taken into account. Throughout the model construction and use, assumptions will be made about the way in which it represents the real sewer network and flows. The auditor must be fully aware of these and consider how they will influence the interpretation of the model results.

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The process of model construction is one of selecting hydraulic and hydrological model parameters based on existing data, manhole surveys, impermeable area surveys, CCTV surveys and other investigations. Confirmation of manhole data quality should be checked by at least a 5% (by area) manhole survey, which should be included in the reports (a standard practice in manhole surveys). Default values and assumptions are often selected where actual information is unavailable. The process of verification is then performed by comparing the flow data recorded during events with the model predicted flows using recorded rainfall as an input to the sewer model. A summary of monitor performance should be included in the verification report. Confirmation that the model and recorded data are presented for the same site may also be prudent.

Mismatches in flows identified in an initial verification check may reveal potential shortcomings in the model and / or the measured flow and rainfall data. The nature of the mismatch should be considered carefully as to the possible root cause. The reliability of the flow data and rainfall data should first be determined to avoid unnecessary site investigations. It is important that the model is not adjusted during the verification process unless actual information is obtained to show the original model to be incorrect. Force fitting the model to achieve good agreement with the verification flow data is not acceptable. Verification may form an iterative process, with further site investigations following subsequent verification checks. The final verification comparisons are then presented to illustrate the models' validity. Clear and concise records of this process should be included in reports for the audit trail.

3.0 Data for Verification

The minimum requirement for the final verification check is 3 measured storm events of differing characteristics of total rainfall, intensity and duration with respect to the time of concentration of the catchment. The flow survey should also be used to measure the diurnal variation in dry weather flow and quantify the domestic, industrial and infiltration components. The measured DWF should be an initial condition of the model before the early verification checks. It remains an assumption that the model can be used for times other than those when the flow and rainfall data was recorded and for events outside the range of those against which the model was verified. For example; catchment responses in the summer are not best verified by winter surveys, and 1 in 5 year return period storm responses, which may cause surcharge and flooding, are not verified by 1 in 5 week return period storms which fail to cause surcharge.

It is the auditors' role to assess the construction and verification of the hydraulic model, judge whether the sampled data are sufficient and to assess whether the model represents the sampled data well enough for the model to be considered as verified for its intended use, ie. it is fit for purpose. This should also consider the level and degree of verification of the model.

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4.0 Verification

The level or extent of verification will to some extent be a function of the purpose of the model (for example, Drainage Area Planning and detailed water / sewer quality modelling will have different verification and audit requirements) and the extent and performance of flow surveys, recorded rainfall, historical information and modelling software used. The degree of verification refers to the goodness of fit at an individual location. The circumstances under which the degree of verification is assessed must be appropriate to the purpose of the model. A good degree of verification for low intensity / magnitude rainfall events is not appropriate if these are not the circumstances under which the sewer system gives problems needing resolution.

4.1 Verification guidelines

i. The following guideline criteria can be used for audit of sewer hydraulic models, particularly on the goodness of fit:

- the model should not show any visible or numerical instabilities for events up to the maximum return period for which it is intended to be used.

ii. With most flow survey instrumentation, observed depths of 100mm or less, and/or where velocities are less than 0.2 m/s, are close to the limits of monitor performance and the observed data are likely to be subject to inaccuracies, unless high resolution flow monitors were employed. The WAA publication 'A Guide to Short Term Flow Surveys' provides additional information on flow survey equipment and reliability.

iii. Where previously verified models have been converted to more recent software, a reverification exercise should be undertaken and presented to the Agency. Such conversion processes can introduce changes in the response and stability of the model, and a reverification is a safeguard against introducing unnecessary errors.

Using available historical data:

iv. Known surcharging should be predicted by the model for a similar return period event.

v. All sites where flooding due to hydraulic incapacity is documented should be reproduced by the model for a similar return period event and predicted total flood volumes in excess of $25m^3$ must be substantiated. Where this is not achieved the reason for the discrepancy should be explained.

Using flow survey data.

vi. Peak flows predicted by the model should be within +25% to -10% of the recorded values.

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vii. Total flow volumes, occurring during the storm flow response should be within +20 % and - 10% of recorded values.

viii. Global effluent volume for the catchment should balance to within ± 10%. A higher accuracy may be justified to assess total DWF from a catchment where this figure is to be used as a basis for extrapolating design DWF and flows to treatment.

ix. Predicted surcharge depths should lie within +0.5m to -0.1m of the observed values, and all flooding locations with volumes in excess of $25m^3$ must be substantiated.

x. Actual flooding during flow surveys should be predicted by the model, and predicted flooding should be investigated to confirm or refute its occurrence.

xi. The time of arrival of modelled peak flows should be within ± 20% of time of arrival of observed peak flows.

xii. The final hydrographs should be plotted to overlay the predicted and observed responses for flow, depth and velocity. The general shape of the hydrographs for each site and event should be similar and the comparison must continue until substantial recession has occurred. The rainfall hydrograph relevant to each site is also helpful in assessing the sewer system response to rainfall.

4.2 Interpretation of verification

Making judgements as to how well a model is verified is not a straight forward assessment against the percentage fit criteria detailed above. There may be sites within a model, where for a variety of reasons, the degree of fit does not fall within these criteria. The auditor should be able to assess how significant such discrepancies are. Discussion with the model constructor to explain and clarify such discrepancies is essential. Equally there may be sites where the apparent fit with some criteria is good due to errors in the model and/or the data therefore judgement and experience is needed.

There are a number of factors which will influence the degree of agreement between observed data and model prediction. A good understanding of these is important as the particular circumstances of each model will need to be taken into account when that model is used for design purposes.

I. The model construction may lead to necessary simplification, which will influence how it represents the system behaviour. The assumptions necessary for this must be clearly stated. A simplified model should still represent the system reliably, within the tolerances above, particularly in the areas of concern or proposed improvements (CSOs, pumping stations, areas of flooding...). If this is not the case, the simpler model can not be considered valid and will need to be reconstructed to its previous degree of complexity with verification checks then undertaken.

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ii. The survey data used to construct the model may be out of date, sparse, concentrated on inappropriate areas for the study in hand or operational regimes may be different from design / expected (eg pumping stations). Survey data should also be subject to quality assurance checks.

iii. The survey data used to verify the model may be subject to numerous problems (for example, poor siting of monitors, total failure, partial failures of different types including siltation and ragging, poor monitor resolution, old data).

iv. There may be events / occurrences in the systems which the model does not represent due to the scope and purpose of the modelling exercise (transient sewer blockage, time varying infiltration or siltation, dual storm / foul manholes). Where this is the case the verification summary should detail what aspects of the catchment response are verified and which are not.

v. It is important to consider how representative the chosen rainfall is for verification; are there spatial and / or temporal variations which might influence catchment performance? The time of surveys, particularly for DWF days, should also be considered, are there trade or public holidays which might influence the flows? The WaPUG Code of Practice and User notes also provide guidance on the suitability of selected rainfall data (covering aspects of magnitude, intensity, duration of event in relation to time of concentration of sewer system) for model verification.

vi. New development and changes in the relative importance of contributing areas can influence the runoff generated by the model. It is desirable that the flow survey verification is undertaken soon after the survey and the model construction are complete; the verification is of the system at a particular point in time. The influence of changes in the catchment must be taken into account during the verification and use of the model.

There are a range of potential outcomes following a verification assessment;

i. The model is accepted as totally fit for purpose. Even in this case, the model results should be used with care and allowance made for the modelling assumptions and uncertainty inherent in the data used to set up the model.

ii. The auditor has concerns over particular areas or aspects of the model which, whilst not precluding its use, mean that the results and outputs from the model or its subcatchments should be interpreted and used with care. Possibly a safety margin or allowance should be incorporated into the application of the model or its sub-catchments.

iii. Following the audit of the model verification, some aspects may require further investigation, for example site survey, impermeable areas or manhole / gradient surveys. The findings of such surveys, whether or not they confirm the suspected error, should be included in the model before reassessing the verification. As with the original process of verification, changes to the model must not be made unless supported by findings from survey work.

iv. The auditor considers that the model is totally inadequate and not acceptable for its intended purpose.

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5.0 Application of A Verified Hydraulic Model

Once the model has been accepted as fit for purpose, with or without caveats, it should be used for design purposes with care. Any caveats for approval should not be forgotten and it is necessary for the auditor to clearly specify how these might influence the results from the model and their interpretation and use. Where a system includes features which are not included in the verified model, such as enhanced infiltration following storms, or stream inflows, the scheme design should address these in a appropriate manner, particularly if they constrain the application and interpretation of the model results.

To run sewer models for analysis of hydraulic deficiencies and design purposes requires rainfall data. The most appropriate method of analysis and type of rainfall data required will depend on the significance of the scheme and its purpose. Examples of a models purpose include predicting storm overflows, predicting DG5 property flooding, determining the required flows to treatment setting and storm storage, and may vary depending on the amenity and type of the receiving waters. You must decide the models purpose and tailor the model build and verification to suit. Changes in the models purpose including the proposed scheme might lead to the need for further modelling and reverification. You should inform the auditor of the models purposes and targets for the needs analysis and the scheme design. The use of time series rainfall is covered in this guidance and in the UPM Manual and should be audited. Guidance on design rainfall is included within the Wallingford Procedure. WaPUG user notes also provide modelling advice on best practice and should have been followed.

Within the UPM procedures the use of simplified sewer models is appropriate for certain circumstances. Where such simplified models are based on detailed hydraulic models the latter should be validated to the criteria discussed above. The calibration of the simplified model against the detailed model results or recorded field data is discussed in the UPM manual. Criteria for the degree of fit on total spill volumes and hourly spill rates are under consideration.

6.0 Bibliography

Technical Committee on Storm Overflows and the Disposal of Storm Sewage. Final Report (1970)

Foundation for Water Research (1998) Urban Pollution Management Manual 2nd edition FR/CL 0009

Hydraulics Research Ltd (1983) Design and analysis of urban storm drainage. The Wallingford Procedure. Volume 1 Principals, methods and practice Volume 3 Maps [Meteorological & soil maps] Department of Environment / National Water Council. Standing Technical Committee Reports No 28

Wallingford Procedure User Group, Users Notes Produced since 1986, currently up to user note 35, covering various aspects of sewer modelling and application.

WRc (1987) A guide to short term flow surveys of sewer systems.

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WRc (1993) Code Of Practice for the Hydraulic Modelling of Sewer Systems. Wallingford Procedure Users Group

WRc. (1994) Sewerage Rehabilitation Manual. Third Edition.

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Annex 1.3 - Rainfall data requirements for UPM modelling purposes

Introduction

Rainfall data are required to drive the models that simulate the wet weather performance of urban wastewater systems. Long time series of rainfall events provide an account of the variability in rainfall over the chosen time period and give the user maximum flexibility in making different event selections depending on the question being addressed.

In all but the simplest of UPM modelling studies, there is a requirement for long series of rainfall data which are representative of the study catchment. The length of the record is important to ensure that the data do not represent a particularly wet or dry period. A record of at least 10 years, but preferably 15 to 20 years, is required for UPM applications. The various elements of UPM modelling require rainfall in a range of formats. The main requirements are for values in hourly or five minute timesteps. Long time series of hourly data are needed as input for simplified sewer flow models, and rainfall data (continuous time series or discrete events selected from the time series) with a maximum timestep of five minutes are required for detailed sewer flow quality modelling.

Historical or synthetic rainfall time series are usually for a single site and it is assumed they can provide a representative input to a sewer system model. This assumption could be inaccurate for many catchments if, for example, they cover a large area or a range of altitude.

Type of rainfall data

Historical rainfall time series (hourly)

Digitised hourly rainfall data are available for many UK sites and may be obtained from, for example, the Meteorological Office. Selection of the most appropriate rain gauge site to represent the catchment to be modelled should be carried out in consultation with the Environment Agency.

One of the factors, which should be considered in the site selection, is the distance of the gauge from the study catchment. Local rainfall variation should be studied if the gauge is not within the actual catchment. This can be initially achieved by, for example, consulting rainfall maps (e.g. Volume 3 of "The Wallingford Procedure", DoE/NWC, 1981). Further more detailed testing whether a particular hourly record is suitable is to compare it with a local daily rainfall record. This is discussed further in Section 3. Historical data should always be screened and checked for missing data values.

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Synthetic rainfall time series (hourly)

There are insufficient hourly rainfall sites, or suitably long records, for all urban areas in the UK. An alternative to historical hourly rainfall, is the use of modelling techniques that generate synthetic data, which provide long rainfall time series containing all of the characteristics of historical data. Further details are provided in the UPM Manual 2nd Edition.

Reliability testing

The rainfall inputs provide the foundation for all hydraulic and quality modelling. It is therefore necessary to ensure that adequate confidence can be given to the rainfall inputs for the study. Comprehensive checks should be carried out to determine whether the rainfall series accurately represents the study catchment, especially in terms of the location and the time period. The records should also be as recent as practically possible. Simple comparisons using average annual and monthly statistics do not provide a sufficiently accurate means of testing rainfall time series.

Testing of an historical hourly series is required if, for example, the raingauge data are only available from a site distant from the study catchment, or it the record is only of a short duration. In these cases the hourly data should be compared with a long (at least 20 years) daily rainfall time series from a local site. A daily record will usually provide an accurate series because the large population of well established daily measuring sites means that data can be obtained from a local site. Also, a long record will indicate the presence of any short term trends. Digitised daily data are available for an extensive number of sites covering much of the UK, available from the Met. Office or from other sources. The daily series should:

Be as local as possible to the study catchment;
Be of at least 20 years duration to detect short term trends; and
Not have extensive periods of missing data.

A simple, but effective, comparison between the daily and hourly series can be achieved by aggregating the hourly data to daily totals and then comparing the number of days equalling or exceeding a range of threshold depth values. For example, the number of days the daily record has in excess of 10, 12, 14 … 30 mm compared with the number of days the hourly record has in excess of the same threshold depth values.

Ideally the historical hourly data series would cover the most recent 10 – 15 years. If an older data set is all that is available, for example due to discontinued data collection, comparative checks should be made with up-to-date daily data (which are more likely to be available). If the series are consistent, the older series can be used, however if not, an alternative must be found or allowances made. Synthetic hourly rainfall should also be checked against a very recent daily data series.

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Event definition

Unless continuous simulation modelling is to be employed, a major first step before using any long rainfall series (either historical or synthetic) is to produce an event file that contains only the events required for subsequent analysis. The definition of an 'event' is dependent on site specific conditions and modelling requirements. In many UPM applications a one hour dry period separating events is suitable when a sewer system does not contain much storage and/or has steep gradient. However, a longer dry period between events is more appropriate for flatter catchments and those containing large storage tanks with extended drain down times.

During the event definition process, the antecedent conditions and catchment wetness indices can be calculated for each discrete rainfall event. These parameters are required for estimating runoff in sewer flow models. Allowances should be made in the choice of the urban catchment wetness values if storms are of a particularly long duration; likely if a lengthy dry period is used to define the event. Catchment specific solutions, such as a median value rather than a start of storm value, should be agreed with the Environment Agency before modelling runs are carried out.

Five minute intensity data

Detailed sewer flow and quality models require the input of discrete rainfall event data at timestep of, ideally, not more than five minutes. However, such historical data are very rare in the UK. Variations of rainfall intensity within any one hour period can be very significant for flow and quality modelling. Therefore, it is important that accurate rainfall data are provided.

Details of a stochastic disaggregation model which produces realistic five minute intensity values from either historical or synthetic hourly rainfall data, are given in the UPM Manual 2nd Edition.

Spatial variation of rainfall

It may be necessary to take into account the spatial and temporal variability of rainfall in planning and designing the sewer system response. The relevance of spatial variability in rainfall occurs particularly during localised convective storms and where the capacity of the sewer system concentrates the runoff response. Orographic effects may also mean the use of a single site rainfall series is inappropriate. The need to consider spatial rainfall also arises in the real time control of storm sewer systems.

Solutions to the problems of correctly interpreting the sewer response can include; Areal reduction actors (described in the Wallingford Procedure [2]) and the application of more than one rainfall series to accommodate variation due to altitude.

In large catchments, the tracking of storms is likely to produce a variation in flow volumes at different points within the catchment during the event. Although there is likely to be spare capacity within the sewer system due to this variation, it is very difficult to predict where and when. Very careful consideration must be taken in design work when attempting to use any spare capacity due to the spatial variation of rainfall.

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References

1. Urban Pollution Management Manual 1998 Foundation for Water Research, Second Edition, Report No FR/CL0009
2. Design and analysis of Urban Storm Drainage. The Wallingford Procedure. 1983 DoE/NWC STC Reports N0 28

Annex 1.4 - Simplified Modelling default and sensitivity data

The recommended default and sensitivity values for simplified UPM modelling are presented in the following tables. These should be used as a starting point for negotiation with the Agency in the absence of local information. They should be used in conjunction with appropriate sensitivity testing in developing and testing solutions and in targeting appropriate sampling programmes to support detailed modelling studies, if required.

The report 'Default and sensitivity values for use in simplified UPM modelling studies' WRc Ref UC6835v2.0 March 2005' containing the analysis undertaken to generate these values.

Many of the processes involved in the interaction between sewers and water courses are very complex and are greatly simplified in models. In addition, estimating the impact of wet weather discharges with simplified models may, under some circumstances, be very sensitive to some of these parameters. It is recommended that appropriate sensitivity testing should be carried out to investigate the significance of key parameter estimates on the loads delivered to water courses and their subsequent impact.

Recommended default and sensitivity test values for simplified UPM modelling

DWF pollution contributions per capita

Determinand	Per capita contribution (g/head/day)	Comment
BOD	55 to 60	Taken from: Characterisation of dry weather flow in sewers**;** 1997, Funders Report/IP/7, CIRIA
Total Ammonia (as N)	6 to 7	

Parameter	Default	Sensitivity	Comment
Surface water runoff			
BOD in surface water runoff (mg/l)			
RE1 river	3	4	These values provide suitable background concentrations
RE2 river	7	8	
RE3 river	10	13	
RE4 river	15	18	

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Parameter	Default	Sensitivity	Comment
Ammonia in surface water runoff (mg N/l)	0.2	0.3	when testing the impact of CSOs
CSO spill concentrations			
a. Factors relative to baseflow concentrations			
Flat/average catchments			
BOD	0.5	0.4	Defaults are
Ammonia	0.3	0.2	conservative.
Steep catchments			Sensitivity values
BOD	0.3	0.2	will help judge the
Ammonia	0.3	0.2	safety margin
b. Average spill concentrations (mg/l)			
Flat/average catchments			The use of factors
BOD	125		is recommended,
Ammonia	8		rather than these
Steep catchments			average
BOD	75		concentrations
Ammonia	4		
Sewer sediments in SIMPOLv2			
BOD sediments			Defaults are
Sediment load kg per m^3/s baseflow	6000	10000	reasonable for
Erosion concentration mg/l	50	100	most storms. The
Interstitial ammonia in sediments			sensitivity values
Sediment load kg N per m^3/s baseflow	200	400	provide a check
Erosion concentration mgN/l	1	2	on the impact of
River process rates			large storms and may be appropriate for the 1 yr RP FIS
Total BOD decay rate (day^{-1})			
River has a continuous discharge from a WwTW upstream.	0.35		
River has lots of rocks and weeds (surface area) for sustaining bacterial communities.	0.3	+/- 50%	
River is generally clean apart from intermittent discharges.	0.1		
Ammonia nitrification rate (day^{-1})			
River has a continuous discharge from a WwTW upstream.	2.0		Include ammonia release from BOD decay
River has lots of rocks and weeds (surface area) for sustaining bacterial communities.	1.0	+/-50%	
River is generally clean apart from intermittent discharges.	0.5		
Reaeration equation	O'Connor Dobbins	Churchill	Include sediment oxygen demand also

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Parameter	Default	Sensitivity	Comment
Manning's n	'Normal' values	Max and min values	From Chow 1973. See below
Other parameters	MIKE 11 defaults		See below

Manning's n

Values of Manning's n for various stream types (from Open Channel Hydraulics; Chow, 1973)

Stream Characteristics	**Minimum**	**Normal**	**Maximum**
Clean, straight, full stage, no rifts or pools	0.025	0.030	0.033
Same as above, but more stones and weeds	0.030	0.035	0.040
Clean, winding, some pools and shoals	0.033	0.040	0.045
Same as above, but some weeds and stones	0.035	0.045	0.050
Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
Very weedy reaches, deep pools	0.075	0.100	0.150

In simplified models it is normally necessary to apply a single **n** value to a whole reach. As a default, it is suggested that the 'normal' value is chosen from Table 4.1 using the stream characteristics which are most representative of:

- the reach location where DO failures would be most likely. and
- the time of year and flow conditions which are most critical for low DO.

The 'minimum' and 'maximum' values provide suitable values for sensitivity tests. The higher the **n** value that is used, the flow depth will be deeper, the velocity slower and the DO prediction more pessimistic.

Annex 1 - for section 2.3.3 Storm overflows

Other parameters

There are a number of other parameters which may be used in simplified models. These are listed in Table 4.6 together with the MIKE 11 defaults. These values are recommended for use in simplified models.

Table 4.6 includes a value for sediment oxygen demand. Sediment oxygen demand is the basic demand of oxygen originating from the river bed due to natural sources of organic matter, that is, not as a result of the pollution sources being studied.

MIKE 11 defaults for other parameters – recommended for simplified models

Parameter	Values
Temperature coefficient for reaeration constant (K2)	1.024
Temperature coefficient for BOD decay rate	1.024
Temperature coefficient for ammonia decay rate	1.130
Sediment oxygen demand (gO_2/m^2 per day)	0.5
Oxygen demand by nitrification (gO_2/gNH_4-N)	4.47
Ratio of ammonia release by BOD decay (gNH_4-N/gBOD)	0.29
Uptake of ammonia by bacteria (gNH_4-N taken up /gO_2 BOD degradation)	0.109

Annex 1.5 - Determination of Aggregations

The need to aggregate together spills from intermittents impacting on the same Shellfish Water is intended to ensure that no location within the Shellfish Water is impacted by more than 10 spills/annum (on average), as different intermittents will operate under differing rainfall conditions.

For the purpose of this guidance:

- Where a number of separately identified Shellfish Waters are contiguous they can be considered to be one large Shellfish Water. For example, in the Solent and Southampton Water the 13 contiguous Shellfish Waters can be considered to be one.

- For clarity, to distinguish them from individual sewerage catchments, the area encompassing all the intermittents that impact on a particular Shellfish Water (or a number of contiguous Shellfish Waters) is referred to as a 'shellfish water catchment'. A shellfish water catchment may contain many sewerage catchments.

Annex 1 - for section 2.3.3 Storm overflows

It should be noted that:

- The whole subject of the impact of intermittents on shellfish quality is an inexact science, and policy has, by necessity, been based on a number of simplifying assumptions.
- Determination of aggregations in complex situations may be difficult, and could involve extensive environmental impact modelling.
- If extensive aggregation across a number of sewerage catchments is proposed, the sewerage modelling and determination of scheme solution may be at best extremely difficult.
- Phased investment across large shellfish water catchments, such as the Ribble, is likely to lead to difficulties with the design of future schemes if aggregation across the whole catchment is required.

Therefore in complex situations, a simple solution needs to be found, to enable aggregations to be determined easily, and to enable the subsequent sewerage modelling to be relatively straightforward.

Any guidance given will, by necessity, be relatively general, since site specifics will remain important.
It is proposed that the following approach is adopted:

1. Where the intermittents to be improved all lie within one sewerage catchment, then it can be assumed that, if deemed necessary in terms of impact, all intermittents in that sewerage catchment can and should be aggregated together in terms of frequency and volume, such that the sewerage catchment as a whole spills no more than 10 per annum on average (see footnote 1). This applies regardless of the size of the catchment - i.e. even if the sewerage catchment is significantly larger than 100 Km^2, see 2. below.
2. If the intermittents to be improved lie within a number of small sewerage catchments, and aggregation is considered necessary, then if the area covered by the intermittents is no more than about 100 Km^2, then they can be aggregated together, and the sewerage models run using the same rainfall (see footnotes 2 and 3).
3. If the intermittents to be improved lie within a number of sewerage catchments, and the overall shellfish water catchment area is significantly larger than 100 Km^2, then the area should be divided into a number of suitable sub-catchments, each with a typical size of around 100 Km^2. Aggregation can then take place within each of these sub-catchments, but each aggregation is considered separately (see footnote 2).
4. Where more than one Shellfish Water are impacted by the same intermittents, then for the purposes of aggregation determination and sewerage modelling, they can be considered to be one Shellfish Water.

It must be emphasised that the above is guidance only, and a different approach may need to be taken, dependent on site specific issues. It is intended that the use of this guidance is at the discretion of the Agency, and the fall back position would be for full determination of the aggregations across the whole shellfish water catchment area.

Annex 1 - for section 2.3.3 Storm overflows

1 A comprehensive Drainage Area Study (DAS) for each sewerage catchment should be sought, from which it may become clear that the list of intermittents identified for improvement in a particular sewerage catchment is incomplete, and that significant discharges have been omitted. It is strongly recommended that any sewerage modelling and scheme design should incorporate all intermittents in the sewerage catchment, so that the design solution is complete. This holistic approach to the sewerage catchment should enable the delivery of a high level of environmental protection in relation to each sewerage catchment, and should be sought as part of the agreement with the operator, since the simplifying proposals relating to aggregation across a sewerage catchment area as suggested in this document might be considered to constitute a relaxation of Agency policy.
2. The recommendations given in footnote 1 apply equally to the scenarios outlined in paras 2 and 3 - once a shellfish water catchment or sub-catchment is targeted for improvements, all intermittents within that catchment or sub-catchment should be included in the sewerage model(s), so that for the purposes of design at least, the solution for the whole catchment is determined.
3. The choice of 100 Km^2 as a suitable size for a sub-catchment was fairly arbitrary, based on a number of factors: it is a size within which it should generally be acceptable to use the same rainfall series; it is a reasonable size with respect to the environmental need for aggregation in that typically it will cover a linear extent of around 10 Km; it is about the size of a medium size city or of a large town plus outlying areas. The actual size of individual sub-catchments will be site specific, and may differ significantly from the suggested guide size of 100 Km^2.

Background to the guidance:

A fundamental assumption lying behind the 10/annum standard is that each spill impacts for 24 hours. In many circumstances the actual impact duration may be significantly less, particularly in areas with good tidal flushing, but equally there may be some scenarios whereby the impact duration is longer than 24 hours.

However, a spill from an individual CSO is unlikely to impact on the whole of the designated Shellfish Water; in fact the area of impact may be quite restricted. Other CSOs spilling to the same Shellfish Water will have different zones of impact, although there may well be parts of the Shellfish Water which are impacted by more than one of the CSOs. If this is the case, then there is a case for aggregation of those CSOs which impact in the same place.

Another factor that needs to be considered is the timing of the impact from different CSOs, and what constitutes an 'impact'. A small volume discharge from a CSO may not have sufficient impact alone to cause a problem with shellfish quality, but in conjunction with 2 or 3 other small discharges from other CSOs the impact may be significant. However, the timing of the impact from each CSO at a particular location may vary, possibly to such an extent that there is no concurrent impact and hence no significant impact at any time. On the other hand, a large volume discharge from one CSO alone may have a significant impact, and if other CSOs discharge with different timing, the overall impact from the 'event' may well be extended over a period of time longer than the individual impacts. Yet the aggregation modelling would be based on the timing of the spills themselves, not the timing of the impacts.

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Problems Associated with the Determination of Aggregations:

Where more than one CSO impact on Shellfish Water, there are a number of approaches to the determination of the appropriate aggregations:

1. If the situation is quite simple, for example a number of CSOs within one sewerage catchment discharging to the head of an estuary within which there is a Shellfish Water, then the aggregation may be clear and straightforward.
2. Where the situation is not clear-cut, there may still be a case for using experience and judgement in determining the nature of the aggregations, in order to avoid having to undertake environmental impact monitoring.
3. Where the situation is clearly complex, then it is likely that the only way forward is to undertake some kind of environmental impact modelling, unless a pragmatic compromise approach can be used.

Once it has been determined that impact modelling is to be undertaken, this in itself is likely to lead to difficulties and compromises. Even assuming that there is a reasonable marine water quality model available for the area in question, the determination of aggregations is difficult, and the difficulty increases with increasing complexity in terms of numbers of discharges, sewerage catchments, shellfish waters, etc. Typical difficulties are listed below:

1. The area of Shellfish Water impacted by a discharge from an intermittent will be dependent on the state of the tide during the discharge period.
2. The extent of the impact will be dependent on the volume of the spill, and its discharge rate.
3. The volume and duration of the spills to be modelled will not be known until the scheme has been designed. The design depends on the aggregations, and will not be available at the time the aggregations are to be determined.
4. If the intermittents that impact on a Shellfish Water are not all modelled together, then it may be difficult to determine which areas are significantly impacted as a result of the combined effects of all the discharges.
5. If the intermittents that impact on a Shellfish Water are not modelled separately (or in discrete sub-sets), then it may be difficult to establish the impact zone of each intermittent or sub-set of intermittents, which will lead to difficulties in determining which CSOs are acting together and hence need to be aggregated.
6. The relative timing of the discharges will be difficult to determine.
7. Bacterial mortality becomes increasingly important as the size of the area being modelled increases, and there is still a great deal of uncertainty associated with the selection of appropriate decay rates.
8. For large shellfish water catchment areas, there may be impacting intermittents that have not been identified for improvement (e.g. all the intermittents from a sizeable town), and information on the volume and duration of spills from these intermittents may not be available. Yet, the determination of aggregations for just those intermittents which happen to have been identified for investment is somewhat meaningless.

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Problems Associated with Sewerage Modelling:

Once the aggregations have been determined, sewerage modelling is undertaken in order to develop the scheme design. If the intermittents to be aggregated all lie within one sewerage catchment, then the process is relatively simple. For a slightly more complex case, e.g. two separate sewerage catchments, one at either end of a relatively small estuary, then the solution is not difficult, so long as the same rainfall series can be used for each sewerage catchment.

An example of a complex situation is the Ribble Estuary, which has designated Shellfish Water at its mouth. The catchment area of the River Ribble is around 2,000 Km^2, and includes numerous towns and villages, including Preston, Wigan, Blackburn, Burnley, and Lytham St Anne's. The shellfish water catchment area includes the whole of the Ribble river catchment, the River Douglas catchment, plus other sewerage catchments including Southport just to the south. It must be assumed that intermittent discharges from all these locations can have some impact on the Shellfish Water, although the magnitudes of the impacts are not known. To consider all the intermittents that potentially impact on the Shellfish Water, and to aggregate them together so that there are just 10 spills per annum (on average) from all the intermittent discharges in all those towns and cities combined would not be realistic. Moreover, with such a large Shellfish Water catchment rainfall varies substantially making summation of spills difficult. To get to 10 spills per annum in agglomeration would be likely to lead to very low spill frequencies from most CSOs within the catchment. If a solution could be found, the cost would be prohibitive, and the sewerage modelling required to achieve the objective may well be beyond the capabilities of any model or modelling team. In addition, not all of the intermittents in the shellfish water catchment have been funded for improvement as part of the same AMP investment round

Annex 1 - for section 2.3.3 Storm overflows

Annex 1.6 - Coastal outfall location spill frequency restrictions

The outfall soffit level of all CSOs must be located below the level of Mean Low Water Spring tides (“MLWS”) as given in the Admiralty Tide Tables and corrected, where necessary, for the actual location of the outfall.

Exceptional circumstances:
Where there are particular local extenuating circumstances which either prevent, or render it impractical to locate the outfall in accordance with the minimum requirement then the following guidance should be applied appropriate to the receiving water category:

Bathing waters:
A spill frequency standard should be applied as follows:

- CSO soffit above MLWS but below the level of high water of mean spring tides (MHWS)

Spill frequency should be set between 3 spills/season and 1 spill in every 5 bathing seasons based on local considerations and the actual location of the CSO soffit.

CSO soffit at MHWS

- Spill frequency should be limited to 1 spill in every 5 bathing seasons.

CSO soffit above MHWS

- Spill frequency should be limited to 1 spill in every 5 years.

Other Waters:
Decisions should be based on local factors, for example visibility of pipe, direct access by the public, overflow located in cliff face etc, and also the practical engineering considerations of construction and maintenance.

Annex 1 - for section 2.3.3 Storm overflows

Annex 1.7 - Information required for audit to confirm fitness for purpose of models

Audit Information Request

The items marked `Required` in the table below are needed by the Environment Agency in order to assess whether the sewer model used/to be used, in assessing the following discharges is suitable for the intended use:
List existing and proposed discharges
The items are required by *date* in electronic format on CD.

Please complete the columns headed `Available`, `Provided, and `Reference`, in the attached table and forward it to us along with the required items to confirm which items are available and provided and reference each item provided to the electronic filename or report. Please also complete the column headed `Reference` where equivalent alternatives to the requested items are available and provided, or where requested items are included within other reports. Further information may be requested should the audit identify a need to consider it.

Annex 1 - for section 2.3.3 Storm overflows

Item	**Report/Information/Data/Files**	**Required** (yes/no)	**Available** (yes/no)	**Provided** (date)	**Reference** (file ref.)	**Adequate** (yes/no)
1	Model Build Report (including modelling methodology)	Yes				
2	Detailed statement of proposed purpose for model (Ids to be improved or affected by the scheme and description of likely schemes if known)	Yes				
3	Plan of sewer system	Yes				
4	Plan of sewer model	Yes				
5	Contributing Area Plans	Yes				
6	Impermeable Area survey	Not Initially				
7	Flood and Surcharge Data	Summary				
8	Manhole survey data	Not Initially				
9	Ancillary Survey Data (including details of any unmodelled ancillaries)	Yes				
10	Ancillary Calculations	Yes				
11	Sewer condition survey data (CCTV Survey)	Summary				
12	Flow Survey interim reports	Yes				
13	Detail plans showing locations of monitors in the sewer system					
14	Flow Survey final reports	Yes				
15	Flow Survey Audit Report	Yes				
16	Verification Report	Yes				
17	Verified model data file and associated files	Yes				
18	Catchment Needs Report	Yes				
19	Model Audit Report	Yes				

Annex 1 - for section 2.3.3 Storm overflows

Annex 1.8 - Information request for application for new storm overflow to resolve flooding

Required flood investigation and improvement work:

The investigation and improvement work identified below is divided up on the Source, Pathway, Receptor principle. Completion of the following work will require collaboration between various stakeholders including the Agency. New CSO applications should include the documented outcome of the following work.

Source information:
Survey and other evidence used to locate and quantify the sources contributing to flooding, eg impermeable areas, infiltration, dry weather flows, land drains, rural inflows, river ingress, throttles in the system, cross connections with other systems, wrong connections etc. Include evidence of how inflow and infiltration rates vary seasonally and during rainfall.

Include evidence of any causes or contributions to sewer flooding that the company considers it does not have direct responsibility for

Validated sewer models representing the sewer flooding. If more than one sewer system exists and forms part of the problem, or the potential solution, then both models should be validated. Receiving waters should also be modelled or represented if they affect the problem or the solution.

Source control:
Costed plan for removing any excessive infiltration, inflows, and runoff etc for which company has direct responsibility. Infiltration should be minimised in accordance with best technical knowledge not entailing excessive costs (BTKNEEC).

Costed plan to ensure sewers for which the company has direct responsibility have appropriate BTKNEEC capacity to deal with the flows generated in dry and wet weather. This should include any scope for surface water separation to alleviate the pressure on the foul/combined system and source control plans based on SUDS principles.

Proposal to carry out this work

Costed plan to remedy, in accordance with BTKNEEC, any other causes or contributions to sewer flooding that the company considers it does not have direct responsibility for. Action plan to implement this work developed in collaboration with relevant bodies eg local councils, householders, riparian owners etc.

Sewer model representing sewer system performance after improvements to BTKNEEC.

Where BTKNEEC level of improvements do not fully resolve flooding then the following additional measures may be necessary.

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Pathway:
Evidence to show route or mechanism of historical flooding.

Validated model of historical flooding including where relevant overland flow routing to show how flooding reaches properties etc suffering flooding. Model must represent interaction between all types of flooding ie fluvial, pluvial, groundwater, coastal, foul/combined sewer and surface water sewer where relevant.

Pathway modification:
Details of any proposals to modify flood pathways for all types of flooding eg river/coastal flood defences, SUDs, raised kerbs, manhole sealing, dropped verges, sacrificial flooding areas etc.

Model to represent improvement to flooding from the combined effects of source and pathway improvements.

Receptors:
Details (locations/numbers/ frequency/ severity) of flooding to houses (internal/external), other buildings, roads, recreational areas etc and any loss of service, before and after improvements to flood sources and pathways.

Receptor resistence/resilience:
Details of any proposals for flood resistance, resilience, at property level. Include any individual or small scale measures such as non return valves on laterals and pumping stations.

Model showing any residual flood risk to properties.

Residual Risk:
If following all the above improvements the residual flood risk remains unacceptable then the Agency expects sustainable long term initiatives to progressively remove residual rainfall run-off, infiltration and inflows.

Where the selected option involves a new CSO or increased discharge from an existing CSO provide evidence of the option investigation and selection process.

Option selection criteria should include where relevant, water quality impact, affect on fluvial flood risk, costs and benefits, sustainability, Carbon footprint, etc.

Where a CSO is proposed as part of that solution, provide evidence the solution is BTKNEEC with respect to the limitation of pollution. Water quality impact criteria includes minimising any deterioration and compliance with the relevant water quality standards.

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Annex 1.9 - Information required to support an application to discharge storm sewage from an existing emergency overflow.

Information requests:
The following items may be drawn from to help compile an information request.

History:
Provide;

- Permiting history
- Catchment and sewerage development
- The history of storm discharges

Overflow impacts:
Assess the impact of existing facility. Provide:

- Assessment of standards, amenity, recreation, and habitats affected by proposed discharge.
- Assessment of whether current impact is satisfactory or unsatisfactory eg aesthetic surveys, biology surveys, and a review of any complaints and incidents.
- Assess whether any impact is due to storm discharges during the normal operation of the overflow or due to impaired operation or failure of the pumping station.

Historic performance of sewerage and pumping station:
Provide evidence and detailed analysis of causes of historic:

- incidents such as emergency failures and pollution incidents, loss of service, and sewer flooding within catchment.
- dry weather discharges due to operational problems, emergency failures, pump incapacity, excess infiltration, population growth etc.
- storm related discharges due to operational problems, emergency failures, pump incapacity, excess impermeable area/permeable area/infiltration, surface water inflow, land drainage, cross or wrong connections etc.
- Written report analysing historic performance including actions taken to resolve previous problems and any proposed actions to resolve ongoing issues.

Sewerage:
Assess whether sewerage system is designed maintained and constructed in accordance with best technical knowledge not entailing excessive costs (“BTKNEEC”) and produce plan to remedy any shortfalls.

Provide:

- Sewer record plans showing the extent of foul, combined, and surface water sewers served by pumping station. Detail any interactions between the various drainage systems, and between the drainage system and overland flows, and water courses. Identify any other drainage within the pumping stations catchment area such as highway drains, surface water sewers, water courses, ditches, soakaways/ infiltration systems, , .
- Information on any wrong connections and assess extent of problem.

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- Sewer record plans showing downstream network identifying any impacts of pumped forward flows on downstream overflows.
- Dry weather flow calculations and measurement.
- Evidence to identify and quantify source of storm and infiltration flows.

Pumping Station Facilities:
Assess whether the pumping station is designed, constructed, and maintained, in accordance with best technical knowledge not entailing excessive costs, and produce plan to remedy any shortfalls. Provide details of full pumping station survey of existing facility and details of proposed facilities including:

Telemetry:

- Telemetry alarm triggers eg: pump/power failure, high level, spills, etc.
- Detail of all records kept eg: pump run times, on/off switch times, flows, alarms, discharges, non-routine maintenance, operational issues and failures.
- Response procedures to all alarms, response times.

Pumps:

- Capacity (l/s): current, design, and applied for.
- Configuration: detail individual duty, assist, standby, and storm pumps.
- Known operational issues such as fouling, air locking, etc

Power:

- Integrity of power supply, standby facilities.

Rising main:

- Capacity (l/s)
- Any operational or structural issues limiting capacity.
- Historic performance.

Storage:

- Capacity (in m3 and hrs at 3DWF) between pump switch on level and overflow level.

Screens:

- Details of existing screens eg: mesh, capacity (l/s), effectiveness in emergency and in storm.

Emergency facilities:

- Tanker access, facilities for over pumping.
- Contingency plans in emergency.

Annex 1 - for section 2.3.3 Storm overflows

Modelling:
Where the sewerage and pumping station improvements required to meet the BTKNEEC requirements do not resolve storm discharges provide:

Report detailing extent to which storm discharges can be eliminated by source control, separating surface water from the foul, eliminating infiltration, increasing sewer capacity, improving existing asset performance, and improving operational management procedures.

Where the above actions do not remove the need for a storm overflow and the current impact of the discharge is assessed as unsatisfactory or unknown model the impact of current and proposed discharge.

Provide:

- Verified sewer model of existing system.
- Model of system reflecting proposed improvements the sewerage and the pumping station.
- Analysis of the storm overflow performance using the proposed sewer system models with 10 year rainfall record.
- Impact assessment of proposed storm discharges. We will consider the proposed discharge as a new CSO therefore the impact assessment should demonstrate the deterioration in the quality of the receiving water from that in the absence of the storm discharge. Follow the planning procedures in UPM manual 2nd edition.
- Assessment of whether hydraulic capacity of receiving water is sufficient to accept storm flows.

Monitoring

Event duration monitoring:
Where your permit requires the reporting of spill event/duration data you must provide it in the following format.

Where your permit is for a storm discharges impacting on Shellfish Waters you should provide an annual report covering the period 1st April to 31st March.

Format Details:
The spill event/duration data are to be provided as an Excel spreadsheet.

Most of the required header information shown on the spreadsheet is self-explanatory. However, there is a field entitled ‘Aggregation Name/Code’. Where intermittents have been aggregated together such that their joint spill frequency does not exceed a specified design target, then a unique aggegation name/code should be given to that aggregation. The name/code for each aggregation, along with a list of the intermittents that comprise that aggregation, should be supplied to the Water Company by Agency Area staff.

You must provide all recorded data, even if you believe the data to be invalid. This is to prevent the possible removal of valid event data. Where you believe recorded data are invalid, you should record this in the comments column, but the data must be returned.

Annex 1 - for section 2.3.3 Storm overflows

Background:

One of the prime reasons for requiring event/duration monitoring is to satisfy our Shellfish Waters policy – this requires all intermittents which are improved on the basis of a Shellfish Water cost driver to have an event duration monitor installed. The fundamental requirement is for the Water Companies to supply the spill data annually to both the relevant local food authority / appropriate environmental health officer and the Agency. In addition to this, the Agency has agreed to supply the data to CEFAS, who use the data to assist with their annual classification of shellfish beds under the Hygiene Directive.

CEFAS will therefore be receiving data from nine water companies, and they have requested that the all the data are in a standard format to assist them with their assessments. It is also in the Agency's interests to receive the data in a common format. The Agency has therefore agreed that a standard format should be adopted.

Examples include bathing water discharges and sensitive inland discharges as well as shellfish waters (see below).

Emergency overflows impacting on shellfish waters

Your permit may specify a requirement to notify both the Environment Agency and the responsible Food Authorities if an emergency discharge occurs. This condition will be applied to new and AMP improved emergency overflows we judge would impact on shellfish waters. Notification must be as soon as practicable after the emergency alarm is received and within 24 hours.

Annex 2 - for section 2.3.4 Emergency overflows

Operations Annex for section 2.4. Emergency overflows

Annex 2.1 - Environmental Consequences

Receiving environment sensitivities
Depending on the uses and attributes of the receiving water it will be allocated a high medium or low sensitivity.

When dealing with shellfish waters and bathing waters high amenity will be assumed and high impact, unless it can be demonstrated that the discharge will have insignificant impact in which case a lower impact can be assumed.

Set out below is a list of receiving environment sensitivities with a high medium or low sensitivity rating assigned to it.

Sensitivity	**Rating**
Bathing Water	High
Shelfish Water	High
Still or slow moving water body	High
High amenity (Public Park, immersion sport eg canoeing, surfing etc)	High
Sustainable fishery	High
Downstream commercial fishery abstraction	High
High strength trade effluent or Dangerous Substances at 10x EQS in sewage	High
Within 3km of a Habitats site or SSSI and in hydraulic continuity (or the potential to impact on a Habitats or SSSI site)	High
Moderate amenity (public footpath etc)	Medium
Downstream abstractions	Medium
Watercourse flows through/alongside private gardens	Medium

If any of the above sensitivities are identified in the receiving water then it is recorded and the highest rating is used in the assessment matrix. If no sensitivity is identified then a low rating is assumed.

Impact of the discharge on the receiving water:
The emergency operation of a sewage pumping station can occur during dry weather and as a result the sewage strength will not be diluted by rainwater. In some cases sewage pumping stations may also serve separate systems and sewage strength would remain relatively stable whether or not storm events occur.

The following general assumptions have been made for the strength of crude sewage.

The Ciria report 177 **Dry Weather Flow in sewers** assumes an ammonia concentration of 47 mg/l as N in crude sewage and a dissolved BOD concentration of 189 mg/l.

Annex 2 - for section 2.3.4 Emergency overflows

An 8:1 dilution of the above concentrations gives approximately 24 mg/l BOD and 6 mg/l ammonia. In slower moving lowland watercourses a BOD in excess of 24 mg/l poses a threat to a cyprinid fishery due to DO depletion. In faster flowing higher gradient upland watercourses an ammonia concentration in excess of 6 mg/l poses a threat to a salmonid fishery.

Therefore to assign a high, medium or low potential impact of the emergency discharge on the receiving water the relative dilution afforded by the watercourse is taken into account as follows;

Watercourse Q95/ SPS DWF is greater than 8:1 - potential impact rating is Low

Watercourse Q95/ SPS DWF is less than 8:1 – move on to the next assessment.

Watercourse mean flow/ SPS DWF is greater than 8:1 – potential impact rating is Medium

Watercourse mean flow/ SPS DWF is less than 8:1 – potential impact rating is High

The low rating is based on Q95 flows and if the dilution is greater than 8:1 at these times, in most cases there will be greater dilution in the event of an emergency discharge.

The medium rating assumes that the dilution will be less than 8:1 during periods of low flow and there will therefore be a greater probability of an impact in the event of an emergency discharge.

The high rating assumes that even with mean flows in the receiving water the dilution afforded will be less than 8:1 and as such there is a high probability of an impact on the receiving water.

The assumption has been made that BOD is the limiting factor in cyprinid slower moving lowland watercourses and ammonia in faster flowing salmonid watercourses. Assuming that an 8:1 dilution is the threshold for both types of watercourse allows the type of fishery to be ignored in the sensitivity analysis and the main factor considered is whether or not the receiving water has a sustainable fishery.

This approach is designed to be simplistic and readily useable by permitting officers or operators, however the Agency or the operator may wish to carry out a more detailed analysis of the impact of an emergency discharge in line with UPM principles.

In some cases the emergency discharge may enter a watercourse which has a different sensitivity and dilution to a stretch downstream of the discharge. In such cases the assessment may be undertaken at a downstream location or at a number of locations.

An example of this would be where a discharge is initially into a low sensitivity watercourse which, further downstream, joins with another watercourse which has a higher sensitivity.

Annex 2 - for section 2.3.4 Emergency overflows

Sensitivity and impact Matrix

The sensitivity and impact ratings are then combined into a matrix and the ratings are converted to scores and multiplied together. High = 3. Medium = 2 and Low = 1

	Sensitivity		
Potential Impact	**High**	**Medium**	**Low**
High	9	6	3
Medium	6	4	2
Low	3	2	1

Annex 3 – Related Documents for section 2.

Annex 3 – Related Documents

- Spill event, time and duration reporting format - excel spreadsheet
- Default and sensitivity values for use in simplified UPM modelling. WRc UC6835v2.0 March 2005
- Proforma for defining the purposes of a sewer model and documenting the audit outcomes.

Discharge Flow Measurements

2.4 Discharge Flow Measurements

What's in this section?

2.4.1 Introduction

This chapter covers your responsibilities in relation to permitted effluent discharge rates and any requirements for you to monitor your effluent discharge rates.

The Environment Agency's Effluent Flow Measurement Policy requires flow monitoring to be undertaken for qualifying continuous discharges of sewage or trade effluent.

2.4.2 Summary of Requirements for Effluent Flow Monitoring

If your permit requires you to monitor the Dry Weather Flow or Maximum Daily Volume of your discharge (see Table S3.1 of your permit), then you must comply with all of the following requirements:

Flow Measurement System

1. You must provide a continuous flow measurement and recording system ("the flow system") that complies with the MCERTS Flow Monitoring scheme which is operated to record the total daily volume of the discharge.
2. The flow system shall also measure and record either the instantaneous flow at least every 15 minutes or the 15-minute averaged flow every 15 minutes. You must provide and operate an on-site visual display from which the Agency can readily obtain the instantaneous or 15-minute averaged flow readings.
3. You must hold records of the total daily volume and the 15-minute flow readings.

MCERTS Certificate

1. As soon as reasonably practicable after installation of the flow system and before the expiry of any certificate issued, you must employ an MCERTS inspector to certify that the flow system complies with the MCERTS Flow Monitoring scheme.

2. You must immediately on issue provide a copy of the MCERTS certificate to the Agency and you must provide a copy of the MCERTS inspector's report to the Agency on request.
3. You must ensure that the flow system is always subject to a current MCERTS.

Maintenance Procedures

1. You must produce and maintain documented procedures for the calibration, operation and maintenance of the flow system ("maintenance procedures").
2. You must employ an MCERTS inspector to certify that the maintenance procedures comply with the MCERTS requirements.
3. You must calibrate, operate and maintain the flow system in accordance with the maintenance procedures. You must keep a record of the maintenance procedures and maintenance records available for inspection by the Agency and provide a copy to the Agency on request.
4. Unless the Agency has agreed that you can operate a "simplified management system" (as described in section 4 of the "Minimum requirements for the self-monitoring of effluent flow", you must produce and maintain a formal Quality Management System ("QMS") for the management of the flow system and the implementation of the maintenance procedures. The QMS must be certified by an appropriate independent certifier.
5. You must ensure that the flow system remains fully operational at all times and shall remedy any failures as soon as reasonably practicable.

Records and Reporting

1. You must record all failures of the flow system and any other breaks in the flow record. The reasons for all failures and breaks that lead to missing or suspect total daily volume records and all steps taken to prevent a re-occurrence shall be recorded.
2. You must provide records of the flow readings and the reasons for any significant breaks in the record when requested, in a format specified by the Agency.

2.4.3 Summary of Requirements for Effluent Flow Monitoring

What's in this section?

2.4.3.1 Regulation of sewage discharge flow

We will set numeric discharge permit limits for the daily Dry Weather Flow or Maximum Discharge Volume of treated sewage or other effluent that operators may discharge.

Discharge Flow Measurements

We will require operators to pass a specified minimum flow of sewage to full treatment before we allow a storm sewage spill.

2.4.3.2 Qualifying discharges

The Agency requirement for all flow monitoring is risk-based. However, in order to assist the decision-making process, a number of flow thresholds have been set.

In general, for flows above those thresholds, the default position is that flow monitoring will be required unless the Agency accepts that the discharge has no significant local or wider environmental effect and there is no specific need for the data.

For flows below the threshold, the default position is that flow monitoring will not be required unless the Agency can justify it by a site-specific environmental need that cannot be met in any other way, taking account of costs and benefits.

The table below outlines the Agency's draft policy on the requirement for flow monitoring in more detail. As this policy is yet to be ratified, you should contact the Agency to check the current position.

Type of Discharge	**Subtype**	**Permitted maximum volume or DWF**	**Require-ment *(see key)***	**Comments**
Sewerage Undertaker sewage treatment	Numeric quality limits on BOD or SS	>50 m^3/d	2	Original policy requirement as implemented through the AMP3 programme.
	Other SU sewage discharges	-	3	These may be continuous sewage discharges with permitted DWF below 50 m^3/d or intermittent discharges. We may require instantaneous flow measurement specifically to confirm that the pass forward flow at a storm overflow achieves the required value before the overflow starts operating. We may also require short-term measurement of the discharged flow to quantify the load discharged and characterise sewerage performance for SUDS and Surface Water Management planning and design

Discharge Flow Measurements

Type of Discharge	Subtype	Permitted maximum volume or DWF	Require-ment *(see key)*	Comments
Non-Sewerage Undertaker sewage treatment	Discharges throughout the year, numeric quality limits on BOD or SS	>50 m^3/d	2	Requirement is the same as the requirement on water companies for identical discharges.
	Discharge falls well below 50 m^3/d for a substantial part of the year, numeric quality limits on BOD or SS	>50 m^3/d	3	These are mainly seasonal discharges, such as holiday properties. We will not require flow measurement unless we can justify it because of significant environmental impact at peak periods and we cannot determine the daily flow by other means (e.g. water meter). Flow measurement systems will not normally meet MCERTS requirements at low flows, so we will only require flow measurement during the period when higher treated sewage flows are expected.
	Other non-SU sewage discharges	-	1	
Trade discharges	Frequent or continuous discharge and numeric quality limits on BOD, ammonia, dangerous or priority substances	>50 m^3/d	2	We will require flow measurement of these trade discharges except: • those specifically identified below, • those qualifying as 'occasional or emergency' (see guidance below), and • those for which we accept that the discharge has no significant local or wider environmental effect and we do not need the measured data for any other purpose. If a discharge contains significant concentrations of dangerous or priority substances, then we may justify flow measurement at a lower flow limit.

Discharge Flow Measurements

Type of Discharge	Subtype	Permitted maximum volume or DWF	Require-ment *(see key)*	Comments
	fish farms	-	1	Practical problems (such as low head) and multiple outlets at many fish farms make flow measurement impractical. For the present, we will not require discharge flow measurement at these sites. We will rely on reported abstraction volumes if we need to estimate discharge volumes for regulatory calculations.
	cress farms	-	1	Peak flows from cress farms are mainly driven by rainfall, spring flows and groundwater levels, so flow measurement has no regulatory value. We will not set flow limits or require flow measurement at these sites.
	rainwater runoff and rainfall driven discharges	-	1	Where flow rates depend primarily on rainfall intensity there is limited regulatory value in continuous flow measurement. We may require temporary flow measurement for regulation and treatment design. This must be justified for each case.
	cooling water	-	3	
	Other trade discharges	-	3	
Water treatment works	Frequent or continuous discharge and numeric quality limits on one or more of BOD, COD, or any metal	>50 m^3/d	2	We will require operators to measure WTW process discharges above 50 m^3/d permitted maximum flow, unless they are 'occasional or emergency' (see guidance below). 'Occasional' includes discharges that are only made on a few days each year, such as discharges from Cryptosporidium removal plants used only when problems arise, or during start up of seasonal treatment plants.
	Other WU water treatment discharges	-	3	

Discharge Flow Measurements

Type of Discharge	Subtype	Permitted maximum volume or DWF	Require-ment *(see key)*	Comments
Requirement key (see guidance for further details)				
1	Flow measurement not required. If, exceptionally, you wish to make a case that, because of serious environmental impact from a site, flow measurement is essential, you must consult Surface Water Technical Services.			
2	We will require flow measurement, unless all the criteria (a) to (d) below are met, in which case, we will not require flow measurement of the discharge. (a) Permitted maximum flow or DWF less than 1000 m3/d (b) Large dilution of discharge (>50:1 at mean flow). For tidal waters, this dilution should be achieved before the discharge reaches the nearest water designated for any specific objective (e.g. bathing water, SAC, etc) (c) No numeric limits for dangerous or priority substances or specific pollutants for which EQS have been set under the Water Framework Directive. (d) Does not discharge to or significantly affect waters designated under the Habitats, Birds, Bathing Waters, or Shellfish Waters Directives or a Water Framework Directive Protected Area			
3	We will not require flow measurement, unless the permit sets numeric limits for dangerous or priority substances or specific pollutants for which EQS have been set under the Water Framework Directive (other than ammonia). If such limits have been set, we will require flow measurement of the discharge.			

'occasional or emergency' – The main purpose of flow measurement is to monitor discharges that occur every day or on most days. The less frequently a discharge is made, the greater the potential impact needs to be to justify flow measurement. It is very unlikely that discharges operating on fewer than 25% of days will justify flow measurement. But each discharge must be assessed against local circumstances.

From the above table, you will be able to determine whether effluent flow monitoring is likely to be required for your discharge. However, you should contact your local Agency office for a definitive answer.

2.4.3.3 MCERTS scheme

If the permit requires the Operator to measure the flow then the flow measurement installation shall comply with the Environment Agency's Monitoring Certification Scheme (MCERTS) for Flow (www.mcerts.net).

Details of the MCERTS scheme are given below.

Discharge Flow Measurements

2.4.4 Flow monitor specification

Full details of the flow meter specification are provided in the MCERTS document entitled "Minimum Requirements for the Self Monitoring of Effluent Flow" (see www.mcerts.net). This section provides a brief summary.

The Agency's requirement is that the uncertainty of the measurement of the total daily volume of discharged effluent should be no greater than 8%. Uncertainties should have a confidence level of 95%. The flow measurement and recording systems should be installed to good engineering practice (e.g. British Standard 3680 for open channel flow systems).

The flow measurement installation must be calibrated within predetermined levels of accuracy and the QMS will ensure that this is maintained. Continuous recording devices should have a digital display and a logging capability. As a minimum the device should record the instantaneous or 15-minute integrated flow rate every 15 minutes and, where calculated, the integrated total daily volume. The display should show the instantaneous or 15-minute integrated flow rate and be located where the Agency can record the information on site visits. The twenty-four-hour period to be used for all daily volume recording will normally be midnight to midnight, GMT. Where justified the Agency may agree an alternative 24-hour period.

The Agency's specification is performance-based and does not specify the type of system to be used. The principle of operation of the installation (weir, flume, ultrasonic, electromagnetic, etc.) should be suitable for site conditions (open channel, rectangular or circular conduit, part-filled pipe, and full pipe). The flow measurement system used should be one with a demonstrated capability of meeting the required uncertainty.

2.4.5 Location of flow monitor

Daily flow volumes can be measured at any suitable location before discharge. The permit holder can propose the flow measurement location, but this is subject to approval by the MCERTS Inspector as part of their site inspection. The MCERTS Inspector will take account of storm overflows, works return liquors, re-circulation, etc.

At sewage works where there is a storm overflow, flow measurement should normally be installed at a location that allows the overflow setting to be checked in addition to measuring daily flows through treatment. Where there is more than one storm overflow, or it is not possible to measure total daily flows near the storm overflow, additional instantaneous flow measurement points may be required by the Agency.

In exceptional circumstances, instantaneous flow measurement at the outlet may be required for discharges where it is necessary to limit instantaneous flow to protect water quality.

Discharge Flow Measurements

2.4.6 The MCERTS effluent flow monitoring scheme

What's in this section?

2.4.6.1 Summary of the scheme

The Environment Agency set up its MCERTS scheme to provide a framework of standards that operators can use to monitor things that affect the environment. One part of the scheme is the effluent flow monitoring MCERTS scheme.

Currently, the MCERTS flow monitoring scheme only includes standards for the measurement of total daily volume of treated effluent discharged to the receiving water. Standards for the measurement of instantaneous flows (e.g. flow monitoring required for UV disinfection or the monitoring of pass forward flow at storm weirs) are under development and will be incorporated within the scheme in the near future.

If your permit says that you must monitor the flow of liquid waste, you must have your arrangements to monitor flow independently assessed against the MCERTS Minimum requirements standard. An MCERTS inspector must carry out this assessment. If the principal requirement for the flow monitoring is other than the measurement of the total daily volume, then you should contact your local Agency office for further information.

Where the fundamental requirement for the flow monitoring is to measure the total daily volume of treated effluent discharged to the receiving water, then the flow monitoring system must be capable of measuring the total daily volume with an uncertainty of no more than 8%.

The Agency does not specify the system to be used for flow monitoring, only the performance of the system.

A full description of the scheme can be found on our web-site. It is called "Minimum requirements for the self-monitoring of effluent flow".

Discharge Flow Measurements

2.4.6.2 How does the scheme work?

There are two main elements of the scheme which are relevant to you. The first is the requirement to have your effluent flow installation inspected by an a MCERTS inspector. The inspector will assess whether the installation is capable of measuring the daily flow of effluent reliably to the required accuracy. He will write a report which he will either provide to you, or if you require, he will send it directly to Sira Certification Services, who run the scheme on the Agency's behalf. The cost of the MCERTS inspection has to be born by you. Details of the inspection process can be found in section 2.2 of the "Minimum requirements" document.

Note that if you are planning to install new flow monitoring equipment, or to get your current installation upgraded, then the MCERTS inspector may be able to offer advice and guidance in advance of the work going ahead.

Secondly, the scheme requires you to have a suitable Management System (MS)in place for effluent flow monitoring. The scope of this MS depends on the scale of your operation. If you operate a number of sites, then you would normally be expected to operate a **standard management system.** Records are normally maintained at a central location, usually the Head Office. A typical example would be a Water Utility company.

On the other hand, if you operate only one or two sites then we may only require you to operate a **simplified management system**. Records are normally maintained on site. A typical example would be an individual site, for example, a privately owned sewage treatment works.

If you operate a standard management system, then this will be audited by an auditor approved within MCERTS. The cost has to be borne by you. If you operate a simplified management system, this will be audited by the MCERTS Inspector when he undertakes the site inspection. This audit will be included in his fee.

Details of the requirements for both management systems can be found in section 4 of the "Minimum requirements" document. Contact details of MCERTS inspectors and MCERTS auditors can be found at the Sira web-site.

Once Sira has evidence that both the installation is satisfactory (via the MCERTS inspector's report) and that the MS is satisfactory (via the MCERTS audit or via the inspector's report), they will issue an 'MCERTS Site conformity inspection certificate'. This is your evidence that you are complying with the Agency's requirements. Sira charge a fee for the issue of this certificate.

A site conformity certificate is valid for 5 years, after which a further inspection will be required. To ensure that there is no 'gap' between certificates, we have adopted an 'MOT' approach, whereby you may apply for a new certificate up to a year before the old one expires. If the site passes, then the new certificate will run for 5 years from the expiry date of the old certificate. This allows time for any remedial work to be undertaken before the old certificate expires. Full details of the re-certification process are given in section 5 of the "Minimum requirements" document.

2.4.6.3 Dispensations

Under normal circumstances, if a flow installation fails the site inspection, then you will be expected to undertake any remedial work required to bring it up to the required standard. However, the site may fail to comply with MCERTS requirements in a relatively minor way that does not significantly affect the resulting flow data, but where the cost of immediate rectification is high. In these exceptional cases an application can be made to the Environment Agency for a dispensation. This will require a cost/benefit business case to be produced. Full details of the process are given in section 2.5 of "Minimum requirements" document.

It is important to note that dispensations are not a permanent provision and it is expected that Operators will need to resolve the problem as soon as reasonably practicable. If a dispensation needs to be extended at the first re-certification then the Operator needs to re-justify the need, including an explanation as to why it has not been resolved in the preceding five years.

Normally, only one extension of a dispensation will be allowed.

2.4.7 Flow Data Format and Reporting Requirements

Introduction

The Environment Agency's data standard for the exchange of Environmental Time-Series Data is XML format, which stands for eXtensible Mark-up

Language. This is a file format designed to exchange any form of text-based data. The format is an international standard, defined by the World Wide Web Consortium. It is system independent so it will work on UNIX, PC, Mac, etc. This data standard has been agreed after consultation with a number of interested parties and is designed to exchange data between a number of key data gathering, modelling and archiving systems. XML is relatively complex, and is intended primarily for use by large organisations which supply large quantities of data from multiple sites – for example by Water Companies.

The Agency recognises that the provision of data in XML format by a private trader with just one or two flow installations is likely to be too onerous a requirement, and so we have made arrangements for the provision of data in a simplified CSV format for such operators.

However, it must be emphasised that the Agency's preference is for data to be provided in XML format, and data must be supplied in that format unless permission is given to use CSV format.

Discharge Flow Measurements

XML Format

Full details of the XML format for flow data are provided in two documents:

- "XML file interfaces: resolution of issues, rules in interpreting the schema for effluent flow data".
- "Plain English description of the Environment Agency's time-series data exchange format".

The latest versions of these documents will be provided to you on request.

CSV Format

Full details of the CSV format for flow data can be provided to you on request.

Flow Data Reporting Requirements

The routine requirement is for you to provide the Total Daily Volumes (TDV) for each calendar year by the end of February of the following year. The data must be accompanied by a list of sites for which the data are provided plus a list of any new sites included in the return and a list of sites for which there was a data return last year but not this year because flow monitoring has ceased.

These should be sent by email to your regional Agency office. You should contact your local office to obtain the name and email address of the recipient.

In addition, you should provide the 15-minutely flow data when we request it.

Use of chemicals in treatment

2.5 Use of chemicals in treatment

What's in this section?

2.5.1 Control of chemicals used for phosphorus removal at waste water treatment plants

What's in this section?

Iron salts are most frequently used and are added to the wastewater Treatment stream to precipitate Phosphorus. Increasingly Aluminium is being considered by the Water Industry and permit conditions for both iron and Aluminium may be granted.

Absolute numeric limits should be used and these should be included as a MAC(Maximum Acceptable Concentration) in the permit.

2.5.1.1 Iron

A national EQS of 1 mg/l dissolved iron as an annual average is established. In order to protect against problems resulting from particulate iron settlement a total iron concentration of 5 mg/l (as a MAC) should also be met in the receiving water. Where total hardness is less than 20mg/l and 95 percentile pH is less than 6.0 (see Table 2) corresponding values should be 0.5 mg/l dissolved and 2

mg/l total. In considering the concentration to set as a limit, the RNC limit should be calculated **and in the first instance should be the preferred limit**. For new discharges, the RNC should be calculated in accordance with the 'No Deterioration' policy whilst for existing cases, the relevant EQS should be applied as the downstream target.

Use of chemicals in treatment

Iron is generally thought to be associated with suspended solids and investigative work by Severn-Trent Water indicates a 1:7 relationship between total iron and suspended solids in the effluent. On this basis, potentially suitable BATNEEC-type iron standards can be derived, as shown in the table 1 below:

Table 1: Iron Standards

Effluent suspended solids (mg/l)	Effluent iron concentration mg/l Total Fe as MAC
7	1
14	2
21	3
28	4
35	5

NB table to be applied to 95%ile solid permit conditions

2.5.1.2 Aluminium and polyelectrolyte dosing

Use standards for Aluminium and polyelectrolytes in Water Treatment section and in Tables 2 and 3 below .

Use of chemicals in treatment

2.5.2 Water treatment works

What's in this section?

2.5.2.1 Background

Effluent discharges from Water Treatment Works arise from a range of activities associated with the process of producing potable water, such as filter backwashing.

These processes, and hence discharges, may be either intermittent or continuous. They may also be contrasted with sewage treatment processes in that the effluent is a by-product rather than the primary product of the process. In this sense, discharges from Water Treatment Works are equivalent to those from any other industrial process.

Recognition is given to the public health implications of water supply, as recognised in aspects of the legislation controlling the industry

2.5.2.2 Standards

Statutory

The Agency will apply all relevant statutory standards (for example, Red List, List 1, List 2). In the absence of statutory values, we use the targets in guidelines below as the best available guidance for protecting aquatic life. We apply these targets on a case by case basis, taking into account:

- the process involved;
- use of the receiving water;
- cost.

Depending on the process, we may include conditions (some may be descriptive conditions) to limit the impact of the following determinands:

- pH;
- suspended solids;
- aluminium;
- iron;
- chlorine;
- granulated activated carbon (GAC) fines.

Polyelectrolyte residuals will not normally have numeric limits. We will principally expect these to be controlled appropriately through the Management System.

We can also set standards for other substances to reflect changes in process, technology or exceptional site-specific issues. For example, to protect designated nitrate-sensitive areas, we might need to use case-specific nitrate and chloride standards to control effluent from nitrate removal plants.

No deterioration

The Environment Agency will not permit significant deterioration in water quality. When calculating permit conditions, we use the following no deterioration criteria:

- No deterioration that causes failure of an EC Directive standard within a designated reach, failure to comply;
- No planned deterioration of more than with UK legislation, or planned worsening of GQA classification 10 % in the mean and 95 %ile concentrations of key determinands in the receiving waters unless there is insignificant environmental change as a consequence;
- No increase either in the load in the permit in force.

Other standards

Standards are included in the permit to control process effluents, including process discharges that are for providing compensation water.

Permits also include effluent flow controls, together with an absolute limit for parameters, based on a limiting factor of:

- standards to achieve the Environmental Quality Standards (EQS) (statutory or non-statutory) measured **in the receiving water**, assuming full mixing;
- emission standard (where appropriate).

For existing unsatisfactory sites where dilution is limited or the EQS are not achievable, the operator must consider options such as altering compensation flows or moving the discharge point elsewhere. If these options are not practical, the operator should try to achieve the best practical environmental option in terms of use and cost.

2.5.2.3 Guidelines for delivering permit standards

When applying these standards you must consider both the use of the receiving watercourse and cost.

Numerical values for receiving water quality standards are listed below and combined in Tables 2 and 3.

Table 1 refers to waters complying with the national pH EQS where upper and lower 95 percentile pH values lie between 6.0 and 9.0.

Use of chemicals in treatment

Table 3 refers to waters having a lower 95 percentile pH of <6.0, where a derogation of the pH standard to reflect 'natural' acidification is acceptable. The table is divided into two total calcium/magnesium hardness classes, expressed as calcium carbonate concentration.

Chlorine

The Environment Agency recommend an EQS of 5 ug/l Total Available Chlorine (free chlorine plus chloramines) as a MAC, to protect cyprinid and salmonid fish stocks. The criterion is dependent upon analytical capability which is currently constrained by a practical field detection limit of 20 - 50 ug/l. Also, we must take into account the rapid breakdown of chlorine in some situations. If 10 x dilution of effluent is available, it may be possible to measure a safe permit-compliance concentration. Where less dilution is available, we must make a site-specific decision.

Aluminium

Aluminium is acutely toxic to fish in its active form and requires control where calcium hardness and pH are low in the receiving water. Standards in Table 2 are set to reduce the possibility of active aluminium occurring downstream of WTW discharges, and to minimise deposition of particulate aluminium on the bed of a watercourse. At dilutions of less than 10:1, the total aluminium standard also limits dissolved aluminium in the discharge.

Standards in Table 3 cover receiving water quality of low pH where discharged aluminium may either remain in solution or re-dissolve. It is probable that in such waters there will already be some dissolved aluminium and the capacity to accept more will be very limited. We need to consider aluminium discharges to these waters on a detailed, case-specific basis.

Polyelectrolytes

Polyacrylamide polyelectrolytes are increasingly being used as secondary coagulants and sometimes as primary coagulants. Cationic polyelectrolytes are highly toxic to fish through a surface active effect which causes gill damage. Acute toxicity occurs at concentrations as low as 300 ug/l, which is lower than the practical chemical analytical detection limit of approximately 1 mg/l.

Anionic and non-ionic polyacrylamide polyelectrolytes are significantly less toxic (in the range 50 - 100 mg/l) but have approximately the same detection limit as cationic forms.

Anionic and non-ionic polyelectrolytes are therefore environmentally preferable in areas where water hardness and pH are low because polyelectrolyte activity will persist longer under such conditions and we need to be able to measure permitted concentrations in the effluent to demonstrate safe environmental concentrations.

For anionic and nonionic polyacrylamide polyelectrolytes, we set an EQS of 3.5 mg/l as a 95 percentile in soft acid waters (pH 6 or less, total hardness 20 mg/l or less). For hardness greater than 20 mg/l as calcium carbonate, a 95 percentile EQS of 7.5 mg/l is appropriate. Alternatively, 0.05 or 0.1 times an actual 24h LC50 for the polyelectrolyte in question could be used as a 95 percentile EQS (see Table 3).

Use of chemicals in treatment

Tables 2 and 3 give default values for polyelectrolytes. More relaxed EQS can be considered on a case by case basis if the operator provides toxicity data and information on analytical methods.

We will normally limit these substances at concentrations well below EQS by operational control through the Management System. We will only very exceptionally need to set a numeric permit limit.

Suspended solids

Suspended solids discharged from water treatment works cause aesthetic and environmental problems in some receiving waters. EQS values are difficult to establish and monitor because of flow dependency, and also because of widely differing background levels between different catchments. The Environment Agency have therefore identified a default permit standard of 100 mg/l. Where local conditions of poor dilution and aesthetic or environmental problems are important, we can apply more stringent standards. More relaxed standards can be applied if no environmental or aesthetic need exists and where achieving the 100 mg/l standard would impose additional cost.

Iron

The established annual national average EQS for dissolved iron is 1 mg/l. To protect against problems resulting from particulate iron settlement, a total iron concentration of 5 mg/l (as a MAC) is set in the receiving water. Where total hardness is less than 20mg/l and 95 percentile pH is less than 6.0 (Table 3) corresponding values should be 0.5 mg/l dissolved and 2 mg/l total.

Evidence suggests that concentrations above 90 mg/kg dry wt total iron may have a detrimental effect on benthic communities. The application and monitoring of compliance with this criterion will be addressed on a case-specific basis.

Granulated Activated Carbon (GAC) fines/residues

Initial backwash waters

Fines from the commissioning of GAC plant could cause visual impact on the receiving watercourse and so they should be eliminated from any discharges from the site. This is normally achieved by collecting initial backwash waters and treating them on site, off site disposal, or discharge to the foul sewer. The operator can use other approaches provided they satisfy the Environment Agency that the effluent will be of adequate quality to protect the environment.

In service backwash waters

In service backwash waters are subject to routine permit controls (flow, sampling facilities and so on), together with appropriate permit conditions

Use of chemicals in treatment

TABLE 2: Waters complying with the national pH EQS where upper and lower 95 percentile pH values lie between 6.0 and 9.0.

Determinand	**Standard**
Chlorine	5 ug/1 MAC as Total Available Chlorine
Aluminium	The standard is 1mg/l (total) MAC EQS but subject to a maximum concentration in the discharge of 10 mg/l (dissolved) EMISSION STD if □1:10 dilution.
Cationic Polyelecs.	EQS will be 0.1 x 24h LC50 for appropriate fish species, as 95p. Dilutions <x30 require case-specific consideration (see text).
Anionic and Non-ionic Polylecs.	7.5 mg/l 95p, EQS OR 0.1 x 24h LC50 for appropriate fish species, if this is known.
Suspended Solids	100 mg/l EMISSION STD OR case-specific std. (See text)
Iron	1 mg/l dissolved AA EQS 5 mg/l total MAC EQS Where the environmental needs of the RESERVOIR are compromised by iron particle deposition you can apply an MAC of 90 mg/kg Fe, dry weight in sediment.

AA = annual average
95p = 95 percentile
MAC = maximum allowable concentration

Note: For GAC effluents see guidelines above.

Use of chemicals in treatment

TABLE 3: Waters having a lower 95 percentile pH of <6.0, where a derogation of the pH standard to reflect 'natural' acidification is acceptable. The table is divided into two total calcium/magnesium hardness classes, expressed as calcium carbonate concentration.

Determinand	**Receiving water quality**	
	pH<6.0 (lower 95p) **$CaCO_3$ <20 mg/l AA**	**pH<6.0 (lower 95p)** **$CaCO_3$ ☐ 20 mg/l AA**
Chlorine	5 ug/l MAC as Total Available Chlorine	5 ug/l MAC as Total Available Chlorine
Aluminium (dissolved) (total)	75 ug/l 95p EQS 100 ug/l MAC EQS 500 ug/l EMISSION STD	500 ug/l 95p EQS 1 mg/l MAC EQS 1 mg/l EMISSION STD
Cationic Polyelecs.	Adopt a case-specific approach while analytical detection limit remains greater than 0.1x fish 24h LC50.	
Anionic and Non-Ionic Polyelecs.	3.5 mg/l EMISSION STD OR 0.05 x 24h LC50 for fish, if this is known as 95p EQS.	7.5 mg/l EMISSION STD OR 0.1 x 24h LC50 for fish, if this is known as 95p EQS.
Suspended solids	100 mg/l EMISSION STD OR case-specific std. (See text)	
Iron (dissolved) (total)	0.5 mg/l AA EQS 2 mg/l MAC EQS	1 mg/l AA EQS 5 mg/l MAC EQS
	Where the environmental needs of a RESERVOIR are compromised by iron particle deposition, apply an MAC of 90 mg/kg Fe, dry weight.	

AA = annual average
95p = 95 percentile
MAC = maximum allowable concentration

Note: For GAC effluents see guidelines above.

Use of chemicals in treatment

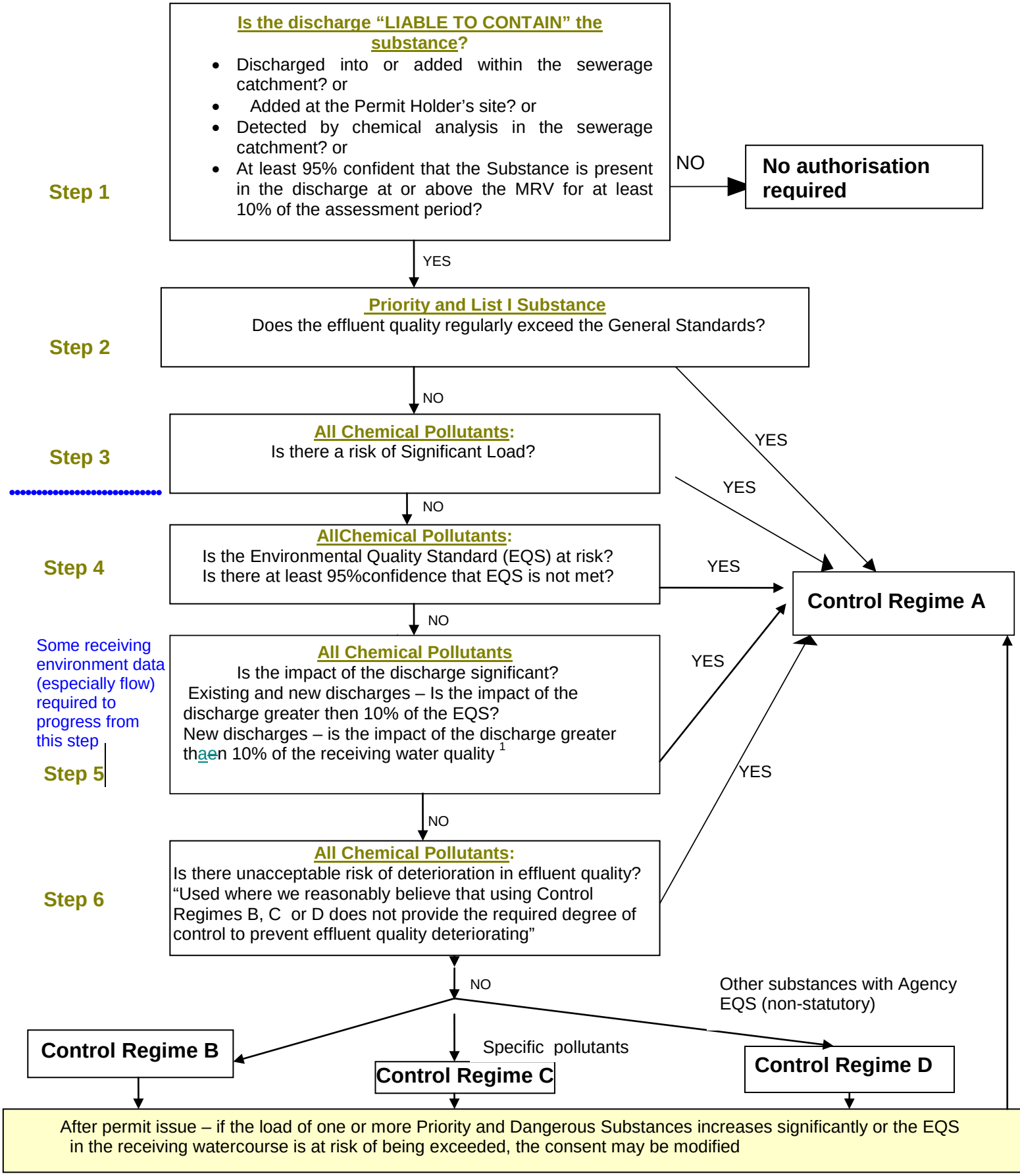
What's in this section?

This document describes how we permit discharges to surface waters which are liable to contain Hazardous Pollutants (Priority HazardousSubstances, Priority Substances and Specific Pollutants) and other dangerous substances. The Water Framework Directive (WFD), the EQS Directive and the Dangerous Substances Directive (DSD) require the control of such discharges. We regulate point sources discharges to surface water of designated dangerous and hazardous substances and any other potentially polluting, toxic, bioaccumulative, carcinogenic, teratogenic or persistent substances, to protect the environment and human health, comply with Directive requirements and minimise loads discharge to the environment.

2.6.1 Derivation of permit limits

Figure 1 below summarises the main stages for permitting Dangerous Substances in surface waters. This guidance will be superceeded by detailed guidance on how we implement the WFD and EQS Directives and how we assess whether a discharge is liable to contain a hazardous pollutant (publishing pending). This revised guidance will apply to discharges to both freshwaters and TraC waters, from all permitting regimes.

Figure 1 Permitting Flow Diagram
Permitting Procedure for Chemical Pollutants in Surface Waters



1Where no receiving water quality data are available, assumptions on the concentration of the substance in the receiving waters are made from this step.

Disinfection (UV and membranes)

2.7 Disinfection (UV and membranes)

What's in this section?

2.7.1 Definition

The term **disinfection** refers to the destruction, inactivation or removal of those micro-organisms with the potential to cause infection and, therefore, to harm people.

Within Environment Agency policy, the term **disinfection** refers to using the technique installed specifically to reduce the number of viable infectious micro-organisms in an effluent.

For example, we do not consider secondary treatment to be a disinfection technique, but we do consider that ultra violet (UV) treatment is. We treat membrane filtration as disinfection if it is used specifically to achieve microbiological objectives beyond those expected from secondary treatment.

Disinfection (UV and membranes)

2.7.2 Micro-biological objectives

What's in this section?

2.7.2.1 Continuous discharges impacting on designated bathing waters

The Environment Agency's bathing water policy requires that a secondary treatment scheme must achieve compliance with both mandatory and guideline standards for faecal coliforms in all bathing seasons.

This requirement is compulsory. The requirement to meet guideline standards is in place as a surrogate to meet the mandatory requirements of the Bathing Waters Directive in relation to enteroviruses.

If a scheme does not deliver these objectives, we require disinfection, unless the outfall can be relocated.

Where disinfection is required, you must demonstrate a **minimum** 25,000-fold (4.4 log) reduction in enteroviruses and a 250,000-fold (5.4 log) reduction in faecal coliforms between the crude influent to the treatment works and the bathing water monitoring point, based on standard influent concentrations.

You can achieve this reduction through a combination of conventional secondary treatment, disinfection, and dilution/dispersion.

See also Minimum pathogen removal requirements.

2.7.2.2 Continuous discharges impacting on designated shellfish waters

Once we have determined that you require disinfection to meet our objectives for shellfish waters, the following microbiological objectives apply.

You must demonstrate a **minimum** 180,000-fold (5.25 log) reduction in faecal coliforms between the crude influent to the treatment works and the shellfish water, based on standard influent concentrations.

You can achieve this reduction by combining conventional treatment, disinfection and dilution/or dispersion. See also Minimum pathogen removal requirements, below.

For discharges outside the shellfish water, you must meet the reduction quoted above at the edge of the shellfish water.

For discharges inside the shellfish water you must meet the reduction quoted above after minimum initial dilution.

2.7.2.3 Disinfected intermittent discharges (impacting on Bathing and/or Shellfish Waters)

The design standards are site-specific, depending on various factors such as spill frequency, spill volume, and discharge location. See also Minimum pathogen removal requirements below. Where you wish to employ disinfection of intermittent discharges to meet Agency objectives, you should contact your local office for guidance. Note that there is not yet any disinfection process which is approved for long-term use with intermittent discharges, see below.

2.7.2.4 Minimum pathogen removal requirements

In addition to the specific microbiological objectives for bathing water and shellfish water schemes, there is an additional minimum design reduction requirement for enteroviruses as follows:

Disinfection Process	Minimum reduction in enteroviruses
Disinfection post-secondary treatment (e.g. UV, 'bolt-on' membrane filtration processes)	1.0 log (10-fold)
Disinfection of untreated or settled storm effluent	1.0 log (10-fold)

Disinfection (UV and membranes)

The minimum pathogen removal requirement applies to **all new** disinfection schemes, including discretionary schemes and intermittent discharges. We only endorse the use of the term 'disinfection' where this condition is met.

Because there is no longer any analysis available for enteroviruses in the UK, where the efficacy for enteroviruses has to be demonstrated (e.g. in trials) then we require the use of F+ bacteriophage as a surrogate.

Where the mean reduction of F+ bacteriophage through the pre-disinfection secondary treatment can be shown to be more than 1.5-log, then the above requirement for a 1-log removal rate through the disinfection process can be relaxed by agreement with the Agency, so long as the total mean removal rate is at least 2.5-log. The removal rate through the secondary treatment must be demonstrated via a sufficiently robust sampling programme.

Note: this does not mean that there is a minimum requirement for a 2.5-log reduction through the works – e.g. if the secondary treatment process has a mean removal rate of 1.0-log, then the disinfection process need only comply with the minimum reduction requirement of 1.0-log.

Existing stand-alone disinfection processes

Many existing disinfection plant do not meet the above minimum pathogen removal criterion. When the disinfection plant is replaced, the Environment Agency would have to make a cost benefit case before requiring an upgrade designed to achieve this requirement. It would not be a like for like replacement under capital maintenance and would be viewed as an enhancement by Ofwat.

2.7.3 Regulation

For processes accepted for long term use, we regulate disinfection through conditions relating to the process, rather than by setting end-of-pipe microbial standards.

In exceptional circumstances, we impose controls on micro-organism concentrations in the effluent.

We require operators to carry out regular microbial efficacy monitoring of discharges which are subject to disinfection.

2.7.4 Status of disinfection processes

The Environment Agency currently accepts only the following disinfection processes for long-term use:

Disinfection (UV and membranes)

- UV disinfection of secondary treated final effluents, using either low or medium pressure UV lamps.
- Kubota® membrane filtration, which is a membrane bioreactor (MBR) process, incorporating conventional biological treatment and filtration in one unit (influent preliminary treated).
- Zenon® membrane filtration, which is an MBR process, incorporating conventional biological treatment and filtration in one unit (influent preliminary treated).
- Memcor® membrane disinfection (influent chemically assisted sedimentation).

We have accepted wetlands (reed beds) for long term use at a few sites, but only following demonstration of performance which is design- and site-specific. You must discuss any proposals to use reed beds with your local Agency officer.

All other techniques are only acceptable on a trial or interim basis, including:

- Other membrane filtration processes;
- All processes for the disinfection of intermittent discharges of storm water.

If you wish to use a process not accepted for long-term use then you should contact your local Agency office.

2.7.5 Background information on UV disinfection processes

What's in this section?

2.7.5.1 Types of UV lamp

There are currently two basic types of UV lamp in common use:

- Low pressure lamps. These emit UV radiation with wavelengths in a very narrow band centred on 254 nm (254×10^{-9} m). As this wavelength corresponds very closely with the wavelength best suited to the inactivation of microbes, these lamps tend to be very efficient in energy terms.
- Medium pressure lamps. These emit UV radiation with wavelengths across a much broader band (~200-300nm). These lamps are less efficient than low pressure lamps, but can be run at higher powers, so the same effective dose can be delivered with fewer lamps.

We currently have no preference for either type of lamp. Our standard permit clauses give options for the two types of lamp.

However, evidence in the scientific literature indicates that effluents which have been subjected to disinfection by medium pressure lamps are less susceptible to subsequent photo-reactivation than those where low pressure lamps have been used. This result has

implications for the target reductions required and for calculating the UV dose, where low pressure lamps may require a larger dose. See also Photo-reactivation, in section below.

2.7.5.2 UV dose

Definition

UV dose is the product of:

- the intensity of the UV to which the effluent is subjected (effectively the power per unit area.) Units milliWatts per centimetre squared (mW/cm^2)

and

- the time that the effluent is subjected to the UV irradiation (known as the retention time). Units seconds (s).

Units for UV dose are therefore:

- milliWatt seconds per centimetre squared (mWs/cm^2)

or

- milliJoules per centimetre squared (mJ/cm^2).

where 1 Joule = 1 Watt-second.

The UV dose is calculated for each UV bank, and then the UV dose per channel is the sum of the doses per bank in that channel.

Retention time in seconds is the volume of wastewater undergoing UV irradiation at any given time within the UV bank (effectively the volume of wastewater "in contact" with the UV tubes) divided by the measured flow rate through the UV bank.

UV transmissivity is a measure of the ability of UV radiation to pass through the effluent. It is defined as the percentage of the UV radiation at 254nm which passes through a 1 cm thick slab of the effluent. The higher the transmissivity the better, because the radiation can penetrate the effluent further.

Measuring UV dose

There are three ways of measuring or estimating the UV dose. These are based on three ways of measuring or estimating the UV intensity.

Received Dose

The dose is calculated from the measured UV intensity, modified by the software to account for the lamp/channel configuration.

Received dose per bank = Measured UV Intensity x Retention time.

Disinfection (UV and membranes)

Applied Dose

The dose is calculated from a theoretical UV intensity which is based on the type of lamp, the lamp/channel configuration, and the assumed UV transmissivity of the effluent.

Applied dose per bank = Theoretical UV Intensity x Retention time.

The assumed UV transmissivity must be the 5% exceeded transmissivity of the effluent.

Measured Applied Dose

A theoretical calculation similar to applied dose above, except that we measure the UV transmissivity rather than using an assumed value to calculate the UV intensity.

In addition, the number of lamps in the bank confirmed as operating is taken into account.

Measured applied dose per bank = Theoretical UV intensity based on measured UV transmittance x Retention time x Number of lamps in bank confirmed as operating/Total number of lamps in bank.

For both the applied dose and the measured applied dose, the Environment Agency assumes that the lamps are clean but at end-of-life, when they are less effective and require replacement.

Current policy

The received dose is, theoretically, the most appropriate measure of dose because it is dependent on effluent quality, lamp performance and lamp cleanliness.

However, it is current policy to base all new permits on the measured applied dose. Our reasons for this are:

- transmissivity is more easily and more accurately measured than intensity
- the measured applied dose is dependent on effluent quality while the applied dose is not.

So, if the effluent transmissivity is poor, using the measured applied dose results in recording a lower UV dose. This may result in the need to turn on extra lamps.

In the same situation, using the applied dose, the recorded dose does not change, possibly resulting in the discharge of effluent that has been insufficiently disinfected.

Existing permits

Many existing permits are based on either the received dose or the applied dose. There are no current proposals to change any of these.

Disinfection (UV and membranes)

2.7.5.3 Photo-reactivation

UV disinfection causes damage through the formation of pyrimidine dimers in the DNA of the target micro-organisms. This inhibits their proper replication and growth and, ultimately, leads to death.

However, many organisms, especially bacteria, have been known to perform DNA repair. One method is photo-reactivation. It occurs when micro-organisms, inactivated by UV radiation, are exposed to longer wavelength light (300 – 500 nm). They use the energy from the light to reverse the UV-induced DNA damage.

We call this event **photo-reactivation**. It reverses the effect of UV disinfection so that micro-organisms are able to replicate again.

Therefore, we must take some account of photo-reactivation. Our current understanding of photo-reactivation has led us to the rules below:

1. **Effluent disinfected with radiation from low pressure UV lamps**

You must assume a 0.5 log increase in faecal coliform concentrations after disinfection.

However, you can ignore this for discharges directly into shellfish water since the photo-reactivation does not take place immediately, allowing time for dilution/dispersion and mortality to more than counteract any photo-reactivation.

2. **Effluent disinfected with radiation from medium pressure UV lamps**

You should assume a 0.0 log increase in faecal coliform concentrations after disinfection (that is, no photo-reactivation).

3. **Faecal streptococci and enteroviruses**

You should assume no photo-reactivation after UV disinfection.

2.7.6 Achieving microbiological objectives

What's in this section?

You can achieve reductions in microbial concentrations in four ways:

- through conventional primary and secondary treatment;
- additional reductions through the disinfection process;
- dilution/dispersion from the point of discharge to the use area;
- mortality, which occurs from the point of discharge to the use area.

Disinfection (UV and membranes)

In addition to the four ways of reduction above, you must also account for any photo-reactivation which increases microbial concentrations.

For the purposes of design, you can use standard assumed reductions for conventional treatment processes. The table below lists these.

	Faecal coliforms	**Enteroviruses**
Primary + activated sludge	2.0	1.5
Primary + oxidation ditch	2.0	1.5
Primary + Biological Aerated (Flooded) Filter (BA(F)F)	1.5	1.0
Percolating filter	1.5	0.3

Note that there are many different treatment processes, even within each of the listed categories. Therefore, we are providing these reductions as a guide only. You may have evidence that a different removal rate should be used at a particular site. If so, you can choose to provide actual removal rates for that site.

These rates should be geometric mean removal rates, based on a sufficient quantity and variability of data.

Consider the two examples below:

2.7.6.1 Example 1: disinfection at a bathing water, medium pressure UV lamps

The table below shows how you calculate the reductions required through UV disinfection for enteroviruses.

Target overall reduction in enteroviruses	4.4 log (25,000-fold)	
Additional reduction required for photo-reactivation (always 0.0 for enteroviruses)	0.0-log (1-fold)	
Total required reduction in enteroviruses	4.4-log (25,000-fold)	
Reduction through secondary treatment (AS)		2.0-log (100-fold)
Minimum dilution/dispersion to monitoring point (site specific)		2.0 log (100-fold)
Mortality (always 0.0 for enteroviruses)		0.0 log (1-fold)
Reduction without disinfection		3.5-log (3,200-fold)

Disinfection (UV and membranes)

Additional reduction required through disinfection	0.9-log (8-fold)
Total reduction achieved	4.4-log (25,000-fold)

In this example, minimum pathogen removal policy dictates that we require a 1.0 log (10-fold) reduction in enteroviruses, rather than the calculated 0.9-log reduction. The UV dose would be based on this requirement. You should undertake a similar calculation for faecal coliforms – but the subsequently derived UV dose will normally be lower than for enteroviruses.

2.7.6.2 Example 2: treated effluent at a shellfish water, low pressure UV lamps

A secondary treated effluent that is discharged outside a shellfish water. It requires disinfection to meet our objectives for faecal coliforms at the shellfish water and the operator has proposed low pressure UV disinfection. The table below shows you how to calculate the reductions required.

Target overall reduction in faecal coliforms	5.25 log (180,000-fold)	
Additional reduction required for photo-reactivation (0.5 for faecal coliforms and low pressure lamps)	0.5-log (3-fold)	
Total required reduction in faecal coliforms	5.75-log (540,000-fold)	
Reduction through secondary treatment (AS)		2.0 log (100-fold)
Minimum dilution/dispersion to monitoring point (site specific)		1.5-log (32-fold)
Mortality (site specific)		1.0 log (10-fold)
Reduction without disinfection		4.5-log (32,000-fold)
Additional reduction required through disinfection		1.25-log (18-fold)
Total reduction achieved		5.75-log (540,000-fold)

For schemes involving UV disinfection, you should use the Agency spreadsheet to determine the required UV dose, see:

Setting the UV dose.

If you prefer, we will compute the UV dose on your behalf, but you must provide all the required information. If you compute the dose yourself, we are likely to check the result.

For schemes involving membrane filtration, you must provide information to demonstrate that the proposed system will achieve the required reductions.

2.7.7 Impact of suspended solids on UV disinfection

The performance of UV disinfection depends on the quality of the effluent. Particles within the effluent can shield microbes from the UV radiation and reduce the efficacy of the process.

Therefore, we will include in the permit limits on the levels of suspended solid in the effluent. The maximum permitted 95 percentile value will be 60 mg/l. However, the performance of the plant may require a lower permitted limit, and where the upstream treatment is BAF(F), the permitted value for suspended solids (95 percentile) will not exceed 30 mg/l.

2.7.8 Setting the UV dose

What's in this section?

2.7.8.1 Continuous discharges

You should establish the required UV dose using the Environment Agency UV Dose Spreadsheet, which is available from your local Agency office.

This spreadsheet is based on relationships developed by the United States Environmental Protection Agency (USEPA). It allows the determination of the dose required to achieve specified reductions in the concentrations of faecal coliforms and enteroviruses through UV disinfection. The required dose depends on the level of suspended solids in the effluent and, to a lesser extent, on the UV intensity.

2.7.8.2 Intermittent discharges

We have not yet derived any methodologies to determine the UV dose required to meet our objectives. We will develop these as we gain experience with the evaluation of UV disinfection of intermittent discharges of storm sewage.

Therefore you should discuss any proposal for the disinfection of storm effluent with your local Agency office.

Disinfection (UV and membranes)

2.7.9 Seasonal disinfection

Agency policy requires disinfection over the whole year, except where there are no clear benefits in maintaining the dosing/application systems continuously. Seasonal disinfection may be acceptable if you can demonstrate to us that there are no clear ecological or user benefits to maintaining the disinfection throughout the year.

Note, however, that we always require year-round disinfection where the discharge impacts on commercially harvested shellfish beds.

If you wish to apply for a permit with seasonal disinfection, then contact your local Agency office for details of the information you will need to provide. This will involve assessing the impact area of your discharge, and then undertaking a use survey of that area of impact.

2.7.10 Management Systems – UV disinfection

What's in this section?

2.7.10.1 Maintenance

You must establish and operate a documented maintenance programme. This must include:

- The method and frequency of cleaning and replacement of UV lamps;
- The method and frequency of cleaning and of calibration of transmittance meters where the permitted dose is measured applied, and of intensity meters where the permitted dose is received;
- The maximum number of UV lamps allowed to fail before all failed lamps are replaced.

Where the flow monitors used to calculate the UV dose are not required to have a flow MCERTS site conformity certificate, the maintenance programme must also include details of the maintenance and calibration schedule for the flow monitors used in calculating the UV dose.

Disinfection (UV and membranes)

You must provide details of the maintenance programme to the Environment Agency for agreement and keep records of the maintenance undertaken (both routine and non-routine).

You must make the maintenance programme and the maintenance records available for inspection by the Environment Agency's officers at all reasonable times.

On request, you must supply the Environment Agency with a written report on the maintenance, and all non-routine actions that may have adversely affected effluent quality.

2.7.10.2 Telemetry

You must provide and maintain a telemetry alarm system connected to a 24-hour manned station to give a warning in the event that:

1. the external power supply to the UV disinfection system has been interrupted;
2. failure of any measurement system used to control the UV dosing system has occurred;
3. the UV dose has fallen below 50% of the full dose specified in the permit for a period of 2.5 hours or more.

In response to any alarm, you must rectify the situation as soon as is reasonably practicable.

2.7.10.3 Emergency notification

You must notify the Environment Agency and also, where the discharge impacts on a Shellfish Water, the Local Food Authority, in the event that either:

1. the UV dose has fallen below 50% of the full dose specified in the permit for a period of 2.5 hours or more; or
2. there has been a failure of any measurement system used to control the UV dosing system, the maximum number of available duty banks of UV lamps were not automatically activated;
3. there has been a loss of secondary treatment.

You must make the notification as soon as practicable and no later than 24 hours after the event, and you must detail the reasons why the situation occurred, and the actions you have taken to remedy the situation.

If the Environment Agency is satisfied that the cause of an occurrence of any of the above was an emergency and outside your control, and that you took all possible measures to minimise the impact of the discharge on controlled waters, then we will not report you as non-compliant as a result of 1. above.

2.7.10.4 Power

For sites where effluent continues to discharge in the event of a power failure then you must put measures in place to ensure that the UV disinfection system continues to operate as normal in the event of a power failure.

2.7.10.5 Reporting

You must supply the Environment Agency with the disinfection process data as required by your permit. This is normally supplied quarterly, unless we have agreed a different reporting interval. The required electronic format for these data can be obtained from your local Agency office.

On request, you must supply the Environment Agency with a written report on the maintenance, and all non-routine actions that may have adversely affected effluent quality.

Disinfection (UV and membranes)

2.7.11 Management Systems – Membrane filtration

What's in this section?

2.7.11.1 Maintenance

You must establish and operate a documented maintenance programme.

This must include:

- The method and frequency of cleaning and replacement of membrane filters;
- The method and frequency of cleaning and of calibration of on-line turbidity meters.

You must provide details of the maintenance programme to the Environment Agency for agreement and keep records of the maintenance undertaken (both routine and non-routine).

You must make the maintenance programme and the maintenance records available for inspection by the Environment Agency's officers at all reasonable times.

On request, the Operator shall supply the Environment Agency with a written report on the maintenance, and all non-routine actions that may have adversely affected effluent quality. 2.7.11.2 Telemetry

You must provide and maintain a telemetry alarm system connected to a 24-hour manned station to give a warning in the event that:

1. the external power supply to the treatment system has been interrupted;
2. there has been a mechanical or control system breakdown;
3. the effluent turbidity exceeds 30 NTU (nephelometric turbidity units).

In response to any alarm, you must rectify the situation as soon as is reasonably practicable.

Disinfection (UV and membranes)

2.7.11.3 Emergency notification

You must notify the Environment Agency and also, where the discharge impacts on a Shellfish Water, the Local Food Authority, in the event of a discharge of sewage effluent which has not been subjected to the required membrane filtration.

You must make the notification as soon as practicable and no later than 24 hours after the event, and you must detail the reasons why the situation occurred, and the actions you have taken to remedy the situation.

2.7.11.4 Power

For sites where effluent continues to discharge in the event of a power failure then you must put measures in place to ensure that membrane filtration continues to operate as normal in the event of a power failure.

2.7.11.5 Reporting

You must supply the Environment Agency with the disinfection process data as required by your permit. This is normally supplied quarterly, unless we have agreed a different reporting interval. The required electronic format for these data can be obtained from your local Agency office.

On request, you must supply the Environment Agency with a written report on the maintenance, and all non-routine actions that may have adversely affected effluent quality.

2.7.12 Efficacy monitoring requirements

Efficacy monitoring requirements are dealt with in section on Operator Self Monitoring (OSM).

Sampling Points OSM operational rules and specification for self monitoring

3 Emissions and Monitoring

3.1 Sampling points

Samples are taken at agreed locations. In most cases the location of the sample point has been chosen so that a fully representative sample of the final effluent can be easily taken

For UWWTD there is always a sample point on the effluent and usually one on the works inlet. MCERTS certified automatic samplers take composite samples and these samples are usually taken in pairs (inlet and outlet) to enable the calculation of percentage removal.

3.2 Operator self monitoring (OSM) operational rules and specification for self monitoring

What's in this section

3.2.1 Introduction

Operator Self Monitoring makes the operator responsible for collecting and analysing discharge effluent samples. It is fundamental to the principles of Better Regulation because alongside Opra it allows the operator to demonstrate that they are a mature and responsible operator, in control of their management systems and assets, and aware of their impact on the environment.

OSM operational rules and specification for self monitoring

The Agency has a duty to ensure that monitoring is carried out to a standard that is suitable to meet the requirements for compliance assessment and water quality planning.

This document says how OSM will work for discharges to controlled waters permitted by water discharge activity permits (or consents previously issued under the Water Resources Act 1991).

The rules do not prescribe how all activities relating to OSM must be carried out, they do provide guidance and set minimum standards.

Operators are encouraged to develop their own systems and procedures and fit them within their own working arrangements whilst adhering to the principles and requirements of OSM. The Agency will assess how effective these systems and procedures are by carrying out audits and inspections.

The rules provide a context to, and further explanation of, the OSM permit conditions which will be incorporated into the permits of all discharges which require OSM.

OSM operational rules and specification for self monitoring

3.2.2 Setting the monitoring programme

What's in this section?

3.2.2.1 Sampling Frequency

Annex 4 and 5 show the required sample frequencies for the OSM phase 1 and phase 2 discharges.

The normal monitoring frequency for a discharge will be 24 or 12 samples per year depending on whether it is Opra Tier 3 or Tier 2. Where a discharge is fully compliant with its effluent quality numeric limits over the preceding 12 consecutive months its sampling frequency will be the reduced frequency of 12, 6 or 4 samples per calendar year depending on which OSM sampling frequency appendix and relevant criteria applies.

Where a discharge fails any permitted numeric water quality limit, it will return to its normal sampling frequency over a 12 month period as soon as reasonably possible and continue at the normal frequency until 12 consecutive months of numeric compliance have been reported when it can return to its reduced frequency of 12, 6 or 4 samples a year or pro rata taken over the remainder of a year where the change is within a calendar year.

Numeric compliance relates to absolute limits, look up table compliance, maximum and minimum limits, mean limits, percentile compliance, comparative limits or other numeric water quality standards specified within the water discharge activity permit for a discharge.

UWWTD permit failures will be taken into account in setting OSM frequencies as failure of these limits demonstrates that a treatment works is not performing to an acceptable standard and therefore poses an increased environmental risk.

The Agency can agree in writing to sampling frequencies other than those shown in Annex 4 and 5 in exceptional circumstances.

OSM operational rules and specification for self monitoring

If an operator asks for monitoring to continue at the reduced rate rather than reverting to the normal frequency following a numeric failure described above, the Agency will not agree unless we are satisfied that the circumstances relating to the failure are exceptional and not as a result of the act or default of the operator.

Unless written agreement is given by the Agency, monitoring at the normal frequency will commence as soon as possible after the operator becomes aware of a numeric condition failure and will continue at that frequency until 12 consecutive months of numeric compliance has been achieved.

3.2.2.2 Setting the programme

The monitoring programme (shown in Annex 4 and Annex 5) runs over a full calendar year and the days of sampling must be scheduled for each discharge before the start of the following calendar year.

The samples will be spot samples which must be collected at approximately equal intervals during the year, but should include samples from different days of the week and different times. Approximately 10% of samples should be out of normal working hours which are 9am - 3pm, Monday to Friday.

The samples will be analysed for each water quality determinand which has a numeric limit specified within the permit which permits the discharge. (This does not include List 1 substances included within a permit in the General Standards table attached to that permit).

The monitoring programme for each discharge (and any changes to it) must be recorded by the operator and be available to us on request.

If a pre-scheduled sample event is missed, the reason must be recorded and the sample re-scheduled to be taken as soon as possible.

If for any reason the result of any parameter can't be reported, the reason must be recorded and the parameter repeated as soon as reasonably possible.

Operators must report any changes to the programme that have occurred throughout the year at the end of each calendar year. This will include all missed and rescheduled sampling events.

OSM operational rules and specification for self monitoring

3.2.2.3 OSM sampling at frequencies higher than the minimum frequencies required by OSM

The OSM sample frequencies are minimum frequencies which have been set to take account of risk. If a company want to sample at a higher frequency then this will result in increased monitoring costs and effort. We therefore expect that OSM sampling frequencies will not be set higher than the minimum frequency required unless the company has sound operational reasons for doing so.

Examples of sound operational reasons are shown below.

- The company wants to carry out process control or performance monitoring at a higher frequency than OSM requires and it is easier for all the samples to be taken as OSM samples than some being taken as process monitoring samples and not reported to us.
- A discharge will move from T2 to T3 (or visa versa) within a calendar year and it is easier to pre-schedule the samples at the T3 frequency for the full year rather than have a change during the year.

If OSM sampling is to be carried out at a higher frequency than required by OSM conditions it must be pre-scheduled before the start of the calendar year and any missed samples must be re-scheduled and the reason recorded.

We expect that OSM sampling will be pre-scheduled at one of the following frequencies, 4, 6, 12, 24 or 48 as these are the frequencies which were used by the Agency when setting annual sampling frequencies and they also include some of the frequencies used in UWWTD self monitoring programmes.

3.2.2.4 No flow sample events

If no sample is available during a sample visit then evidence of this must be recorded and made available to the Agency upon request. Acceptable evidence includes a digital photo of the sample point showing no sample is available with the time and date recorded or, where available, flow monitoring data.

Where no sample is available and evidence is gathered which will demonstrate this to the Agency's satisfaction the sample will be reported to the Agency as compliant for all permitted determinands and will not need to be rescheduled.

An exception to the above could be where treated sewage effluent is discharged from a site from more than one permitted outlet or sample point but the discharges do not occur simultaneously. In such cases it may be necessary for the Agency to confirm in writing on a site by site basis how the discharges from the site should be sampled, reported and checked for compliance. For example at what frequency, individually, or as a total, samples must be taken, how samples and no flow samples are to be reported and how permit compliance will be assessed.

3.2.2.5 Increased sampling frequency following failure

The OSM sanitary sampling frequency must be increased for a full 12 months starting as soon as reasonably practicable following the date of the latest failing sample result until 12 consecutive months of numeric compliance have been reported. Following 12 months compliance the frequency can be changed back down to the relevant reduced frequency of 12, 6 or 4 samples a year or pro rata taken over the remainder of a year where the change is within a calendar year.

3.2.2.6 Schedule visibility

Operators must ensure that, except in very exceptional circumstances (for example due to health and safety considerations), the OSM monitoring programme is not visible to operational staff responsible for discharge performance. Where it is unavoidable and operational staff have to be aware of a sampling event then they must receive notification as late as is reasonably practicable.

OSM provides companies with the opportunity to make an efficiency saving by combining it with the UWWTD monitoring programme. Where a company chooses to carry out combined monitoring it must ensure that it meets the requirements of each combined monitoring programme. For UWWTD and OSM combined monitoring this means that the dates of the UWWTD monitoring must be unknown to operators on site, with procedures put in place to ensure this is the case.

Where procedures cannot be put in place to ensure that all the requirements of combined programmes are met then the monitoring programmes must be carried out separately

OSM operational rules and specification for self monitoring

3.2.3 Quality Management Systems (QMS) and MCERTS

What's in this section?

3.2.3.1 QMS

Operators will have a Quality Management System (QMS) which covers all aspects of Operator Self Monitoring, including the pre-scheduling of the sampling programme, sampling, transport, storage, analysis and reporting to the Agency.

The QMS should be introduced at a senior management level and ensure that OSM is operated as independently as possible without interference from within the business.

The QMS should be in accordance with any MCERTS requirements for sampling and analysis.

The operator must ensure that actions and activities carried out to fulfil the requirements of OSM are appropriately recorded.

3.2.3.2 MCERTS

We published the MCERTS standard, Performance Standard for Organisations Undertaking Sampling and Chemical Testing of Water (Part 1) in July 2008.

This standard is based on ISO 17025 – General Requirements for the competence of testing and calibration laboratories, and Agency procedures and guidance on Water Quality Sampling.

Before 1 July 2010, organisations taking samples and carrying out analysis for OSM purposes will be required to have applied to UKAS for this MCERTS accreditation and have gained accreditation after that date. We may agree to a later date on a case by case basis in light of circumstances which may reasonably be outside of the organisation's control.

OSM operational rules and specification for self monitoring

We expect that organisations carrying out OSM sampling and analysis will operate within the spirit of this MCERTS standard up to gaining full accreditation. After gaining accreditation ongoing compliance will be checked by UKAS audits of sampling and laboratory procedures and processes.

The operator must maintain all required records of compliance and accreditation with ISO17025 for the MCERTS standard, Performance Standard for Organisations Undertaking Sampling and Chemical Testing of Water (Part 1).

3.2.3.3 QMS and MCERTS where an OSM service is provided for operators/permit holders

OSM may be carried out by other organisations on behalf of the Operator. We expect that work carried out by these organisations will be incorporated into the operator/permit holders QMS procedures and that they will also have their own procedures to ensure that OSM is delivered effectively.

Other organisations providing an OSM service to the Operator must have the appropriate accreditation for the activities they are carrying out. The MCERTS rules apply to all organisations involved in OSM on behalf of the Operator.

It is the operators responsibility to ensure that actions and activities carried out on its behalf to fulfil the requirements of OSM are appropriately recorded and copies are available for Agency audit purposes and for provision to the Agency following record requests.

3.2.4 Keeping Records

Records may be paper or electronic. They must be retained for 6 years from the date they were made. Records must be legible and must be made as soon as reasonably practicable. If they are amended, this should be done so as to allow both originals and amendments to be retrieved.

The Operator will supply copies of records requested in writing by the Agency within 14 days of request.

The Operator must ensure that relevant records relating to work carried out by other organisations to deliver OSM on behalf of the Operator meet the above rules and are also available within 14 days of request by the Agency.

OSM operational rules and specification for self monitoring

3.2.5 Reporting OSM Results

What's in this section?

OSM samples must be analysed within timescales set down by ISO17025 for the MCERTS standard, Performance Standard for Organisations Undertaking Sampling and Chemical Testing of Water (Part 1) and as soon as reasonably practical.

The results of analysis must be available for reporting to the Agency by the Operator as soon as reasonably possible.

3.2.5.1 Routine Reporting

The results for any sample taken as part of the OSM monitoring programme shall be reported to the Agency as soon as is reasonably practicable for each sample and at least quarterly.

Procedures in operators` Quality Management Systems, and in others providing them an OSM service, must ensure that the data transfer of sample results from laboratory to operator occurs as soon as possible after analysis has been completed and sample results are reported to the Agency in the next available data transfer after the results have been provided to the operator.

Audit of OSM practices, procedures, and management systems will allow us to identify activities which we consider could reasonably be improved. We would expect operators to act on such recommendations.

An operator clearly failing to follow their own QMS procedures leading to a significant delay in reporting results to us will be considered as not reporting as soon as is reasonably practicable.

OSM operational rules and specification for self monitoring

We have a new system which will help us receive and process Operator Self Monitoring data from our customers called Generic Operator Returns (GOR). GOR availability and user support and guidance can be found using our website at e business GOR

3.2.5.2 Look up table compliance

A discharge won`t become non-compliant due to a change in sample frequency alone. To ensure that a Look up Table failure doesn`t occur because of a change in sample frequency Look up table compliance should only be assessed by looking back 12 months only when an individual look up table exceedance occurs. Not on a routine monthly basis or whenever a sample is taken.

The number of samples taken in the preceding 12 month period up to and including the exceedance is used to show the allowable number of exceedances using the Look up Table. If the number of exceedances for the determinand in this period is more than the allowable number, then the discharge has failed the look up table limit for that determinand on the date of the latest exceedance.

3.2.5.3 Reporting exceedances

When an operator becomes aware that a sample result has exceeded a water quality numeric limit they must notify the Agency of the failure as soon as is reasonably practicable. Exceedances to be reported include individual results which exceed look up table numeric limits as well as absolute and comparative limits.

Procedures must be built into Operators` Quality Management Systems to ensure that they are aware of a failure as soon as possible after a sample has been taken, take appropriate action to investigate why the failure has occurred and make improvements to stop it happening again and report it to us as soon as possible.

Audit of OSM practices, procedures, and management systems will allow us to identify activities which we consider could reasonably be improved. We would expect operators to act on such recommendations.

An operator clearly failing to follow their own QMS procedures leading to a significant delay in reporting a failure to us will be considered as not reporting as soon as is reasonably practicable.

We have given details on how operators must notify exceedances and failures to us. Future development of GOR should include notifications as well as data reporting capability.

OSM operational rules and specification for self monitoring

3.2.5.4 Challenges to OSM results

The operator must notify the Agency of all results which are failures or exceedances and have passed normal laboratory validation procedures as soon as is reasonably practicable.

We do not expect the operator to carry out further validation before reporting the result to us.

If the operator believes that a result notified to the Agency as an exceedance or failure should be discarded and the sample rescheduled then they must present their reasons to the Agency and the Agency will decide whether or not the result stands.

In order to ensure that there are no undue delays in this process the operator must provide a challenge to a result within 10 working days of notifying us of a result. The Agency will then respond within 10 working days of receiving the challenge. The periods can be extended by mutual agreement.

Unless we agree otherwise in writing, the sampling frequency for a failing discharge must be increased as soon as possible following a reported failure, it must not be postponed pending the outcome of investigations into the validity of a sample result.

3.2.5.5 Annual summary reporting

The operator must provide a summary report within two months after the end of each calendar year.

The annual OSM summary report must include the following information.

- A list of discharges where the required number of samples have not been taken in the calendar year, showing the number of samples that were required to be taken and the number missed, along with the dates and the reasons. This will not include missed samples which were rescheduled and samples taken.
- A list of missed and rescheduled samples showing the date a sample was originally scheduled and the date it was rescheduled to and the reason for the sample being missed.
- A list of discharges where the sample frequency changed up or down during the calendar year showing the change in frequency and the date the change took effect and the reason for the change.

OSM operational rules and specification for self monitoring

Missed samples table

Discharge	Samples required	Samples taken	Date of missed sample(s)	Reason for missed sample(s)
STW	12	11	DD/MM/YY	

Missed and rescheduled samples table

Discharge	Date of original sample	Rescheduled date	Reason
STW	DD/MM/YY	10/05/09	Lab error
STW	DD/MM/YY	01/10/09	Vehicle breakdown

Changes to sample frequency table

Discharge	Date of change	Previous sample frequency	New sample frequency	Reason for change
STW	DD/MM/YY	12	24	LUT failure on DD/MM/YY

3.2.6 Agency audit and inspection

OSM will provide effluent sample results for compliance assessment and water quality planning purposes.

The Agency will also carry out site inspections and audits of systems, procedures and activities which underpin OSM, and assess compliance with permit conditions.

We will develop guidance and tools to allow audits and inspections to be carried out in a consistent and proportionate manner. We will report the results of audits and inspections back to operators.

We will review our audit and inspection activities to ensure that they are proportionate and risk based by taking account of operators` performance following the introduction of OSM, the introduction of subsequent phases of OSM and ongoing compliance with permits and environmental standards.

Following MCERTS accreditation UKAS will carry out audits on aspects of OSM covered by the MCERTS accreditation.

OSM operational rules and specification for self monitoring

3.2.7 Additional monitoring effort

Where we need additional information about a discharge, for example where it might be causing or contributing to an environmental standard failure, we will seek to work with the operator to investigate. This might require us to take additional samples ourselves or make agreements with the operator to take additional samples for us.

Disinfection efficacy sampling

3.3 Disinfection efficacy sampling for continuous discharges

What's in this section?

3.3.1 Introduction

We do not set effluent microbiological quality standards in permits. However, we do need to know that the plant is performing to the required standards, and so for continuous discharges of disinfected effluents we require you to undertake regular effluent samples for microbiological analysis.

If you operate Operator Self Monitoring (OSM), then efficacy sampling should be considered to be part of OSM, and all OSM rules apply. If you do not operate OSM, then you must still arrange for the collection and analysis of efficacy samples, and report the results to the Agency.

The Environment Agency can require changes in the monitoring frequency and/or changes to the sampling locations and/or changes to the determinands to be analysed by informing you in writing.

Note that the efficacy monitoring requirements given here do not apply to trials of novel disinfection processes or for disinfection of intermittent discharges of storm effluent. These must be determined on a trial-specific or site-specific basis.

3.3.2 Determinands and sampling location

Efficacy self-monitoring will be for the following determinands, based on Environment Agency assessments of impact:

1. Discharges impacting on Bathing Waters:

- Faecal Coliforms
- Faecal Streptococci
- Suspended Solids

2. Discharges not impacting on Bathing Waters:

- Faecal Coliforms
- Suspended Solids

Your permit will make it clear which of these two options you are required to follow.

Effluent samples for microbiological determinands must be collected after disinfection. Suspended solids can be measured either before or after disinfection.

3.3.3 Other information required

You must record the variables below to coincide with the collection of the samples described above.

1. The measured flow through each UV irradiation channel;
2. The applied dose / received dose / measured applied dose for each UV irradiation channel;
3. The UV transmittance at 254nm at the inlet to the UV irradiation plant measured by in-situ meter (where there is a meter present).

3.3.4 Frequency and sampling programme

Disinfection efficacy monitoring is aligned with Operator Self-Monitoring (OSM). The sampling frequency for disinfection efficacy is the same as that for sanitary samples for OPRA Tier 3 sites. So, the sampling frequency is either 24 per annum or 12 per annum depending on the overall compliance and performance of the site. Where there is failure to comply with UV conditions, then the sampling frequency for efficacy samples only may revert to 24 despite it remaining at 12 for other OSM samples.

For sites with seasonal disinfection from May to September, the number of samples is now either 10 or 5 per season. For sites with seasonal disinfection of other durations, the number of samples will vary, still aligned with the OSM OPRA Tier 3 sanitary sampling programme.

The sampling frequency for OSM is dependent on the performance of the site in terms of compliance with permit conditions. For sites which require disinfection efficacy sampling, compliance with all disinfection permit conditions will be included in the determination of OSM sampling frequency.

3.3.5 Additional efficacy data

Where we consider it necessary, for instance to characterise the performance of a particular UV configuration, or where the routine efficacy data or environmental data indicate

problems, we may require additional efficacy self-monitoring on a site-specific basis. This additional self-monitoring can include additional determinands such as F-specific bacteriophage, Salmonella, or E.Coli,

This additional self-monitoring may include samples from other locations within the works, for example at the crude influent to the works, or pre-disinfection. For this reason, your permit may refer to the locations from which these additional samples may be required.

3.3.6 Reporting

You should report your efficacy data electronically every 3 months (or at a different frequency where agreed with your local Agency office) and in a specified format. The data should be reported no more than 2 months from the end of the reporting.

The reporting format can be supplied to you by your local Agency office on request.

3.3.7 Intermittent discharges

At present we do not intend to require routine efficacy monitoring of disinfected intermittent discharges. Any efficacy monitoring is likely to be time-limited and site-specific. Details will be agreed when the permit is issued.

Annex 4 - Opra tier 3 sampling frequency

Emissions and Monitoring Annex for sections 3.1 – 3.3

Annex 4 – Opra tier 3 sampling frequency

Determinand	`Normal frequency` of samples per year	Reduced Sampling frequency after 12 consecutive months of numeric permit compliance, samples per year or pro rata over the remainder of a year	On permit failure return to Normal frequency as soon as reasonably practicable, samples per 12 months	Out of hours samples
Sanitary	24	12	24	For 24 samples 2 out of hours samples per annum
Non sanitary	12	12	12	For 12 samples 1 out of hours sample per annum

Appendix 1 relates to spot samples which must be collected at approximately equal intervals during the year, but should include samples from different days of the week and different times. Approximately 10% of samples should be outside of the normal sampling window which is 9am - 3pm, Monday to Friday.

Annex 5 - Opra tier 2 sampling frequency

Annex 5 – Opra tier 2 sampling frequency

Tier 2 Category	Determinand	`Normal frequency` of samples per year	Reduced Sampling frequency after 12 consecutive months of numeric permit compliance, samples per year or pro rata over the remainder of a year	On permit failure return to Normal frequency as soon as reasonably practicable, samples per 12 months	Out of hours samples
>5 m3/d (not in tier 3) with numeric limits for ammonia or nutrients or dangerous substances or UWWTD self monitoring	Sanitary	12	6	12	For 12 samples 1 out of hours samples per annum, for 6, 1 every 2 years on average
	Non sanitary	6	6	6	
>20 m3/d (but not in tier 3) with numeric limits for one or more of biochemical oxygen demand or suspended solids or pH or temperature or oil and grease only.	Sanitary	12	4	12	For 12 samples 1 out of hours samples per annum, for 4, 1 every 3 years on average

Appendix 2 relates to spot samples which must be collected at approximately equal intervals during the year, but should include samples from different days of the week and different times. Approximately 10% of samples should be outside of the normal sampling window which is 9am - 3pm, Monday to Friday

Compliance

4.0 Compliance

What's in this section?

4.1 Compliance assessment

In assessing permit compliance with Water Quality Water discharge activity permits you will have to refer to the methodology for the separate permit conditions as set out below:

- Descriptive sewage works compliance, using Environment Agency site visits.
- Numeric compliance (Percentile, Mean, Maximum and Differential Limits) using Environment Agency spot sampling and Operator Self-Monitoring (OSM) data.
- Urban Waste Water Treatment Directive (UWWTD) compliance. Using Operator Self-Monitoring (OSM) composite sampling. Site Audits, Laboratory Audits and Quality Manual Audits.
- Ultra Violet Disinfection (UV) Compliance. Using Water Company Self-Monitoring Data.
- Flow compliance. Using Water Company Self-Monitoring Data.

These activities are used to provide the compliance information required as part of the Compliance Classification Scheme

Descriptive Permit compliance

Compliance is assessed for continuous sewage discharges that we permit using descriptive, rather than numeric, conditions.

Compliance is judged only by reference to the inspection items that are relevant to the specific permit based upon a standard inspection form.

Assessing compliance of numeric limits

To assess compliance with water company and non-water company discharges, a prescheduled sampling programme is set with a frequency of spot sampling .

The rules relate only to spot sample results and apply to those permits which have numeric effluent composition conditions in them (for example suspended solids).

4.2 Compliance assessment methods for numeric limits

What's in this section?

4.2.1 Introduction

We set discharge limits calculated to ensure that the receiving water complies with its water quality objectives. Each water quality objective is associated with a number of Environmental Quality Standards (EQSs) for individual determinands. We use mathematical water quality models to calculate the numeric discharge limits required to ensure that all EQSs will be met.

The calculated limit may be set as:

- Percentile limit
- Mean limit
- Maximum limit
- Differential limit

This section defines how we will assess compliance against each of these types of limits. It also sets out general provisions that will apply to all compliance assessment, unless a compliance method in this document specifically disallows the provision. **We will interpret any reference in a permit to any of the listed compliance methods as we define them here**.

We have dealt with the procedures for assessing compliance with the standards in the Urban Waste Water Treatment Directive (UWWTD) separately under the section for that Directive.

4.2.2 General provisions

With the exception of a maximum standard, the limits and compliance methods specified here are only suitable for discharges that will be routinely sampled several times each year. Therefore, we will only use them where we intend that the discharge compliance will be measured by routine sampling. We will use them for appropriate water company treated sewage discharges, private treated sewage discharges and trade effluent discharges that either the operator or we will routinely sample.

Compliance

When assessing compliance with a limit, we will always take and use the sample results at face value. We will not make any allowance for the uncertainty of chemical analysis in the results of individual samples. This is because, in considering the samples as a group, the impact of the analytical uncertainty tends to cancel out and because our compliance assessment methods allow for this uncertainty. For maximum limits, we may make allowance for uncertainty when determining the appropriate enforcement action to respond to an exceedance.

Either the operator, under operator self-monitoring (OSM), or the Environment Agency will take compliance samples. We will try to ensure that the sampling body spreads the routine sampling evenly, or representatively, over the 12-month period in a regular, but randomised programme.

With the exception of a maximum standard, to avoid bias, we will only use qualifying samples that the body responsible for sampling has pre-planned for routine monitoring, or catch-up samples taken when the routine sample has been missed.

If the sample is not taken, or no result is obtained for any other reason, then the body responsible for sampling must reschedule the sample. For operators undertaking self-monitoring, the rules for rescheduling will be in the OSM agreement.

If no discharge is occurring on the planned sample date, then we will normally treat that as a compliant sample. Note that if this happens frequently at a discharge, we may amend the monitoring arrangements to avoid unnecessary visits.

Unusual weather conditions

If the operator believes that unusual weather conditions were adversely affecting their treatment process at the time of sampling, then they may notify us and provide evidence to support their claim. Evidence may include photographs, temperature records and process monitoring records. Sampling of the discharge should continue, where possible, following the planned sampling programme.

If we are satisfied that the operation of the treatment process was significantly affected by weather-related effects outside the control of the operator, then no result of a sample of the discharge taken during that time will be taken into account in deciding whether or not the emission limit of the permit has been complied with. This means that the sample will still count towards the required annual sample frequency, but we will disregard any failure and it will count as a compliant sample.

Adverse operational effects may include, but are not limited to: freezing of equipment; excessive snow deposits preventing operation; substantial tidal or fluvial flooding of the site; or weather related failures of the electricity distribution system. Note that we will not accept large amounts of rain alone as sufficient excuse, since we expect the operator to design their treatment system to cope with that circumstance.

The operator must use its best endeavours to mitigate any adverse environmental effect. They must also take all practicable steps after the event to prevent or reduce the risk of a recurrence of the problem. If the operator fails to take all practicable steps, we may not accept that a recurrence of the problem is outside their control.

The evidence must show that the treatment was operating correctly before the unusual weather. The operator should record all relevant details, including any mitigation measures that it takes, whenever unusual weather conditions could have adversely affected treatment. They should record that adverse weather has affected treatment within 14 days of the incident. They must make any claim against a sample and submit their supporting evidence within 14 days of the date they become aware that a sample has failed. We may request further evidence, if the initial evidence is not conclusive.

4.2.3 Percentile limit with look-up table (LUT) compliance assessment

What is it?

We set discharge standards calculated to ensure that the receiving water complies with its water quality objectives. To provide effective control and allow for the natural variability of discharge quality, we set concentration limits for some determinands that the discharge must meet for at least ninety-five percent of the time (a 95-percentile limit). To regulate the discharge during the remaining five percent of the time and prevent short-term pollution, we normally also set a higher maximum concentration limit for that determinand.

Because we are using a relatively small number of samples to assess the annual compliance of discharges that usually operate continuously, we must allow for the statistical uncertainty of sampling. Our policy is that we will only record a failure of the percentile limit when we are at least 95% confident that the apparent failure is not the result of chance. We do this by assessing compliance over any 12-month period using the look-up table (LUT) method, which we have based on binomial statistics. This table has two columns, one listing the number of samples taken in the year and the other showing the maximum number of sample results that we allow to exceed the numeric limit before we are 95%-confident that the discharge has exceeded the limit for more than 5% of the time, that is, it has failed the 95-percentile limit.

Table 1 below shows the LUT for 95-percentile limits.

When do we use this limit?

We use this limit only for water company treated sewage discharges that are routinely sampled several times each year for effluent compliance. We use it for limits on sanitary determinands; that is ATU-BOD, suspended solids, ammoniacal nitrogen, colour and COD in water company treated sewage discharges. We may use it in future for other discharges and other determinands when we think it is appropriate.

Compliance

How do we assess compliance?

Whenever a pre-scheduled compliance monitoring sample result for a determinand is higher than its 95-percentile numeric limit it is an individual LUT exceedance. Whenever a LUT exceedance occurs, we count the number of qualifying samples taken in the 12-month period up to and including the date the latest exceedance sample was taken and count the total number of exceedances for that same determinand in that 12 month period.

We use the LUT to assess compliance. We find the row in column 1 where the range includes the number of samples taken in the 12-month period and read across to column 2 to see how many exceedances we allow in the same 12-month period. If the number of LUT exceedances we counted in the 12-month period is more than the number of permitted exceedances shown in column 2 then there has been a LUT failure. We record this as occurring on the date of the latest exceedance.

If a sample cannot be taken on the scheduled date because no discharge is occurring, then we will count the event as a compliant sample when assessing compliance. If we have accepted that the unusual weather waiver applies to a sample, then we will count the sample as a compliant sample when assessing compliance. In both these cases, the event or sample will count towards the number of samples taken, but will not count as a LUT exceedance.

Table 1 - Look-up table

Number of samples taken in any period of 12 months	Maximum number of samples permitted to exceed limit for given determinand
4–7	1
8–16	2
17–28	3
29–40	4
41–53	5
54–67	6
68–81	7
82–95	8
96–110	9
111–125	10
126–140	11
141–155	12
156–171	13
172–187	14
188–203	15
204–219	16
220–235	17
236–251	18
252–268	19
269–284	20
285–300	21
301–317	22
318–334	23
335–350	24
351–365	25

4.2.4 Annual mean limit compliance assessment

When do we use this limit?

We set discharge standards calculated to ensure that the receiving water complies with its water quality objectives. Some determinands have a low acute toxicity and our main aim is to limit the overall load of the substance discharged to the environment and achieve an annual mean environmental standard. For these determinands, we may also set the permit limit as an annual mean. We use this limit only for discharges that will be routinely sampled several times each year for effluent compliance. We use it for limits on plant nutrients; that is compounds of phosphorus and nitrogen, but we may use it for other determinands when we think it is appropriate.

The annual mean has the advantage that it gives the maximum precision from limited numbers of samples.

How do we assess compliance?

We calculate the annual mean by summing the concentrations in all qualifying samples in a 12-month calendar year period and dividing by the number of samples.

Any results recorded as 'greater than' values will be included in the calculation as the recorded numeric value. Any results recorded as 'less than' values will be included in the calculation as zero, that is they will not contribute to the sum of the concentrations, but will be included in the total number of samples in the divisor. Note that spreadsheet calculations and other computer calculations of the mean do not usually calculate the mean in this way, so cannot be relied on. We calculate the mean for compliance in this way because exceedance of the limit is a criminal offence that we must prove beyond reasonable doubt. We must therefore give the benefit of any uncertainty to the operator.

We will exclude from the mean calculation samples where there is no result because there was no discharge on a planned routine sampling occasion and samples that we have accepted as affected by unusual weather conditions.

We will calculate the mean and standard deviation of the annual data and then calculate the 90%-confidence interval around the mean. According to the formula

Lower confidence interval = mean – (t x standard error of mean)

Where t is derived from Table 2 below for n-1 degrees of freedom, where n is number of samples and the standard error of the mean is the standard deviation of the dataset $\div \sqrt{n}$

If the lower ('optimistic') confidence interval exceeds the permit limit, then we are 95%-confident that the limit has been exceeded. In this case, we will record a failure as occurring on the last date of the 12-month calendar year period. Note that it is only necessary to calculate the lower confidence interval if the face-value of the mean exceeds the permit limit for the mean. We will take account of the statistical confidence of failure and the magnitude of the failure in determining our enforcement response.

Table 2 – values of t

Degrees of freedom	t for 90% confidence interval
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860
9	1.833
10	1.813
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753
16	1.746
17	1.740
18	1.734
19	1.729
20	1.725
25	1.708
30	1.697
35	1.690
40	1.684
50	1.676
60	1.671
70	1.667
80	1.664
90	1.662
100	1.660
1000	1.646

4.2.5 Maximum limit compliance assessment

What is it?

A maximum limit is a concentration that no sample result should exceed. However, discharge permit conditions established only in terms of maxima pose problems for both the regulator and the operator. A maximum limit has a finite probability that a sample result will exceed it through normal variation of discharge quality, even when the discharge quality is acceptable. If a reasonable limit is set, it is almost certain that it will be exceeded from time to time.

Because we expect occasional random exceedances of maximum limits by environmentally satisfactory discharges, we must establish procedures to determine whether occasional exceedances are significant in order to determine our appropriate response.

When do we use this limit?

Because of the difficulty in assessing the significance of a maximum limit exceedance, this limit should normally only be used in conjunction with a primary limit, such as a percentile limit.

We may use it alone for discharges that will not be regularly sampled. For these discharges, it provides the opportunity to demonstrate non-compliance with a single sample if the discharge malfunctions and causes environmental damage.

Because of historical practices, many existing discharge permits have limits set solely as a maximum. We plan to update these limits when an opportunity arises. We will assess compliance with maxima as set out below.

How do we assess compliance?

We compare the sample result with the maximum limit. If the sample result exceeds the limit, then we record a failure.

Any results recorded as ‘greater than’ values will be included in the calculation as the recorded numeric value. For permits, other than differential permits, any discharge results recorded as ‘less than’ values will be included in the calculation as zero. For differential permits any inlet sample points recorded as ‘less than’ values will be recorded at face value. For outlet samples ‘less than’ results will be recorded as zero.

Unlike other limits, we assess all sample results against this limit, including non-routine samples.

If a sample result exceeds the limit, then we will assess the significance of the exceedance in determining our appropriate enforcement action. For this assessment, we may consider some or all of the following factors:

- Allow for analytical uncertainty by using the laboratory's target precision coefficient of variation for the determinand to determine if we are at least 95% confident that the result exceeded the limit.
- If it still fails, check the previous compliance record to see if the fail is a one-off or part of a pattern of failures
- Is the proportion of failing samples increasing?
- Is the quality significantly deteriorating?
- How much in excess of the limit is / are the failing results?
- What impact has the failure had on the receiving water?
- Whether the site significantly fails if we treat the maximum limit as a 99-percentile using a 99-percentile LUT
- Has the operator taken action to mitigate the problem and prevent a recurrence?

4.2.6 Differential limit compliance assessment

What is it?

If an operator abstracts water from ground or surface water for use before discharge and the abstracted water contains some of the determinands that we wish to limit at concentrations similar to our desired discharge limit, then we may choose to apply a differential limit. This sets a limit on the increase that the operator may cause between the inlet and the discharge point. It ensures that we can distinguish between increases caused by the operator and natural environmental variations.

When do we use this limit?

We use this for temperature in cooling and heating water discharges. We also use it for BOD, suspended solids, ammonia and phosphorus compounds in fish farm discharge and for phosphorus compounds in watercress farm discharges. However, we may also use it for other determinands when we think it is appropriate.

How do we assess compliance?

We ensure that samples are taken at the inlet and the discharge sampling point on each sampling occasion. We subtract the results for each relevant determinand at the inlet from the result for the determinand at the discharge sampling point to calculate the difference.

Because this method relies on both samples, if either sample is not taken, or no result is obtained for any other reason, then the sampling body must reschedule both samples.

Any inlet samples recorded as 'less than' values will be recorded at face value. For outlet samples 'less than' results will be recorded as zero.

Because in most cases there is no single 'time of travel' through a site, we cannot sample the same water entering and leaving. The permit will therefore specify that the sampling body collects the two samples on the same sampling occasion and as close to the same time as possible.

Compliance

The differential limit may be set as a maximum or as an annual mean. We assess compliance of the dataset of differences using the appropriate method as described in previous sections.

Compliance

4.3 Urban Waste Water Treatment Directive

What's in this section?

4.3.1 Introduction

The Urban Waste Water Treatment Directive Regulations (UWWTR) set out the checks needed to complete the compliance assessment of UWWTR discharges.

The discharges assessed under UWWTR are mainly sewage works above a certain size (see table below). These discharges are self-monitored using 24-hour composite samplers, usually on a time-proportional basis, by automatic samplers which should be MCERTS accredited.

The composite samples are analysed by the operator's laboratories for the following UWWTR determinands.

Biochemical Oxygen Demand (BOD-ATU), Chemical Oxygen Demand (COD) and sometimes total phosphorus (P) and total nitrogen (N).

Total phosphorus and total nitrogen determinands should be monitored if the works is above a certain size and discharges into a Sensitive Area Eutrophic, SA(E) designated under the UWWTR.

4.3.2 Discharges to be assessed for compliance

UWWTR compliance is to be applied to those discharges with UWWTR conditions in their permits.

Table below sets out the analysis required for these discharges.

Sewage discharges to	Type of area	Population equivalent* more than	Perform analysis for
Freshwaters	Normal	2,000	BOD, COD
	Sensitive	10,000	BOD, COD, P and/or N
Estuarine Waters	Normal	2,000	BOD, COD
	Sensitive	10,000	BOD, COD, P and/or N
Coastal Waters	Normal	10,000	BOD, COD
	Sensitive	10,000	BOD, COD, P and/or N

***Population equivalent** We will normally accept the population equivalent estimated by each water company for Ofwat. However, if the population equivalent is particularly critical then it must be calculated by the operator using 60g of BOD per person per day in the influent wastewater. Operators must report this figure annually.

4.3.3 Sample points

Samples are usually taken in pairs (influent and effluent) and always on the same day to enable percentage removal through the treatment process to be calculated.

However, the inlet sample is optional and should only be taken if percentage removal compliance is to be calculated.

These samples are taken at agreed locations using MCERTS certified automatic samplers to ensure representative samples are taken.

4.3.4 Sampling programmes

Before the start of each calendar year operators must tell us the dates they intend taking composite samples. Samples which end on Saturday or Sunday are counted as weekend samples and account for 10% of the overall programme. BOD and COD are assessed using the Look Up Table (LUT) compliance assessment procedure. To avoid bias the samples should be spread evenly, or representatively over the whole calendar year.

4.3.5 Sampling frequency

The sampling frequency for each discharge is based on its population equivalent and the samples should be pre-programmed at regular and randomised intervals according to the table set out below:

Population equivalent	No of samples per year	Number of weekend samples
2,000 to 9,999	12 in the first year 12 if any failures, then four if no failures in first or subsequent years	**One per year** (where 12 are taken) **One every three years** (where four are taken)
10,000 to 49,999	12	1
50,000 and greater	24	2 or 3

4.3.6 Missed samples

If any programmed samples are missed during the year, the operator must tell us within **one working day**, and re-programme the sample to be taken as soon as practicable.

4.3.7 Non Compliance with UWWTR

There are up to **five ways** in which an UWWTR discharge can be non-compliant:

- inadequate provision of treatment by statutory deadline;
- inadequate provision of required self-monitoring data (for example, not enough samples taken);
- non-compliance with LUT limits (percentage removal and concentration limit) for BOD and COD only;
- non-compliance with Upper Tier (UT) limits for BOD and COD only;
- non-compliance with annual average and percentage reduction for P or N [Applies to qualifying discharges to UWWTD designated Sensitive Areas (Eutrophic) only].

4.3.8 Important Notes on UWWTR compliance

Compliance with all UWWTR discharges are based on a calendar year dataset

If the evidence provided by the operator supports the fact that unusual weather has had an adverse impact on the operation of a treatment process, then we will assess this evidence. If we agree we will count any non-compliant result as a compliant result in the compliance assessment procedure.

4.3.9 Check the provision of self monitoring data

Assess if there are enough sample results provided for each determinand (BOD, COD and, where needed P and N) by checking the dataset against the criteria provided in the table below.

If the number of results provided is less than number required then the discharge will be reported as failing UWWTR on the grounds of provision of insufficient samples.

Population equivalent	Minimum annual number samples that must be collected at regular intervals during the year
2,000 to 9,999	12 samples during the first year. If the discharge complies in the first year then take 4 samples in subsequent year. If, having complied with the provisions of the regulations in the first year; and one sample of the four fails, take 12 samples in the year that follows. UWWTR allows reduced sampling for all determinands
10,000 to 49,999	12 samples
50,000 or over	24 samples

4.3.10 Check the LUT compliance (BOD and COD only)

LUT compliance is assessed separately for BOD and COD.

If final effluent sample results only are available for each sampling event then these should be compared against the BOD and COD UWWTR concentration limits in the table below. A sample will pass if the sample result is less than or equal to that of the UWWTR concentration limit.

If both influent and effluent sample results are available for each sampling event then these should be compared against both the concentration and the minimum percentage removal limits in the table below. A sampling event will pass if **either** the sample result is less than or equal to the UWWTR concentration limit **or** the percentage removal value exceeds that of the minimum percentage removal UWWTR limit.

Parameter	Concentration	Minimum percentage reduction (See Note 1)
Biochemical Oxygen Demand (BOD5 at 20 degrees C) without nitrification. See **Note 2**.	25 mg/l O_2	70 - 90
Chemical Oxygen Demand (COD)	125 mg/l O_2	75
Note1: Percentage reduction in relation to the load of the influent. **Note 2:** The parameter can be replaced by another parameter: Total Organic Carbon (TOC) or Total Oxygen Demand (TOD) if a relationship can be established between BOD5 and the substitute parameter.		

After all the BOD and COD comparisons have been made for all the calendar year sampling events a check should be made of the number of recorded exceedances against the number allowed under the LUT.

If the number of recorded LUT exceedances is greater than the LUT allowance then the BOD or COD has failed and the discharge will be reported as failing UWWTR for that determinand

4.3.11 Check the UT compliance (BOD and COD only)

UT compliance is assessed separately for BOD and COD.

UT compliance assessment will only apply to results that have failed to achieve the minimum percentage removal or where the percentage removal cannot be calculated.

If the effluent sample result is greater than the concentration limit in the table below then the discharge should be reported as failing UWWTR for that determinand.

Parameter	**Maximum permitted concentration**
Biochemical Oxygen Demand (BOD5 at 20 degrees C) without nitrification	50 mg/l O_2
Chemical Oxygen Demand (COD)	250 mg/l O_2

4.3.12 Check the annual average (Phosphorus or Nitrogen)

Compliance is assessed separately for P and N.

For those discharges which require P or N removal, under the UWWTR, the following compliance assessment needs to be done. P or N compliance has to be assessed on a complete calendar years data, using the sample results obtained from the same sampling programme as described for BOD and COD.

If final effluent sample results only are available for the calendar year then these should be averaged and compared against the P or N UWWTR mean concentration limits in the table below. If the annual average concentration limit is greater than that of the UWWTR mean concentration limit then the discharge will be reported as failing the UWWTR for that determinand.

If both influent and effluent sample results are available for the calendar year then the annual average of each individual sampling event should be compared against both the concentration and the minimum percentage removal limits in the table below. The discharge will fail if **both** the average of these results are greater than that of the UWWTR mean concentration limit **and** the average of the individual percentage removal results are less than the minimum percentage removal required.

Compliance

Parameter	Concentration (Annual Mean)	Minimum percentage reduction (Annual Mean) (See Note 1)
Total phosphorus	2 mg/l P (10,000 –100,000 population equivalent) 1 mg/l P (>100,000 population equivalent)	80
Total nitrogen. (See Note 2)	15 mg/l N(10,000–100,000 population equivalent) 10 mg/l N (>100,000 population equivalent)	70 - 80
Note 1: Percentage reduction in relation to the load of the influent. **Note 2:** Total nitrogen means the sum of total nitrogen Kjeldahl nitrogen (organic N + NH_3), nitrate (NO_3)-nitrogen and nitrite (NO_2)-nitrogen.		

4.3.13 Definition and interpretation

Normal operating conditions, unusual situations and normal local climatic conditions

Regulations terminology – where we use the terms

The term ‘normal operating conditions’ is used in paragraph 4(b) of Part II of Schedule 3; the phrase ‘unusual situations such as those due to heavy rain’ is used in paragraph 5 of Part II of Schedule 3; ‘normal local climatic conditions’ are referred to in regulation 4(4)(a).

Interpretation

In order to assist in interpreting the weather conditions that might be considered to be abnormal or unusual; here is a definition of exceptional weather conditions, together with an example of what you might consider to be other kinds of abnormal or unusual operating conditions.

Definition

Sewage treatment works will be deemed to have been under normal operating conditions except during that period when:

1. sections 87(2) or 89(1) of the Water Resources Act (WRA)1991 applied;
2. unusual weather conditions occur, including:-

- low ambient temperatures as evidenced by effluent temperatures of 5 degrees centigrade or less, or by the freezing of mechanical equipment in the works;
- significant snow deposits;
- tidal or fluvial flooding;
- weather conditions causing unforeseen loss of power supply to the sewage treatment that could not be ameliorated by the reasonable provision and operation of standby generation facilities;

3. we have issued a notice of variation of the permit for reasons such as capital works construction.

It is standard practice in the UK to take account of local climatic conditions.

4.4 Disinfection - Assessing compliance for continuous discharges of treated wastewater

What's in this section?

4.4.1 Introduction

The Environment Agency regulates disinfection plant through permit conditions relating to:

- achieving the disinfection process, such as UV dose;
- continuously recording the performance of the plant;
- a requirement for a microbiological efficacy monitoring programme.

The permits require you to undertake all the monitoring yourselves and report the results to us. There are generally no permit limits for microbial concentrations in the final effluent.

4.4.2 Achieving compliance with your permit

You must comply with any of the following requirements which are specified in your permit:

- Undertake continuous monitoring.
- Report the monitored data to us. To comply with this requirement, you must supply at least 99% of the UV dose data or 99% of turbidity data (membrane filtration) required over a year or season.
- Undertake efficacy monitoring.
- Report the efficacy data to us.

In addition, you must ensure that all the requirements of the management system as detailed in this guidance are complied with.

Once we receive the continuous monitoring data from you, for UV disinfection we will use it to assess compliance with the UV dose requirements of the permit as follows:

- the 99% rule which states that the UV dose must exceed the consented dose for at least 99% of the measurements in any period of 12 consecutive months or over a season.
  For the purposes of this assessment, the consented dose is reduced to allow for meter inaccuracy.
- the 90% 24 hour rule which states that no more than 10% of measurements taken consecutively during any 24 hour period from midnight to midnight should fall below half the consented dose.
  There is no allowance for meter accuracy for the assessment against this rule. However, we will accept that you have complied with this condition if:
  1. you reported the occurrence to us; and

2. we are satisfied that the cause was an emergency, outside of your control, and that you took all possible measures to minimise the impact of the discharge on controlled waters.

4.5 Compliance with permitted flow rates

What's in this section?

4.5.1 Introduction

To achieve full compliance with your permit, you must be fully conversant with both the permit conditions and the requirements outlined in this guidance note, and understand what is required. Where there is any doubt as to the meaning of either of the above, then you should contact your local Agency office for clarification.

There are two distinct sets of requirements related to effluent flow:

- Those which specify the various maximum or minimum permitted volumes and flow rates; and
- Those relating to the requirement to monitor effluent flow.

Where there is a requirement for effluent flow measurement, then compliance with the permitted volumes and/or flow rates will be based on the effluent flow measurement data which you must provide to the Agency.

Where the permit does not require effluent flow measurement, then there is normally no formal assessment of compliance with the permitted volumes and/or flow rates.

The Agency will generally undertake compliance assessment with numeric limits once per year, but may undertake assessment of compliance with other conditions as and when necessary as well as at the year-end.

4.5.2 Maximum daily volume

As mentioned above, this condition is normally applied to sewage discharges from small package plants or to discharges of trade effluent.

For package plant sewage discharges, flow monitoring is unlikely to be in place, in which case there is no formal assessment of compliance with the permitted maximum daily volume. The onus is on you to ensure theoretical compliance based on the design flow rates in "Flow and Loads – 3". If the Agency has reason to believe that permitted flow rates are being consistently breached, then it may require the installation of either a temporary or permanent flow measurement system.

Where flow monitoring is required (e.g. for some trade effluent discharges), then we will use the Total Daily Volume data to check compliance with the permitted Maximum Daily Volume. We will make an allowance of 8% for flow monitor measurement uncertainty.

4.5.3 Dry weather flow

Measurement of compliance against the 90%-exceeded volume (Q_{90})

The permitted DWF limit is set at your planned annual 80%-exceeded flow (Q_{80}). The section above explains how you should determine the value of DWF which for which you wish to apply.

The permit condition states that in determining compliance with your permit, the measured DWF is the total daily volume that is exceeded by 90% of the recorded measured total daily volume values in any period of 12 months – in other words the Agency will assess compliance against the measured Q_{90}, which will always be a lower value than the measured Q_{80}. Compliance is assessed in this way in order to account for year-on-year variability in the flow rates and also to allow for the uncertainty in the measurement of daily volume.

In a wet year, the DWF as measured by the Q_{80} may be higher than normal, and also perhaps higher than it was in any of the years of data on which the permitted DWF was based. If compliance were assessed against the Q_{80}, then it is likely that at some time there will be a non-compliance recorded for reasons outside your control.

Research undertaken by UK Water Research Ltd (UKWIR) showed that if we assess compliance against the Q_{90}, we will be at least 95% confident that any failure to achieve compliance with the DWF limit is a true non-compliance, and not one brought about by chance. In other words, the difference between the Q_{80} and the Q_{90} is sufficient to account for the variability in annual determinations of DWF and for the uncertainty in the measurements themselves.

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

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 = Integer(0.1N) and N is the number of good measurements of TDV in the year.

For example, if N = 332, then n = Integer(0.1 x 332) = 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.

Actions to be taken in the event of non-compliance

Before we go into the detail regarding actions in the event of non-compliance, it is important to note that we do not expect non-compliance with DWF limits as a result of situations over which you have control, for example growth of connected population. We expect permit holders to engage in the planning system to account for increased flows arising from new development and to plan and install additional treatment and sewer capacity accordingly. You must plan ahead and apply for variations to accommodate proposed increases in flow well in advance. This will largely avoid non-compliance with flow limits.

If your discharge exceeds its consented DWF limit then you are required to investigate the reasons for the exceedance and provide a report to the Agency. The consequences depend on the results of the investigation as outlined in the table below:

Cause of Exceedance	Action by Permit Holder
(1) Growth of connected pop, or (2) Long-term increase in existing trade discharges, or (3) New trade discharge, or (4) Connection of other drainage systems	In the exceptional event of non-compliance as a result of any of these causes, you should apply for higher flow limit. If the Agency requires extra capacity or higher quality then you should propose a timetable for Agency agreement. The timetable should normally provide for construction as soon as reasonably practicable.
(5) Infiltration	Reduce infiltration or apply for higher flow limit. If you apply for a higher flow limit and the Agency requires extra capacity or higher quality then you should propose a timetable for Agency agreement. The timetable should normally provide for construction as soon as reasonably practicable. If you propose reduction of infiltration then you should provide a reasonable timetable for production of a plan and milestones for its implementation for Agency agreement.
(6) Short-term high trade flow	Require the trader to reduce and control the flow if temporary. If increase becomes permanent then take action as (2) above.
(7) Measurement system problem, e.g. missing data	Correct problem with measurement system as soon as is practicable. Take necessary action to minimise risk of repeat.
(8) Weather	Because this is the only cause outside the control of the permit holder, we will expect the consent holder to provide convincing evidence that this is the cause.

An exceedance of the DWF limit will not be recorded as a failure if you take the appropriate action to the satisfaction of the Agency. Only if the cause of exceedance is identified as due to the weather is there no action required, except if you cannot identify the cause of the exceedance after investigation and the Agency agrees that a suitable investigation has been undertaken, then again there is no action.

Where the cause of exceedance is not identified, then if the flow limit is exceeded again in the following year then you should treat the increase as permanent and apply for a higher flow limit, even if you still cannot identify the cause.

If you believe that a works has failed to comply with its consent limit solely because data is missing from the annual dataset, then you should justify your view to us. The

permit requires you to make a report if there is a substantial gap in the data record. This report is for you to explain why the data is missing and what steps you have taken to reduce the risks of it happening again. This report should include any explanation as to why the missing data caused a failure of the consent limit. You may base the justification on the factors identified above or any other relevant facts.

Note that whilst a problem or failure of the measurement system may be an acceptable cause of DWF exceedance, it may well be the case that you are non-compliant with some other aspect of the consent relating to flow measurement.

4.5.4 Maximum discharge rate

We do not wish to limit the amount of sewage arriving at a works that is treated, so normally we do not set a maximum discharge rate. However, in some very specific circumstances, such a limit may be set, for example if the operator can appreciably vary the discharge rate and control is necessary to limit the environmental impact, for instance, in tidal balancing schemes.

Where this is the case, and assuming the flow measurement system is at the outlet (which in these circumstances the Agency should have ensured), then the measured instantaneous flow data will be requested, and compliance assessed against the limit. For this assessment, the Agency will make an allowance of 8% for the uncertainty in the measured flow data.

4.5.5 Discharge of settled storm sewage from storm tanks

For STWs with storm tanks, we set permit conditions that only permit spills to the storm tank for flows in excess of the Flow to Full treatment (FFT), and which do not allow spills from the storm tank unless the tank is full.

With respect to the impact on the receiving water, compliance with these conditions is very important, as failure to pass forward sufficient flow to treatment will result in premature filling of the storm tank possibly leading to excess spills of untreated sewage.

As a minimum, where the overflow is fixed and flows cannot be adjusted, you should keep evidence of the calculations and settings used to fix the FFT. These may be requested at routine inspections.

Where the overflow setting can be adjusted, for instance by an adjustable weir plate, a penstock, or by varying pump operation, then ensuring pass forward flows meet permit requirements can only be achieved by continuous recording during operation of the overflow.

Where the certified flow measurement device is located at the storm tank weir, the 15-minutely instantaneous or averaged data can be used to determine compliance with the minimum PFF limit.

Compliance

As mentioned above, the MCERTS scheme does not currently include standards for the maximum uncertainty in the measurement of PFF at the storm tank weir. The 8% uncertainty applies only to Total Daily Volume. However, from the site investigation report, it may be possible to determine the uncertainty at the PFF. If this is the case, we will make an allowance for this uncertainty when determining compliance. Otherwise, we will assume an uncertainty of 8% which will almost certainly be an over-estimate. So for example, if the permitted minimum PFF is 100 l/s, and the MCERTS site inspection report shows that the uncertainty for that site at that flow rate is 3%, then if the measured PFF is less than 97 l/s, the site will be deemed to have failed. Of course, any enforcement as a result will depend on the magnitude of the failure.

In order for the Agency to determine compliance with the minimum PFF at the storm tank weir, you may be asked to provide 15-minutely flow data, and possibly also data on spills to the storm tank if this is a requirement of the permit. These data must be provided in either XML format or CSV format, depending on which is the normal format for your company.

4.6 Compliance with flow measurement and reporting requirements

What's in this section?

4.6.1 Introduction

Our requirements for flow measurement and reporting are given in this guidance.

The Table below summarises the requirements for effluent flow monitoring, and shows what is expected of you.

Table: Requirements for effluent flow monitoring

Consented requirement	What we expect from you	What will constitute a failure
Provision of flow monitoring installation.	To install flow monitoring equipment as required by consent.	Delay in installation of more than 6 months from consented date (without valid reason or agreement).
MCERTS certificate	Current MCERTS certificate at all times. Certificate lasts for five years and the system must be recertified before the previous certificate expires. MCERTS scheme allows inspection any time in the final 12 months of current certificate and this allows time for any problems to be resolved before the previous certificate expires.	Except in those cases where there is an agreed delay in obtaining an MCERTS certificate (a situation which should essentially be longer required in the near future), all sites without a current MCERTS certificate will be considered to have failed.
Quality Management System (QMS) (standard management system,)	A satisfactory QMS certified by an external auditor. Consistent compliance with QMS requirements, demonstrated at formal audits and in day-to-day operations. Minor shortcomings to be dealt with as required by the auditors or the Agency.	Withdrawal or failure of the QMS certification will be the ultimate sanction against a company that continually fails to respond to audit recommendations, or where it is demonstrated through other means (e.g. Agency site inspections show multiple and consistent occurrences of

Consented requirement	What we expect from you	What will constitute a failure
		lack of maintenance) that the QMS procedures which in theory are OK are not being complied with adequately.
Flow installation maintenance	A maintenance programme which has been agreed with the MCERTS inspector. Full compliance with that maintenance programme. Records (evidence) of maintenance undertaken. Flexibility in the programme – e.g. increasing frequency of cleaning if it becomes clear that agreed programme is inadequate.	Site inspection from which it is clear that the maintenance is inadequate. Lack of evidence of maintenance. Poor data may indicate poor maintenance, but this will be difficult to prove from the data, so failure will be based on direct evidence.
Report flow data	Reporting of calendar year data in the specified format by end of March.	Late submission in correct format unless this is the first time you are reporting such data (from any site), when we will agree a timetable for re-submission in the correct format.
Remedy problems as soon as practicable.	You are required to ensure that the flow monitors perform as well as practicable. Where there are missing or suspect data of continuous duration of more than 14 days or for more than 10% of the year, then you are required to report the reasons why and the actions they are taking to avoid repetition. You then have to undertake these actions.	There will be no failure specifically for any quantity of missing/suspect data, although a site visit to check maintenance may be triggered. Failure will occur if the agreed actions to resolve are not carried out or are inadequately carried out. We would not expect continuing missing/suspect data the following year for the same reason(s) unless those reasons are outside the control of the company.
Provide visual display	Provision of visual display of instantaneous flow with access for Agency staff.	No visual display within 6 months of the consented date (without valid reason).
Investigate DWF exceedance and take appropriate action.	Where the measured DWF (90%-exceeded daily flow) is greater than the permitted DWF (planned 80%-exceeeded daily flow) then the company is required to investigate the cause and take appropriate	Any failure to undertake any of the procedures tasks listed in the previous box will constitute a failure.

Consented requirement	What we expect from you	What will constitute a failure
	action to minimise the risk of further non-compliance. Appropriate actions for different causes of failure have been agreed in Agency guidance. Plan of action to determine cause of non-compliance to be provided within 3 months of failure being reported to company. Timescale for completion of investigations to be agreed with the Agency. Programme of measures to be taken and date of compliance to be agreed by Agency. Compliance with the agreed programme of measures.	

These are dealt with in more detail in the sections that follow.

4.6.2 Provision of Flow Monitoring Equipment

The requirement here is straightforward. You will be non-compliant if you do not provide flow monitoring equipment where it is required (see section ??? . However, the Agency realises that sometimes delays can occur for valid reasons, and will therefore take no action if you have a valid reason which we accept and the installation is complete no more than six months after the permitted date. If you do not have a valid reason, then we may take action earlier.

4.6.3 MCERTS Site Inspection Certificate

You are required to have a valid MCERTS certificate at all times.

At a few sites for some operators, we have agreed a date for obtaining certification to allow for the large work programme required to obtain these certificates. For these sites we will take no action if the certificates are obtained by the agreed dates. However, these agreements are now nearing their end.

The section above explains the process for obtaining an MCERTS certificate. Note that because we allow an re-inspection up to 1 year before the expiry date, we do expect you to have an MCERTS certificate at all times. If you delay your re-inspection so that you have no time to put in place any works to bring the site up to MCERTS standards, then you will be non-compliant with your consent.

Note that if you request a dispensation, then if you are successful, an MCERTS certificate will be issued.

4.6.4 Quality Management System

To obtain an MCERTS certificate, you must have a suitable management system.

1. Standard Management System

If you fail to take on board the auditors recommendations, or the Agency obtains repeated and consistent evidence that the management system is not being adhered to or is not achieving its objectives, then the management system certification can be formally withdrawn by the auditor. Evidence of a failure of the management system could be lack of maintenance at a number of sites.

2. Simplified Management System

The management system audit is effectively part of the MCERTS site inspection undertaken by the MCERTS Inspector. You must satisfy the MCERTS Inspector that you have a suitable management system, otherwise you will not be able to obtain an MCERTS certificate, and will be non-compliant with this requirement.

4.6.5 Flow Installation Maintenance

Proper and regular maintenance is extremely important, as without it the flow measurement accuracy is likely to be well outside the +-8% required by the MCERTS scheme. The Agency will inspect sites to ensure that maintenance is being carried out, that maintenance programmes are being adhered to, and that records are kept. Additionally, poor data quality may be evidence of poor maintenance.

If the Environment Agency has reasonable evidence of lack of maintenance, then the site will become non-compliant. In addition, as discussed above, if there is clear evidence of an endemic lack of proper maintenance across a number of sites, then you are at risk of having the management system certification withdrawn (where you have a standard management system).

4.6.6 Flow Data Reporting

You must supply the flow data to us in the format we have specified and when we request it. See above.

You must endeavour to provide the annual Total Daily Volume data to us by the end of February, with a final date of the end of March. We accept that the first time you report these data you may have problems with the format, in which case we will agree a

timetable for re-submission in the correct format. We will guidance and feedback where possible.

Failure to provide the data as outlined above will be recorded as a failure.

4.6.7 Remedy problems as soon as practicable

Whenever you encounter a problem which results in missing or suspect flow data for either 14 days continuously and/or for a total of 10% of the daily measurements over the year, then you must report the reason to us. You must also tell us what you intend to do to resolve the problem, and then do it. So long as we are satisfied that you have undertaken all the above, then we will not record a failure specifically against the requirement to record the data.

However, if we suspect that the data losses are as a result of lack of maintenance, for example, then we might initiate a site inspection to check on maintenance procedures. This could lead to a failure to comply with the maintenance condition.

We would not expect a repeat of the same problems the following year, unless the cause was outside your control. Such an occurrence could lead to a reported failure.

Annex 6 - Definition of “domestic sewage” and “trade effluent” for permitting

Annex 6 - Definition of “Domestic Sewage” and “Trade Effluent” for permitting

Background

The Water Resources Act 1991 and Water Industry Act 1991 contain very similar definitions of trade effluent. Neither Act defines ‘domestic sewage’, although the Water Industry Act defines domestic sewerage purposes, in the context of effluent that a sewerage undertaker may be obliged to receive into a public sewer. The UWWT Regulations define ‘domestic waste water‘ as “waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities”. The reference to ‘services’ clearly brings in premises other than houses and results, in effect, with the same definition as the WIA.

‘Domestic sewerage purposes’ has been defined by case law under the Water Industry Act and includes wastes arising from normal domestic activities wherever carried out.

Under the Water Resources Act we have traditionally taken a very hard line definition that ‘domestic sewage’ comes only from residential housing, so that trade effluent is anything that is not from houses used solely for dwellings. We have classed any commercial or not-for-profit work activities as ‘trade’. This goes right down to small scale commercial activities, such as B&Bs.

Our old interpretation could lead to apparently unfair outcomes. EPR has stimulated us to look again at our definition of ‘domestic sewage’ and change to the one based on the UWWTD definition and, in the case of the WIA, case law.

Revised interpretations of ‘domestic sewage’ and ‘trade effluent’

Domestic sewage includes wastes arising from normal domestic activities wherever carried out. Therefore, sewage from schools, restaurants, takeaways, holiday parks and nursing homes is domestic. Determining whether a discharge contains trade effluent should not involve a detailed audit of the substances used by an applicant on a particular site. If the effluent is broadly of a domestic nature it is domestic sewage. If a significant proportion of the waste generated by a commercial enterprise is different from that found in a normal home then it becomes a mixture of domestic sewage and trade effluent. Because waste from, say a fast-food restaurant, is just toilets, cooking meals and washing up it is domestic sewage, not trade effluent.

Annex 6 - Definition of “domestic sewage” and “trade effluent” for permitting

Note that the definition of ‘domestic activity’ goes beyond just ‘cooking’, it also takes in the nature of the activity. Thus, preparing and cooking a meal is a normal domestic activity, even if the meal will be consumed off the site e.g. takeaway curry, pizza, sandwiches etc. whereas food processing or cooking and packaging of quantities of food for sale off site will be trade. In determining whether an activity is domestic in nature it will sometimes be necessary to consider the scale of that activity. For example, producing 30 jars of jam in a day is a domestic activity even if some or all of those jars of jam are then sold elsewhere. However, regularly producing 300 jars a day for sale would be classed as a trade. Butchering the occasional carcass in a restaurant or farm shop is domestic, butchering dozens of animals each day is trade.

As long as the nature and treatability of the waste and the discharge from a restaurant or caravan park is similar to that from housing, then there is no disadvantage in making this change. Under EPR, it will give small businesses the opportunity to benefit from exemptions and Standard Permits, which is in line with Government and Agency policy.

If a discharge from a commercial or non-profit activity contains substances of a type that are significantly different from effluent that would arise from normal domestic activities, in terms of the treatability, quality and composition of the discharge, then the discharge will not consist solely of domestic sewage. Therefore discharges from, for example, a commercial laundry would not be domestic, but discharges from the works canteen and the on-site toilets would be domestic.

Annex 1.1 below is an attempt to define the boundaries of what are domestic activities and when it strays over into trade. This is to provide practical guidance to operators and our staff.

Annex 1.2 provides an overview of the process of deciding whether a discharge contains trade effluent, but must be read in conjunction with the whole of this guidance. If the effluent discharged is not categorised as containing trade effluent using the process set out in Annexe 2 it should be categorised as domestic sewage. If we are uncertain whether it contains trade effluent, we will give the benefit of the doubt to the operator.

Note that the balance or nature of activities on a site may change with time and this may change the category of the sewage. If this happens then the operator should apply for an administrative change in the nature of the discharge on the permit.

Annex 6 - Definition of "domestic sewage" and "trade effluent" for permitting

Annex 6.1

TRADE OR DOMESTIC ? An analysis of activities

Activity	**Trade or Domestic**
Toilet waste	Domestic
Chemical toilet waste (regardless of whether site is commercial or residential)	Trade (Note 1)
Personal washing, showering and bathing	Domestic
Domestic cooking for family and friends	Domestic
Household washing of clothes, bedding, etc using domestic detergents, etc	Domestic
Commercial cooking - for sale directly to consumers and consumption on or off the site (e.g. restaurant, pub, burger outlet, sandwich bar)	Domestic (Note 2)
Commercial cooking - for sale off the site (e.g. manufacture of ready meals or jams, preparation of sandwiches for sale at petrol stations, canteens etc.)	Trade
Washing of dishes and cooking utensils after use on the premises	Domestic
Washing at commercial premises of clothes or linen from activities or residents on the site (e.g. camp site launderette)	Domestic
Washing at commercial premises of clothes or linen received from off the site bedding, tablecloths, towels, etc solely for use on the site (e.g. camp site launderette open to non-residents, high street launderette or centralised laundry for hotel chain)	Trade
Swimming pool filter backwash water	Domestic or Trade (Note 3)
Hospitals, vets, schools and universities	Domestic or Trade (Note 4)

Note 1 – It is recommended that chemical toilet waste is not discharged to a package treatment plant, as the chemicals may poison the treatment system and cause pollution

Annex 6 - Definition of “domestic sewage” and “trade effluent” for permitting

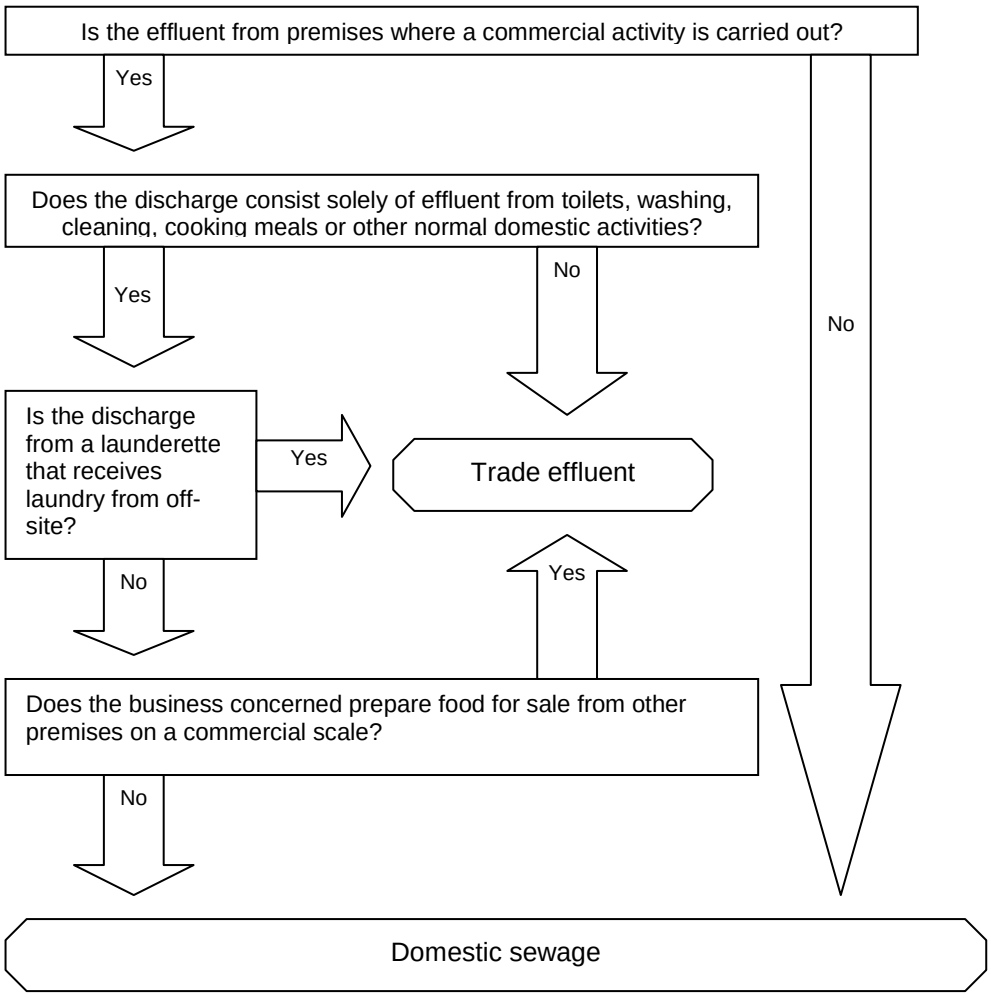
Note 2 - The definition of ‘domestic activity’ goes beyond basic activity definitions, such as ‘cooking’. It also takes in the nature of the activity. Thus, cooking food to serve as a meal is a normal domestic activity, even if the meal is sold to a customer. Cooking meals in quantity for sale elsewhere, or cooking food to put in cans is not a normal domestic activity. Where a commercial enterprise generates effluent that is different to that of a normal home, then it will cease to be a domestic only activity and will be a combination of domestic sewage and trade effluent.

Note 3 – Depends on the nature of the swimming pool. Pools at houses or hotels where they are provided free for the use of residents are domestic. Municipal or commercial pools, where the pool is a major part of a commercial activity are trade. Note that small package plants and septic tanks are unsuitable for the treatment of pool filter backwash, as it contains bactericidal chemicals that can damage the treatment process. They should only be discharged to treatment plants if they will be substantially diluted by other waste components, which is unlikely to be the case for smaller package plants. If a public sewer or large private treatment plant is not available, then the backwash should be discharged to a properly designed soakaway.

Note 4 – Depends on the nature of the discharge and how waste and drainage is managed. For example larger hospitals are likely to discharge trade effluent due to the kind of activities taking place on site, but a smaller hospital may well discharge solely domestic sewage. Where the discharge includes animal wastes or clinical wastes that would not be expected to occur in domestic sewage that part of the discharge will be trade effluent.

Annex 6 - Definition of “domestic sewage” and “trade effluent” for permitting

Annex 6.2 – ‘Domestic Sewage’ or ‘Trade Effluent’ decision tree



Annex 7 - Trade operations - fish farms

Annex 7 - Trade operations – fish farms

General

This guidance deals with the regulation of intensive fish farms discharging to freshwaters. These are mainly 'off-line' farms raising trout for food or restocking. However, the regulation applies to any fish farm where there is abstraction of water from a watercourse (which may be supplemented by groundwater) for use in the fish farm and subsequent discharge to the same watercourse. This guidance doesn't apply to in-river fish farms, marine fish farms, ponds where there is no continuous through flow or extensive fish rearing in lakes.

Management system

The Operator must prepare a management system to control those aspects of its operations that could affect the environment. The permit requires that they must manage operations on site in accordance with the management system.

The management system must identify and minimise risks of pollution, including those arising from operations, maintenance, accidents, incidents and non-conformances and those drawn to the attention of the Operator following complaints. The Operator must ensure that there are sufficient competent people to operate the activities. It is the Operator's responsibility to ensure that staff are adequately trained.

The Operator must maintain the management system and records demonstrating compliance with the management system and make them available to the Environment Agency, on request.

The Operator must inform anybody working on the fish farm who could affect the operations in the management system of the requirements of the document and permit. They must have convenient access to a copy of them kept at or near the place where they carry out those duties.

Annex 7 - Trade operations - fish farms

Risk management

In preparing the management system document, the Operator must review its operation to identify activities and possible accidents, mistakes and malfunctions that may result in damage to the environment. This guidance identifies some of the main potential impacts, but the Operator may identify other risks. The Operator must include in the management system their procedures for managing all the risks they identify. They must include their procedures for complying with the requirements identified in the 'Discharge requirements' section below.

Where possible, the Operator should stop potentially damaging activities. If it is not possible to stop, then the Operator should either change the operation or treat the discharge from the operation to prevent or minimise risk to the environment.

The Operator should have systems in place to ensure that staff follow the procedures and keep proper records. It should train staff in the procedures. This permit requires that the Operator complies with the documented operating procedures and keeps operational records. The Environment Agency may audit these from time to time, particularly if there are concerns about the environmental impact of the farm.

The Operator should:

1. Maintain and implement the management system.
2. Review it at least every 4 years or as soon as practicable after an accident, (whichever is the earlier) and make any necessary changes to the plan.
3. Make any appropriate changes to the plan identified by a review.

Annex 7 - Trade operations - fish farms

Operations

Permitted activities

The normal permit covers discharges from fish farming operations only and does not cover any other trade effluents not related to fish cultivation. Discharges from secondary commercial activities that may occur on such sites, such as preparation and packing of fish, may be included in the permit on the condition that the combined discharge complies with the same conditions as for fish farming alone. Failure to comply with any of the conditions is a breach of permit requirements and could lead to prosecution or other enforcement action.

Discharge requirements

Suspended solids

Excessive suspended solids in the discharge may settle in the downstream watercourse. This may affect appearance, fish spawning, plant growth and other ecological effects. For this reason, Operators must ensure that they do not discharge excessive quantities of suspended solids. High levels may arise when the fish are disturbed during feeding or netting or when the Operator is cleaning the pond between stocking.

The Operator must develop its own documented operational plan to contain suspended solids, depending on local circumstances. The Operator should ensure solid feed levels in ponds follow fish health requirements as closely as possible to minimise generation of suspended solids in the ponds and discharge to the watercourse.

The Operator should stop flows through the affected ponds during cleaning, or reduce them as much as reasonably possible for other operations. Where possible, they should divert the remaining flows to settlement ponds or other solids separation system. Instead of settlement, the Operator may use a mechanical system screening system or microstrainer. The Operator should remove solids until the discharge from the ponds runs clear. The Operator must remove accumulated solids from settlement ponds before loss of settlement capacity significantly affects their efficiency.

The Operator must ensure that excess flow through settlement ponds caused by storm events does not result in discharge to the stream of additional suspended solids.

The Operator must have documented procedures for monitoring and maintaining suspended solids removal and for removing accumulated solids as necessary, for safe disposal in accordance with waste management regulations.

Operators must manage their operation to ensure that the suspended solids in the discharge do not exceed the incremental limit set in their permit. This will normally be set at 5 mg/l above the concentration in the inlet sample. A higher limit may be allowed where there is substantial dilution.

Annex 7 - Trade operations - fish farms

Where an Operator installs a continuous turbidity monitoring system and has procedures in place for responding rapidly to incidents of increased turbidity or suspended solids, this is considered good practice. The operator will need to establish the relationship between turbidity and solids in order to set the alarm to a level that ensures compliance with the suspended solids limit on the permit.

Fish ingress and exit

The Operator should ensure that suitably robust screens are in place on discharge pipes or channels to prevent the loss of stock to the watercourse.

The Operator must screen the inlet to the fish farm to prevent the entry of wild fish into the farm. If this inlet screen is off the main river then the Operator must provide a pipe or channel from just upstream of the screen to allow wild fish to re-enter the main river channel.

The Operator must ensure that the screens provided to meet these requirements are adequately fixed to the sides of the pipe or channel so that:

1. it does not come loose
2. that the outlet screen is capable of reliably preventing the passage of stocked fish and
3. that the inlet screen is capable of reliably preventing the passage of wild fish.

Phosphorus

Phosphorus inputs to rivers boost plant growth in the river and cause many undesirable ecological effects. For this reason, discharges of phosphorus to rivers from all sources must be minimised. Many rivers downstream of fish farms have high conservation value and are designated as Sites of Special Scientific Interest (SSSIs) under UK legislation and Special Areas of Conservation (SACs) under the Habitats Directive. Targets for phosphorus have been set to protect these interests and further targets have been set to meet requirements of the Water Framework Directive. Although fish farm inputs are small compared with other sources of phosphorus, they can be locally significant in headwater streams. Fish farms in this situation should be especially careful to control phosphorus emissions.

Phosphorus is an essential fish nutrient. However, Operators should use fish feed formulations containing phosphorus concentrations as low as is practicable, consistent with fish health to minimise nutrient concentrations in discharge. For most fish farms, there is no practical treatment to reduce phosphorus in the discharge, other than normal solids removal as discussed in the previous section.

Annex 7 - Trade operations - fish farms

The permit will normally require that the discharge does not exceed a mean differential (compared to incoming water) concentration limit of total reactive phosphorus (TRP). We will calculate the required limit based on the uses, objectives and target standards required to protect the receiving watercourse. Where it is not technically feasible to achieve these standards, we will consider refusing a permit application, or setting a limit that reflects current industry good practice.

We will normally assess compliance with this limit over a calendar year. On each sampling occasion, a sample will be taken of the incoming water and the discharge for analysis for TRP. The difference between the incoming and outgoing sample will be calculated. The annual mean of these differences should not show an increase greater than the permit limit. Note that TRP is the same determinand that we have previously referred to as orthophosphate.

Where the fish farm is solely groundwater fed and we are satisfied that the groundwater concentration of TRP is relatively stable, then the agreed mean concentration can be used to calculate the differential increase. It will only be necessary to sample the groundwater three times per year to measure any longer term trends. In order to carry out this trend analysis; we need four years of data, (and a minimum of 10 samples). If this shows that the groundwater concentration is changing, then incoming water samples will need to be taken on each occasion the discharge is sampled.

Ammonia

Ammonia is potentially toxic in watercourses and its breakdown absorbs dissolved oxygen. It originates in fish farms from the excretion of the fish and the load discharged is dependent on the total mass of fish on the farm and their stage of development. Operators must manage their operation to ensure that the ammonia excreted by the stocked fish does not exceed the incremental limit set in their permit. This will normally be set at 0.5 mg/l above the concentration in the inlet sample, but may be lower if justified by river needs.

Biochemical Oxygen Demand (BOD)

BOD is a measure of how much oxygen the discharge will take up in the receiving water. In fish farm discharges, it is largely derived from fish faeces and decaying unconsumed food. This material also contributes much of the suspended solids load in the fish farm discharge. The Operator must devise operating procedures to remove this material from the fish ponds and minimise the concentrations in the discharge to ensure that does not exceed the incremental limit set in their permit. This will normally be set at 3 mg/l above the concentration in the inlet sample, but may be lower if justified by river needs.

Dissolved Oxygen

Fish on the farm remove oxygen from the water passing through the ponds. Because most fish farms have limited opportunities for re-aeration, the water leaving the fish farm is normally significantly lower in dissolved oxygen than the incoming water. This may affect concentrations in the watercourse below the fish farm, particularly if the fish farm is

Annex 7 - Trade operations - fish farms

taking a substantial proportion of the river flow. On many farms, Operators must provide additional aeration to ensure that the stocked fish are not stressed.

Operators must devise operating procedures to prevent dissolved oxygen in their discharge falling below the minimum limit set in their permit. This will normally be set at 70% of the air saturation value if the fish farm takes a substantial part of the summer flow of the watercourse. A lower concentration may be allowed if the fish farm discharge always has substantial dilution during summer low flows.

Pollution control

The Operator should assess the potential environmental impact of all normal operations on the farm and the consequences of any accident or malfunction. They should put in place measures and contingency plans to minimise the environmental consequences of their operation. The Operator must include these in the management system.

If the Environment Agency believes that the fish farm is having any environmental impact, then the Operator should co-operate with the Environment Agency in investigating the matter. If the discharge is causing a significant environmental impact then the Operator should assist the Environment Agency in developing a practical solution and in implementing it as soon as is reasonably practicable. Operators should notify the Environment Agency as soon as reasonably practicable of any pollution incident or incident on their site that may cause pollution of the watercourse or surrounding area.

Prophylactic or therapeutic chemical use

These chemicals should normally only be used under veterinary supervision when they are essential for fish health. Operators must not use any prophylactic or therapeutic chemicals on the farm in such a way that they could be present in the discharge, unless the chemical and method of use is included in their management system. In preparing the management system, the Operator should consider how they will use the chemical at the farm, including the method of disposal of the contents of any tank used in treatment demonstrating that it will not have any effect on the environment. Because most fish farms will use the same chemicals, the Environment Agency will normally require only a restricted risk assessment that just addresses the proposed method of use on the individual farm, rather than the safety of a chemical that we have already approved for use elsewhere .

If the Operator proposes to use a chemical new to the site then they must produce an amended management system, which assesses the risks of the new chemical use. Normally, these should be prepared in advance of the need. However, in an emergency and if administered under veterinary supervision, the Operator may notify the Environment Agency before use and provide the amended management system within 14 days of the use. The Environment Agency reserves the right to refuse to agree the use or method of use of any chemical where it believes that the threat to the environment outweighs the arguments of fish health.

Annex 7 - Trade operations - fish farms

The Operator must comply with any conditions relating to their use and/or discharge required by the Environment Agency and shall keep a record of use available for inspection by the Environment Agency.

The Operator must use a procedure that protects the environment if they wish to use chemicals on site, including emergency procedures. Operators must ensure that staff using any chemicals are appropriately trained in the use of chemicals and any precautions.

Discharge flow

We will set a maximum daily flow limit based on the operator's required maximum flow. We will set a maximum instantaneous flow limit that takes account of the normal variation around the daily flow limit. In calculating discharge requirements, we will treat the maximum limit as a 95%ile to derive a mean and standard deviation.

Because many fish farms have several outlets and limited head for flow measurement, we have accepted that the costs of flow measurement of these discharges are not justified by any potential benefit. We will therefore not require that operators install continuous flow measurement on their discharges.

We would normally expect that, where a farm abstracts water which is returned as effluent to the same watercourse, that there is adequate dilution even at periods of low flow.

Information

All the records that the permit requires the Operator to make must:

1. be legible;
2. be made as soon as reasonably practicable, normally within 48 hours;
3. if amended, be amended in such a way that the original and any subsequent amendments remain legible or are capable of retrieval; and
4. be retained, unless otherwise agreed by the Environment Agency, for at least 6 years from the date when the records were made.

The Operator must supply any records that the permit requires them to make to the Environment Agency within 14 days of any request for the records.

Annex 7 - Trade operations - fish farms

Reporting & Notifications

Reporting

The Operator must send all reports and notifications that the permit requires to the Environment Agency using the contact details supplied in writing by the Environment Agency.

Notifications

The Operator must notify the Environment Agency without delay following the detection of:

1. any malfunction, breakdown or failure of equipment or techniques, accident or emission of any substance which has caused, is causing or may cause significant pollution;
2. the breach of a limit specified in this permit; or
3. any significant adverse environmental effects.

The Operator should provide written confirmation of actual or potential pollution incidents and breaches of discharge rules within 48 hours. Note that in this requirement “may cause significant pollution” means a situation where standby equipment and emergency procedures have failed to rectify the problem and significant pollution is likely. The intention of immediate notification is to enable Environment Agency officers to mobilise to assist in preventing or minimising pollution or rectifying its effects. It should be interpreted with that objective in mind. In these situations, the Operator should continue to take all practicable steps to prevent further pollution and minimise its effects.

The Environment Agency must be notified within 14 days of the occurrence of the following matters except where such disclosure is prohibited by Stock Exchange rules:

1. Where the Operator is a registered company:

- any change in the Operator's trading name, registered name or registered office address
- any change to particulars of the Operator's ultimate holding company (including details of an ultimate holding company where an Operator has become a subsidiary); and
- any steps taken with a view to the Operator going into administration, entering into a company voluntary arrangement or being wound up.
- Where the Operator is a corporate body other than a registered company:
- any change in the Operator's name or address; and
- any steps taken with a view to the dissolution of the Operator.

Annex 7 - Trade operations - fish farms

2. In any other case:

- the death of any of the named Operators (where the Operator consists of more than one named individual); and
- any steps taken with a view to the Operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case them being in a partnership, dissolving the partnership.

Interpretation

In the permit, the expressions listed below have the meaning given.

“Operator” means the person or company responsible for operating the water discharge activity.

“We” means the Environment Agency or its representatives

“Accident” means an accident that may result in pollution.

“Groundwater” means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

“Pollution”, in relation to a water discharge activity or groundwater activity, means the direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which may:

1. be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems,
2. result in damage to material property, or
3. impair or interfere with amenities or other legitimate uses of the environment;

"Year” means calendar year commencing on 1st January, unless otherwise stated.

In the wording contained within the permit, references to reports and notifications mean written reports and notifications (including email), except where reference is made to notification being made "without delay", in which case it should be provided by telephone.

Annex 8 - Trade operations - watercress farms

Annex 8 - Trade operations – watercress farms

What's in this section?

General management

What's in this section?

Management system

The Operator must prepare an environmental management system (EMS) to control those aspects of its operations that could affect the environment. The permit requires that they must manage operations on site in accordance with the EMS. The EMS may include site operational instructions to staff, such as instruction son use of settlement, etc.

The EMS must identify and minimise risks of pollution, including those arising from operations, maintenance, accidents, incidents and non-conformances and those drawn to the attention of the operator following complaints. The Operator must ensure that there are sufficient competent people to operate the activities. It is the Operator's responsibility to ensure that staff are adequately trained.

The Operator must maintain the EMS and records demonstrating compliance with the EMS and make them available to the Environment Agency, on request.

The Operator must inform anybody working on the watercress farm who could affect the operations in the EMS of the requirements of the document and permit. They must have convenient access to a copy of them kept at or near the place where they carry out those duties.

Risk management

In preparing the EMS document, the Operator must review its operation to identify activities and possible accidents, mistakes and malfunctions that may result in damage to the environment. This guidance identifies some of the main potential impacts, but the Operator may identify other risks. The Operator must include in the EMS their procedures for managing all the risks they identify. They must include their procedures for complying with the requirements identified in the 'Discharge requirements' section below.

Where possible, the Operator should stop potentially damaging activities. If it is not possible to stop, then the Operator should either change the operation or treat the effluent from the operation to prevent or minimise risk to the environment.

Annex 8 - Trade operations - watercress farms

The Operator should have systems in place to ensure that staff follow the procedures and keep proper records. It should train staff in the procedures. This permit requires that the Operator complies with the documented operating procedures and keeps operational records. The Environment Agency may audit these from time to time, particularly if there are concerns about the environmental impact of the farm.

The operator should:

1. Maintain and implement the EMS.
2. Review it at least every 4 years or as soon as practicable after an accident, (whichever is the earlier) and make any necessary changes to the plan.
3. Make any appropriate changes to the plan identified by a review.

Annex 8 - Trade operations - watercress farms

Operations

What's in this section?

Permitted activities

The normal permit covers discharges from watercress cultivation operations only and does not cover any other trade effluents not related to watercress cultivation. Discharges from secondary commercial activities that may occur on such sites, such as washing and packaging, may be included in the permit on the condition that the combined discharge complies with the same conditions as for watercress cultivation alone. Failure to comply with any of the conditions is a breach of permit requirements and could lead to prosecution or other enforcement action.

Discharge requirements

Phosphorus

Phosphorus inputs to rivers boost plant growth in the river and cause many undesirable ecological effects. For this reason, discharges of phosphorus to rivers from all sources must be minimised. Many rivers downstream of watercress farms have high conservation value and are designated as Sites of Special Scientific Interest (SSSIs) under UK legislation and Special Areas of Conservation (SACs) under the Habitats Directive. Non-statutory targets for phosphorus have been set to protect these interests and further targets have been set to meet requirements of the Water Framework Directive. Although watercress farm inputs are small compared with other sources of phosphorus, they can be locally significant in headwater streams. Watercress farms in this situation should be especially careful to control phosphorus emissions.

Operators should only use solid fertilisers with a low water-soluble phosphorus concentration. Where liquid feeds are necessary to meet crop demands, the Operator must carefully meter them. The Operator should regulate the dosing of all fertilisers as closely as possible to meet crop demands.

The Operator should not apply solid fertilisers to more than 25% of their total bed area in any one day, or to more than one bed, if that bed makes up more than 25% of the total bed area. After application of solid fertiliser to a bed, the effluent water will have higher phosphorus concentrations for up to 24 hours. The effluent flow from treated beds during this period could be directed to the settlement ponds until the solids release has reduced to minimise discharge of phosphorus to the environment.

Annex 8 - Trade operations - watercress farms

The Operator should manage its operation to ensure that, as far as is practicable, it does not cause any short-term concentrations of phosphorus in the combined discharge that are more than three times the mean limit.

The permit will normally require that the discharge does not exceed a mean differential (compared to incoming groundwater) concentration limit of total reactive phosphorus (TRP). We will calculate the required limit based on the uses, objectives and target standards required to protect the receiving watercourse. Where it is not technically feasible to achieve these standards, we will consider refusing a permit application, or setting a limit that reflects current industry good practice.

We will normally assess compliance with this limit over a calendar year. The Operator will be required to provide a representative sampling point to monitor the incoming groundwater. On each sampling occasion, a sample will be taken of the incoming groundwater and the discharge for analysis for TRP. The difference between the incoming and outgoing sample will be calculated. The annual mean of these differences should not show an increase greater than the permit limit.
Sample points for incoming water should be:

- Representative of the water coming into the cress farm;
- Where the majority of the water enters the cress farm;
- As close to the top of the site as possible and prior to where contaminants may enter;
- A defined point that is safe and convenient for the Agency to access at all times;
- For naturally emerging groundwater, as near to the top of the series of beds and at a point which is wet even during very dry weather;
- For pumped groundwater, as near to the abstraction point/top of the series of beds as possible. If there is more than one pumped input, and they are close together then the one with the greater abstraction would be most appropriate.

Note: In some circumstances, it may be necessary to have more than one inlet sample point. The number of incoming water sample points will depend on the site, and whether the different water sources are likely to be of a different quality. In order to assess whether they are likely to be significantly different it will be necessary to consider things such as the location, type, depth, and geology of the abstraction. You may want to discuss this with you local Environment Agency office.

If we are satisfied that the groundwater concentration of TRP is established as relatively stable, then the agreed mean concentration can be used to calculate the differential increase. It will only be necessary to sample the groundwater three times per year to measure any longer term trends. In order to carry out this trend analysis; we need four years of data, (and a minimum of 10 samples). If this shows that the groundwater concentration is changing, then incoming water samples will need to be taken on each occasion the discharge is sampled.

Annex 8 - Trade operations - watercress farms

Sediment

Excessive sediment in the discharge may precipitate in the downstream watercourse. This may affect appearance, fish spawning, plant growth and other ecological effects. For this reason, Operators must ensure that they do not discharge excessive quantities of sediment. Higher levels may arise from bed cleaning, harvesting and the first flows after planting out. During these operations, the Operator should reduce flows through the affected beds as much as reasonably possible and divert the remaining flows to settlement ponds or other solids separation system. The operator should maintain the diversion until the effluent from the beds runs clear.

The Operator must remove accumulated sediment from the settlement ponds before loss of settlement capacity significantly affects their efficiency. It is a good idea to keep a continuous low flow of water through the settlement ponds to prevent algal blooms. Some growth of macrophytes in the settlement pond acts as a natural filter and is acceptable as long as it does not adversely affect the settlement efficiency.

The discharge shall not normally contain suspended solids in excess of 20 mg/l. We may discount individual exceedances of the 20 mg/l limit if the Operator shows that wildlife in the farm caused the higher level of solids in the discharge (e.g. birds, fish, etc) or rainfall has caused solids run off from neighbouring land that it cannot reasonably divert or prevent. Operators should prevent such runoff, where reasonably practicable.

Where an Operator installs a continuous turbidity monitoring system and has procedures in place for responding rapidly to incidents of increased turbidity or suspended solids, this is considered good practice. The operator will need to establish the relationship between turbidity and solids in order to set the alarm to a level that ensures compliance with the suspended solids limit on the permit.

Zinc

Zinc is toxic to aquatic life and its use should be minimised as much as possible, consistent with crop health. The Operator should only use it if a crook root problem is likely. Use should also be restricted to winter months when higher river flows and reduced biological activity reduce the risk of toxic effects.

If the operator uses zinc, it will normally be used for several months during winter. The Operator should control the dose to maintain a mean concentration in the discharge over the period of dosing below the zinc EQS concentration (see table below). The Operator must say in the management system when they might use zinc at a site and describe how they will control the dosing to ensure that the target concentration will not be exceeded in the farm discharge. The Operator must collect and have analysed at a UKAS accredited laboratory monthly spot samples during any zinc application period, to confirm the compliance with the mean limit. The Operator must notify the Environment Agency of the results of the daily samples as soon as practicable after the completion of zinc dosing.

Annex 8 - Trade operations - watercress farms

Note that the Environment Agency is reviewing the EQS for zinc, as it is a Specific Pollutant under the Water Framework Directive. At present, the zinc EQS is set as a total zinc concentration, but the new EQS will be as soluble zinc. Until the new EQS is adopted by the UK, the Operator should analyse for total zinc during any period of use. After adoption, they should analyse for soluble zinc. The table below shows the required discharge standard, which varies according to the hardness of the receiving water.

Water hardness to which the corresponding standards in Column 2 apply*	Concentration in the discharge must not exceed
Column 1	Column 2
Annual mean concentration of CaCO3 in receiving water (mg/l)	Mean concentration µg/l of total zinc during the period of dosing
0-50	8
50-100	50
100-250	75
>250	125

* The standards applicable to intermediate water hardness must be calculated by simple linear interpolation

Chemical Pesticides

The Operator should only used chemical pesticides approved for use on watercress or with off-label approval for that use. The Operator must ensure that no detectable concentrations of pesticides are discharged. The Operator must say in the management system how they will do this. Treatment should generally be restricted to aerial application to seedlings before planting out. There must be a gap of several days between the last treatment and planting out the seedlings.

Chlorine

Chlorine and the products of chlorination have been shown to adversely affect animals in the watercourse downstream of watercress farm discharges. Chemicals for removing surplus chlorine, such as bisulphite, can easily be over-dosed and are environmentally damaging. For this reason, the operator should not use chlorine or chlorine-based disinfectants to disinfect watercress wash waters, or for other bulk uses where they will be present in the discharge. They can be discharged from small volume uses of a few litres, such as surface disinfection of equipment.

If large volumes of water containing chlorine-based disinfectants are generated, the operator must not discharge them in the farm discharge. The water should be irrigated to soakaway on a grassed area away from any watercourse. Alternatively, the water can be held for several days, until the residual chlorine and chlorinated organic compounds have dissipated to an insignificant concentration.

Annex 8 - Trade operations - watercress farms

The discharge must not contain chlorine or products that contain reactive chlorine or any appreciable quantities of chlorination by-products, such as chloramines or chlorinated organic compounds.

Ammonia and ammonium salts

Ammonia is potentially toxic in watercourses. Operators should minimise the risk of discharging ammonia by using fertilisers primarily containing nitrogen in other forms. All fertilisers should be stored under cover where any spillage will be contained.

We will only include a discharge ammonia limit on the permit, if it is necessary to protect the uses, objectives and target standards of the receiving watercourse. Where it is not technically feasible to achieve these standards we will consider refusing an application for a new permit, or setting a limit based on what can be achieved following good practice.

Biochemical Oxygen Demand (BOD)

BOD is a measure of how much oxygen the discharge will take up in the receiving water. We will apply a discharge BOD limit to the permit only if it is necessary to protect the uses, objectives and target standards of the receiving watercourse. Where the required limit is not technically feasible we will consider refusing an application for a new permit, or setting a limit based on what can be achieved following good practice.

Plant debris and other larger solids

The Operator should ensure that sufficient measures are in place to prevent their operations causing significant quantities (i.e. enough to cause damage to the riverine ecosystem or cause visual offence) of plant debris and other larger solids to enter the receiving watercourse.

Discharge flow

Peak flows from watercress farms are mainly driven by rainfall, spring flows and groundwater levels and are not under the control of the Operator. Because of this, we cannot set maximum flow limits and flow measurement has no regulatory value. We will therefore not set flow limits or require flow measurement of watercress farm discharges. In order for us to determine the potential quality impact of the discharge, the Operator should provide in their management system their best estimate of the annual-mean daily flow of the discharge in dry weather.

Because the discharge flow is normally restricted when the discharge quality is likely to be at its worst, there is likely to be an inverse correlation between flow and quality of the discharge. Unless we take account of this, we may over-estimate the impact of the discharge on the receiving water.

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Monitoring of discharges

At present, Environment Agency staff take samples of discharges and incoming groundwater.

Information

What's in this section?

Records

The permit requires the Operator to keep records. The operator must provide copies of these records to the Environment Agency or make them available for inspection when we request them.

The Operator must supply any records that the permit requires them to make to the Environment Agency within 14 days of any request for the records.

Reporting and Notifications

The Operator must send all reports and notifications that the permit requires to the Environment Agency using the contact details supplied in writing by the Environment Agency.

The Operator must notify the Environment Agency immediately following the detection of any problem on the watercress farm that causes or may cause an appreciable adverse environmental impact in the receiving watercourse. The operator should send written confirmation within 48 hours. Note that written communication includes email and other electronic communications.

Note that in this requirement "may cause significant pollution" means a situation where standby equipment and emergency procedures have failed to rectify the problem and significant pollution is likely. The intention of immediate notification is to enable Environment Agency officers to mobilise to assist in preventing or minimising pollution or rectifying its effects. It should be interpreted with that objective in mind. In these situations, the Operator should continue to take all practicable steps to prevent further pollution and minimise its effects.

The Environment Agency must be notified within 14 days of the occurrence of the following matters except where such disclosure is prohibited by Stock Exchange rules:

1. Where the operator is a registered company:

- any change in the operator's trading name, registered name or registered office address

Annex 8 - Trade operations - watercress farms

- any change to particulars of the operator's ultimate holding company (including details of an ultimate holding company where an operator has become a subsidiary); and
- any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.
- Where the operator is a corporate body other than a registered company:
- any change in the operator's name or address; and
- any steps taken with a view to the dissolution of the operator.

2. In any other case:

- the death of any of the named operators (where the operator consists of more than one named individual); and
- any steps taken with a view to the operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case them being in a partnership, dissolving the partnership.

Annex 8 - Trade operations - watercress farms

Interpretation

In the permit, the expressions listed below have the meaning given.

”Operator” means the person or company responsible for operating the water discharge activity.

“We” means the Environment Agency or its representatives

“Accident” means an accident that may result in pollution.

“Groundwater” means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

“Pollution”, in relation to a water discharge activity or groundwater activity, means the direct or indirect introduction, because of human activity, of substances or heat into the air, water or land that may

- be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems,
- result in damage to material property, or
- impair or interfere with amenities or other legitimate uses of the environment;

"Year” means calendar year commencing on 1st January, unless otherwise stated.

In the wording contained within the permit, references to reports and notifications mean written reports and notifications (including email), except where reference is made to notification being made "without delay", in which case it should be provided by telephone.

Annex 9 - Regulation and risk assessment of reservoir releases

Annex 9 - Regulation and risk assessment of reservoir releases

This section is included as a working document and will be kept under review

Summary

- We recognise that reservoir safety requires regular testing of scour valves and that this entails releases from the reservoirs.
- We recognise that dams interrupt the natural transport of sediments in rivers and that a programme that simulates natural sediment flushes can be beneficial.
- Some releases from reservoirs require a consent or permit from the Environment Agency.
- As a condition of granting a consent or permit, we will require the reservoir undertaker to carry out a risk assessment of the potential environmental and safety risks of their proposed releases.
- We will require that undertakers develop a management system that includes all reasonably practicable procedures to minimise any adverse impact. The consent or permit will require that the undertaker follows this management system when making a release.
- If scour valve testing has not been carried out for some years, it is likely that the undertaker will have to agree and undertake a planned programme of restoration with the Environment Agency before normal routine testing can be commenced. The restoration programme must be included in the management system.

Annex 9 - Regulation and risk assessment of reservoir releases

Introduction

All reservoirs routinely release water into the downstream watercourse – as compensation flow, to provide for downstream abstraction or as part of the reservoir management when the reservoir is full or to manage flood flows. These releases are normally of water from the upper layers of the reservoir and do not cause any appreciable polluting impact downstream.

However, sometimes it is necessary to release water from the bottom layers of the reservoir through the scour valve. These will inevitably contain some suspended solids from the bed of the reservoir and the water may contain polluting concentrations of chemicals. There are three main occasions when a reservoir undertaker might need to release water from the scour valve – to test the operation of the valve; during routine or planned maintenance or in an emergency.

The commonest release is during testing of the bottom outlet or scour valve. The scour valve allows the undertaker to draw down the reservoir quickly in an emergency to reduce pressure on the dam. Testing of the scour valve has two separate purposes. Firstly, to ensure that the mechanism works and the scour valve and stop valve can be fully opened in an emergency and, secondly, to keep the valve intake and culvert clear of sediment and ensure that it will operate in an emergency.

A reservoir may occasionally need partial or full planned drawdown as part of an investigation, or to carry out maintenance and repair work.

If there is a significant risk of a dam failing, an inspecting engineer can, by law, recommend and supervise any measures considered necessary in the interests of safety. These may include a precautionary partial or full drawdown of the reservoir to reduce the water pressure on the structure.

In an extreme case when the dam is in serious danger of failing the undertaker's first priority will be to lower water levels in the reservoir as quickly as possible. This will prevent an uncontrolled release of water, which could cause widespread flooding and potentially serious loss of life.

From 2010, undertakers are required to produce on-site emergency plans. These will set out what they will do in an emergency to try to contain and limit the effects of the incident. It will include a plan for communicating with external organisations, mainly the emergency services.

Some releases from a reservoir can have significant effects on the environment. The major potential effects are summarised in Annex 1.

Annex 9 - Regulation and risk assessment of reservoir releases

We recognise that the drawdown occasions summarised above are essential for the long-term safety of the human and animal population downstream and to prevent catastrophic dam failure and flood events. When the undertaker is preparing an application for a consent or permit to make releases from a reservoir, we require that they carry out a risk assessment of all potential release events and produce an management system that minimises adverse impacts. It is the undertaker's responsibility to identify risks and mitigation measures. This document suggests some of the factors that the undertaker should consider.

Legal provisions

Reservoir undertakers releasing water from a reservoir may need a consent or permit from the Environment Agency. The detailed legal provisions are included under Annexes 2A and 2B. Any releases authorised by an abstraction licence or by any Act of Parliament that authorised the construction of the reservoir may not require a permit or consent. Release of non-polluting surface waters from a reservoir do not require a permit or consent.

Water undertakers (i.e. companies licensed by the regulator to supply drinking water) own and operate around 35% of reservoirs in England and Wales. The Water Industry Act 1991 regulates some discharges from these reservoirs. It contains provisions in respect of discharges from the construction, alteration, repair, cleaning or examination of any reservoir. Section 165 of the Act allows the water undertaker to discharge such water from a pipe of less than 229 mm diameter without a permit, as long as the undertaker has taken all steps to ensure that it is as free as may be reasonably practicable from pollutants. A discharge caused by the specified activities that is discharged through a pipe larger than 229 mm diameter, which will include all scour valves, requires the consent of the Environment Agency under S.166. This consent is not subject to the formal permitting process under the Environmental Permitting Regulations 2010, but is determined under procedures specified in S.166 of the Act. Note that the Water Industry Act provisions require the water undertaker to have a consent for the water release and any pollutants, solid or dissolved, that it may contain. Discharges from the water undertakers' reservoirs can be consented under these Water Industry Act provisions, or under an environmental permit as described below depending on the nature of the activity/operation and the discharges.

The provisions of Water Industry Act 1991 and EPR regulate different but sometimes overlapping activities. A discharge made under and in accordance with a consent granted under the Act acts as a defence to any offence under EPR, so water undertakers do not need a separate permit under EPR for such a discharge.

Annex 9 - Regulation and risk assessment of reservoir releases

The Environmental Permitting Regulations 2010 (EPR) regulate some discharges from the remaining 65% of reservoirs not owned by a water undertaker. These Regulations specify that the removal from any part of the bottom, channel or bed of any inland freshwaters of a deposit accumulated because of any dam by causing it to be carried away in suspension in the waters, is a water discharge activity. The EPR make it illegal to cause or knowingly permit a water discharge activity, unless in accordance with an environmental permit. The EPR specify the process for applying for an environmental permit.

Although different reservoir undertakers are subject to different legislative provisions, all require our agreement for any discharges from a reservoir that may carry polluting material downstream. We will determine both types of permit in a similar way and place similar requirements on both groups of reservoir undertakers.

Environmental risk assessment and mitigation measures

Risk assessment

Reservoir undertakers should consider each type of release they may make from a reservoir and decide whether they need a permit or consent for the discharge. For those discharges that may contain polluting matter and require a permit or consent, the reservoir undertaker should ensure that a competent person undertakes a suitable and sufficient assessment of the potential impact of releases from the reservoir. This assessment should determine whether any such release is a significant hazard to humans, animals or the environment.

The undertaker should ensure that they document this assessment. The undertaker should review the assessment from time to time and update it if circumstances have changed. The technically competent person may be an employee of the undertaker.

It is possible that the reservoir will be upstream of designated nature conservation sites. The undertaker must specifically check to assess whether their proposed release could have a likely significant detrimental effect on any such sites. If the release may have an effect, then the Environment Agency must consult Natural England or the Countryside Council for Wales before issuing a consent or permit. We cannot issue a consent or permit if the activity may damage a designated site or species.

If the undertaker's assessment indicates that the release may represent a significant risk to humans, animals or the environment, then they should undertake a detailed assessment to further define the risk and identify any practicable mitigation measures. The undertaker may need to employ a qualified specialist to undertake the detailed assessment. It is the undertaker's responsibility to devise the mitigation measures and to demonstrate to us in their management system that they will make the discharge with minimal polluting impact on the environment.

The following sections identify some of the main potential effects and their causes. However, the list is not exhaustive and the undertaker may identify other, site specific, risks that they must address.

Annex 9 - Regulation and risk assessment of reservoir releases

Sediment release

Feeder streams to a reservoir will carry sediment into the reservoir, where it will settle. The amount of sediment that will be discharged through the scour valve when it is opened will depend on many factors, principally: the size of the reservoir, the location of the feeder streams, the amount of sediment transported by the feeder streams, the nature of the sediment collected in the catchment; the time since the scour valve was last opened and the extent of the drawdown.

We recognise that some sediment release is inevitable and acceptable, since in the absence of the dam it would have been transported naturally down the river. By stopping this natural sediment transport in the watercourse, the reservoir damages the downstream watercourse and some release of sediment from the reservoir can be beneficial. The undertaker's aim should be to demonstrate that they will control, as far as is reasonably practicable, the release of sediment to ensure that it does not overwhelm the natural transport mechanisms and damage the downstream river. This may involve several smaller events in a year, rather than one major release.

The undertaker can undertake routine testing of a scour valve by regular opening or partial opening, before large amounts of sediment have accumulated. Timing of planned opening to coincide with higher natural river flows will help to prevent locally damaging sediment accumulation. At times when the river is transporting elevated concentrations of natural sediments following rainfall, studies have shown that a release of additional sediment from a reservoir scour valve will normally have no appreciable effects. Gradual opening of the scour valve may mobilise less sediment from the reservoir than rapid opening and the undertakers should consider this, where practicable.

We accept that given the flow velocity and volume discharged, even by scour valve testing, there are at most reservoirs no practicable measures to remove sediment from the discharge.

If the undertaker has not opened the scour valve for some years, then they must first carry out a survey to establish how much sediment has accumulated that may be washed through the scour valve. Techniques such as side scan sonar, depth sounding and sediment sampling to test density and composition may be required. Comparison with construction plans will enable the undertaker to map the sediment accumulation. If a large quantity of sediment has accumulated that may wash through the scour valve, then the undertaker must develop a plan to prevent a damaging release. If the sediment is natural sediment that would have washed down the river in the absence of the dam, then the undertaker may base the restoration plan on planned smaller releases from the scour valve whenever increased river flows and increased natural sediment transport provides an opportunity. This little and often approach may take some time before normal testing can safely be undertaken, but by simulating natural releases it should have no appreciable environmental impact.

Thereafter the undertaker should test the valve with sufficient frequency to prevent future large accumulation of sediment.

Annex 9 - Regulation and risk assessment of reservoir releases

Regular testing of the scour valves in planned discharges will help to minimise the release of sediment if precautionary or emergency drawdown is needed. While safety will always take priority in emergencies, undertakers should still seek to minimise environmental impact consistently with that primary aim.

Release of polluted sediment

The undertaker should also consider whether pollutants might be present in significant amounts in the sediment. If the reservoir is in an industrial area, it could have accumulated toxic industrial wastes in the sediment.

If the initial risk assessment indicates there is a risk that sediments might contain pollutants, the undertaker must have the sediment chemically tested. This is more likely for older reservoirs that served manufacturing industry. Release of such sediments to a river may cause a major pollution of the river.

In old mining areas, reservoir sediments may contain elevated concentrations of metals from eroded mining waste. If the concentration of metals in the dam sediment is similar to that in the sediments of similar adjacent tributaries, then the undertaker may conclude that the sediment in the dam will have no appreciable additional polluting effect.

If the undertaker identifies high levels of industrial pollutants in dam sediment, then they should consult the Environment Agency about possible mitigation measures. It may be necessary for the undertaker to dredge sediment from the reservoir before they can safely test the scour valve without a risk to the downstream river. Note that the dredged sediment will be waste and only permitted contractors must dispose of it.

If the Environment Agency considers that release of the sediment to the downstream watercourse would cause serious long-term pollution and removal of the sediment is not practicable or financially possible, then it may be necessary to close the reservoir and stabilise the sediment in situ.

Release of poor quality water

Some reservoirs may thermally stratify in summer. When the sun warms the surface waters, they become less dense than the deeper water that remains colder. This can produce two separate layers of water that do not mix, separated by a layer where the temperature and density change rapidly, called the thermocline.

Annex 9 - Regulation and risk assessment of reservoir releases

Because the lower layer is not in contact with the air, little oxygen reaches it. The decay of organic matter in the water and on the bed of the reservoir depletes the oxygen in this layer and it may even become completely anoxic. Under the low oxygen conditions the concentrations of substances such as iron, manganese, ammonia and sulphides increases in the water and it become toxic to fish and other aquatic life. If the undertaker tests the scour valve under these conditions this poor-quality water will be discharged down the river, causing pollution, killing fish and other animals and causing an offensive smell and appearance. The water will travel some distance downstream before re-aeration in the river breaks down the pollutants. This is one of the most environmentally damaging aspects of reservoir releases.

Undertakers must check whether their reservoir is subject to thermal stratification. If it is, then they must test using a dissolved oxygen probe lowered through the water before making a release. If the bottom water that they will release has a significantly depleted dissolved oxygen concentration, then the undertaker must not open the scour valve for a planned discharge until the stratification has broken down and dissolved oxygen in the bottom water has improved. This overturn will normally occur in autumn as air temperatures cool. The undertaker can prevent stratification in reservoirs by destratification devices, such as a bubble curtain, that keeps the water mixed in spring and summer. The undertaker should not schedule routine testing of the scour valve at reservoirs that stratify at times of the year when the reservoir may be stratified. However, since stratification can be unpredictable, the undertaker should always test the dissolved oxygen before each release, if the reservoir may stratify. The consent or permit will make it an offence to make planned releases of bottom water when the reservoir is stratified.

Algal blooms in the reservoir may also result in poor quality discharge water. Undertakers should not make planned discharges if a severe algal bloom is occurring, unless they have shown that the bloom does not affect the deep water that they will release. They should avoid scour valve testing for some time after the bloom has died back, as the decay of the algae will increase the organic content of the bottom water and reduce the dissolved oxygen concentration. In this situation, the undertaker should test the dissolved oxygen in the bottom water before release. A minimum of 50% of the air saturation value must be present in the bottom water before they make a release.

Release of fish

When the scour valve is tested, then some fish may be washed from the reservoir with the discharged water. However, the effect is not significant in proportion to the total population and the undertaker cannot reasonably prevent it, so no action is necessary.

If the undertaker is planning a substantial drawdown of a reservoir, either for maintenance and refilling, or to a permanently lower level, then a large number of fish may be displaced. In this circumstance, the undertaker should contact the local Environment Agency Fisheries team to assist in rescuing the fish for relocation elsewhere or restocking after they have refilled the reservoir.

Annex 9 - Regulation and risk assessment of reservoir releases

Increase in downstream flow

Excessive increase in water flow in the river downstream of the reservoir can have serious environmental impacts and safety risks. When the undertaker opens the scour valve, a flood wave may pass downstream scouring water plants and animals; scouring the banks and river channel; damaging bankside structures and risking washing away animals and people, with a risk of death or injury. The rise in the height of water in the channel may cause flooding of land or property. The volume and velocity of the water flow may wash fish, other animals and plants downstream. These effects will clearly be more marked in smaller watercourses.

We accept that discharges from the reservoir through spillways and scour valves will affect the character of streams downstream of reservoirs. We set against that the benefits of the reservoir in attenuating normal flood flows in the downstream catchment and, in many cases, supporting river flows under low flow conditions. However, we require that the reservoir undertaker undertake routine drawdown operations to as far as is practicable prevent or mitigate significant damage and flood risks identified by their risk assessment.

If it is not possible to fully open a scour valve without risking significant downstream damage, then the undertaker should agree an acceptable programme of testing with the supervising engineer. It may be that the undertaker will have to fully open the scour valve and stop valve separately to test their mechanisms without releasing large flows. They may accompany this with more frequent partial opening to release sediment build up without generating damaging flow velocities downstream. The undertaker may be able to develop alternative operating methods depending on the local circumstances, which will be different for each reservoir.

The undertaker must identify through its risk assessment any properties or situations that may be adversely affected by its routine discharge operations, such as bankside properties, caravan and camp sites in the flood plain, angling clubs, etc . It should maintain a contact register and, where necessary, give due warning before undertaking a drawdown operation that may affect those interests.

Risk assessment

The construction of a dam greatly alters the nature of the watercourse below the dam. It will greatly alter the natural flow patterns. It may reduce or increase peak flows and summer flows, depending on the purpose of the reservoir and its operating regime. The reservoir also acts as a sediment and nutrient trap, in most cases almost eliminating the supply of sediment immediately downstream. This results in increased erosion and deepening of the downstream channel and reduction in deposited sediments, gravels and riffles. High peak flows from the reservoir will increase erosion in the channel, producing scouring of sediments, plants and animals. The overall effect downstream of a reservoir is usually a reduction in the range of species found and the numbers of individuals of the species present.

Annex 9 - Regulation and risk assessment of reservoir releases

Therefore, when assessing the potential impact of a planned reservoir release, either routine scour valve testing or a larger permanent or temporary drawdown, we must take into account that the environment is already significantly changed from the natural. A number of studies have been undertaken on the effects of sediments and flow from scour valve testing. The general conclusion is that even where the release temporarily quite markedly discolours the river with sediments, there is little detectable effect on biota. In cases where the reservoir reduces natural spate flows in the downstream watercourse, the higher flow velocities during scour valve testing can clean river gravels of deposited fine sediment.

However, the undertaker must avoid creating extreme sudden high flows that cause channel and bank scouring and flooding. They must also avoid excessive short-term release of sediment that overwhelms the natural transport processes and produces damaging sediment accumulation in pool sections.

The conclusion of many studies is that scour valve releases that simulate as closely as possible the natural flow patterns of the river are the best for maintaining as natural an environment as possible. In developing a risk assessment, the undertaker must consider the peak flows that the downstream channel can accommodate without damage and the sediment transport capacity of the watercourse during release and ways to limit both to acceptable levels during testing.

If there is a designated statutory conservation site or conservation interest downstream, then the undertaker must demonstrate that the release will not damage the site or interest. Such studies may involve monitoring conditions at the site during natural high flows. If the conditions during a reservoir release will be similar to natural events, then it may reasonably conclude that there will be no adverse impact on the site. If it is not possible to immediately confirm there will be no adverse effect from the planned releases, the undertaker may work with the Environment Agency to monitor the effects of smaller trial releases. The undertaker can gradually increase the releases to the planned operating regime if they do not detect any adverse effects.

Permitting

Undertakers should apply for a consent or permit for all planned drawdown operations through the scour valve that it proposes to carry out and any other releases that may discharge solids or other pollutants. Only reservoir undertakers who are also water undertakers can apply for consents under section 166 Water Industry Act 1991. All other undertakers would need to apply under EPR if their activity meets definition of water discharge activity. The undertaker’s risk assessment and proposed mitigation measures plan will be the main part of the application. We will consider whether the management system has properly assessed the risks and whether the undertaker is proposing to use all reasonably practicable mitigation. If the permitting officer has concerns over what is practicable, they may consult with our Reservoirs Safety team.

Annex 9 - Regulation and risk assessment of reservoir releases

The permit will require that the undertaker carry out the discharge in accordance with the management system. If the operation conforms to the plan, but still results in serious environmental impact, then we may require the undertaker to review the plan to determine whether they can further mitigate the impact.

In addition to requiring conformance with the management system, the permit will specifically prohibit any release of bottom water when the reservoir is stratified or the dissolved oxygen in the bottom water is less than 50% saturated. It will also prohibit any significant release of solids under low flow conditions and require that such releases are made at times when river flows are naturally higher. In view of the risks of sampling the high flows and the impossibility of obtaining representative samples, we will not put any numeric quality limits on the discharge.

Annex 9, Appendix A – Factors in reservoir releases potentially causing environmental damage

Appendix A - Factors in reservoir releases potentially causing environmental damage

Cause	Potential physical effects	Potential environmental effects
Release of sediment from reservoir	significant deposits in downstream river if the load overwhelms the natural transport mechanism	• Damage to river ecology • Loss of fish habitat and breeding sites • Appearance of river affected
	if the reservoir sediment contains pollutants these will be carried into the downstream river	• Deterioration in river quality, WFD objectives at risk • Damage to river ecology • Long term habitat damage • Effect on abstractions
Release of poor quality water from the reservoir	if the reservoir is stratified released water will cause a deterioration of downstream river quality e.g. low dissolved oxygen and elevated iron and manganese	• Fish and other aquatic animals killed • Effect on abstractions • Deterioration in river quality, WFD objectives at risk
Release of fish from the reservoir	fish transferred from lake into downstream river	• Minor, some fish displaced from lake

Annex 9, Appendix A – Factors in reservoir releases potentially causing environmental damage

Cause	Potential physical effects	Potential environmental effects
Water level in downstream watercourse	if the flow exceeds the channel capacity it will flood property and land and damage bridges and bankside structures	• Loss and damage to property • Land use affected • Risk to human and animal life and health
Rate of rise in water level in downstream watercourse	if too rapid it may wash away animals and people	• Risk to human and animal life and health
Volume and velocity of released water	scours river sediments	• Damage to river ecology • Appearance of river affected
	erodes river banks	• Loss of land • Risk to bankside property • Damage to bankside ecology
	washes out rooted aquatic plants	• Appearance of river affected • Loss of fish habitat and breeding sites • Damage to river ecology
	displaces fish downstream	• Fish removed from downstream river • Damage to river ecology

Annex 9, Appendix B1 – Provisions of the Environmental Permitting Regulations 2010 in respect of discharges from reservoirs

Appendix B1 – Provisions of the Environmental Permitting Regulations 2010 in respect of discharges from reservoirs

- **SCHEDULE 21 - Provision in relation to water discharge activities**

  Meaning of "water discharge activity"

  3.—(1) A "water discharge activity" means any of the following—

  (c) the removal from any part of the bottom, channel or bed of any inland freshwaters a deposit accumulated by reason of any dam, weir or sluice holding back the waters, by causing it to be carried away in suspension in the waters, unless the activity is carried on in the exercise of a power conferred by or under any enactment relating to land drainage, flood prevention or navigation; or

- **Regulation 8** provides that all water discharge activities are regulated facilities.
- **Regulation 12** provides that a person must not, except under and to the extent authorised by an environmental permit, operate a regulated facility or cause or knowingly permit a water discharge activity.
- **Regulation 40** provides a defence in certain circumstances.

  Defences

  40.—(1) It is a defence for a person charged with an offence under regulation 38(1), (2), (3), (4) or (5) to prove that the acts alleged to constitute the contravention were done in an emergency in order to avoid danger to human health in a case where—

  (a) the person took all such steps as were reasonably practicable in the circumstances for minimising pollution; and

  (b) particulars of the acts were furnished to the regulator as soon as reasonably practicable after they were done.

NB Regulation 38, inter alia, provides that it is an offence to contravene or knowingly permit the contravention of Regulation 12.

Annex 9, Appendix B2 – Provisions of the Water Industry Act 1991 S.165 and 166 in respect of discharges from reservoirs

Appendix B2 – Provisions of the Water Industry Act 1991 S.165 and 166 in respect of discharges from reservoirs

165 Discharges for works purposes

(1) Subject to the following provisions of this section and to section 166 below, where any water undertaker—

(a) is exercising or about to exercise any power conferred by section 158, 159, 161 or 163 above (other than the power conferred by section 161(3) above); or

(b) is carrying out, or is about to carry out, the construction, alteration, repair, cleaning, or examination of any reservoir, well, borehole, or other work belonging to or used by that undertaker for the purposes of, or in connection with, the carrying out of any of its functions,

the undertaker may cause the water in any relevant pipe or in any such reservoir, well, borehole or other work to be discharged into any available watercourse.

(2) Nothing in this section shall authorise any discharge which—

(a) damages or injuriously affects the works or property of any railway undertakers or navigation authority; or

(b) floods or damages any highway.

(3) If any water undertaker fails to take all necessary steps to secure that any water discharged by it under this section is as free as may be reasonably practicable from—

(a) mud and silt;

(b) solid, polluting, offensive or injurious substances; and

(c) any substances prejudicial to fish or spawn, or to spawning beds or food of fish,

the undertaker shall be guilty of an offence and liable, on summary conviction, to a fine not exceeding level 3 on the standard scale.

(4) In this section "relevant pipe" means any water main (including a trunk main), resource main, discharge pipe or service pipe.

Annex 9, Appendix B2 – Provisions of the Water Industry Act 1991 S.165 and 166 in respect of discharges from reservoirs

166 Consents for certain discharges under section 165

(1) Except in an emergency, no discharge through any pipe the diameter of which exceeds two hundred and twenty-nine millimetres shall be made under section 165 above except with the consent of the NRA and of any navigation authority which carries out functions in relation to—

(a) the part of the watercourse where the discharge is made; or

(b) any part of that watercourse which is less than three miles downstream from the place of the discharge.

(2) Where a water undertaker makes an application to any authority for a consent for the purposes of this section—

(a) that application shall be accompanied or supplemented by all such information as that authority may reasonably require; and

(b) the undertaker shall serve a copy of the application, and of any consent given on that application, on every person who—

(i) is registered with the undertaker in respect of any premises which are within three miles of the place where the discharge to which the application relates is proposed to be made and are not upstream from that place; and

(ii) has not agreed in writing that he need not be served with such a copy;

but, subject to subsection (4) below and without prejudice to the effect (if any) of any other contravention of the requirements of this section in relation to such an application, a failure to provide information in pursuance of the obligation to supplement such an application shall not invalidate the application.

(3) Subject to subsection (4) below, an application for a consent for the purposes of this section shall be determined—

(a) in the case of an application with respect to a particular discharge, before the end of the period of seven days beginning with the day after the application is made; and

(b) in any other case, before the end of the period of three months beginning with that day;

and, subject to that subsection, where an application for any consent is required to be determined within the period specified in paragraph (a) above and is not so determined, the consent applied for shall be deemed to have been given unconditionally.

(4) Where—

Annex 9, Appendix B2 – Provisions of the Water Industry Act 1991 S.165 and 166 in respect of discharges from reservoirs

(a) an undertaker which has made an application to any authority for a consent for the purposes of this section has failed to comply with its obligation under subsection (2)(a) above to supplement that application with information required by that authority; and

(b) that requirement was made by that authority at such a time before the end of the period within which that authority is required to determine the application as gave the undertaker a reasonable opportunity to provide the required information within that period,

that authority may delay his determination of the application until a reasonable time after the required information is provided.

(5) A consent for the purposes of this section may relate to a particular discharge or to discharges of a particular description and may be made subject to such reasonable conditions as may be specified by the person giving it; but a consent for those purposes shall not be unreasonably withheld.

(6) Any dispute as to whether a consent for the purposes of this section should be given or withheld, or as to whether the conditions to which any such consent is made subject are reasonable, shall be referred to the arbitration of a single arbitrator appointed by agreement between the parties to the dispute or, in default of agreement, by the President of the Institution of Civil Engineers.

(7) Where any discharge under section 165 above is made in an emergency without the consent which, if there were no emergency, would be required by virtue of this section, the undertaker which made the discharge shall, as soon as practicable after making the discharge, serve a notice which—

(a) states that the discharge has been made; and

(b) gives such particulars of the discharge and of the emergency as the persons served with the notice might reasonably require,

on every person on whom that undertaker would have been required to serve the application for that consent or any copy of that application.

(8) If any water undertaker contravenes, without reasonable excuse, any of the requirements of this section or any condition of a consent given for the purposes of this section, it shall be guilty of an offence and liable, on summary conviction, to a fine not exceeding level 3 on the standard scale.

(9) Nothing in this section shall require any consent to be obtained, or any notice to be served, in respect of any discharge if the requirements of section 34 of the [1945 c. 42.] Water Act 1945 (temporary discharges into watercourses) in relation to that discharge had been satisfied before 1st September 1989.

Annex 10 Standard Rules Technical Guidance SR2010 No2.

Annex 10 - Standard rules technical guidance SR2010 No2

Guidance on determining whether your discharge complies with standard rules SR2010 No2 - Discharge to surface water: cooling water and heat exchangers

This document advises what discharges you need a permit for, sets out all the main standard rules and advises you on how to decide if your discharges meets the rules and qualifies for a standard permit.

Do I need a permit?

Not all discharges of water used to provide heating for buildings require a permit. If your proposed system is to serve a single house with a discharge rate up to 8 litres / second and a maximum drop in water temperature between the inlet and the outlet of 5°C, then you do not need a discharge permit. If your proposed discharge is larger than 8 litres / second or will serve more than one house, then you should consult us to determine whether you will need a permit. If your discharge will have substantial dilution in a river, then you may not need a permit for a larger discharge.

If your discharge is from heating for offices, factory or other working building, then you will always need a permit.

You will always need a permit for all discharges of cooling water from air conditioning for any building, both housing and commercial.

Note that if you abstract more than 20 cubic metres / day of water from a river or from the ground for any purpose, you will also need an abstraction licence.

If you need a permit and will comply with the rules set out below, then you may apply for a standard rules permit. If you do not meet the rules, then you must apply for a bespoke permit.

The rules are:

1. **The discharge of water is from heating or cooling use, where the only change is the temperature.**

   If your discharge will contain discharges from other sources, then you do not qualify for this standard permit.

2. **In accordance with a written management system**

   See general guidance

Annex 10 Standard Rules Technical Guidance SR2010 No2.

3. **The maximum daily volume shall not be greater than 1000 cubic metres per day**

   This equates to 11.6 litres / second, if operated continuously. You should calculate your total daily volume from the design flow of your system and the maximum number of hours you will use it during each 24-hour period.

4. **Temperature change between inlet and outlet must be less than 8 degrees Celsius and the temperature of the discharge at the outlet must not exceed 25 degrees Celsius**

   The system should not increase or decrease the temperature of the abstracted water by more than 8°C between the inlet and the outlet to the river and the discharge temperature should not exceed 25°C. These temperature rules are required to protect the plants, fish and other animals in the river. They can be very susceptible to sudden changes of temperature.

   Your permit requires that you install temperature measurement at the inlet and outlet so that you can ensure that you comply with the permit and do not damage the environment.

   You may use a cascade or similar technique to reduce the maximum temperature or temperature difference before discharge to bring the discharge within the rules.

5. **The total daily volume of the discharge shall not exceed 25% of the total daily flow in the receiving water body**

   This rule ensures that your discharge will always receive dilution to ensure that the environmental effect is small. For all but the smallest watercourse, you should have no difficulty in meeting this rule. Note that the dilution requirement only applies to the periods when you will be making the discharge.

6. **The discharge must be to the same water body from which you abstracted the water, located to ensure maximum dilution in the receiving water and not within 200 metres of another cooling or heating discharge.**

   By ‘same water body’, we mean that there is a connection between the water at your abstraction point and your discharge point. Therefore, if it is the same river, or abstraction from a tributary and discharge to the main river, it meets this rule.

   If you abstract from one source, such as a pond or groundwater, and discharge to a stream, then you may introduce water containing different chemical compounds and cause an environmental impact. In many cases, such transfers will be acceptable, but we need to assess the risks through a bespoke permit determination.

   “Located to ensure maximum dilution” means you should avoid backwaters for your discharge and place it close to the main flow in the watercourse.

The rule “Not within 200 metres of another cooling or heating discharge” is to prevent a succession of such discharges having a polluting effect on the watercourse. You may should check for such discharges, but we will inform you if we know that your proposal is too close to another similar discharge. In many cases, if there is substantial dilution, such a discharge will be acceptable, but we need to assess the risks through a bespoke permit determination.

7. Emissions of substances not controlled by emission limits

If you use chemicals to prevent fouling of you pipework, then you must ensure that they are neutralised before discharge to prevent them killing plants and animals in the watercourse. Your system installer will advise on how you should do this.

8. The discharge shall not be made in freshwater within 500 metres upstream from the nearest boundary of an identified bathing water, a designated shellfish water, European Site, Site of Special Scientific Interest (SSSI), National Nature Reserve, Local Nature Reserve or any body of water identified as containing a Protected Species or within 100m upstream from a Local Wildlife site.

See general guidance. You will need to contact us with details of the proposed location of your discharge and we will tell you if it falls outside the specified distance for any of these sites. For a site in tidal water, ‘500 metres upstream’ means within 500 metres by the shortest distance over water in any direction from the nearest boundary of any of these sites. Only sites that are water-based and linked to the receiving water downstream of the discharge point are included in this rule.

9. Records required to be made by these standard rules

Your permit requires that you keep a record of all routine maintenance and repairs and of your checks on temperature. If you have a maintenance contractor, you may ask them to hold the maintenance records, but you must ensure that you can get copies, if necessary, because you are responsible for providing them to us if we request them.

Annex 11 Standard Rules Technical Guidance SR2010 No2.

Annex 11 - Standard rules technical guidance SR2010 No3

Guidance on determining whether your discharge complies with standard rules SR2010No3 -Discharge to surface water: secondary treated domestic sewage with a maximum daily volume between 5 and 20 cubic metres per day

This document sets out all the main standard rules and advises you on how to decide if your discharges meets the rules and qualifies for a standard permit.

The rules are:

1. **In accordance with a written management system**

   See general guidance

2. **The maximum daily volume shall be greater than 5 but not greater than 20 cubic metres per day**

   The maximum daily volume is the theoretical maximum flow that the treatment plant could receive from the connected properties. You must calculate it as defined in “Flows and Loads 3 - Sizing Criteria, Treatment Capacity for Small Wastewater Treatment Systems (Package Plants)” published by British Water (ISBN: 978-1-903481-10-3 Revised 2009). This calculates the maximum number of residents that could be accommodated in the connected properties. For much of the time the actual number will be fewer, but the treatment capacity must be based on the maximum possible load.

3. **The discharge shall only be made to a watercourse that normally contains water throughout the year**

   Larger rivers, lakes and streams will normally meet this criterion, but smaller streams may dry for substantial periods of the year. Without dilution the discharge may accumulate and cause pollution. If the proposed receiving watercourse is small and not familiar to you, you should make enquiries of local residents and land owners as to whether it normally contains water. We accept that streams may dry in exceptional circumstances and we will not consider it a breach of your permit if the watercourse occasionally dries, unless that results in significant pollution.

4. **The sewage shall be solely domestic sewage and contain no trade effluent**

   See general guidance

Annex 11 Standard Rules Technical Guidance SR2010 No2.

5. The sewage shall not contain a significant proportion of rainwater or groundwater

In older properties, roof water and run-off from other hard surfaces may be drained to the same pipes as the foul sewage. Also the foul sewage drain may be cracked under ground. If the water table in the ground is high then large quantities of groundwater may leak into the drain. Both these defects may increase the volume of sewage to several times the foul sewage flow. Small sewage treatment plants rely on retaining the sewage in the plant for quite long periods to provide effective treatment. If you allow large amounts of water into the sewage then the retention time will be greatly reduced and the treatment will not be effective. You may also wash the treatment bacteria out of the plant resulting in a complete failure of treatment.

If you have either of these drainage defects, then you should seek advice from your maintenance contractor on how to remedy the problem.

6. The sewage must have received secondary treatment at a treatment plant designed and constructed to meet the requirements of BS 12566 and sized in accordance with "Flows and Loads 3"

"BS 12566" means BS EN 12566-3:2005 "Small wastewater treatment systems for up to 50 PT. Packaged and/or site assembled domestic wastewater treatment plants" (ISBN: 0 580 47444 5 Publication Date: 15th Feb 2006). Certification to this standard is your assurance that the plant is built to a satisfactory standard and should provide reliable treatment. It is a requirement for all new and replacement treatment plants.

If your plant is older and pre-dates this standard, we will not require you to replace your existing plant as long as it is performing reliably and is consistently producing a good quality discharge.

7. The discharge cannot reasonably, at the time it is first made, be made to an existing foul sewer

See general guidance.

8. The discharge shall not be made into ponds or lakes or freshwater within 1 kilometre upstream from the nearest boundary of an identified bathing water, a designated shellfish water, European Site, Site of Special Scientific Interest (SSSI), National Nature Reserve, Local Nature Reserve or any body of water identified as containing a Protected Species or within 100m from a Local Wildlife site.

See general guidance. You will need to contact us with details of the proposed location of your discharge and we will tell you if it falls outside the specified distance for any of these sites. For a site in tidal water, '1 kilometre upstream' means within 1 kilometre by the shortest distance over water in any direction from the nearest boundary of any of these sites. Only sites that are water-

based and linked to the receiving water downstream of the discharge point are included in this rule.

9. Weekly visual examination - Discharge must be clear, with no adverse visible effect on the receiving water, the bed of the watercourse, or any plants or animals within the watercourse

You should check that the plant is operating correctly and your discharge is not causing any visible pollution. If the plant is not operating or your discharge is causing pollution, then you must call in your maintenance contractor immediately.

If you are applying for a permit for an existing treatment plant, you will need to confirm that you have undertaken these checks for several weeks and that your discharge is operating satisfactorily and has not caused any pollution.

10. Records required to be made by these standard rules

Your permit requires that you keep a record of all routine maintenance and repairs and of your weekly checks on plant operation and discharge appearance. You may ask your maintenance contractor to hold the maintenance records, but you must ensure that you can get copies, if necessary, because you are responsible for providing them to us if we request them.

Annex 12 Setting Upper Tier Limits for Sanitary discharges of BOD and Ammonia

Annex 12 - Setting Upper Tier Limits for Sanitary discharges of BOD and Ammonia

Application of percentile, upper tier and absolute limits

This section addresses how percentile, absolute and upper tier limits are used to control discharges to water and defines how upper tier limits are applied.

Percentile Limits

Percentile limits will normally only be used for water company sewage treatment works effluents. However, when greater operational control is specifically justifiable they may be applied to other process effluents to supplement absolute limits. A revision to this position is currently under consideration. This guidance will be amended once any changes have been confirmed.

(a) UWWTD requires compliance with percentile and upper tier limits specified in the UWWTD Regulations. The relevant limits must be included in the environmental water discharge activity permit for every sewage treatment works (water company or other) with a population equivalent (pe) greater than 2000pe.

Look-up tables will be used as the basis for assessing compliance with percentile limits on a rolling year basis for the sanitary determinands of suspended solids, Biochemical Oxygen Demand (Allylthiourea) [BOD_5(ATU)], and ammonia where these determinands appear in the permit.

Sample compliance assessment is on a determinand by determinand basis. See section 4.2.3

Upper Tier Or Absolute Limits

Water company sewage works will also be subject to Absolute Limits for BOD_5(ATU) and Ammonia, referred to as Upper Tiers, set in accordance with the interim relationships set in compliance with the DoE Upper Tier Guidance, 20th December 1995, given in Tables 1 and 2 below.

The Urban Waste Water Directive (UWWTD) requires that permits for sewage treatment works set absolute ceilings for certain parameters in the effluent, otherwise known as upper tiers. These are designed to prevent incidents of gross pollution; a single sample which exceeds the upper tier would represent a breach.

Annex 12 Setting Upper Tier Limits for Sanitary discharges of BOD and Ammonia

Discharges other than water company sewage works will normally be controlled by Absolute Limits on concentration and flow. In some cases an Absolute Limit on load (concentration x flow) may be required. In these cases it is important to specify the basis of the load calculation - very different values will result from, for instance, instantaneous concentration x instantaneous flow, and 24 hour composite concentration x daily mean flow.

Upper tier limits are to be based on the percentile limits in Tables 1 and 2 below.

Guidance on setting Upper Tier values locally

For upper tier multiples less than those shown in the tables, the multiplier is to be determined locally. The effect is that the tighter the main permit percentile limit, the more latitude needs to be given in setting the upper tier.

Ammonia: where the %ile values are less than 5 mg/l for ammonia, an upper tier limit should be extrapolated from the table. However for values of Ammonia of 3mg/l or less, an upper tier limit of 12 mg/l is normally adequate.

BOD: where the %ile values are less than 13mg/l the value of upper tier required to protect the receiving water depends very much upon the re-aeration characteristics of that water. If dilution is low and the flow in the receiving water *slow-flowing*, an upper tier BOD should be extrapolated from the table. If the receiving water is *fast flowing*, and re-aeration rate therefore higher, the table upper tier of 50mg/l may be adequate at all %ile values less than 13mg/l.

Spot upper tiers should be set to apply under normal operating conditions. For those STWs with environmentally protective permit limits less stringent than the UWWTD, an upper tier multiplier of 2x for BOD should be applied, in line with the Directive. For those STWs with spot limits more stringent that the Directive's composite sample requirements, there would be a range of upper tier multipliers which in the case of BOD would be from 2 to 3.9. Tables 1 and 2 below present this relationship for BOD and ammonia.

Parameters not mandatory in UWWT directive

Permits should contain spot upper tiers for ammonia where appropriate (e.g. for the protection of fisheries) and the basic régime should be the same as for the UWWTD and as reflected in Table 2 below.

Spot upper tiers for suspended solids will only be applied in exceptional environmental circumstances (e.g. the presence of salmonid spawning ground) where the application of a BOD upper tier would not provide

Annex 12 Setting Upper Tier Limits for Sanitary discharges of BOD and Ammonia

sufficient protection. In such circumstances, the value for the upper tier will be decided on a case by case basis.

Smaller sewage treatment works

Smaller STWs are, for the purposes of the UWWT Directive, those with a population equivalent of less than 2,000 for discharges to freshwater and estuaries, and less than 10,000 for discharges to coastal waters. The Directive provides for appropriate treatment to be given by such works. For some small sewage only discharges, permits do not include numeric limits: in these circumstances the question of upper tiers does not arise. Other STWs less than the Directive's cut-off have numeric consents. There is no intention at present to apply upper tiers in any form at smaller STWs, which represent a lower priority.

Annex 12 Setting Upper Tier Limits for Sanitary discharges of BOD and Ammonia

Notes:

1. Bold values are taken from UWWTIG agreed papers Appendix 1 to annex B for both tables.
2. Upper Tier limits for 95ile values *more* than those in the table a 2 times multiplier should be applied.
2. Upper Tier limits for 95%ile values *less* than those in the table the multiplier is to be determined locally. The effect is that the tighter the permit percentile limit, the more latitude needs to be given in setting the upper tier. Guidance on setting these limits locally is given above.

Table 1

BOD 95%ile Limit	**Upper Tier Limit**
13	**50**
14	50
15	50
16	51
17	53
18	54
19	**55**
20	56
21	57
22	58
23	58
24	59
25	**60**
26	61
27	62
28	63
29	63
30	64
31	**65**
32	65
>32	2 x %ile

Table 2

NH_3 95%ile Limit	**Upper Tier Limit**
5	**20**
6	23
7	27
8	30
9	33
10	37
11	**40**
12	41
13	42
14	43
15	44
16	45
17	46
18	46
19	47
20	48
21	49
22	**50**
23	51
24	53
25	54
26	56
27	57
28	58
29	60
30	61
31	62
32	64
33	**65**
>33	2 x %ile

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