Water Use

Regulatory Method (WAT-RM-28)

Modelling for Water Use Activities

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Update Summary

Version	Description
1.0	First issue for Water Use reference using approved content from the following documents: *RM28 - Guidance on SEPA's Approach to Modelling Impacts of Controlled Activities.doc*
v2.0	*Consent* renamed *Licence*, New base template applied, links to docs revised for new SEPA website, Nov 2008
v3.0	Expired CMS links reviewed and updated.

Notes

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

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

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

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1. Key Points

This document provides guidance on modelling discharges and abstractions for:

- *Rivers*, including engineering structures
- *Lochs*, including engineering structures
- *Marine waters*
- *Groundwater*

2. Process Summaries

This section summarises the modelling requirements process for:

- *Discharges to River*
- *Abstractions*
- *Engineering*
- *Marine Environment*

Figure 1 Modelling Requirements for Discharges to a River

STEPS	ACTIONS	REFERENCES
Pre_application Discussion ↓	**EPI** • IMPORTANT: Inform the discharger at the earliest opportunity of SEPA's expectations in terms of discharge modelling.	
Modelling Requirement ↓	**EPI/EAU** • **Registration activities** Modelling not required unless discharge to a protected area needing site-specific conditions. • **Licensed sewage and organic trade discharges (p.e. <100)** Modelling only required where the dilution <100:1 (or <200:1 depending on additional pollution pressures. See *WAT-RM-03* for guidance) • **All other discharges (p.e. >100 and inorganic trade)** Modelling is required to calculate numeric consent conditions.	• WAT-RM-03 • CAR Practical Guide • When to model ? (section 4.1.1)
Collection of Data ↓	**EPI** • **Basic information required** Prior to mathematical modelling, collate basic details on the discharge and receiving environment, including flow information, if available, and details of other abstractions, impoundments and discharges in the water body.	
Obtaining Flow Information ↓	**EPI/Hydrology** • If real flow information is not available from hydrology then Low Flows 2000 should be used to calculate flow information.	
Discharge from a sewerage System?	**YES**: Go to WaPUG Guidance **NO**: Go to next step (Multiple interacting discharges)	
Multiple interacting discharges (Organic / non-organic)?	**YES**: Go to More complex catchment **NO**: Go to next step (Single discharge) • Interacting discharge is when conditions for a licence application can not be calculated without taking decisions at upstream discharges. See *WAT-SG-02* for more detail.	• WAT-SG-02 • Multiple interacting discharges (4.2.2)
Single Discharge ↓	**EPI** Monte Carlo mass balance modelling required • If real data is not available estimates will be required using low flows 2000 • Estimates for water quality using similar rivers, mid-point of classification or downstream data • Estimated inputs to the model produce less reliable outputs so whenever possible applicant should obtain real time flow and quality data.	• WAT-SG-02 (section 3.2) • Single licensed discharges (4.2.1)
Single Discharge ↓	**EPI** Monte Carlo mass balance modelling required • If real data is not available estimates will be required using low flows 2000 • Estimates for water quality using similar rivers, mid-point of classification or downstream data • Estimated inputs to the model produce less reliable outputs so whenever possible applicant should obtain real time flow and quality data.	• WAT-SG-02 (section 3.2) • Single licensed discharges (4.2.1)

More Complex Catchment	**EPI/EAU**
	More complex catchment modelling to be considered – discuss with Environmental Assessment Unit (EAU)
	• Use of catchment modelling is likely to be reserved for situations which are either:
	  ○ Complex in nature (i.e. interaction of multiple discharges and management options), and/or
	  ○ Significant in terms of the potential capital outlay or environmental risk.	

WaPUG Guidance	**EPI**
	Advise applicant that SEPA expects model to adhere to WaPUG guidance.
	• WaPUG provides a Code of Practice for hydraulic modelling of sewers and for river modelling
	• Inform applicant that application must be submitted along with:
	  ○ Paperwork relating to validation of the model
	  ○ Justification of model outputs e.g. what info was fed in
	• Once model is received pass it to EAU
		• WAPUG Code of Practice
		• Discharges from Sewerage System (4.2.4)

Does system contain intermittent wet weather discharges ?	**YES**: Go to next step (UPM Study) **NO**: Go to Review • For info on CSOs, refer to WAT-RM-07 in addition to guidance below.	• WAT-RM-07
UPM Study Required ↓	**EPI/EAU** Seek advice from EAU - UPM study is required even for new systems with no identified problems. • UPM is a range of approaches from simple desktop assessment to detailed dynamic models.	• UPM Manual • UPM Study Requirements (4.3)
Review ↓	**EPI/EAU** Review submitted water modelling and supporting docs. • EAU review the modelling data received.	

Figure 2 Modelling Requirements for Fresh Water Abstractions

STEPS	ACTIONS	REFERENCES
Pre_application Discussion ↓	**EPI/SWRO** • IMPORTANT: Inform the discharger at the earliest opportunity of SEPA's expectations in terms of modelling of an outfall.	
Modelling Requirement ↓	**EPI** • **Abstractions <10 m3/day** : Follow the GBR only • **Abstractions 10 to 50 m3/day** Registration-level activities do not require modelling, including conceptual modelling. Possible exception where the abstraction is from a protected area or a water body which is at risk of not achieving good status, or is already below good status. • **Abstractions >50 m3/day** New and modified abstractions >50 m3/day will require a conceptual model and mathematical modelling for the more complex situations	• When to model ? (section 4.4.1) • Abstractions from Lochs (section 5.2) • Abstractions from Marine Waters (section 6.3)
Conceptual model ↓	**EPI** **How to build a conceptual model** • For all licensable activities and for those registration activities mentioned above, the first step is to collate basic details on the discharge and on the receiving environment including flow info if available and details of other abstractions, impoundments and discharges in the water body. This is a conceptual model and can vary in complexity depending on need and it can develop further as the steps below are carried out. • The conceptual model should highlight other existing abstractions in the water body and where there may be areas of conflict due to there being insufficient water available for all proposed and existing activities. In such cases, follow the **Local Knowledge Test (Stage 1)** guidance in WAT-RM -01.	• Conceptual model (section 4.4.2) • WAT-RM-01
Obtaining Flow Information ↓	**EPI/Hydrology** **Obtain flow information from Hydrology** • It may be obvious from a conceptual model that there is insufficient flow in the river to support the abstraction. ○ Discuss with senior water resource officer if required. • If it appears that there is sufficient flow to support the abstraction then accurate flow information will be required as part of numeric modelling.	

Numeric Modelling ↓	**EPI/Applicant**
	A wide variety of tools and methodologies are available for many different purposes connected with water resources management.
	• Examples of possible models that can be adopted are:
	  ○ SWALP
	  ○ WEAPMODFLOW
	• The decision about selecting a specific model should be done in consultation with Senior WR officers, SEPA hydrology and the applicant.
	• The selection of specific numeric models depends on a number of factors, such as data availability, additional data gathering, software cost, modelling complexity, training requirements, etc.
		• Numeric Modelling (section 4.4.4)

Review	**EPI/SWRO** Applications received which contain modelling info should be passed to the senior water resource officers	

Figure 3 Modelling Requirements for Engineering Activities

STEPS	ACTIONS	REFERENCES
Pre_application Discussion ↓	**EPI** • IMPORTANT: Inform the discharger at the earliest opportunity of SEPA's expectations in terms of modelling for an engineering proposal.	• WAT-RM-02
Request Basic Information ↓	**EPI** Basic information required includes: • Type of engineering structure • Location, size • Reason for proposal • Other designs which were considered • River typology The ecological status and conservation status should be available via SEPA's GIS system.	
Conceptual Model ↓	**EPI** • Prior to carrying out any assessment of impact from the engineering activity, a detailed conceptual model must be constructed which allows an initial assessment on the feasibility of the proposal. • The conceptual model should include the basic information and details of the water body classification, other engineering modifications, discharges and abstractions in the water body and/or adjacent water bodies that might be affected.	• CAR Practical Guide

Impact Assessment ↓	**EPI/Hydrology**
	• A more detailed assessment is required for licensed, and possibly registration, activities that lie within a protected area. See *Impact Assessment and Monitoring Techniques* for details.
	  ○ Table 1 (p10): Lists geomorphological techniques available to assess the impact of various activities
	  ○ Table 2 (p12): Including explanatory notes, gives guidance on the most suitable technique to use depending on the activity proposed.
	• The applicant is expected to carry out the assessment with SEPA's engineering officers auditing it.
		• Impact Assessment and Monitoring Techniques

Further Assessment ↓	**EPI/Engineering Specialist** • Receipt of application containing geomorphic technical assessmentIf real data is not available estimates will be required using low flows 2000 • Assessment by engineering team/officers	

Figure 4 Modelling Requirements for the Marine Environment

STEPS	ACTIONS	REFERENCES
Pre_application Discussion ↓	**EPI** • IMPORTANT: Inform the discharger at the earliest opportunity of SEPA's expectations in terms of modelling for a marine discharge.	
Modelling Requirement ↓	**EPI** • **Prior to mathematical modelling** Collate basic information on the discharge and receiving environment, including o Discharge and flow information if available o Details of other abstractions, impoundments and discharges in the water body. • **Mathematical modelling** Mathematical modelling is required for the following new or modified marine discharges: o New and modified sewage discharges with a p.e. of >100 o Significant industrial discharges (e.g. >100 p.e. and/or contains priority substances or specific pollutants) • However, particular circumstances may require modelling of discharges below the above thresholds, e.g. discharge to a shallow enclosed bay.	• WAT-SG-11 • When to Model for Marine Waters (section 6.1.1)
Confirm Effluent Composition ↓	**EPI/Applicant** Confirm what substances will be in the effluent, such as Priority substances • Applicant should be able to provide a list of all substances that would be expected to be in the effluent. • See look-up table in *WAT-SG-05* to check for any that have been missed	• WAT-SG-05 • WAT-RM-14
Receiving Environment ↓	**EPI/Hydrology** • Check GIS for any designated marine protected areas in vicinity of the receiving environment. • Receiving waters which have been identified as requiring compliance with microbiological environmental quality standards must also comply with guidance in *WAT-RM-13* and *WAT-SG-11*	• GIS • WAT-RM-13 • WAT-SG-11 • Microbiological Conditions of Receiving Environment (section 6.1.3)
Environmental Standards ↓	**EPI** Once all this information has been collected then this can form the basis of the model. • Any other discharges or abstractions in the water body/ies should be considered. • An initial assessment on the proposed discharge can then be made. • Discharges require to be modelled to demonstrate compliance with relevant EQSs for the receiving water.	• Regulatory Standards • WAT-RM-28 (section 6)
Determine Conditions ↓	**EPI/Marine Modellers** • Having collected the above information, discuss with marine modellers if required. • Advise discharger to follow SEPA guidance.	• WAT-SG-11
Review ↓	**Marine Modellers/Hydrology** • Model and supporting documents should contain the information and reporting requirements specified in SEPA's modelling guidance • Electronic copies should be submitted where possible. Two paper copies are required where sewer modelling has been carried out.	

3. Purpose

This guidance is intended for use by SEPA staff and by those wishing to apply for a CAR authorisation for a point source, abstraction or engineering activity. It provides an overview on the procedures to follow, to ensure that all of SEPA's modelling requirements are met.

3.1 Introduction

When dealing with applications for new activity, SEPA must determine whether the authorisation will contain numeric standards and if so modelling will be required to ensure the appropriate licence conditions are set. Modelling is not routinely required on licences which only contain descriptive conditions however it is required for combined sewer overflows and emergency overflows.

The level of modelling required can be simple or complex (such as a hydrodynamic model). The level of complexity used will depend on the behaviour of the discharge components, the scale of the discharge/abstraction and the sensitivity of the receiving media. To determine this, a conceptual model can be used, as described below.

3.2 Modelling Types

3.2.1 Conceptual Modelling

In the early stages of considering an application for a CAR Authorisation, such as an abstraction, and before commencing any numeric modelling, it is vital that all readily available information is put together to create a basic picture of the impacts on the receiving environment, so that an initial assessment of the application can be made. This is called a conceptual model. It may include information on discharge or abstraction volumes, type of receiving environment, other activities in the area etc. Some of this information e.g. volume to be abstracted, will already have been used as part of the risk assessment to determine the level of authorisation to apply for however in the conceptual model it is used to build up a picture of the activity and impacted environment to understand what conditions are required for the authorisation.

3.2.2 Numeric Modelling

Numeric models are typically computer based methodologies, which use environmental and discharge/abstraction data to help arrive at the appropriate numeric licence conditions and predict the concentration of a parameter in the environment from a given activity e.g. discharge.

It is important to recognise the limitations of the model and the reliability of the data that went into it and take these into consideration when viewing the results.

3.3 Who Should Carry out the Numeric Modelling?

Single discharges to rivers may only require the use of Monte Carlo Simulation which SEPA's EPI staff will carry out.

For more complex discharges to marine, fresh water, ground water and for abstractions, SEPA would expect the applicant or their consultant to carry out the modelling which must comply with SEPA'S modelling requirements as described in the sections below. For this reason it is important that the applicant engages in discussions with SEPA at early design stages to ensure that SEPA's modelling requirements are met. It is important therefore to discuss modelling requirements at the pre application stage.

4. Modelling for Rivers

4.1 Discharges to Rivers

When processing an application for a discharge to a river, Figure 1) gives an overview of modelling considerations that must be taken into account. Additional general guidance is given below however the detailed technical information is contained in *WAT-SG-02: Modelling Continuous Discharges to Rivers* which should be read in conjunction with this document when undertaking or advising on modelling.

When calculating discharge flow volumes use *Flows and Loads* (British Water Code of Practice) to obtain a figure for litres per head per day from domestic, industrial and other sites.

When calculating the flow for a combined sewer overflow however a figure of 150l/head/day should be used with an accurate infiltration figure and otherwise a figure of 50l/head should be used.

4.1.1 When to Model?

Modelling of discharges to fresh water varies from Monte Carlo Simulation to complex catchment modelling and models that are developed by the discharger.

For all GBR activities, modelling is not required unless the activity has been risk assessed to a higher activity category.

Registration activities are considered to be relatively low risk activities and modelling should not be undertaken unless there are particular environmental concerns e.g. the discharge is within a constrained or protected area depending on the reason for the designation. For sewerage discharges e.g. septic tanks <15 p.e. refer to *WAT-RM-03: Regulation of Sewage Discharges to Surface Waters* which gives guidance on the level of treatment required depending on the dilution available in the water course.

For licensed sewage activities and other organic discharges with a p.e. < 100, refer to *WAT-RM-03* which states that where there are other development pressures and no designated areas then:

- If dilution > 400:1, then primary/septic tank treatment is satisfactory (presumption of a partial soakaway).
- If dilution >200:1 and <400:1, then secondary treatment with a default single tier BOD standard of 50mg/l would normally be appropriate.
- If dilution <200:1, then the discharge is of higher risk and modelling should normally be undertaken as described below.

For locations where no other developments resulting in polluting discharges are anticipated and the discharge is not to a designated area, then the guidance states that

- If dilution > 400:1, then primary/septic tank treatment is satisfactory (presumption of a partial soakaway).
- If dilution >100:1 and <400:1, then secondary treatment with a default single tier BOD standard of 50mg/l would normally be appropriate.
- If dilution <100:1, then the discharge is of higher risk and modelling should normally be undertaken.

For all sewage discharges with a population equivalent > 100 and for all other discharges e.g. inorganic trade discharges, modelling should be undertaken to calculate the licence conditions.

The modelling requirements for single and multiple interacting discharges differ as set out below.

4.2 Appropriate Types of Modelling

4.2.1 Single Licensed Discharges

Where a single point source discharge e.g. from a factory or STW is proposed and there are no other discharges with which it interacts, then Monte-Carlo Simulation will be used to calculate the licence conditions. This can be performed by SEPA's EPI staff.

Monte Carlo Simulation can be used to calculate the down stream impact of a discharge or to determine discharge flow and/or quality needed to meet the downstream river quality target. When this modelling is carried out, to achieve reliable results, real data of adequate quality should be used. The recommended minimum data set being 36 data points over 3-4 years. Where real data is not already available, then the possibility of obtaining real time flow and quality data should be discussed with the applicant even where this may mean delaying the application. If this is not possible then estimates will be required for flows, using low flows 2000 and for water quality using data from a similar river, mid point of the classification or down stream data. Refer to *WAT-SG-02* for further information on data use (Data Collection and Analyses).

Where inputs to the model have been estimated then the outputs are less reliable and this should be taken into account when considering the results.

For guidance on using a Monte Carlo Simulation refer to *WAT-SG-02* (see Monte Carlo simulation).

4.2.2 Multiple Interacting Discharges

Where it has been determined that the discharge applied for interacts with other existing or proposed discharges then more complex, catchment modelling should be considered e.g. SIMCAT or TOMCAT. This would be for example where

- A decision cannot be made on one discharge without considering possible changes to up stream discharges or,
- Decisions cannot be made on a discharge without considering action to control diffuse pollution.

It should be noted that in nearly all cases good decisions can be made without a catchment model and the use of such modelling is likely to be reserved for situations which are either complex in nature (i.e. interaction of multiple discharges and management options) and/or significant in terms of the potential capital outlay or environmental risk.

For further information, refer to the *Catchment section* of *WAT-SG-02* and contact SEPA'S Environmental Assessment Unit to discuss the best way forward.

4.2.3 Existing Discharges

Where changes are made to the flow volume or pattern, constituents or site of an outfall pipe, of an existing licensed discharge, then SEPA must be informed of these changes which are likely to lead to a licence review. All previous modelling information should then be collected and the responsible person or their representative should discuss with SEPA whether the changes mean that the discharge should be remodelled.

4.2.4 Discharges from the Sewerage System

Discharges from a sewerage system will require to follow the WaPUG *Code of Practice*, which contains good practice guidance on

- Hydraulic Modelling of sewers
- River Modelling guide
- River Data collection guide
- CSO design guide

The Design of CSO Chambers to Incorporate Screens
Guide to the quality modelling of sewer systems
River data collection guide
River modelling guide
Integrated urban drainage modelling guide

Where wet weather (intermittent) discharges are to be made from the sewerage system then the UPM procedure should be followed to identify the level of investigation required, WAPUG guidance is particularly relevant to aid the development of river models for use in UPM studies.

4.3 UPM Study Requirements

SEPA will expect the use of the UPM procedure, as described in the *Urban Pollution Management Manual*, for existing unsatisfactory and all new applications for licence for intermittent wet weather urban wastewater discharges. Where an environmental problem related to urban wet weather wastewater discharges has been identified from an existing network in a specific catchment area, improvement options need to be identified. The Urban Pollution Management (UPM) Manual provides a procedure for carrying out this work. This procedure and any associated modelling is normally carried out by the applicant or by a consultant on their behalf and can range from a simple desktop assessment up to detailed dynamic models.

There are 3 main concepts of the UPM procedure:

- It treats all discharges within a wastewater system i.e. sewer system, the treatment plant and the receiving water as interdependent.
- The modelling process is aimed at demonstrating the compliance of a scheme with the standards identified by the regulator.
- The level of modelling complexity will be proportionate to the technical needs of a study and as mentioned above may be as simple as a desk top exercise.

SEPA will expect models used within the UPM study to comply with good practice as detailed in the latest version of the *Code of Practice for the Hydraulic Modelling of Sewers*.

SEPA will also expect the modelling outputs for a system to be accompanied by information relating to the validation of the model and details of the data used within the model e.g. how were river flows, discharge flows and effluent quality derived as the model outputs will be less reliable where estimated data has been used.

SEPA's Environmental Assessment Unit (EAU) will audit the modelling information it receives as part of a licence application.

4.3.1 In-sewer Modelling

In sewer modelling is used to predict where spills occur within a sewerage system during different rainfall events. As this uses rainfall data these models will be assessed, once received as part of a licence application, by SEPA's hydrology department. Guidance on sewer modelling is found within the *WAPUG Code of Practice*.

4.4 Abstractions from Rivers

This section is still being developed.

When considering SEPA's modelling requirements for an abstraction from fresh water, Figure 2 gives an overview of the procedure to follow with more detail in the text below.

4.4.1 When to Model?

To determine environmental capacity (i.e. the proportion of flow or water storage that can be abstracted), set up mitigation measures (i.e. compensate the negative impacts of changes in flow or storage) and equitably allocate water between upstream and downstream stakeholders, modelling of the catchment hydrology may be required.

This can be done simply using conceptual models or more complex computer, water modelling depending on the complexity of the situation.

Computer models can be powerful tools to interactively simulate different abstraction scenarios, which can inform the decision making process.

Abstractions of 10 – 50 m^3/day i.e. registration category will not require modelling including conceptual modelling, except where a risk has been identified through risk assessment procedure e.g. a protected area or a water body which is at risk of not achieving good status or is already below good status.

For new and modified abstractions > 50 m^3 per day i.e. licensing category, SEPA will require at the very least conceptual modelling to be carried out. Mathematical models are required for the more complex situations both are detailed below.

Larger complex applications such as for Scottish Water potable water supply, may already be subject to a water resource plan. More info required from WR TT or a reference

4.4.2 Conceptual Model

For an initial assessment of the application and before commencing any numerical simulation, a detailed conceptual model must be built of the catchment and/or the water bodies. This should include other discharges and abstractions on the water bodies and adjacent ground water body if relevant to describe pressures and impacts related to the proposed abstraction. The conceptual model can contain as much detail as is thought to be necessary and can be built upon as the application is progressed. If available, river flow data can be included, obtained from SEPA's Hydrology Department if not Low Flows 2000 should be used to calculate estimated flow levels.

It may be obvious from a conceptual model that there is insufficient flow in the river to support the abstraction e.g. a large hydropower scheme in a small headwater. This should be discussed with a senior water resource officer if required.

4.4.3 Obtaining Flow Information

If it appears that there is sufficient flow to support the abstraction then accurate flow information will be required as the application/ proposal should be considered further.

4.4.4 Numeric Modelling

Undertaking numerical modelling of the water resources of a catchment would normally consist of the following steps:

1. Data Collection- Wide range of data is required normally over a long historic period 20 – 30 yrs
2. Conceptual modelling -as above
3. Water Balances – quantitative test of the conceptual model
4. Numeric Modelling – the model itself
5. Data Requirements

There is a wide variety of tools and methodologies available for water resources management. The decision about selecting a specific model should be done in consultation with Senior WR officers, SEPA hydrology and the applicant. The selection of specific numeric models depends on a number of factors, such as data availability, additional data gathering, software cost, modelling complexity, training requirements, etc

For more information on modelling, refer to *WAT-RM-27: Modelling Methods for Groundwater Abstractions*.

4.5 Engineering Activities in the Vicinity of a River

When processing an application for an engineering activity in the vicinity of a river, Figure 3 gives an overview of modelling considerations that must be taken into account.

5. Modelling for Lochs

5.1 Discharges to Lochs

Freshwater lochs are subject to phosphorus inputs from both diffuse and point sources. Since phosphorus is usually the key limiting nutrient in freshwater systems it is important to evaluate the changes that may occur if a new development has the potential to increase the Total Phosphorus load in a given loch. Guidance on a methodology for modelling the impacts of new fish farms and forestry developments in lochs is provided in *WAT-RM-37: Regulation of Phosphorus Discharges to Freshwater Lochs*. This methodology is currently used mainly by HIG with similar methods in use in other regions. The guidance is to be adapted in the near future to make it national.

There is no modelling method currently available for modelling the impacts of nitrogen inputs to lochs.

NOTE: Information on Discharges to Lochs will be

5.2 Abstractions from Lochs

No information available at present. For up-to-date details contact Ecology.

5.3 Engineering Structures in Lochs

No information available at present. For up-to-date details contact the Ecology Unit Manager.

6. Modelling for Marine Waters

6.1 Discharges to Marine Waters

When processing an application for a discharge to marine waters, Figure 4 gives an overview of modelling considerations that must be taken into account. Additional guidance is given below.

When calculating discharge flow volumes use *Flows and Loads* (British Water Code of Practice) to obtain a figure for litres per head per day from domestic, industrial and other sites.

When calculating the flow for a combined sewer overflow however a figure of 150l/head/day should be used with an accurate infiltration figure and otherwise a figure of 50l/head should be used.

6.1.1 When to Model for Marine Waters

Modelling will vary from a desktop exercise to mathematical modelling tools depending on the complexity of the proposal.

Mathematical modelling is required for the following:

- New and modified sewage discharges with a p.e. of >100
- Significant new or modified industrial discharges. Existing discharges should only be re-modelled if previous modelling data does not satisfy SEPA's modelling requirements as set out in *WAT-SG-02* and *WAT-SG-11: Modelling Coastal and Transitional Discharges* or if there is a history of non-compliance with existing or revised standards.
- Discharges to identified Shellfish growing waters.

It should be noted that some site specific conditions will result in variations from the above rules.

6.1.2 Collection of Basic Information

The following information will be required by the marine modellers to assess the proposal:

- What substances will be in the effluent e.g. priority substances
- The volume and flow pattern of the effluent
- Information regarding any specific requirements of the receiving environment e.g. is it a protected area?
- The standards to be met in the environment
- Data about the receiving waters, e.g. currents, tidal elevations
- Any available information about the discharge hardware, depth/ size orientation of the pipe

Having collected the above information the marine modellers should be consulted unless the consultant or the discharger feel confident about the chosen methodology.

The discharger should then be advised to follow the guidance in *WAT-SG-11: Modelling Coastal and Transitional Discharges* which outlines some models that can be used to calculate initial dilution and also sets out minimum requirements for mixing zones for sewage discharges >100 population equivalent and 'significant' new or modified industrial discharges.

The requirements for initial dilution, set as 95%iles, are:

- x 100 for primary treated sewage effluent
- x 50 for secondary treated sewage effluent (> 100pe)
- x 50 for industrial effluents, case-specific dependent on treatment, etc

6.1.3 Microbiological Condition of the Receiving Environment

The most practical and cost effective method of ensuring that the relevant microbiological environmental standard is achieved by a licence limit is by modelling the initial dilution, dispersion and microbiological inactivation of the discharged effluent. For a full assessment to be made, the model has to be capable of multiple runs under different conditions to allow for a percentile compliance test to be simulated. Such models should be appropriate to the scale of the development and must comply with *WAT-SG-11: Modelling Coastal and Transitional Discharges*.

6.1.4 CSOs Discharging to Marine Waters

The level of modelling required to determine CSO discharges to coastal and transitional waters, is dependant on the significance of the discharge including the designation of the receiving water. Sewer modelling will also be required for medium and high significance discharges, this modelling data should be assessed by SEPA's hydrology section for verification of the rainfall data contained within it.

Where an environmental problem related to urban, wet weather, wastewater discharges has been identified from an existing network in a specific catchment area improvement options need to be identified. The *Urban Pollution Management Manual* provides a best practice guide for carrying out this work although not mandatory. The modelling is normally carried out by the applicant or by a consultant on their behalf.

There are 3 main concepts of the UPM procedure

- All discharges within a wastewater system i.e. sewer system, the treatment plant and the receiving water are interdependent.
- The modelling process is aimed at demonstrating the compliance of a scheme with the standards identified by the regulator.

- The level of modelling complexity will be proportionate to the technical needs of a study.

SEPA will expect models used within the UPM study to comply with good practice as detailed in the *River Modelling Guide* (WaPUG).

SEPA will also expect the modelling outputs for a system to be accompanied by information relating to the validation of the model and details of the data used within the model e.g. how discharge flows and effluent quality has been derived as the model outputs will be less reliable where estimated data has been used.

For further information on model type, calibration and specific information re coastal waters and sea lochs refer to *WAT-SG-11: Modelling Coastal and Transitional Discharges* (sections 3, 4 & 5*)*.

6.1.5 Existing Discharges

Where changes are made to the flow volume or pattern, constituents or sighting of an outfall pipe of an existing licensed discharge then SEPA must be informed of these changes which are likely to lead to a licence review. All previous modelling information should then be collected and the applicant should discuss with SEPA whether the changes mean that the discharge should be remodelled.

6.1.6 In-sewer Modelling

In sewer modelling is used to predict where spills occur within a sewerage system during different rainfall events. As this uses rainfall data these models will be assessed when received as part of a licence application, by SEPA's hydrology department. Guidance on sewer modelling is found within the Urban Pollution Manual.

Once the application has been submitted to SEPA the marine modelling section will audit the modelling data supplied.

6.2 Fish Farm Discharges to Marine Waters

Refer to the SEPA *Aquaculture* website for information on the modelling methodology used to assess appropriate licence limits.

Information is available on the following:

- Appropriate licence limits for In-feed Sea Lice treatment medicines
- Appropriate licence limits for farm maximum biomass

6.3 Abstractions from Marine waters

Normally an abstraction from coastal water will not pose a significant environmental risk due to the small proportion of flow abstracted. For those

that do pose a risk to the environment see section above on modelling abstractions from rivers as the method used is the same.

7. Modelling for Groundwater

7.1 Modelling Discharges to Groundwater

The requirements of the Groundwater Directive and the Groundwater Regulations 1998 will be fulfilled by the Controlled Activities Regulations. Details of these requirements can be found on the Groundwater Intranet Site but in general the Groundwater Regulations aim to prevent entry of List I substances into groundwater and prevent groundwater pollution by List II substances. The listed substances are the same as those from the Groundwater Directive.

To achieve this, the regulations require that the direct or indirect discharge of list I or II substances must be subject to prior investigation and authorisation. The regulations also allow notices to be served to control activities which might lead to an indirect discharge of List I substances or groundwater pollution by an indirect discharge of substances in List II.

A direct discharge to groundwater is one which discharges directly to the saturated zone, for example down a borehole or via a poorly designed infiltration system (also known as a soakaway).

An indirect discharge to groundwater is one where the effluent percolates through the soil and strata before reaching groundwater for example via an infiltration system to the unsaturated zone or the disposal of trade effluent to land.

7.1.1 Standards for Direct/Indirect Discharges to Groundwater

To ensure that groundwater is adequately protected when authorising discharges follow the guidance set out in:

- *WAT-RM-04: Regulation of Indirect Sewage Discharges to Groundwater*
- *WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater*

7.2 Modelling Abstractions from Groundwater

Modelling of abstractions from groundwater is used to assess the environmental sustainability of the abstraction. They may be constructed to analyse the groundwater resource potential or to evaluate the impacts of the abstraction upon specific water features. Initially conceptual modelling should be undertaken which may lead to mathematical modelling. All modelling should comply with *WAT-RM-27: Modelling Methods for Groundwater Abstractions*.

References

NOTE: Linked references to other documents have been disabled in this web version of the document.

See the Water >Guidance pages of the SEPA website for Guidance and other documentation (*www.sepa.org.uk/water/water_regulation/guidance.aspx*).

All references to external documents are listed on this page along with an indicative URL to help locate the document. The full path is not provided as SEPA can not guarantee its future location.

Regulatory Methods and Guidance

WAT-RM-03: Regulation of Sewage Discharges to Surface Waters

WAT-RM-04: Regulation of Indirect Sewage Discharges to Groundwater

WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater

WAT-RM-27: Modelling Methods for Groundwater Abstractions

WAT-RM-37: Regulation of Phosphorus Discharges to Freshwater Lochs

WAT-SG-02: Modelling Continuous Discharges to Rivers

WAT-SG-11: Modelling Coastal and Transitional Discharges

Other Documents

Aquaculture (www.sepa.org.uk)

Flows and Loads British Water Code of Practice (www.britishwater.co.uk/)

Urban Pollution Management Manual Third Edition, Foundation for Water Research (www.fwr.org)

Code of Practice (for Hydraulic Modelling of Sewers) WaPUG (www.ciwem.org/)

River Modelling Guide WaPUG (www.ciwem.org/)

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