Irish Water

TECHNICAL STANDARD

STORM WATER OVERFLOWS

Document Number: IW-TEC-800-03

Revision: 1.0

RECORD OF CHANGES AND AMENDMENTS

Amendment Number	Amendment Date	Author	Initials	Brief Summary of Change	Document Version Number
1	25/09/2017	Wastewater & Sludge Strategy	MG/DMcM/KK/ RK	Approved WTEF	1.0

FOREWORD

GENERAL PURPOSE

The Irish Water Standards and Specifications suite of documents describes the minimum standards to be achieved by those engaged in the Design, Construction and Installation of Irish Water assets.

GENERAL SCOPE

The Irish Water Standards and Specifications shall apply to all new assets and to all existing assets undergoing refurbishment, replacement or expansion.

The design guidance outlined in this Technical Standard is Irish Water's required practice and shall be followed unless there is a valid reason for deviating from it. Any deviation shall be notified in writing to Irish Water and shall not be put in place without the written approval of Irish Water.

RESPONSIBILITY

The responsibility for ensuring compliance with the Irish Water Standards and Specifications shall lie with Designers and Contractors. Irish Water reserve the right to inspect all assets at any time to ensure compliance with the Standards and Specifications is being achieved.

The design guidance outlined in this Technical Standard is Irish Water's required practice and shall be followed unless there is a valid reason for deviating from it. Any deviation shall be notified in writing to Irish Water and shall not be put in place without the written approval of Irish Water.

REFERENCES

The Irish Water Standards and Specifications may make reference to external documentation (e.g. National Standards Authority of Ireland (NSAI) Standards, British Standards (BS), etc.) which are deemed to form part of the Standards & Specifications. It shall be the responsibility of the Designers and Contractors to obtain copies of all referenced external documentation where this is necessary to ensure compliance with the Standards and Specifications. The most recent version of all external documentation is to be used.

IMPLEMENTATION OF CHANGE

Irish Water reserves the right to implement change at any time to this Technical Standard. Such changes may be required through a change in National Legislation, internal Policy or Strategic Direction. Any changes to the Technical Standard will be taken through the relevant Irish Water change process/governance procedures and these changes or amendments will be notified to all appropriate stakeholders.

CONTENTS

LIST OF ACRYOMNS

ATEX - Appareils destinés à être utilisés en **AT**mosphères **EX**plosibles.

CESWI – Civil Engineering Specification for the Water Industry

CSO – Combined Sewer Overflow = Storm Water Overflow (SWO)

DWF – Dry Weather Flow

EO – Emergency Overflow

EQS – Environmental Quality Standard

LCC – Life Cycle Costs

PCRSWOs - "Procedures and Criteria in Relation to Storm Water Overflows" by the DoEHLG, (1995).

PE – Population Equivalent

PFF – Pass Forward Flow

RAM – Remote Asset Management

SUDs – Sustainable Drainage Systems

TSR – Time Series Rainfall

UWWTD – Urban Wastewater Treatment Diective

WLC – Whole Life Costs

WIMES – Water Industry Mechanical and Electrical Specifications

WWDA – Waste Water Discharge (Authorisation)

WWTP – Wastewater Treatment Plant

1. PURPOSE

The purpose of this Technical Standard is to produce a formal document that ensures the delivery of consistent new Storm Water Overflows that meet the regulatory obligations. The Technical Standard will also be used in the upgrade of existing Storm Water Overflows (SWOs).

The licencing of SWO's under the Waste Water Discharge (Authorisation) Regulations, SI No. 684 of 2007 requires that Storm Water Overflows are assessed and designed in accordance with "Procedures and Criteria in relation to Storm Water Overflows" (PCRSWOs) by the DoEHLG, (1995).

The purpose of this technical standard is to provide guidance and interpretation of the above DoEHLG document on the assessment, compliance and design of Storm Water Overflow's.

This Technical Standard also covers SWO Screening and Monitoring requirements which are not covered by the DoEHLG document.

Under the current Wastewater Discharge (Authorisation) Regulations 2007, Irish Water has the responsibility to provide the required level of wastewater collection and treatment prior to discharge to the environment. The Regulations, through a agglomeration Wastewater Discharge Authorisation (WWDA) Licence (>500 PE) or Certificate (≤500 PE), prescribe the quality standards to be applied, the relevant supervision required and the enforcement procedures in relation to the discharges.

This Technical Standard will guide the designer and / or contractor in establishing engineered solutions that deliver robust, reliable and repeatable performance that meets Irish Water's objectives for Storm Water Overflows.

The Technical Standard describes requirements for Storm Water Overflows. While the Technical Standard is provided to convey Irish Water's specific baseline requirements with regard to Storm Water Overflows, the appointed designer or contractor will retain the role of detailed system designer and each design will be carried out on a site specific basis, accounting for all constraints and restrictions therein.

Where the term Whole Life Cost (WLC) is referred to in this document it shall include all costs incurred throughout the service life of the Storm Water Overflow such as design and capital costs, operating costs, depreciation, and disposal costs. It shall also include environmental impact and social costs.

Where the term Life Cycle Cost (LCC) is referred to in this document this refers to the total costs incurred throughout the service life of a screen system including capital, installation and commissioning, energy, operating, maintenance, unplanned downtime, environmental and decommissioning costs.

Where appropriate, this Technical Standard will make reference to the relevant Water Industry Mechanical and Electrical Specifications (WIMES) which have been adopted by Irish Water in a bid to ensure a baseline quality standard of system design and installation across all categories of Storm Water Overflows. For this Technical Standard, the user should make reference to the WIMES documents and associated Irish Water amendments (see Reference section).

The aforementioned WIMES documents shall form the basis of equipment selection, installation and testing for all Storm Water Overflow installations and, in tandem with this document, should be used as a reference point by the designer / contractor to ensure compliance with Irish Water requirements. Where additional information is required, the designer may also refer to the following Irish Water documents:

- *General M&E Specification IW-TEC-200-01*
- *General M&E Specification Notes for Guidance IW-TEC-200-02*

For civil engineering works the specification requirements of CESWI with Irish Water Supplementary Clauses shall apply as listed below.

- General Civil Engineering Specification IW-TEC-300-01
- General Civil Engineering Specification Notes for Guidance IW-TEC-300-02

Where conflicts between these documents occur, the Irish Water Standards shall take precedence.

This Technical Standard will remain in place until such time as the Irish Water Storm Water Overflow Policy is both finalised and implemented under the Tier 2 Wastewater Compliance Strategy, in consultation with national stakeholders and aligned with national policy requirements and regulations.

2. SCOPE

This Technical Standard sets out Irish Water's requirements for all new Storm Water Overflows and for the refurbishment and upgrading of existing Storm Water Overflows (including Storm Water Overflows at WWTP's) subject to the provisions outlined below.

This Technical Standard does not apply to the following:

- Private Drain or Service Connections
- Emergency Overflows (EO's)

For Technical Standards relating to Wastewater Gravity Sewers, Wastewater Pumping Stations & Rising Mains and Storm Water Tanks on Wastewater Networks refer to the following Technical Standards:

- Irish Water Technical Standard for Wastewater Gravity Sewers IW-TEC-800-01
- Irish Water Technical Standard for Wastewater Pumping Stations & Rising Mains IW-TEC-800-02
- Irish Water Technical Standard for Storm Water Tanks on Wastewater Networks IW-TEC-800-04

3. TERMINOLOGY

The term Storm Water Overflow (SWO) is defined under EU Directives and Irish legislation whereas the more familiar term Combined Sewer Overflow (CSO) is not. However for the purpose of this document both terms have the same meaning and can be used interchangeably.

4. BACKGROUND

During rainfall events, SWO's act as relief valves within the system, allowing excess combined storm water to be released to the storm water network, or directly to receiving waters (including rivers, lakes, estuarine or coastal waters). This helps protect properties from flooding and prevents wastewater backing up into streets and homes during heavy storm events. This important function has to be balanced with protection of the environment while considering financial constraints.

5. LEGISLATION

The Urban Waste Water Treatment Directive (UWWTD), Article 3 contains specific requirements with regard to collection systems. Annex 1(A) of the Directive outlines the approach and states that " The design, construction and maintenance of collection systems shall be undertaken in accordance with best technical knowledge not entailing excessive costs, notably regarding:

- Volume and characteristic of urban waste water;
- Prevention of leaks
- The limitation of pollution of receiving waters due to storm water overflows"

Apart from the specific requirements of the UWWTD certain quality standards or objectives for the aquatic environment must be considered in relation to the provision of upgraded or new SWOs. The objectives that have been given legal effect in Ireland by means of the Directives and National Regulations.

6. DEFINITIONS

6.1. STORM WATER OVERFLOWS

The Waste Water Discharge (Authorisation) Regulations, SI No. 684 of 2007, defines a storm water overflows as follows:

"storm water overflow" means a structure or device on a sewerage system designed and constructed for the purpose of relieving the system of excess flows that arise as a result of rain water or melting snow in the sewered catchment, the excess flow being discharged to receiving waters;

An overflow that can spill in storm conditions but is constructed on a separate or partially separate foul sewer should be classed as a SWO – the presence of inflow due to mis-connections (storm to foul) means that the foul sewer is effectively combined. However these SWOs are subject to different performance criteria to SWOs constructed on combined systems.

A single outfall point into receiving water may receive flows from more than one SWO. Conversely, an overflow pipe from a SWO may diverge to more than one outfall point.

SWO's should not be confused with a bifurcation, which is a structure where wastewater can be diverted into a different part of the sewer system. Flows that are diverted at a bifurcation still reach the wastewater treatment works whereas flows that are diverted at a SWO do not.

6.2. EMERGENCY OVERFLOWS

An Emergency Overflow (EO), typically provided at a Pumping Station, is designed to operate only in the event of operational failure at a pumping station (e.g. power, mechanical, electrical or control failure), rising main failure or blockage in the downstream sewer. The overflow may occur at the pumping station itself or at a chamber upstream on the incoming sewer.

EOs are not SWOs as they are not designed to operate in response to rainfall. They may be present on separate sewerage systems as well as combined sewerage systems.

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

Because the emergency overflow may operate in dry weather or discharge to a relatively small watercourse, the environmental impact can be larger than at SWOs. If the overflow operates in storm conditions it should be classed as a SWO rather than an emergency overflow.

Irish Water's requirements with regard to EO's are provided in Irish Water Technical Standard for Wastewater Pumping Stations & Rising Mains IW-TEC-800-02.

7. PRINCIPLE PERFORMANCE CRITERIA

The operational requirements of an effective SWO structure are directly compatible with the overall objectives of a sewerage system. An effective SWO should:

- provide adequate hydraulic relief of the sewerage system so as to meet the target for flood control.
- control the pass forward (continuation) flow (PFF) so as to protect the downstream sewerage system and wastewater treatment works from overloading.
- control the pass forward flow (PFF) so as to maximise the amount of polluting material that is passed forward to treatment.
- control the spill flow so as to meet the regulatory requirements for intermittent discharge to the receiving water.
- operate automatically and minimise any operational requirements for maintenance and not expose operatives to unnecessary health and safety risk.
- minimise whole life cost (WLC)

The following are the principle design criteria that should be followed in relation to SWO's:

1. The SWO should not operate in dry weather.
2. The SWO should not cause visual or aesthetic impact or public complaints.
3. The SWO should not cause deterioration in water quality in the receiving waters.
4. Formula A flow is a minimum hydraulic requirement for all SWOs, and downstream restrictions should not impede the Formula A flow passing requirement.

For details of Formula A refer to Irish Water Technical Standard for Sewers IW-TEC-800-01.

8. DESIGN

8.1. DESIGN STANDARD

The appropriate design standard for SWO's will be dependent on the following factors:

- Receiving Water Type (Freshwater or Coastal/Transitional)
- Receiving Water Body Designation or Use (Bathing, Recreational, Sensitive, etc…)
- SWO Significance (refer further to Section 8.3)
  - Receiving Water (Low Flow Dilution, Designation)
  - SWO Dilution
  - PE of catchment upstream of SWO

Tables 1 and 2 refer to the SWO Significance as per Appendix 1 of PCRSWOs, the Design Standard and the design approach required to demonstrate compliance with the Design Standard.

Where current performance is assessed as non-compliant, a structured approach to selecting and evaluating potential improvements to the SWO should then be taken. In evaluating improvements, they should typically include any upgrading likely to be required for:

- eliminating unwanted throttles in the sewer system;
- the rationalisation of SWO's, e.g. to eliminate unwanted, obsolete or redundant overflows;
- meeting flooding or structural upgrading requirements; and,
- other planned allowances, e.g. for new development.

When evaluating future system performance, it is important that any future changes that need to be evaluated should be incorporated, particularly in relation to the following:

- Population growth or decline;
- Industrial/commercial growth or decline
- Climate change;
- Urban Creep;
- Misconnection Allowance
- Reduction in inflow and/or infiltration

For a definition of Urban Creep and Misconnections, reference should be made to Irish waters Technical Standard for Wastewater Gravity Sewers.

8.2. METHOD OF ANALYSIS

8.2.1. HYDRAULIC MODELLING

Where necessary, hydraulic modelling of SWO performance may be required to assses impact on receiving waters. Model detail should be commensurate with the complexity of the sewer network, SWO Significance and the scale of likely scheme cost.

Where a fully calibrated and verified sewer network model is required this must be developed using an audited hydraulic model built and verified in accordance with the latest version of Irish Water's *Wastewater Network Hydraulic Model Build and Verification Standard* IW-TEC-200-001 or, if deemed acceptable by Irish Water in the case of older models, in accordance with the *WaPUG Code of Practice for the Hydraulic Modelling of Sewer Systems, 2002*. In particular, the hydraulic model used in the design process shall exhibit high verified confidence in its predicted performance (flow and depth) for a range of rainfall scenarios in the area of the proposed SWO.

8.2.2. DESIGN RAINFALL AND TIME SERIES RAINFALL

The design rainfall storm used in the modelling process for developing the SWO design shall be in accordance with Irish Water Guidance Note on the Application of Rainfall Data in Wastewater Network Modelling addresses the following items:

- Design Rainfall
- Time Series Rainfall
- Areal Reduction Factor
- Wetness Parameter (New PR Runoff Model)
- Climate Change

8.2.3. CALCULATION OF SURFACE WATER FLOWS - RIVERS

When calculating SWO Significance, a robust method for the assessment of receiving water flows must be used.

In the first instance, hydrometric data from a local gauging station with a record duration of greater than 10 years should be used to support estimation of 95%ile (Q95) low flows. Where this is not possible, donor gauges may be used to transpose data to the SWO location where catchments are hydrologically similar. Where this is not possible the EPA Hydrotool may be used where appropriate.

Similarly for hydrological inputs to water quality models (simple or complex), hydrometric data from a local gauging station with a record duration of greater than 10 years should be used to drive the assessments.

Where this is not possible, donor gauges may be used to calibrate simple hydrological run-off models which can be applied to the SWO catchment where catchments are hydrologically similar.

Other methods of synthesising flow records may be considered by Irish Water on a case by case basis.

8.2.4. SPILL FREQUENCY

Detailed analysis using a calibrated and verified network model in conjunction with an appropriate Time Series Rainfall (TSR) dataset may be used to estimate the frequency and volume of discharge of receiving waters.

Where the design standard for a SWO is based on a certain spill frequency, this is to be determined by running a minimum of a 10 year Times Series Rainfall (TSR) through an appropriate verified model of the sewer system representing the performance of the SWO.

8.2.5. RECEIVING WATER QUALITY MODELLING

Where water quality modelling is required, a tiered approach to assessment should be adopted.

The approach should be commensurate with the designation/use of the receiving water, SWO Significance and the scale of potential construction costs.

For Low Significance SWOs and Medium significance SWOs simple mass balance based calculations may be used to demonstrate that a proposed scheme will be compliant with 99 Percentile standards..

For High Significance SWOs more detailed river, estuary and/or marine models may be required to demonstrate compliance with standards.

The specification for receiving water quality modelling is to be discussed and confirmed with Irish Water prior to proceeding.

8.2.6. POLLUTANT LOAD FROM SWO'S

It is required that the methodology for Dry Weather Flow (DWF) is based on the Construction Industry Research and Information Association (CIRIA) report on Dry Weather Flow (DWF) in Sewers, Report R177. Guideline per capita pollutant loadings from CIRIA R177 are to be used in conjunction with per capita consumption rates (as verified by DWF flow survey data), to determine the concentration of pollutants entering the network from domestic sources.

Pollutant loads from SWO discharges during periods of rainfall may be estimated using a water quality model with standard water quality parameters assigned in accordance with CIWEM Guide to the Quality Modelling of Sewer Systems[1]. All user defined inputs should be confirmed with Irish Water prior to proceeding.

8.2.7. 99 PERCENTILE STANDARDS

The Urban Pollution Management Manual (UPM) Manual[2] proposes alternative approaches to setting standards to protect freshwaters from the impact of storm water overflows. This includes 99 percentile river quality standards for BOD, Total Ammonia and Un-ionised Ammonia based on the ecosystem class. Where required, designs shall be demonstrated to be in accordance with 99 percentile quality standards for the designated river class and

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[1] http://www.ciwem.org/wp-content/uploads/2016/05/Guide-to-the-Quality-Modelling-of-Sewer-Systems.pdf
[2] http://www.fwr.org/UPM3/

shall be applied using simple mass balance methods, or complex receiving water models, as appropriate.

The application of this methodology is to be discussed and confirmed with Irish Water prior to proceeding.

8.3. SIGNIFICANCE OF SWO'S

The approach to the design of SWO's is dependent on the categorisation of its Significance. The SWO Significance can be either Low, Medium or High. The Significance of a SWO is taken as the assessment of the potential impact of the discharge from the SWO on the receiving water body. Assessment of impact of SWO discharges is a critical factor for both designing new SWO's and assessing performance of existing SWO's.

Tables 1 and 2 provide guidance on interpretation of SWO Significance from the PCRSWOs document. A summary of interpretation has been extracted from Urban Drainage, 2nd Edition by Butler and Davies and an extract from this publication is provided below.

Table 12.3 Criteria to assess significance of CSOs on freshwaters

Significance	*Dilution*	*Interactions*	*Population equivalent*	*Fisheries*	*Assessment criteria*
Low	>8:1	None	–	–	Emission control, e.g. Formula A
Medium	<8:1	Limited	>2000	Cyprinid	Simple models, e.g. SDD, QUALSOC, CARP + sewer hydraulic model
High	<2:1	Significant	>10 000	Cyprinid or salmonid	Complex models e.g. sewer and river quality models

8.3.1. RECEIVING WATER: SURFACE WATERS – RIVERS & LAKES

Within the PCRSWOs the dilution relating to a SWO is defined as the ratio between the foul DWF in the sewer (per SWO) and the 95%ile flow in the receiving water.

SWO significance (and subsequent design standard) is on a SWO by SWO basis. Therefore there may be different SWO standards within a single agglomeration.

It is important to note that where there is interaction with any other urban wastewater discharges (including other SWOs) to surface waters, the SWO significance and associated design standard shall be determined using the cumulative dilution. The determined significance shall apply to all interacting SWOs.

It is noted that freshwater may also have a bathing water designation / water contact usage and therefore the appropriate bathing design standard should be applied in conjunction with freshwater standards.

8.3.2. RECEIVING WATER: CONTACT/RECREATIONAL

Contact/recreational waters are waters where bathing and /or contact sports (immersion) is regularly practiced (e.g. wind-surfing, canoeing).

Where a discharge impacts on contact/recreational waters, SWOs should be designed so that the maximum number of independent storm events discharged via the storm water overflow must, on average, not exceed 7 per bathing season. The bathing season in Ireland runs from 1 June to 15 September.

8.3.3. RECEIVING WATER: BATHING

Identified bathing waters are bathing waters (sea, river or lake surface waters) which local authorities consider to be widely used by the public for bathing. Identified bathing waters are monitored, managed and assessed under the requirements of the 2008 Bathing Water Quality Regulations.

Where a discharge impacts on an European Union Bathing Water Directive designated bathing water, SWOs should be designed so that the maximum number of independent storm events discharged via the storm water overflow must, on average, not exceed 3 per bathing season.

Water quality modelling may be considered to demonstrate that spills in excess of this design standard can be permitted in the case where compliance with the relevant bathing water standard can be demonstrated.

The bathing season in Ireland runs from 1 June to 15 September. All bathing water monitoring results are available from Splash (EPA Website http://splash.epa.ie/#) and posted on notice boards at the beaches throughout the season.

8.3.4. RECEIVING WATER: SHELLFISH

The areas designated as Shellfish Waters are listed under Schedule 3 of the European Communities (Quality of Shellfish Waters) Regulations 2006 (S.I. No. 268 of 2006).

There is no current national policy on the assessment and design of intermittent discharges which discharge near / into designated shellfish waters. As an interim approach, the methodology used in UPM3 is to be adopted, with SWOs to be designed so that the maximum number of independent storm events discharged via a SWO must, on average, not exceed 10 per annum where such discharges are directly or in close proximity of the designated shellfish water.

8.3.5. RECEIVING WATER: NUTRIENT SENSITIVE WATERS

In line with the requirements of the UWWTD requirements for sensitive waters, where eutrophication is a potential problem, the PCRSWOs document states that the requirement for effluent treatment prior to discharge to sensitive areas is a minimum 80% reduction in total phosphorus and a 70-80% reduction in total nitrogen.

This requires that the design limit the percentage of combined sewage spilled from a SWO during storm events at overflows to 20% of the total flow (i.e. total pass forward flow plus total spilled flow).

An additional requirement for TSR assessment of SWO discharges to Sensitive Waters is that the analysis requires consideration of SWO performance during independent storm events. This requires the removal of intervening dry weather periods from the TSR dataset used for hydraulic modelling to ensure the assessment is not distorted by pass-forward dry weather flow under normal climatic conditions.

Using approach outlined above will generally result in a scheme that is consistent with an 80% reduction target which would meet the minimum requirement for treated effluents.

Where continuous water quality modelling is required to demonstrate compliance with relevant Environmental Quality Standard (EQS), the TSR dataset used in the hydraulic model shall include intervening dry weather periods between storm events. SWO hydrographs derived from a verified sewer network model should be used as additional inputs to the receiving water model and used in combination with appropriate event-mean concentrations to assess compliance with the relevant EQS.

8.4. DESIGN OPTIONS

The design of a new SWO or upgrade of an existing SWO shall involve a rigorous appraisal of all potential options in order to achieve the lowest compliant whole life cost solution. The optioneering associated with the SWO should be undertaken as early as possible in the design process. The scale of the optioneering undertaken should be appropriate and commensurate with the scale of the project.

Solutions to non-compliant SWOs can comprise, but is not limited to, one or more of the following elements:

- Source Control
- Aesthetic controls (screens, scum boards etc.) ;
- Preventing reverse flow from receiving water (non-return valves, relocated outfall)
- Raising overflow levels, or controlling flows through chamber to reduce spills.
- Reducing overflow outlet throttles.
- Upgraded chamber structure and geometry;
- Relocating point of discharge to more suitable location.
- Separation from combined system of sewers and drains carrying surface water flows[3]
- Re-direction of upstream flows
- Additional storm storage near the overflow (on-line/off-line storage, upsized sewers etc)
- Increased sewer capacity downstream (gravity sewer or pumped sewer)
- Real time control of sewers to utilise more in sewer storage capacity

Option selection should pay due regard to sustainability and in particular to WLC implications.

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

[3] Preferable by utilising sustainable drainage systems (SUDs) to manage surface water to reduce storm water flows in the combined sewer

<table>
<tr><td colspan="2">Table 1: SWO SIGNIFICANCE AND MINIMUM DESIGN STANDARD MATRIX</td><td colspan="4">SURFACE WATERS</td></tr>
<tr><td>SWO Catchment Size (PE)</td><td></td><td>SWO Dilution ≥ 8:1</td><td>SWO Dilution < 8:1, > 2:1</td><td>SWO Dilution ≤ 2:1</td><td>Nutrient Sensitive Agglomerations >10,000 PE</td></tr>
<tr><td><2,000</td><td>SWO Significance</td><td>Low</td><td>Low</td><td>Medium</td><td rowspan="6">Formula A Minimum

and

80% of combined sewage to be retained during independent storm events, per SWO, as per section 8.3.5 of this technical standard.

Or / as agreed on a project by project basis,

Formula A Minimum and Continuous Water Quality Modelling linked to outputs from a Verified Network Hydraulic Model to demonstrate compliance with relevant EQS standard.</td></tr>
<tr><td></td><td>Design Standard</td><td>Formula A Minimum</td><td>Formula A + Storage of:
40 l/p.e. (for dilution between 4:1-8:1)
80 l/p.e. (for dilution between 2:1-4:1)</td><td>Formula A + Storage of 120 l/p.e.
and
hydraulic modelling with mass balance assessment to demonstrate scheme compliance with 99 percentile standards</td></tr>
<tr><td></td><td>Methodology</td><td>Hydraulic Model</td><td>Hydraulic Model</td><td>Simple River Water Quality Modelling</td></tr>
<tr><td>2,000 - 10,000 and/or limited interaction with other discharges</td><td>SWO Significance</td><td>Low</td><td>Medium</td><td>Medium</td></tr>
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</table>

>10,000 and/or interactions with other discharges	SWO Significance	**Medium**	**Medium**	**High**	As per above.
	Design Standard	Formula A Minimum	Formula A + Storage of 120 l/p.e. and Simple hydraulic modelling with mass balance assessment to demonstrate scheme compliance with 99 percentile standards or Formula A minimum & Complex modelling to demonstrate scheme compliance with 99 percentile standards	Formula A Minimum & Complex modelling to demonstrate scheme compliance with 99 percentile standards	
	Methodology	*Hydraulic Model*	*Hydraulic Model*	*Detailed River and Verified Network Hydraulic Models*	
Notes:	• Where Formula A is the more onerous condition, Formula A to be achieved except where Storm Water Storage is provided in accordance with Section 8.5 of this Technical Standard or where Water Quality determines that water quality objectives can be met with a higher spill frequency • For further details on Simple River Water Quality Modelling and Detailed River Water Quality Modelling refer to				

	Appendix B • Hydraulic model to be supported by flow/rainfall survey data.

Table 2: SWO SIGNIFICANCE AND MINIMUM DESIGN STANDARD MATRIX		**COASTAL/TRANSITIONAL WATERS Discharge into / or close proximity to:**			
SWO Catchment Size (PE)		**Recreational[1] Water Use**	**Bathing Waters[1]**	**Shellfish Waters**	**Nutrient Sensitive Agglomerations >10,000 PE**
<2,000	SWO Significance	**Medium**	**Medium**	**Medium**	Formula A minimum and 80% of combined sewage to be retained during independent storm events, per SWO, as per section 8.3.5 of this Technical Standard Or / as agreed on a project by project basis, (b) Formula A Minimum and Continuous Water Quality Modelling linked to outputs from a Verified Network Hydraulic Model to demonstrate compliance with
	Design Standard	Max. number of independent storm events discharged not exceed 7 per bathing season.	Max. number of independent storm events discharged not exceed 3 per bathing season.	Maximum number of independent storm events discharged not exceed 10 per year	
	Methodology	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	
2,000 - 10,000 and/or limited interaction with other discharges	SWO Significance	**Medium**	**Medium**	**Medium**	
	Design Standard	Max. number of independent storm events discharged not exceed 7 per bathing season.	Max. number of independent storm events discharged not exceed 3 per bathing season.	Maximum number of independent storm events discharged not exceed 10 per year	

					relevant EQS standards
	Methodology	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	
>10,000 and/or interactions with other discharges	SWO Significance	**Medium**	**High**	**High**	As per above.
	Design Standard	Max. number of independent storm events discharged not exceed 7 per bathing season.	Max. number of independent storm events discharged not exceed 3 per bathing season	Maximum number of independent storm events discharged not exceed 10 per year	
	Methodology	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	*Verified Network Hydraulic Model*	
Notes:		• Formula A to be achieved in all cases except where Storm Water Storage is provided in accordance with Section 8.5 of this Technical Standard. Where spill frequency targets (for bathing or recreational use waters) are the more onerous condition these are to be achieved except where assessment using appropriate water quality modelling determines that water quality objectives can be met with higher spill frequencies. • [1]For SWO's discharging to Surface Waters, the same design standard criteria shall apply.			

8.5. STORM WATER STORAGE

The sizing and capacity of storm water storage on the combined network will be based on meeting the design standards set out in Table 1 and 2.

Pumping stations on combined sewer networks commonly pump a multiple of DWF e.g. 3 x DWF flows as a Pass Forward Flow (PFF). In these cases where Formula A is not passed forward, storage based on **2 hours at Formula 'A' – PFF** shall be provided. This is similar to what would happen at the wastewater treatment works but this approach reduces pumping requirements to the WWTP and storage at the WWTP. Such storage shall be provided **in addition** to any storage required to meet the SWO design standards in Tables 1 and 2 which is based on available dilutions and significance of the overflow.

It should be noted that in addition to the above network storm tanks, further storage capacity may have to be provided at the WWTP for SWO's on the inlet sewer depending on the SWO significance. The modelling requirements will be the same for a SWO at a WWTP as a SWO on a network.

8.6. SWO CHAMBER DESIGN

New or upgraded SWO Chambers shall be designed in accordance with WaPUG Guide 'The Design of CSO Chambers to Incorporate Screens, 2006'.

8.7. CONTROL OF OVERFLOW FLOWS

The setting of the overflow is normally based on the continuation flow when spills start. The outflow should be controlled so that variation with depth is limited as much as possible. Suitable methods of control include:

- fixed orifice plate
- adjustable penstock
- vortex flow regulator
- throttle pipe.

Orifices and throttle pipes should be a minimum of 200mm to prevent blockages. The length, diameter and hydraulic gradient shall be taken in account in the design to ensure appropriate application.

8.8. MARINE SWO OUTFALLS

Outfalls for all new SWO discharges into coastal waters should usually be located below the Mean Low Water Springs Level (MLWS). Where there are particular local extenuating circumstances which either prevent, or render it impractical to locate the outfall below MLWS the design will require the number of spills that are made through these outfalls to be limited. For outfalls that are above the Mean High Water Springs (MHWS) level the spill frequency could be limited to 1 in every 5 years.

Marine outfalls to coastal or transitional may require a Foreshore License. The Marine Planning and Foreshore Section administer applications for consent under the Foreshore Act for developments which fall within the statutory responsibility of the Minister for the Housing, Planning, Community and Local Government.

An application for Foreshore License consent is made on the application form provided by the Marine Planning and Foreshore Section. An application must be accompanied by the materials necessary to support the application and to allow a full assessment of the proposal, such as an environmental impact statement and/or Natura impact statement where required, maps, plans, or any other information which the Minister may require to fully assess the application.

9. SWO SCREENS

This Section shall be read in conjunction with the latest issue of WIMES for the plant specified, including any Irish Water amendments and generic data sheets.

The following WIMES documents apply to Screening: -

- WIMES 5.02 Coarse (1D) Screens for Sewage Treatment
- WIMES 5.03 Fine (2D) Screens for Sewage Treatment
- WIMES 5.04 Overflow Screens for Sewerage Systems and Sewage Treatment Works.

Electrical installation shall be in accordance with WIMES 300 series, and associated Irish Water amendments and in particular:

- WIMES 3.03 Low-voltage ac electrical motors for use in the Water Industry
- WIMES 3.04 Low-voltage electrical specification for package plant for use in the Water Industry

Corrosion protection shall be in accordance with WIMES 4.01 – Paints/polymeric coatings for corrosion.

All screening wash water shall be returned to the pass forward flow for full treatment. All fixings shall be manufactured from stainless steel[4] with appropriate isolation kits where necessary to prevent galvanic corrosion.

9.1. APPLICATION OF THIS STANDARD

The Designer / Contractor shall demonstrate that the screening plant provided satisfies the following requirements:-

- Low whole life cost (WLC);
- Low energy usage;
- High reliability;
- Robustness and operational flexibility;
- Low maintenance and low frequency of operator's visits;
- Meets Health & Safety Requirements (e.g. minimise operator handling);
- Good operability and maintenance (e.g. accessibility, ease of process control); and

[4] The selection of steel grade shall be made on the basis the degree of corrosion resistance required. This shall be a function of the aggressiveness of the environment, particularly with respect to the presence of chlorides, and the frequency and duration of immersion.

- Low environmental impact (e.g. odour, vehicular movements).

The design process parameters given in the following sections are minimum requirements based on current good practice. A detailed process design shall be undertaken for each proposed works to suit the site specific flow and loading characteristics of the upstream network and the requirements outlined in the WWDA,

The design and layout of all plant and ancillary equipment shall take into account health & safety requirements, along with maintenance requirements.

Considerations shall be given to all screening equipment and how this equipment will be serviced during breakdowns.

All overflow screens should be designed to reduce manual handing and/or biological risk associated with their cleaning.

The overall design and layout of a SWO Screen shall minimise adverse environmental impacts. As part of the design process, the operation and maintenance strategy needs to be taken into account, such that accurate whole life cost decisions can be made.

This Technical Standard is part of a suite of standards that includes higher level general requirements, including requirements for compliance with the ATEX Directive 1999/92/EC as incorporated into Part 8 of the 2007 Safety Health and Welfare at Work (General Application) Regulations and Safety and Welfare at Work (Confined Spaces) Regulations 2001 (S.I. No. 218 of 2001).

IW is currently developing an ATEX zoning designation policy and risk assessment tool, and this is in draft form at present. All new and refurbished storm water overflow works shall be assessed in accordance with this draft policy and using the risk assessment tool until this is replaced with the final version of both the zoning policy and risk assessment tool at which time the approved policy and risk assessment tool shall be used. The risk assessment tool evaluates catchment risk in determining the zoning requirements at SWO Screens.

Where there is any perceived conflict in requirements, clarity should be sought through agreement with IW Asset Management. Waiver / change request arrangements should be sought through agreement with IW Asset Management. The National and European standards in Appendix A shall be read in conjunction with this Technical Standard where appropriate.

9.2. GENERAL

SWOs must be designed to minimise the visual impact caused by the discharge. Potential impacts include gross sewage solids, paper, plastic and sewage fungus being visible 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 and for existing non compliant SWOs. 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.

9.3. AESTHETIC REQUIREMENTS NEW SWO'S

The provision and size of screens for new SWO's shall be in accordance with the table below:

Amenity Category	Amenity Type Description	Aesthetic Control Requirements[5]
High	• Area where bathing and water contact sport immersion is regularly practised. • Designated Shellfish Waters • Waters designated under Birds and Habitats Directives • Sensitive Areas.	10mm solid separation[6] and where the frequency of spill is greater than once per year, 80% of the volume should be screened with 6mm solids separation[7]
Moderate	• Boating on receiving water. • Popular footpath adjacent to watercourse. • Watercourse passes through housing or frequented town centre area (pedestrian area, bridge, shopping area). • Recreation and contact sport (non-immersion area)	Solids Separation[6] achieved through "Best Engineering Design[8]" of SWO chamber. or 10mm solids separation.
Low	• Basic amenity use only. • Casual limited riverside access on a limited infrequent (bridge in rural area, footpath adjacent to river).	Solids Separation[6] achieved through "Best Engineering Design[8]" of SWO chamber. or 10mm solids separation.
Non-Amenity	• Seldom or never used for amenity purposes. • Remote or inaccessible access.	Solids Separation[6] achieved through "Best Engineering Design[8]" of SWO chamber. or 10mm solids separation.

Table 9.3: Aesthetic Requirements for New SWOs

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[5] Applies to all flows up to a 1:5 year rainfall period. Solids separation through Best Engineering Design of the SWO is the preferred method for aesthetic control.

[6] 10 mm solids separation: defined as "separation, from the effluent, of a significant quantity of persistent material and faecal/organic solids giving a performance equivalent to that of a 10 mm bar screen".

[7] 6 mm solids separation: defined as "separation, from the effluent, of a significant quantity of persistent material and faecal/organic solids greater than 6 mm in any two dimensions".

[8] Best Engineering Design: defined as "design of combined sewer overflow structures in accordance with the recommendations of FWR report FR0488 (Balmforth et al, 1994) and WaPUG Design Guide, 2006.

9.4. AESTHETIC REQUIREMENTS EXISTING SWO'S

The provision of and size of screens for existing SWO's shall be in accordance with the table below:

Amenity Category	Performance	Aesthetic Control Requirements
All	Satisfactory	No action.
All	Unsatisfactory: Verified complaints and incidents have been attributed to the activation of the SWO in terms of visual impact.	Apply measures as per New SWO. Requirements in previous section [9]

Table 9.4: Aesthetic Requirements for Existing SWOs

9.5. SCREEN TYPES

This Technical Standard applies the following type of overflow screens:

- Static screens
- Self-cleaning screens; and
- Powered screens.

The above screens are designed for installation at an overflow weir(s). If WWTP inlet screens are required for an overflow screen application, refer to IW Technical Standard IW-TEC-700-99-02 Inlet Works & Stormwater Treatment (wastewater).

[9] Subject to a hydraulic assessment to ensure no detriment post installation.

9.5.1. MAINTENANCE OF ASSETS

All assets shall, at a minimum, meet the following maintenance requirements:-

- All regular inspection and cleaning maintenance should be achievable without requiring access below ground.
- No elements that require greasing shall be below the water line.
- Minimum clearance should be provided such that parts can be removed in a safe & reliable way, without interference to operation.
- Wearable brushes (where used) should be replaceable by a single operator.
- All flanges shall be PN16.
- Screens should be maintainable from the dry channel.

Refer to individual sections for more specific requirements.

9.6. SCREEN PERFORMANCE REQUIREMENTS

9.6.1. GENERAL

The screen shall effectively remove debris (screenings) from wastewater flows and shall be capable of operation for long periods without attention under all weather conditions and be robust and reliable in operation.

The screens shall separate from the effluent a significant quantity of persistent material and faecal/organic solids greater than the specified size in 2 dimensions.

The screen shall operate automatically and unless otherwise specified shall also be cleaned automatically.

9.6.2. DESIGN LIFE

The screen asset life shall be as follows (for all non wearing/non-consumable components):

- Minimum 20 years for screens

For screen components where applicable:

- Minimum 3 years for non-metallic wearing components (i.e. brushes, seals, strips, etc.).

- Minimum 5 years for metallic wearing components (i.e. chains, rollers, guides, etc.).

9.6.3. DESIGN FLOW RATE

The values for the design flow rate per square metre of clean submerged screen at the maximum design flow shall be as follows:

Screen Type	Design Flow Rate l/s/m2
Static Screens	50
Power Screens	380

Table 9.6.3: Screen Design Flow Rate

9.6.4. BLINDING FACTOR

The hydraulic design shall be based on the fine screen(s) being blinded by a factor of 50%.

9.6.5. MAXUMIUM VELOCITY

The velocity through the screen aperture should be restricted to a maximum of 1.2 m/s.

9.6.6. SCREENS LOADING FACTOR

If a screens loading value is not available for the given sub-catchment, the typical value of $0.03m^3$/1000PE/day shall be used.

9.6.7. SCREENINGS RETENTION VALUE (SRV)

The term SCREENINGS RETENTION VALUE (SRV) refers to the benefit provided to the total solids retention efficiency of a CSO (SWO) chamber as a result of the inclusion of a screen, taking due regard of the solids separation performance of the chamber. In other words the ‘added value’ which represents the extra efficiency added to the combined CSO(SWO)/Screen arrangement by the addition of the screen.

The principles behind the SRV value are provided in UKWIR Report Ref. No. 06/WW/08/14 National CSO Test Facility, Wigan WwTW, CSO Screen Efficiency 1997 – 2005. The SRV is defined by equation below:

$$SRV = \frac{[TSRE_{WITH} - TSRE_{WITHOUT}]}{[100 - TSRE_{WITHOUT}]} \times 100\%$$

Where:

$TSRE_{WITH}$ = Total Solids Retention Efficiency of the chamber and Screen

$TSRE_{WITHOUT}$ = Total Solids Retention Efficiency of the chamber without the Screen

The minimum average SRV % value that is acceptable for the types of screens is provided below. The actual SRV% value shall be provided based on measured value during type-testing and performed as 'type-test" at the UKWIR CSO Test Facility.

Screen Type	Minimum Average SRV (%)
Band Screens/Belt Screens	50%
Static Screens	44%
Spiral Screens/Brush Screens	30%
Bar / Disk Screens	30%

Table 9.6.7: Minimum SRV% Values

9.6.8. PEAKING FACTOR

The Peaking Factor Assessment Protocol (P-FAP) developed by Thompson RPM, will be used to determine the peaking factor (PF) and shall be calculated in accordance with IW Technical Standard IW-TEC-700-99-02 Inlet Works & Stormwater Treatment (wastewater).

For further details refer to technical note TRPM-TN004 *Sewage and Catchment Characterisation* (a copy of this document is available as part of the IW document suite).

For Irish Water assets the peaking factor shall be a minimum of 50 in all cases (covering fine and coarse screens).

Note – the peaking factor relates only to the screenings loading volume / rate, it is not applicable to the flow rate to the screen.

9.6.9. PEAK FLOW RATE

The screen shall be designed as a minimum requirement that it has sufficient hydraulic capacity to cope with events up to and including the 1 in 5 year rainfall event without becoming blinded and bypassed.The required size of a screen shall be based on screening up to the simulated peak flow for a 5 year return period storm over a range of storm durations including the critical storm duration.

9.6.10. HEADLOSS

The maximum allowable headloss across the screen shall be based on meeting hydraulic performance requirements and appropriate service levels and shall based on outputs from a verified model.

The actual headloss at the screen shall be based on the maximum flow rate to be screened and the blinding factor.

The screen unit shall be designed to withstand the maximum possible head differential without incurring any structural damage or excessive distortion. The screen shall be capable of effective operation after this head differential has reduced to normal operational levels.

The maximum head differential shall be that which would occur with the upstream network filled with sewage to its maximum level and the overflow channel empty.

9.7. SCREEN SELECTION

Criteria that influence screen selection include:

- Screen choice must be integral with the design of chamber.
- Screen performance should be effective and be compliant with standards and licence requirements.
- Screens should be appropriately maintained. Static screens shall only be selected where infrequent use is expected due to general requirement to inspect screen after each spill occurrence or to check if screen blinding has occurred. The static screen should be suitable for visual inspection from ground level and that is can be capable of being washed from ground level with a jet wash. These requirements shall be considered in the WLC Assessment process. For guidance purposes only, when the predicted spills are less than 10 per annum then particular consideration should be given to static screens; this will have the additional benefit of avoiding the cost for controls and power supplies and potentially planning permissions for the housing of ancillary above ground equipment.

9.8. SITE CONSIDERATIONS

The following are the site specific considerations with respect screen selection and design:

- The amenity value of the receiving water:
- The predicted maximum number of storm spill events per annum.
- The availability of (or the possibility of providing) a suitable power supply
- The nature and characteristics of the upstream catchment as this will influence the temporal distribution of the flow and the aesthetics loadings that enter the screened SWO chamber.
- The location of the overflow in relation to the location of other overflows in the catchment.
- If upstream overflows are screened the quantities of aesthetic solids may increase towards the downstream end of the system.
- Catchments which have historic operational information available with regard to the following problematic issues;
    - High levels of fats, oils or greases.
    - High levels of grit
    - A reverse in the flow direction to the screen

9.9. CONFINED SPACES

The storm water overflow shall be designed in such a way as to minimise the creation and/or reduce the creation of confined spaces. Where entry by maintenance staff is more regularly required. Areas where confined space classification cannot be avoided shall be designed in such a way that health and safety is in line with the HSA's Code of Practice for Confined Space Locations.

10.EVENT/FLOW MONITORING

Event logging and flow monitoring shall be carried out as per figure 10.1 below.

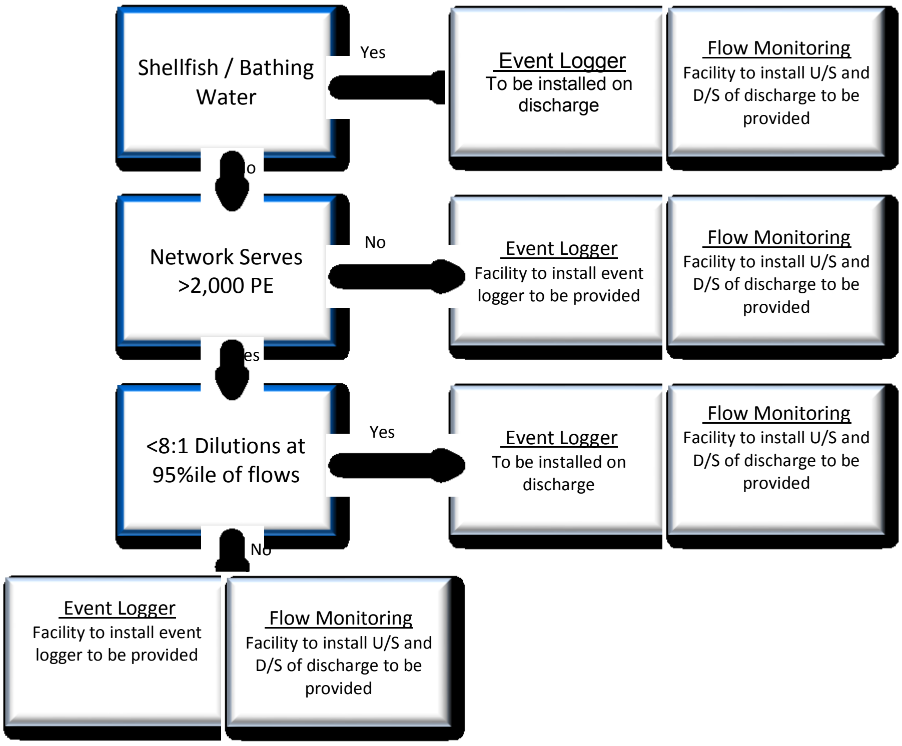

Figure 10.1: Event Logging and Flow Monitoring Requirements Flow Chart

Event logging is required to record date, start time and end time of overflow events.

Flow monitoring is required to record date, times and volume of overflows.

Event logging and flow measurement shall report to telemetry and SCADA where installed.

Alarms shall be provided to indicate failure of the following:-

- Power failure
- Screen malfunction

- Screen overload
- Screen overtopping

The Remote Asset Management (RAM) Policy for Waste Water Network Combined Sewer Overflow (CSO), Document Number: IW-RAM-SPEC-5030-003 defines the business requirements for telemetry information for Combined Sewer Overflows (CSO).

The policy sets out how assets will be monitored in respect of:

- Alarm Response:

The actions arising from a set of “abnormal” conditions which require intervention/remedial actions within prescribed timescales.

- Performance Measures:

A range of parameters against which the performance of an asset may be assessed and upon which interventions will be taken to improve overall business performance.

11. DETAILED DRAWINGS & SPECIFICATIONS

All details shall be in accordance with Irish Water Standard Drawings, unless agreed otherwise with Irish Water.

- Irish Water Standard Details for Waste Water Networks.
- Irish Water As Constructed Cad Standards IW-TEC-100-001

The specification requirements of CESWI with Irish Water Supplementary Clauses shall apply.

- General Civil Engineering Specification IW-TEC-300-01
- General Civil Engineering Specification Notes for Guidance IW-TEC-300-02
- General M&E Specification IW-TEC-200-01
- General M&E Specification Notes for Guidance IW-TEC-200-02

Where conflicts between these documents occur, the Irish Water Technical Standards shall take precedence.

12. REFERENCES

Internal:

- IW-TEC-200-01 General M&E Specification
- IW-TEC-200-02 General M&E Specification Notes for Guidance
- IW-TEC-300-01 General Civil Engineering Specification
- IW-TEC-300-02 General Civil Engineering Specification Notes for Guidance
- IW-TEC-800-01 Irish Water Technical Standard for Wastewater Gravity Sewers
- IW-TEC-800-02 Irish Water Technical Standard for Wastewater Pumping Stations & Rising Mains
- IW-TEC-800-04 Irish Water Technical Standard for Storm Water Tanks on Wastewater Networks
- IW-TEC-200-001 Irish Water Wastewater Network Hydraulic Model Build and Verification Standard
- IW-TEC-700-99-02 Inlet works & Stormwater Treatment (wastewater)
  IW-RAM-SPEC-5030-003 Remote Asset Management (RAM) Policy for Waste Water Network Combined Sewer Overflow (CSO)

- WIMES Series 300 Electrical (3.01 to 3.12 inclusive)
- WIMES 3.03 Low-voltage ac electrical motors for use in the Water Industry
- WIMES 3.04 Low-voltage electrical specification for package plant for use in the Water Industry
- WIMES 4.01 - Paints & Polymeric Coatings for Corrosion Protection
- WIMES 5.02 – Coarse (1D) Screens for Sewage Treatment
- WIMES 5.03 – Fine (2D) Screens for Sewage Treatment
- WIMES 5.04 - Overflow Screens for Sewerage Systems and Sewage Treatment Works
- WIMES 8.03 Mechanical Installations

External:

- Construction Industry Research and Information Association (CIRIA) report on Dry Weather Flow (DWF) in Sewers, Report R177
- WaPUG Guide The Design of CSO Chambers to Incorporate Screens, 2006.
- WaPUG Guide to the Quality Modelling of Sewer Systems
- Foundation Water Research (FWR) Report FR0488 " Storm Water Overflow Design
- TRMP-TN002 ThompsonRMP Combined Sewer Overflows (CSO) and Screens; January 2016
- TRPM-TN004 *Sewage and Catchment Characterisation*
- UKWIR Report Ref. No. 06/WW/08/14 National CSO Test Facility, Wigan WwTW, CSO Screen Efficiency 1997 – 2005

APPENDIX A: EXTERNAL STANDARDS

External Standards:

- ISO 9223, "Corrosion of metals and alloys - Classification of corrosivity of atmospheres."
- ISO 9224, "Corrosion of metals and alloys - Guiding values for the corrosivity categories of atmospheres."
- EN ISO 3651-2 "Determination of resistance to intergranular corrosion of stainless steels."
- BS 5493 "Code of practice for protective coating of iron and steel structures against corrosion."
- BS EN ISO 12944 "Paints and varnishes. Corrosion protection of steel structures by protective paint systems."
- BS EN ISO 14713 "Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures."
- BS 7079 Part A1 "Specification for the preparation of steel substrate before application of paints and related products."
- BS EN ISO 1461 "Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods."
- BS EN 22063 "Metallic and other inorganic coatings. Thermal spraying. Zinc, aluminium and their alloys."
- BS 3170 "Specification for flexible couplings for power transmission."
- BS 4504 "Circular flange for pipes valves and fittings (PN designated)."
- BS 4662 "Boxes for flush mounting of electrical accessories. Requirements, test methods and dimensions."
- BS 4999 "General requirements for rotating electrical machines."

APPENDIX B: WATER QUALITY MODEL TYPES

SIMPLE RIVER WATER QUALITY MODELLING

Use of sewer model and river flow data/models as inputs to a simple mass-balance assessment of the receiving water(s). This process may be Stochastic (monte-carlo) or Deterministic (based on 10 years time series data).

Following this process, an assessment of compliance with EQS for BOD, Total Ammonia, MRP) and 99 percentile standards (BOD, Un-ionized Ammonia) can be made.

The following assumptions are permitted for Simple River Water Quality Modelling exercises:

- Where a calibrated and verified (to Irish Water Standards) model is not available, existing models should be considered for use. In the absence of any sewer modelling tools, a validated network model should be constructed to estimate flows and loads from sewer network to receiving waterbody. With respect to model complexity, this may be WaPUG Type 1, with suitable calibration and validation using EDM and limited flow/rainfall survey data. Flow survey should capture SWO events in order to demonstrate the model represents SWO operation.
- In the absence of a validated sewer quality model, Event-mean concentrations may be applied to inflows to rivers from SWOs
- Depending on the size, and complexity of the agglomeration and proximity to a hydrometric gauge, mass balance assessment may be carried out using gauged flows and ambient concentrations from WFD monitoring.
- In the absence of data relating to the oxygenation/chemistry conditions in the river, ambient concentration values for pollutants may be inferred from the biology status of the river by assuming a pollutant concentration of the mid-point of the status band based on the current biological status band.
- In the absence of local gauged data, river flows may may be generated using a long term record from an analogue gauging station from a hydrologically similar catchment and adjusted for area.
- Where no suitable river flow data exists, simple catchment/river models and rainfall data may be used to synthesise flows from rainfall records.
- Proposed Methodologies to be agreed with Irish Water Environmental Strategy Team

DETAILED RIVER WATER QUALITY MODEL

Use of a detailed hydraulic sewer and river water quality model as inputs to carry out a detailed deterministic, 10 year time-series assessment of the receiving water driven by a targeted monitoring campaign.

Following this process, an assessment of compliance with EQS (DO, BOD, Total Ammonia, MRP) and 99 percentile standards (BOD, Un-ionized Ammonia) can be made.

The following assumptions are permitted for Detailed River Water Quality Modelling exercises:

- Calibrated and Verified Network model to IW Standard shall be used to develop inputs to river model
- River model may be dynamically linked to network model, but a decoupled approach may be suitable where it can be demonstrated that there is no scope for exchange of water from rivers to networks.
- Long term flow record, (gauge data or modelled) should be used in conjunction with flow/load relationship to provide ambient concentrations in river. Flow/Load relationship should be informed by campaign of WQ monitoring. This monitoring should be carried out upstream, midstream and downstream of the agglomeration.
- River model shall include oxygenation processes and pollutant decay
- Where an approach other than 1D is proposed to model the river, proposed simulations periods/events shall be agreed on a case by case basis.
- Event-mean concentrations or direct inputs from inputs from SQM may be used to simulate SWO loads.
- Proposed methodologies to be agreed with Irish Water Environmental Strategy Team