Bathing Water Quality Phase 2: Proposed Environmental Quality Standards for the Isle of Man

Client: The Department of Environment Food and Agriculture

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Rob Moore, Dr Michael Dobson

Client:	**The Department of Environment Food and Agriculture**
Address:	**Thie Slieau Whallian**
	Foxdale Road
	St John's
	Isle of Man
	IM4 3AS
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Project Director:	**Dr Michael Dobson**
Project Manager:	**Rob Moore**
Other:	

APEM Ltd
Riverview
A17 Embankment Business Park
Heaton Mersey
Stockport
SK4 3GN

Tel: 0161 442 8938
Fax: 0161 432 6083

Registered in England No. 02530851

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1. Introduction

Water bodies in the Isle of Man are hugely important for the environmental, economic and social benefits they provide. Upland streams need protection because they feed reservoirs for drinking water, rivers support fish and provide opportunities for recreation, and coastal waters are important as fisheries and bathing waters. All are home to a range of organisms that comprise the biodiversity supporting other plants and animals, including migratory fish that are important for conservation. High levels of pollutants in water can threaten all of these factors: treating water for human consumption is expensive; harvestable products may become unacceptably contaminated for human consumption; bathing waters may not meet the required standards; and biodiversity will be reduced. If pollution is not controlled it will have a negative impact on the environment for local people and visitors alike.

Sources of pollution that need to be controlled include poor quality discharges from point sources such as sewage treatment works, septic tanks and landfill sites, along with diffuse sources of pollution from land runoff in response to rainfall events.

In December 2019, Tynwald approved the recommendations for adopting the 2006 Bathing Water Directive standards in the Isle of Man. This was the culmination of Phase 1 of a project to improve bathing water quality in the Isle of Man, and proposed standards for monitoring and reporting water quality at designated bathing waters. Phase 2 of the project, as presented in this report, proposes standards for ensuring that water quality itself is improved for all surface waters (collectively referred to as controlled waters), including streams, rivers, lakes and coastal waters whether or not they are designated for bathing. Recommendations made in this report will be used by the Department of Environment, Food & Agriculture (DEFA) to develop regulations, which will go to Tynwald in December 2020 for approval.

Specifically, Phase 2 requires the following.

1. Setting Water Quality Objectives (WQO). A WQO means the status set by Government for an area of controlled water to be met by a certain date. The status for a given water body is to be presented as a classification category (as defined in Section 2).
2. Setting Environmental Quality Standards (EQS). An EQS is defined as the range of concentrations, or just a concentration, of a particular substance in water which should not be exceeded to meet the WQO. These provide acceptable limits or ranges for concentrations of polluting substances present in the water. Implementing EQS for freshwater and coastal water quality in the Isle of Man provides the necessary safeguards to the water environment from the threat of pollution.
3. Identifying the Manx-specific discharge standards, and modifications to the licensing provisions in the existing Water Pollution Act 1993 that are required to deliver these, which will enable proportionate compliance with the proposed EQS.

This report sets out a recommended approach for the development of EQS for controlled waters. It describes what an EQS is and why they are needed. It explains how EQS are applied in the UK through the EU Water Framework Directive (WFD) [2], and the approaches followed by the other Crown Dependencies, Jersey and Guernsey. It then presents a detailed consideration of what we recommend for the Isle of Man.

The specific EQS recommended for implementation in the Isle of Man are then presented. This is accompanied by a high-level assessment of the implications of these standards on

[2] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000 establishing a framework for Community action in the field of water policy.

different users of the water environment, and the wider benefits the Isle of Man can expect to see as a result of the actions taken.

While the proposed EQS and monitoring programme are influenced by the WFD, as applied in the UK and EU, we recommend that the WFD is not adopted by the Isle of Man Government. This is because generally water quality is already of a reasonably high quality. Action will be required by DEFA to control pollution but compared to the UK the extent of the interventions required is relatively small. Furthermore, the UK government has found it very challenging trying to meet the WFD objectives and standards. In the UK, water remains under significant pressure many years after the WFD was introduced. The main problems for WFD implementation in the UK have included the large variety of different issues experienced by different regions, the extensive datasets that need to be collected, developing the detailed understanding of cause and effects of pollution, and the uncertainty over what are effective actions for meeting the targets and objectives.

2. Setting appropriate standards

To help achieve the Good bathing water standard as recommended in Phase 1 and approved by Tynwald in December 2019, DEFA should update the river quality objectives scheme that has been used in the Isle of Man since 2001. This established river quality objectives and set out criteria for chemical standards, derived from the General Quality Assessment (GQA) formerly used in England and Wales. DEFA monitors river quality through biological and chemical sampling at a range of sites, the results of which are used to provide indications of river quality.

The GQA system established in 2001 for the Isle of Man is now out of date. A new system and updated standards will bring the Isle of Man approach in line with the UK. We recommend that the new scheme should be expanded to cover all controlled waters, and the objectives will therefore become WQO rather than river quality objectives.

The UK no longer uses the GQA scheme, but instead applies the standards specified in the WFD. The WFD physical and chemical standards are similar to those in the GQA scheme formerly used in the UK.

We recommend that the Isle of Man introduces a new system for water quality, for river quality and coastal waters, based on the WFD standards and tailored to the circumstances of the Isle of Man. The same standards that are used in the UK should be adopted, but limited to the known pollutants in the Isle of Man.

WQOs will be assigned to every river reach based on five categories: Excellent status, Good status, Moderate status, Poor status and Bad status (Table 1). WQOs will be specific to each river reach, which is how the classification system for the WFD is applied in the UK.

Table 1 WQO classification categories

WQO classification	Description
Excellent status	Indicates that water quality is virtually unchanged by human activity compared to natural conditions.
Good status	Indicates that water quality is only slightly changed compared with the natural conditions.
Moderate status	Indicates that water quality is more moderately changed from natural conditions and is therefore slightly polluted.
Poor status	Indicates a more disturbed water quality status compared with Moderate, and it is more severely polluted.
Bad status	Indicates that water quality has been severely changed from the natural condition as a result of human activities and is therefore badly polluted.

The status for each river is determined separately for a series of components, which fall into five categories.

1. Physico-chemical components - concentrations of ammonia, biochemical oxygen demand (BOD), dissolved oxygen and pH. They are classified using the categories in Table 1.
2. Nutrient components – nitrogen (as nitrate) and phosphorus. They are also classified using the categories in Table 1.
3. Heavy metal components - specified heavy metals. Classified either as Pass or Fail; fail being triggered by the presence of unacceptably high concentrations of one or more of the components to be measured.
4. Chemical components –specified chemicals. Classified either as Pass or Fail; fail is also triggered by presence of unacceptably high concentrations of one or more of the components to be measured.
5. Biology components – macroinvertebrates. Classified using the categories in Table 1.

We recommend that the Isle of Man Government set an objective to meet Good status as a minimum for physico-chemical, nutrient and biology components in all controlled freshwaters. Chemical component status (including heavy metals) should be a Pass for all controlled waters. Any river that does not meet Good status should be investigated by DEFA to determine what action may be taken to improve water quality. Where the action required would be technically infeasible, or if it is likely to be very expensive, either a date could be set into the future to meet the standard or a reason should be provided to explain why it will not be possible.

The same procedure should be applied to transitional and coastal waters, based on a range of specified chemical and physico-chemical components. There is a separate bathing water standard, based on faecal indicator organisms (FIO), which has previously been approved.

The EQS for freshwater and coastal water quality should be Manx specific, based on the island's mining legacy, land use and system of sewage disposal. To meet the EQS will require changes to the discharge licensing scheme, to ensure that relevant discharges are controlled using standards that will not threaten the achievement of EQS, and that pollution is also controlled so the EQS can be met.

A biology component is important for river quality assessment, as ultimately the aim is to ensure that the ecology of the rivers is acceptable. However, an appropriate biology status procedure does not currently exist for the Isle of Man. The macroinvertebrate survey and data generation method is well established and acceptable, but the classification category is determined using a system designed for use in Great Britain and Northern Ireland. The status of the Isle of Man, as a small, physically isolated land mass, means that there is a considerably lower species richness and variety of macroinvertebrates than on the larger land masses of Great Britain and Ireland and, as a consequence, applying the currently available classification method cannot differentiate adequately to produce a precise classification. In effect, it can only confirm whether or not a site should be classed as Bad. The current monitoring activity is of value for other reasons (see Section 4.7 below), and there is a mechanism in place for developing a classification system applicable to the Isle of Man. It is recommended that this is developed as soon as possible to ensure the correct biological classification of Manx rivers, and this is explained further in Section 4.7.

3. Current monitoring programme and proposed changes

3.1 The current monitoring programme

DEFA currently carries out monitoring every year at 26 river sites for biological and chemical quality and a further 62 sites for chemical quality alone. The biology sampling is carried out by DEFA three times a year: in spring, summer and autumn, and at the same time a water sample for chemical analysis is also collected. Chemical samples are taken by DEFA once a year during the summer at the remaining 62 sites.

Biological sampling for streams and rivers involves use of the kick method. This method, adopted as standard practice in the UK, ensures that a representative complement of animals present at the site are collected in the sample. These animals are identified by DEFA analysts in a laboratory, and a score is produced and compared against values in RIVPACS (River Invertebrate Prediction and Classification System) developed in the UK for classifying the biological quality of rivers. The RIVPACS assessment is completed by DEFA staff.

Currently the only physico-chemical reading taken in the field is temperature, which is measured at all sites on each occasion. The water samples are tested in the laboratory for: total ammonia, BOD, dissolved oxygen, heavy metals and nutrients (nitrate and phosphate).

3.2 Proposed changes to the monitoring programme

It is recommended that a risk-based approach is used to identify the substances that need to be monitored in each river. A risk assessment will involve either collecting new monitoring data or using existing data to review what substances have been found and at what concentration. Where substances are found at levels significantly lower than the EQS, they should not be included in future monitoring. It is likely that all rivers will need to be monitored as a minimum for the standard physico-chemical determinands and those found within catchments with a legacy of mining will need monitoring of heavy metal concentrations.

DEFA has recently undertaken a review of the current monitoring sites and revised these to provide good coverage of all the rivers across the Isle of Man. This has resulted in a small increase in the number of biological and chemical sampling sites to 31 and a reduction in the number of sites sampled for chemistry alone to 56. We recommend that biological sampling is carried out during a minimum of two seasons per year (spring and autumn), bringing it in line with the UK. We recommend that chemical sampling, to include nutrients, ammonia and

BOD, along with heavy metals and chemical components as appropriate to each site, is increased to four times per year, once in each season. This is because there are often strong seasonal variations in water quality parameters, and it is important to understand them. It also ensures that assessments are not based on very small datasets, and that any atypical results (for example due to collecting a sample following heavy rain), do not unduly influence classification of a water body. We also recommend that a field probe is used to take in situ measurements of physico-chemical components: water temperature, dissolved oxygen, pH and conductivity. A summary of the recommended monitoring programme for river quality is shown in a table in Appendix 1.

Action will need to be taken by DEFA to help minimise the risk of deteriorating river water quality status due to water pollution. No deterioration will mean that no significant change should occur either within the status class or from a higher to a lower class. For example, no more than a 10% deterioration should be acceptable for any parameter within a class, and if this occurs then appropriate measures should be taken to restore this status. Minimisation of the risk of class deterioration can be achieved by educating landowners (such as those in the agricultural sector and those with privately owned sewage treatment plants) about the risks of pollution and the importance of following the guidelines on good practices.

4. Environmental Quality Standards (EQS)

4.1 Proposed standards

In this section we will present the EQS for bathing waters, rivers and streams, and coastal waters. We will show the parameters that need to be measured, if known at this stage, and explain why the EQS are important.

The EQS presented are measurable values, and the boundaries between the classification statuses are given. The mechanism for adopting the WFD in the UK acknowledges that there will be occasions when extreme values of a measurable pollutant are recorded, for example caused by runoff from the land following extreme rainfall and flooding, but that these peaks will last for only a very short period. The method of calculating the value for each site, being based on multiple samples, takes this into account and is therefore included here.

4.2 Faecal indicator organism EQS for bathing water quality

In Phase 1 a strategy for bathing waters was produced by DEFA, and the Isle of Man Government adopted Good status as the minimum WQO to be achieved from 2021 for bathing waters. The EQS that are being applied and starting in 2021 are for faecal indicator organisms (FIOs). These will only apply during the bathing season, which runs from early May to the middle of September each year.

The EQS are set for two FIOs: *Escherichia coli* and intestinal enterococci. Their presence in bathing water indicates there is possible faecal contamination, which affects bathing water quality because it presents a risk to bathers' health. The EQS for FIOs are measured as colony forming units (CFUs) per 100 millilitres of water and a statistical method is applied to the data to determine the rate of compliance. This is in accordance with the approach as used in the UK and EU. The EQS for bathing waters are presented in Table 2.

Table 2 EQS for Bathing Waters (in CFU/ 100 ml)

Parameter	Excellent status	Good status	Sufficient status
Intestinal enterococci	100	200	185
Escherichia coli	250	500	500

Note: Excellent status and Good status are both assessed by calculating the 95th-percentile concentration from the data set; Sufficient status is less stringent as it uses the 90th-percentile concentration. These are the rules which are set out in the 2006 Bathing Water Directive[3].

These standards compare to the previous Isle of Man bathing water standards as follows:

- Excellent – approximately twice as stringent as the current guideline standard
- Good – similar to the current guideline standard
- Sufficient – more stringent than the current mandatory standard.

4.3 Physico-chemical EQS for rivers and streams

We have compared the EQS for the physico-chemical GQA to those used now in the UK. In some cases a slightly more stringent standard will be needed. Adopting these standards will ensure that the Isle of Man is applying the same standards as the UK and it reflects the latest scientific understanding. The EQS for rivers are presented in Table 3 to Table 6.

Table 3 EQS for Biochemical Oxygen Demand (in mg/l)

Status	Existing standards	New standards
Excellent	2.5	3
Good	4	4
Moderate	6	6
Poor	8	7.5
Bad	15	N/A

Note: Values quoted are maximum allowable concentrations. For both the existing and new standards, compliance is determined using the 90-percentile concentrations.

[3] Directive 2006/7/EC concerning the management of bathing water quality and repealing Directive 76/160/EEC

Table 4 EQS for total ammonia (in mg/l)

Status	Existing standards	New standards
Excellent	0.25	0.2
Good	0.6	0.3
Moderate	1.3	0.75
Poor	2.5	1.1
Bad	9	N/A

Note: Values quoted are maximum allowable concentrations. For both the existing and new standards, compliance is determined using the 90-percentile concentrations.

Table 5 EQS for dissolved oxygen (as the percentage saturation)

Status	Existing standards	New standards
Excellent	80	80
Good	70	75
Moderate	60	64
Poor	50	50
Bad	20	N/A

Note: Values quoted are the minimum allowable concentrations. For both the existing and new standards compliance is determined using the 10 percentile concentrations. This differs from BOD and ammonia, which use 90 percentiles, as a high saturation reading is desirable for dissolved oxygen whereas low reading is desirable for the other components.

Table 6 EQS for pH

Status	5 and 95 percentiles
Excellent/Good	≥6 to ≤9
Moderate	N/A
Poor/Bad	<6 and >9

Note: pH differs from the other EQS in that there is a maximum and minimum acceptable value. Excellent and Good status are the same.

Setting EQS for these water quality parameters is important because it provides a good level of protection for the general health of rivers and streams, including for the protection of fish. Pollutants such as ammonia typically enter water from sewage discharges and runoff containing livestock waste. Measuring river water quality against the EQS shown in Tables 3-6 will indicate whether water is meeting Excellent, Good, Moderate, Poor or Bad status (or pass/fail for some parameters). Achieving Good status as a WQO for rivers will also help meet the objective for bathing waters: rivers containing elevated levels of ammonia or BOD also often contain high concentrations of the FIOs which are measured at bathing beaches (see Section 4.2 above).

4.4 Nutrient EQS for rivers

We recommend that EQS are set for two nutrients, nitrogen (as nitrate) and phosphorus, as these two nutrients are known to cause water quality problems through eutrophication in both freshwater and marine water bodies. Eutrophication is the term referring to increase in nutrient concentration to unnaturally high levels, causing unwanted effects such as a reduction in the quality of the biological structure of plants and animals, and a reduction in the concentration of dissolved oxygen and, in extreme cases, severe algal blooms. The sources of nitrogen include ammonia from sewage effluent and nitrate from fertiliser. The sources of phosphorus include fertiliser use and discharges of treated sewage effluent.

The GQA scheme in the Isle of Man already includes standards for nitrate and phosphorus. The EQS from the GQA scheme and the new EQS are shown in the following two tables. Current nitrate standards are considered acceptable for the new EQS, whereas some slight adjustments to phosphorus standards are proposed, which would ensure that the Isle of Man is using the same standards as the UK.

Achieving Good status for nutrients in rivers will also help meet the objective for bathing waters: rivers containing elevated levels of nutrients also often contain high concentrations of FIOs.

Table 7 EQS for Nitrate (in mg/l as NO_3)

GQA Description	Standards	EQS Status
Very low	<5	Excellent
Low	>5 to 10	Good
Moderately low	>10 to 20	Moderate
Moderate	>20 to 30	
High	>30 to 40	Poor
Very high	>40	Bad

Note: compliance is determined using the 95-percentile concentration.

Table 8 EQS for Phosphorus (in mg/l as P)

GQA Description	Existing standards	New standards	EQS Status
Very low	Less than 0.02	0.023	Excellent
Low	0.02 to 0.06	0.046	Good
Moderate	>0.06 to 0.1	0.128	Moderate
High	>0.1 to 0.2	0.884	Poor
Very high	>0.2 to 1.0	N/A	-
Excessively high	>1.0	N/A	-

Note: compliance for the phosphorus standard is determined by using the mean concentration for values of reactive phosphorus.

4.5 Heavy metal EQS for rivers

Heavy metals enter water from sewage effluent discharges, in drainage from former mining sites and active quarries, and from road drainage (for example, tyres contain heavy metals which are released as they wear down).

Setting EQS for heavy metals is important because they can cause toxicological effects on aquatic organisms if they are present at elevated concentrations.

We recommend that EQS for more heavy metals are introduced due to the natural geology of the Isle of Man and its metal mining history. DEFA has carried out screening by sampling rivers and streams for a range of heavy metals. This has provided the evidence indicating which heavy metals are present and at which sites they should be monitored. The EQS for heavy metals are shown in Table 9.

Table 9 EQS for heavy metals (dissolved metals, µg/l)

Heavy metal	Existing standards	Standards*	EQS Status
Arsenic	No existing standards	50	Pass/Fail
Cadmium	No existing standards	EQS will be site specific*	
Copper	No existing standards	EQS will be site specific*	
Iron	No existing standards	1000	

Heavy metal	Existing standards	Standards*	EQS Status
Nickel	No existing standards	EQS will be site specific*	
Lead	No existing standards	1.2	
Manganese	No existing standards	EQS will be site specific*	
Mercury	No existing standards	0.07	
Zinc	Existing standards from 0.2 to >1 mg/l depending on water hardness (measured as CaCO3, mg/l)	EQS will be site specific*	

* Most river reaches in the Isle of Man will not need to be monitored for heavy metals and the EQS will be set as a site-specific standard only in certain reaches. A site-specific standard is required because the toxicity of some heavy metals is known to depend on the concentration of alkalinity (also known as water hardness), pH, and the levels of dissolved organic carbon and calcium. DEFA routinely measure alkalinity and pH in river samples and therefore no additional monitoring will be required for those parameters. There will however be a requirement to collect some additional data and we recommend that samples are collected for dissolved organic carbon and calcium at each site where metals will be sampled, which should be repeated every few years.

This approach to setting EQS for heavy metals will ensure that the Isle of Man is reflecting the latest scientific understanding. APEM will either determine the EQS for heavy metals or will provide a software tool and training for DEFA to do this.

We recommend that no EQS is used for aluminium. This is because the latest scientific understanding shows that the part of aluminium which is highly toxic to aquatic organisms is very difficult to analyse. No EQS has been adopted for aluminium in the UK.

4.6 Chemical EQS for rivers

Chemical standards refer to substances that are artificially manufactured or used in concentrations far exceeding those found naturally, and can be harmful to aquatic life if they enter water. They include pesticides used in agriculture, cleaning materials used in people's homes and in industrial applications, and residues of oil, tyres and fuel from vehicles. Many chemicals used in agriculture are broken down naturally in soil, and chemicals used in homes and by industry are mostly discharged to sewer and removed by the sewage treatment process. However small amounts of chemicals may still enter water bodies, and even when they occur at very low concentrations they may be toxic in rivers where dilution is low. Old landfill sites may be a significant source of chemical pollution.

It is necessary to set EQS to control the levels of chemicals in rivers to ensure that the water quality can support a biologically diverse ecosystem. To set EQS for chemicals DEFA will need information on their known use in the Isle of Man. This information is likely to come from

monitoring carried out by Manx Utilities Authority (MUA), monitoring carried out by DEFA at sites including at landfills and information collated by DEFA on chemical use (including pesticides) in the Isle of Man. Some types of chemicals can affect the sewage treatment process and therefore MUA is implementing a trade effluent consenting regime to control and monitor what is allowed to enter the sewerage system, which will provide useful information for DEFA.

We recommend that EQS for chemicals are introduced only if they are known to be in widespread use. It is likely that EQS will be required for the specific group of substances shown in

Table 10. However, the EQS for chemicals will need to be developed after screening work has been completed by DEFA to understand the extent, and therefore the risk, of chemical usage in the Isle of Man.

With respect to PCBs, deliberate discharge is banned, but it is acknowledged that there is some residual discharge. Any monitoring for PCB discharges should therefore be set at the lowest achievable limit of detection (LoD - currently 15 ng/l) as the maximum allowable concentration and this level should be set for the discharge water rather the receiving water body.

Table 10 **Chemicals for which EQS will be developed for rivers, with an indicative EQS where applicable (µg/l)**

Parameter	Mean value	Maximum concentration*	Reason for including
Benzo(a)pyrene (used as an indicator for poly aromatic hydrocarbons)	0.00017	0.027	A chemical residue from vehicle use and fuel which may bioaccumulate in the environment
Pesticides	The EQS will be specific for the particular type of pesticide		To manage pesticides, including herbicides, used by agriculture and for amenity purposes and which may be toxic to aquatic organisms. Old landfill sites may also be a source.
Solvents	The EQS will be specific for the particular type of solvent		To manage chemicals used in some types of industry including dry cleaning, engineering and manufacturing. Old landfill sites may also be a source.
Surfactants	The EQS will be specific for the particular type of surfactant		To manage chemical used in engineering and manufacturing industries. Old landfill sites may also be a source.

4.7 Summary - EQS for rivers

A summary of the EQS required for the protection of freshwaters are shown in Table 11. In some cases the EQS, or the need to include some of the parameters in the table, will be determined by further investigations.

Table 11 Summary of the EQS for rivers

Parameter	Mean value	Maximum or percentile concentration	Type of parameter
Ammonia (total as N 90%ile, mg/l)	-	0.3	Physico-chemical parameter
Biochemical oxygen demand (BOD 90%ile, mg/l)	-	4	Physico-chemical parameter
Dissolved oxygen (as percentage saturation, 10%ile))	-	75	Physico-chemical parameter
pH (5 and 95 percentiles)	-	≥6 to ≤9	Physico-chemical parameter
Nitrate (as NO3, mg/l)	-	>5 to 10	Nutrient
Phosphorus (as P, mg/l)	0.046	-	Nutrient
Arsenic (µg/l)	50	-	Heavy metal
Cadmium (µg/l)	EQS will be site specific	-	Heavy metal
Copper (µg/l)	EQS will be site specific	-	Heavy metal
Iron (µg/l)	1000	-	Heavy metal
Nickel (µg/l)	EQS will be site specific	-	Heavy metal
Lead (µg/l)	1.2	-	Heavy metal
Manganese (µg/l)	EQS will be site specific	-	Heavy metal
Mercury (µg/l)	-	0.07	Heavy metal
Zinc (µg/l)	EQS will be site specific	-	Heavy metal
Benzo(a)pyrene (used as an indicator for poly aromatic hydrocarbons)	0.00017	0.27	Chemical
PCBs		Below the lowest achievable LoD (currently 15 ng/l)	Chemical

Parameter	Mean value	Maximum or percentile concentration	Type of parameter
Pesticides	The EQS will be specific for the type of pesticide		Chemical
Solvents	The EQS will be specific for the type of solvent		Chemical
Surfactants	The EQS will be specific for the type of surfactant		Chemical

4.8 Biology EQS for rivers

Biological classification of river status in the Isle of Man is currently based on the River Invertebrate Prediction and Classification System (RIVPACS). This allocates each macroinvertebrate taxon (invertebrate family or equivalent) a score, based on its known sensitivity to water quality. Sensitive species, which require clean, oxygen-rich water, score highly, while those that are tolerant of dirtier water and low oxygen concentrations have low scores. The scores for each taxon present at a site are calculated and used to generate two index metrics– NTAXA (number of taxa present at the site) and ASPT (average score per taxon).

The two metrics are then fed into the River Invertebrate Classification Tool (RICT), which determines the classification of each site. The system works by comparing the data with that from a series of reference sites known to be of a high biological quality. Using a series of non-biological readings, including altitude, distance from source, river width and river bed composition, RICT compares the invertebrates present at the survey site with what would be expected from an undisturbed site, based on its reference site database, and allocates the survey site a proportional score for each metric, in which 1.00 means that the site is undisturbed and ant value below this given an indication of the percentage deviation from the expected reference condition. When applied to the WFD, the classification category is derived from the percentage similarity to the theoretical undisturbed condition (

Table 12).

Table 12 EQS for macroinvertebrates, as used in the UK for WFD assessment

These EQS values are shown to give an indication of values that may be applicable to the Isle of Man, once a suitable tool is developed.

EQR values		Invertebrate status class
NTAXA (number of taxa)	ASPT (average score per taxon)	
>0.80	>0.97	Excellent
>0.68	>0.86	Good
>0.56	>0.72	Moderate
>0.47	>0.59	Poor
<0.47	<0.59	Bad

The problem with applying this method to the Isle of Man is that the reference sites, chosen because they have been subject to minimal human disturbance, do not include any in the Isle of Man. The invertebrate fauna is naturally more diverse in Great Britain and Ireland than in the Isle of Man, a consequence of their larger size, greater geological diversity and fewer restrictions to dispersal. Therefore the reference sites available in the UK RIVPACS are unable to predict correctly what the expected taxon composition would be in the Isle of Man and the classifications derived using this are consequently flawed.

This issue can be rectified by developing a RICT system that is specific to the Isle of Man, based only on the invertebrates that occur naturally on the island. There is a precedent for this, as the fauna of Ireland is different that of Great Britain, so extra reference sites from Northern Ireland were included to ensure that the UK RICT works effectively there. A single stage of development is required, ensuring that the Isle of Man has a workable classification tool for its rivers. It is therefore recommended that this development of a Manx-specific RICT takes place.

It is, however, important to continue the biological monitoring as recommended in Section 4.1 above, even as a tailored classification system is being developed. This is because the data currently collected can be used, through expert judgment, to determine the general ecological health of each river and to provide a warning of any deterioration due to short- or long-term pollution events.

4.9 Groundwater standards

We recommend that no EQS are set for groundwater. This is because the public water supply in the Isle of Man is derived from four impoundment reservoirs that are all fed by surface water draining from upland areas. In the UK the public water supply is much different, and standards have been set to protect water quality. The UK water supply is provided by a mix of groundwater and surface water sources, with groundwater supplying approximately 30 per

cent of the water for England. The groundwater in the Isle of Man is used to supply a number of properties which are not connected to the public water supply. The quality of this water is managed by the Public Health Department and is therefore a localised issue.

4.10 Coastal water standards

We recommend that water quality in coastal waters is protected by setting EQS for physico-chemical and some other substances, but this should only be required if there are sensitive areas near to the discharge sites. Most of the treated sewage effluent from MUA sites discharges into the sea where there is a large dilution available, and other discharges such as landfills, also discharge effluent into the sea. The discharges should be controlled by issuing licenses with numeric limits to meet the EQS shown in Table 13 based on the concentrations after mixing. In a mixing zone, some discharges may lead to small areas where the levels of pollution are above the EQS and the substances are referred to as contaminants of concern. After dilution if the contaminant of concern still exceeds the EQS at the edge of the mixing zone a permit limit will be required. The size of the mixing zone and the amount of dilution is calculated using simple mathematical models. Mixing zones are an important part of the process for managing the impact of discharges and their use will mean that the Isle of Man Government is in line with the UK.

Table 13 **EQS for coastal water (in µg/l unless otherwise stated)**

Parameter	Mean value	Maximum concentration*	Sediment (µg/kg)	Biota (µg/kg)	Reason for including
Arsenic	25	-			May bioaccumulate in shellfish and fish
Benzo(a)pyrene (used as an indicator for poly aromatic hydrocarbons)	0.00017	0.027			May bioaccumulate in shellfish and fish
Cadmium	0.2	-			May bioaccumulate in shellfish and fish
Chlorine	-	10			To control risk from overuse used for controlling algae in marinas
Chromium	0.6	32			May bioaccumulate in shellfish and fish
Copper	3.76	-			May bioaccumulate in shellfish and fish
Dissolved inorganic nitrogen (micromoles per litre)	-	18.7			For control of algal blooms
Dissolved inorganic phosphorus (micromoles per litre)		0.74			For control of algal blooms
Dissolved oxygen (mg/l)	-	4*			Will cause stress/death of fish and other animals
Iron	1000	-			Toxic to aquatic organisms

Parameter	Mean value	Maximum concentration*	Sediment (µg/kg)	Biota (µg/kg)	Reason for including
Lead	1.3	14			May bioaccumulate in shellfish and fish
Mercury	-	0.07			May bioaccumulate in shellfish and fish
Nickel	8.6	34			May bioaccumulate in shellfish and fish
Polychlorinated biphenyls - congeners					May bioaccumulate in shellfish and fish
- PCB28			1.7	64	
- PCB52			2.7	108	
- PCB101			3.0	120	
- PCB118			0.6	24	
- PCB138			7.9	316	
- PCB153			40	1600	
- PCB180			12	480	
PCBs	-	Below the lowest achievable LoD (currently 15 ng/l)	-	-	Some residual discharge occurs. Measurements to be made in discharges, not receiving water bodies.
pH	-	≥6 and ≤9*			For control of algal blooms
Tributyltin	0.0002	0.0015			May cause toxicological effects in shellfish
Unionised ammonia	21	-			May cause toxicological effects in fish

Parameter	Mean value	Maximum concentration*	Sediment (µg/kg)	Biota (µg/kg)	Reason for including
Zinc	6.8	-			May bioaccumulate in shellfish and fish

*Dissolved oxygen is a minimum concentration; pH is an acceptable range, with a maximum and minimum.

The EQS for coastal water include un-ionised ammonia (which is toxic to fish), dissolved oxygen, nutrients (nitrogen and phosphorus), and some heavy metals and chemicals. The heavy metals and chemicals that need an EQS will be determined by a risk assessment using monitoring data held by DEFA and MUA for screening to determine which substances are being discharged and at what concentrations. Some additional monitoring by DEFA may be required in coastal water, but modelling should be used as a first step to indicate if any EQS are likely to be exceeded.

Chlorine is applied as hypochlorite, and monitoring should be used to determine the impact of its use in ports, harbours and marinas. Chlorine can be measured in the surrounding water by DEFA using a field test kit.

5. Approaches taken in other Crown Dependencies

As Crown Dependencies, Jersey and Guernsey are similar to the Isle of Man in that they are under no obligation to adopt the WFD, however there remains a need to understand and control water pollution in these jurisdictions. Therefore the approaches followed in each of the territories is summarised below.

Jersey and Guernsey differ from the Isle of Man in that their rivers and streams suffer from considerably lower chemical and biological quality, and therefore their approaches are expected to be different to the Isle of Man.

Despite making improvements in water quality over the past decade, pollution in Jersey and Guernsey is predominantly caused by the intensive nature of agriculture over a large area of the Islands. The problems this creates include excess concentrations of nitrate, phosphate and pesticides entering watercourses. Drinking water at times exceeds the limits for nitrate and pesticides; phosphate causes algal blooms in drinking water reservoirs leading to periodic closures. In Jersey there have been instances of excessive green seaweed growth in St Aubin's Bay due to nitrate levels.

In Jersey, the approach to water resource management follows the WFD, but it has been adapted for the Jersey context. Most water bodies are only of Moderate status, but the aim is to achieve Good status. Jersey has developed a water management plan with extensive monitoring: physico-chemical readings are taken in all streams and rivers, whereas only 50% are monitored for macroinvertebrates and only 20% are sampled for chemicals, including heavy metals. Chemical sampling follows a risk-based approach that excludes industrial chemicals. Bathing waters are monitored 20 times during the season for *Escherichia coli* (*E. coli*) and intestinal enterococci.

In Guernsey, the approach to water resource management does not follow the WFD. The island's freshwater streams are monitored by Guernsey Water, who assess chemical quality and macroinvertebrates in the watercourses. The aim of monitoring has been to manage the risk associated with known pollution issues: these stem from intensive agriculture and specific pollution problems associated with land contamination, including from the airport due to the loss of firefighting foam into groundwater. Bathing waters are monitored throughout the bathing season for *E. coli* and intestinal enterococci.

6. Discharge licensing

Meeting WQOs will require DEFA to ensure that impacts due to discharges are kept to within tolerable limits and the EQS are met. We recommend that licences are issued by DEFA to control significant discharges, such as treated effluent from sewage treatment works, and for small discharges guidance on best practice is issued rather than licences. For example, this latter approach may be suitable for septic tanks from single houses discharging mainly to land (i.e. to a soakaway).

Under this system every major discharge will be issued with a licence to discharge, and so long as the effluent falls within specific limits for polluting substances the operator will be deemed to have met the conditions. Each licence will be specific to a discharge, with limits set according to the volume, type of effluent and other features (i.e. sensitivity and available dilution) of the water body into which it discharges.

There are software tools available to enable licence conditions to be determined. These include the Environment Agency's RQP (River Quality Planning) tool. This tool will be suitable for setting limits for most discharges, but the bigger discharges from MUA sites will require a different approach based on more detailed modelling. MUA are carrying out modelling which will enable DEFA to set numeric limits for treated sewage effluent discharges.

The limits to be set for discharges to meet EQS should be based on the dilution which is available in the receiving water. Immediately following the discharge there might be an area where the levels of pollution are slightly above the EQS, this small area is known as the mixing zone. The level of dilution available for discharges is calculated using mathematical models, such as the River Quality Planning tool which is used in the UK by the environmental regulators, and which is available free of charge. Mixing zones are important for managing the impact of discharges and their use will mean that the Isle of Man Government is in line with the UK.

7. Resources/Cost implications

7.1 DEFA – high level of impact

The recommendations in this report will have resource and cost implications for DEFA and MUA as summarised below.

The number of sites for chemical analysis will be reduced from 93 to 87, but the sampling frequency raised from 1 to 4 times per year. The total number of samples analysed per year will therefore rise from 93 to 348, with consequent increases in staff and consumable resources at the Government Laboratory. There will be an increase in time required for DEFA staff to take the samples, as the number of visits to each site will rise from 1 to 4. There is likely to be an increase in the number of substances being analysed, but this will depend on

the outcome of screening that is currently being undertaken by DEFA and this will be available later.

The number of sites monitoring for macroinvertebrates will increase from 25 to 31, but the frequency will drop from 3 to 2 times per year, a net decrease of 13 (17%). This will free up time from DEFA staff to cover some of the extra required for increased water chemistry sampling.

APEM will develop a process for DEFA for setting WQO. A key factor for deciding what objective to set will be to establish whether the WQO can be met. If it cannot be met straightaway, it is important to understand how much improvement work would be needed and whether that is cost effective and technically feasible.

Once EQS are set, licensing for discharges into controlled waters will have resource requirements. DEFA will need to set standards for MUA sewage treatment works continuous effluent discharges. Each discharge will have a set of limits to be met, as a minimum they will include biochemical oxygen demand, suspended solids and ammonia. Setting licence limits will be a one-off resource requirement for DEFA. The standards can be determined either by simple modelling, such as the Environment Agency's mass balance software (RQP) tool, or by more detailed, hydrodynamic, modelling.

There will be an ongoing requirement for DEFA to audit the results of sampling carried out by MUA, and to provide an annual report on MUA compliance with licence conditions. DEFA will also be required to allocate ongoing time to ensuring that other discharges, such as those private homeowners are appropriately controlled.

7.2 Community – medium level of impact

River quality monitoring will demonstrate if there is a need for action to control the impact of private sewage discharges. If improvements are necessary this will require action by DEFA to ensure that homeowners take the appropriate action and maintain their treatment systems according to the manufacturers recommendations. This is likely to mean that such systems will require desludging by Manx Utilities for a fee.

7.3 MUA – medium level of impact

MUA is undertaking monitoring of its discharges and modelling impacts from its infrastructure on freshwaters and bathing waters. There will be some increase in reporting requirements to DEFA, but this is not expected to be large. A short programme to screen discharges for some additional parameters will be required, for examples for some chemicals, heavy metals and nutrients. The new physico-chemical EQS for freshwater discharges should not have an impact on MUA. This is because the discharges have already been licensed to meet the Very Good standard under the previous scheme.

The level of impact will be maintained so long as effluent discharges do not breach the proposed new discharge licence conditions. If they are breached, then remediation works of sewage treatment works may be required, hence this is a medium level of impact.

7.4 Farming – low level of impact

There are grants available to farmers in the Isle of Man through the Agriculture and Lands Directorate at DEFA, and more funding has been provided for water quality protection measures such as slurry stores, covering of feed areas etc.

Farmers will need to increase their awareness of water protection, particularly with respect to adverse weather, but once good practice is established then ongoing impacts should be low. Of key importance will be cleaning out silt traps and keeping concreted areas clean of agricultural waste, including oil and livestock waste, which may result in some extra work for the farming community.

7.5 Industry– variable level of impact

There are industrial sites that discharge directly into rivers, including quarries, fish farms, existing landfills and waste transfer sites. Further studies into these impacts might need to be carried out by DEFA to fully assess the level of risk. Old landfill sites will continue to be a risk for water quality, action should be taken where it is possible to find solutions to address this source of pollution and to continue monitoring for impacts against EQS.

The impact on each individual business will be determined by its current effect on water quality through its discharges and whether remediation is required to meet EQS. This can only be determined once the impacts are understood and the scale and timetable of any remediation (one off or continuous) is known.

8. Legislative changes required

Controlled waters are regulated by DEFA under section 5(6) and 5(7) of the Water Pollution Act 1993. DEFA will develop a scheme using provisions in the Water Pollution Act 1993 which will be submitted to Tynwald in December 2020.

9. Summary of Isle of Man WQO

A summary table is presented below to show how the EQS and WQO are combined for rivers and for coastal water (Table 14).

Table 14 Summary of water quality EQS

For the determination of water quality status, setting discharge licence standards and pollution control

Type of WQO	Broad Suite of Parameters	Grading Scheme
WQO for Rivers	Physio Chemical EQS • BOD - Table 3 • Ammonia – Table 4 • Dissolved Oxygen – Table 5 • PH – Table 6 Nutrient EQS • Nitrate – Table 7 • Phosphorus – Table 8 Heavy Metal EQS • Table 9 Chemical EQS • Table 10 Biological EQS • Macroinvertebrates – Table 12	Excellent/High Good Moderate Poor Bad (Pass or Fail for chemicals and heavy metals)
WQO for Coastal Water	Bathing Water EQS (Bathing season only) – Table 2 Physico-chemical, chemical, nutrients, heavy metal EQS – Table 13	Excellent Good Moderate (Sufficient for Bathing Waters) Poor Bad (Pass or Fail for chemicals and heavy metals)

Table 15 Overall grading categories for WQO - Rivers

Chemistry	Biology	Nitrate	Phosphate
A – Excellent	A – High	A – Excellent (Very low)	A – Excellent (Very low)
B – Good	B – Good	B – Good (Low)	B – Good (Low)
C – Moderate	C – Moderate	C – Moderate	C – Moderate
D – Poor	D – Fair	D – Poor (High)	D – Poor (High)
E – Bad	E - Poor	E – Bad (Very High)	E – Bad (Very High)
Corresponding EQS			
BOD – Table 3	Macroinvertebrates – Table 12	Nitrate – Table 7	Phosphorus – Table 8
Ammonia – Table 4			
Dissolved Oxygen – Table 5			
pH – Table 6			
Heavy metals – Table 9			
Chemicals – Table 10			

Table 16 Overall grading categories for WQO – Coastal Water

<table>
<tr><th>Chemistry (and biota)</th><th>Nitrate</th><th>Phosphate</th><th>Bathing Waters (Bathing Season Only)</th></tr>
<tr><td rowspan="2">Pass</td><td rowspan="2">Pass</td><td rowspan="2">Pass</td><td>Excellent</td></tr>
<tr><td>Good</td></tr>
<tr><td rowspan="2">Fail</td><td rowspan="2">Fail</td><td rowspan="2">Fail</td><td>Sufficient</td></tr>
<tr><td>Poor</td></tr>
<tr><th colspan="4">Corresponding EQS</th></tr>
<tr><td colspan="3">Table 13, includes EQS for the following type of substances:
Physico-chemical parameters
Heavy metals
Benzo(a)pyrene
Chlorine
Nutrients
PCBs
Tributyltin
(some additional chemicals may be required depending on their use)</td><td>FIO – Table 2
Intestinal enterococci and Escherichia coli</td></tr>
</table>

Table 17 Discharge Licence WQO & corresponding EQS

Chemistry	Nitrate	Phosphate	Bathing Waters (Bathing Season Only)
A – Excellent	A – Excellent (Very low)	A – Excellent (Very low)	Excellent
B – Good	B – Good (Low)	B – Good (Low)	Good
C – Moderate	C – Moderate	C – Moderate	Sufficient
D – Poor	D – Fair (High)	D – Fair (High)	
E- Bad	E- Poor (Very High)	E- Poor (Very High)	
Corresponding EQS			
BOD – Table 3 Ammonia – Table 4 pH – Table 6 Heavy metals – Table 9 Chemicals – Tables 10 and 13	Nitrate – Table 7	Phosphate – Table 8	FIO – Table 2 Intestinal enterococci and *Escherichia coli*

10. Summary of the report recommendations

The following table (Table 18) is a summary of the recommendations required for implementing the EQS in the Isle of Man.

Table 18 Summary of the recommendations for adopting EQS

Recommendations	Section containing the recommendation
The GQA system established in 2001 for the Isle of Man is now out of date. A new system and updated standards will bring the Isle of Man approach in line with the UK. We recommend that the new scheme should be expanded to cover all controlled waters, and the objectives will therefore become WQO rather than river quality objectives.	Section 2
We recommend that the Isle of Man introduces a new system for water quality, based on the WFD standards and tailored to the circumstances of the Isle of Man. The same standards that are used in the UK should be adopted, but limited to the known pollutants in the Isle of Man.	Section 2
We recommend that the Isle of Man Government set an objective to meet Good status as a minimum for all controlled waters. This is also in line with the agreement by Tynwald to achieve Good bathing water quality.	Section 2
We recommend that a risk-based approach is used to identify the substances that need to be monitored in each river.	Section 3.2
We recommend that chemical sampling is increased to four times per year, once in each season. This is because there are often strong seasonal variations in water quality parameters, and it is important to understand them.	Section 3.2
We recommend that biological sampling continues for a minimum of twice per year, in spring and autumn.	Section 3.2
We recommend that field measurements are made at each site of water temperature, ammonia concentration, oxygen concentration, pH and conductivity.	Section 3.2
We recommend that updated EQS are set for physico-chemicals to bring the Isle of Man in line with the UK	Section 4.3
We recommend that EQS are set for nutrient levels in rivers and stream to control problems due to eutrophication	Section 4.4
We recommend that EQS for more heavy metals are introduced due to the natural minerology of the Isle of Man and its metal mining history.	Section 4.5

Recommendations	Section containing the recommendation
We recommend that samples are collected and analysed for dissolved organic carbon and calcium at each freshwater monitoring site where metals will also be monitored, which should be repeated every few years.	Section 4.5
We recommend that no EQS is used for aluminium.	Section 4.5
We recommend that EQS are introduced for chemicals only if there is considered to be a potential risk or widespread use.	Section 4.6
We recommend that a river invertebrate classification tool specific to the Isle of Man is developed as soon as possible.	Section 4.7
We recommend that no specific EQS are required for groundwater	Section 4.8
We recommend that water quality in coastal waters is protected by setting EQS for physico-chemical and some other substances based on a screening assessment to identify any risks.	Section 4.9
We recommend that discharge licences are issued by DEFA to control significant discharges, such as treated effluent from sewage treatment works, and for small discharges guidance on best practice is issued rather than licences.	Section 6

11. Glossary

Bathing Water Directive. The European directive, adopted in the UK, from which approach the EQS proposed here are derived.

BOD - biochemical oxygen demand. A test that is routinely used to measure the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms present in water to break down organic material at a certain temperature over a specific time period (usually at 20°C and over a period of 5 days).

CFU – colony forming units. A measure of the viable bacterial cells used for bathing water quality assessment tests.

Coastal Waters. Any waters which are within the area which extends landward from those baselines as far as the limit of the highest tide or, in the case of the waters of any relevant river or watercourse, as far as the fresh-water limit of the river or watercourse, together with the waters of any enclosed dock which adjoins waters within that area.

Controlled waters. Controlled waters referred to in this report, means inland freshwaters, groundwater, coastal waters and relevant territorial waters. The references to controlled waters in this report have the same meaning as the definition shown in Part 1 (Inland and Coastal Waters) in the Water Pollution Act 1993.

EQS – environmental quality standard(s). An EQS is defined as the concentration of a particular pollutant in water which should not be exceeded in order to meet the water quality objective (WQO). EQS are the acceptable limits for concentrations of polluting substances in the water.

FIO - faecal indicator organism(s). The European bathing water quality standards are based on FIO concentrations present in the water at defined bathing locations. These are typically ***Escherichia coli*** (*E. coli*) and **intestinal enterococci**, two types of bacteria that can indicate presence of sewage.

GQA – General Quality Assessment scheme. The Environment Agency's previous methodology (before the implementation of the WFD) for classifying the water quality of rivers and estuaries. It is designed to provide an accurate and consistent assessment of the state of water quality and changes in this state over time.

Heavy metals. These are metallic elements that have a relatively high density compared to water. Their 'heaviness' and toxicity are inter-related, and heavy metals can induce toxicity at very low levels of exposure**.** The main heavy metals known to be toxic to aquatic organisms are arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, mercury and zinc. They often have a role to play in keeping living organisms healthy, but too much of them can lead to problems for organisms, including toxicity which affects reproduction, susceptibility to disease and it may lead to mortality for part of all of a population.

Intestinal enterococci. See **FIO**.

Kick sampling method. This method is used for collecting biological samples in rivers using a hand net with a 1 mm mesh to collect macroinvertebrate animals. The DEFA officer moves around the monitoring site to sample the different habitats found in the stream, such as fast-moving riffles, shallow water, slow water, weeds and tree roots. The survey takes three minutes, dividing the time to sample the habitats in proportion to their coverage of the riverbed. This is followed by a one-minute hand search, in which hard surfaces are examined for species that attach themselves firmly and are therefore difficult to dislodge by kicking.

Macroinvertebrate. An invertebrate animal with a body length greater than 1 mm. In fresh waters these include various insects (including beetles, mayflies and caddisflies), snails, shrimps and leeches.

Nutrients. A term to describe the essential chemicals, nitrogen and phosphorus, that are necessary for plant growth. As a common component of fertilisers, an excess of nutrients can leach into watercourses from agricultural land resulting in the prolific growth of algae, an event known as eutrophication.

Physico-chemical substances. A term used to cover the combination of attributes of a water body that can be measured using an electronic hand-held meter in the field. These are temperature, ammonia, oxygen level, pH (a measure of acidity of the water) and conductivity (a measure of the water's ability to conduct electricity – this varies according to the concentration of substances dissolved in the water and can therefore be used as a proxy for contamination with pollutants).

Pollutants. A broad term for contaminants from industrial, agricultural and domestic waste that typically enter watercourses from run-off and discharges. These can include pesticides, heavy metals and nutrients.

River reach. An uninterrupted section of a watercourse that has consistent hydrological conditions.

RICT (River Invertebrate Classification Tool). A method using the outputs from RIVPACS to determine class status of a river based on its macroinvertebrate fauna.

RIVPACS (River Invertebrate Prediction and Classification System). A method for assessing the quality of the macroinvertebrate assemblage at a given location in the absence of human impact. It considers geographical location and range of variables including altitude, geology, river size, etc., and then calculate how similar the macroinvertebrate assemblage is to what may be expected in the absence of human impact. The predictions are based on a series of reference sites of high quality in the UK, and the naturally more impoverished fauna of the Isle of Man means that is has some difficulty in classifying Manx sites.

Taxon (plural: taxa). A term referring to a taxonomic group used to classify animals or plants. Used when different groups are identified to different levels. For example, for RICT requires identification of most invertebrates to family, but some to order or subclass, so use of the term 'taxa' covers all of these.

WFD – Water Framework Directive. The European directive, adopted in the UK, from which approach some of the EQS proposed in this report have been derived.

WQO – water quality objective(s). A WQO means the status set by Government for an area of controlled water to be met by a certain date.

Appendix 1 Summary table of river quality monitoring requirements

Site Code	River Name	Site Name	Biology	Physico-chemistry	Heavy Metals	Nutrients
2001	Middle River	u/s River Douglas	Y	Y		Y
2002	Middle River	Richmond Hill	Y	Y		Y
2003	River Douglas	d/s Pulrose	Y	Y		Y
2004	River Dhoo	u/s Quaterbridge		Y		Y
2005	Middle River	u/s discharge		Y		Y
2006	River Dhoo	Union Mills	Y	Y		Y
2011	River Dhoo	d/s Greeba confluence	Y	Y		Y
2013	River Glass	Quaterbridge		Y		Y
2015	Sulby Stream	u/s River Glass		Y		Y
2017	Bladwin River	u/s Glass Confluence		Y		Y
2019	River Glass	u/s Baldwin Tributary		Y		Y
2022	River Glass	d/s reservoir		Y		Y

2023	River Glass	Injebreck	Y	Y		Y
2026	River Dhoo	u/s Glen Vine Bridge		Y		Y
2027	Greeba River	Creg-y-Whuallian		Y		Y
2028	River Dhoo	d/s Archallagon		Y		Y
2031	Middle River	Oakhill		Y		Y
2101	Groudle River	Port Groudle	Y	Y		Y
2102	Baroose Stream	u/s Footbridge		Y		Y
2201	Baldrine Stream	Garwick Bay		Y		Y
2211	River Laxey	Old Laxey	Y	Y	Y	Y
2213	Glen Roy Stream	u/s River Laxey	Y	Y		Y
2216	Laxey River	u/s Glen Roy Confluence		Y	Y	Y
2218	Laxey River	u/s Mooar Confluence		Y	Y	Y
2311	Cornaa River	Port Cornaa	Y	Y		Y
2315	Cornaa River	Ballaglass Glen		Y	Y	Y
2421	Glen Audlyn Stream	u/s Sulby confluence	Y	Y		Y

2422	Fern Glen Stream	u/s Glen Auldyn Stream		Y	Y	Y
2423	Glen Audlyn Stream	Glen Auldyn Arm		Y		Y
2424	Garey Stream	u/s Sulby Confluence		Y		Y
2427	Sulby River	Garey Weir		Y		Y
2428	Sulby River	Ellenbane	Y	Y		Y
2429	Ballamenaugh Stream	u/s Sulby River		Y		Y
2430	Sulby River	u/s Ballamenaugh Confluence		Y		Y
2431	Ballakerka Stream	u/s Sulby Confluence		Y		Y
2432	Sulby River	u/s Ballakerka Confluence	Y	Y		Y
2433	Block Eary Stream	u/s Sulby Confluence		Y		Y
2434	Sulby River	u/s Block Eary Confluence		Y		Y
2435	Sulby River	d/s reservoir	Y	Y		Y
2436	Sulby River	Druidale		Y		Y
2438	Lhergyhenny Stream	u/s Reservoir		Y		Y
2511	Lhen Trench	Cronk-ny-bing		Y		Y

2512	Lhen Trench	Kerrowmoar		Y		Y
2513	Lhen Trench	Close-y-kewin		Y	Y	Y
2603	Ballaugh Stream	u/s Ballaugh Bridge	Y	Y		Y
2634	Kirk Michael Stream	d/s Fish Farm Abstraction		Y		Y
2651	Mooar Stream	u/s Ford		Y		Y
2711	River Neb	d/s weir & Raggatt	Y	Y		Y
2714	Foxdale Stream	u/s River Neb	Y	Y		Y
2715	St John's Stream	u/s Foxdale Stream Confluence		Y		Y
2718	Foxdale Stream	u/s St John's Stream Confluence		Y	Y	Y
2720	Foxdale Stream	Lower Foxdale		Y		Y
2721	Foxdale Stream	u/s Foxdale		Y	Y	Y
2722	River Neb	u/s Foxdale Stream Confluence		Y		Y
2725	River Neb	Glen Helen		Y		Y
2726	River Neb	u/s Ballahra		Y		Y

2728	River Neb	u/s Raggatt Landfill Site		Y		Y
2801	Glen Maye Stream	d/s Glen Maye	Y	Y	Y	Y
2802	Glen Maye Stream	u/s Glen Maye		Y	Y	Y
3002	Colby River	Kentraugh		Y		Y
3004	Colby River	Colby Glen	Y	Y		Y
3021	Ballabeg Stream	Strandhall	Y	Y		Y
3031	Polyvaaish Stream	u/s beach	Y	Y		Y
3103	Awin Ruy	u/s Silverburn Confluence		Y		Y
3105	Silverburn	u/s Awin Ruy Confluence		Y		Y
3107	Awin Ruy	St Marks		Y		Y
3111	Glashen Stream	Derbyheaven	Y	Y		Y
3201	Santonburn	Ballawoods	Y	Y		Y
3203	Santonburn	Ballalona		Y	Y	Y
3205	Santonburn	Tosaby		Y	Y	Y
3231	Crogga River	Port Soderick	Y	Y		Y

3233	Crogga River	d/s Bushey's Brewery		Y		Y
3235	Crogga River	u/s Mount Murray		Y		Y
3240	Port Erin Stream	Athol Park Glen		Y		Y
3241	Cott-Ny-Greiney	Surby		Y		Y
3242	Cott-Ny-Greiney	Gansey Mill		Y		Y
3243	Grenaugh River	Port Grenaugh		Y		Y
3244	Dhoon River	Dhoon Glen		Y	Y	Y
3245	Port Jack River	Port Jack Glen		Y		Y
3246	Summerhill River	Summerhill Glen		Y		Y
New for 2020	River Glass	Tromode	Y	Y		Y
New for 2020	River Glass	Papermill	Y	Y		Y
New for 2020	Groudle River	Whitebridge	Y	Y		Y
New for 2020	Silverburn	Ballamodha	Y	Y		Y
New for 2020	Silverburn	Ronaldsway Halt	Y	Y		Y
New for 2020	Santonburn	Mullinaragher		Y		Y

New for 2020	River Neb	Tynwald Mills	Y	Y		Y
		Total	**30**	**87**	**13**	**87**