

Appendix 2: Characterisation, monitoring and classification

Characteristics of Scotland’s waters

The process of reviewing and updating our assessments of pressures and impacts on the water environment has been ongoing throughout the period of 2015 to 2021 and will continue as our understanding improves and pressures shift and change.

We have not made any changes to the general characterisation of water body types or the sub-types we used in defining reference conditions since the second plan was published in 2015.

For the production of this plan, we have applied any revised methods and standards which have been approved by Scottish Ministers following consultation in 2020-21. The 2014 directions on status and standards are in the process of being updated to incorporate those revisions and are due to be published shortly as the 2021 version. These will be linked into the relevant sections as soon as they are available.

The location and boundaries of bodies of surface water can be found on the [Water Environment Hub](#)

Table A2.1: Summary of changes and updates since 2015

We have refined the boundaries of a number of bodies of surface water. This has included merging some water bodies, and splitting others into more than one body to reflect our improving understanding of how the condition of the water environment varies from place to place. As a result, the overall number of bodies of surface water in Scotland has increased from 3247 to 3249 in 2020.

Surface water category	Coverage of water bodies	No. of water bodies	No. excluding heavily modified and artificial	No. heavily modified or artificial ¹
River	<ul style="list-style-type: none"> All watercourses or parts thereof in Scotland with a catchment area greater than 10km²; coastal streams with a catchment areas of 10km² or less but which fulfil one or more of the criteria in UK guidance on the identification of small water bodies; all small lakes connected to watercourses within the catchment of a river water body that do not meet the criteria below for identification as lake water bodies; the main stem of each water body together with the network of tributary watercourses draining to that main stem. 	2410	1639	771

Table A2.1: Summary of changes and updates since 2015 continued

Surface water category	Coverage of water bodies	No. of water bodies	No. excluding heavily modified and artificial	No. heavily modified or artificial ¹
Lake (freshwater lochs)	<ul style="list-style-type: none"> All lochs or parts thereof in Scotland with a surface area greater than 0.5km²; Lochs with a surface area of 0.5 km² or less but which fulfil one or more of the criteria in UK guidance on the identification of small water bodies; Any short lengths of river that do not meet the criteria above for identification as a river water body that connect a lake water body to an estuary or coastal water body. 	334	227	107
Estuary (transitional)	<ul style="list-style-type: none"> All estuaries or parts thereof in Scotland with a surface area greater than 0.5km² or a length longer than 1km; Estuaries with an area of 0.5km² or less and a length of 1km or shorter but which fulfil one or more of the criteria in UK guidance on the identification of small water bodies. 	48	39	9
Coastal water	All coastal water in Scotland from mean high water spring tidal limit and a distance of three nautical miles seaward of the baseline from which UK territorial waters are measured.	457	444	13
All		3,249	2349	900

Note: Further information on the identification of heavily modified and artificial water bodies is provided in Appendix 3.

Table A2.2: Characterisation of surface water body types

Summary of changes and updates since 2015

We have not made any changes to the general characterisation of water body types or subtypes we included in the first plan in 2009. Nor have we made any additional changes to the sub-types we use in defining reference values for hydromorphological, physicochemical, and biological reference conditions for the second plan in 2015.

Surface water category	Ecoregion	System used to differentiate types	Criteria used to characterise types	No. of different types in Scotland	Mapping of types
River	Great Britain	System A in accordance with UK guidance	<ul style="list-style-type: none"> • mean catchment altitude; • catchment size; • dominant geology. 	20	Water Environment Hub
Lake (freshwater lochs)	Great Britain	System B adapted in accordance with UK guidance	<ul style="list-style-type: none"> • latitude and longitude (ecoregion); • catchment geology; • depth. 	16	Water Environment Hub
Estuary (transitional)	North Sea; Atlantic Ocean	System B in accordance with UK guidance	<ul style="list-style-type: none"> • latitude and longitude (ecoregion); • tidal range; • salinity; • mixing characteristics; • mean substratum composition; • wave exposure; • depth. 	3	Water Environment Hub
Coastal water	North Sea; Atlantic Ocean	System B in accordance with UK guidance	<ul style="list-style-type: none"> • latitude and longitude (ecoregion); • tidal range; • salinity (euhaline); • wave exposure. 	8	Water Environment Hub

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Rivers; freshwater lochs; estuaries; coastal waters	<p>Morphological conditions</p> <ul style="list-style-type: none"> physical condition of beds, banks and shores 	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And, in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>Standards for high status in Schedule 3 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And, in Schedule 3 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>For coastal waters, the reference morphological conditions take account of modifications that would affect the direction of dominant currents.</p> <p>For estuaries and coastal waters, the reference morphological conditions take account of modifications that would affect wave exposure.</p>	No change

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Rivers; freshwater lochs	Hydrological regime <ul style="list-style-type: none"> water flows and levels 	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And, in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>Standards for high status in Part B of Schedule 2 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And, status in Part B of Schedule 2 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>For rivers, the reference conditions for water flows take account of the connection to bodies of groundwater (in terms of groundwater flow) expected under reference conditions.</p>	No change
Rivers	River continuity <ul style="list-style-type: none"> access for fish migration 	All	<p>Standards for high status in Schedule 3 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And to status in Schedule 3 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	No change

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Estuaries	Tidal regime <ul style="list-style-type: none"> • freshwater flow 	All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021 And, in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021 The sub-types collectively encompass all water bodies in Scotland.	Standards for good status in Schedule 3 to the Scotland River Basin District (Standards) Directions 2021 And in Schedule 3 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021	No change

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Rivers	<p>General physicochemical conditions</p> <ul style="list-style-type: none"> oxygenation conditions thermal conditions (temperature) acidification status nutrient conditions 	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>Standards for high status in Part C of Schedule 2 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Part C of Schedule 2 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	No change
	<p>General physicochemical conditions</p> <ul style="list-style-type: none"> salinity 	All	Reference conditions correspond to the observed mean salinity of the river water body concerned. This is because there are no pressures in Scotland that have more than very minor effects on the salinity of river water bodies	No change

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Freshwater lochs	<p>General physicochemical conditions</p> <ul style="list-style-type: none"> • oxygenation conditions • salinity • acidification status • nutrient conditions 	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>Standards for high status in Part C of Schedule 2 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Part C of Schedule 2 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	<p>New standards for Nitrate in lochs</p>

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Estuaries; coastal waters	General physicochemical conditions <ul style="list-style-type: none"> • oxygenation conditions • nutrient conditions 	All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021 And in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021 The sub-types collectively encompass all water bodies in Scotland	Standards for high status in Part C of Schedule 2 to the Scotland River Basin District (Standards) Directions 2021 And in Part C of Schedule 2 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021	No change

Table A2.3: Establishment of hydromorphological and physicochemical reference conditions for bodies of surface water continued

Surface water body category	Condition	Types for which reference conditions identified	Reference conditions	Summary of changes and updates to reference conditions since 2015
Coastal waters	<p>General physicochemical conditions</p> <ul style="list-style-type: none"> • salinity • thermal conditions 	All	Reference conditions correspond to the observed mean salinity and mean temperature of the coastal water body concerned. This is because there are no pressures in Scotland that have more than very minor effects on the salinity or thermal conditions of coastal waters.	No change
Rivers; freshwater lochs; estuaries; coastal waters	<p>Specific pollutants selected following peer review on the basis of nationally established method which takes account of:</p> <ul style="list-style-type: none"> • hazardous properties – the persistence, potential to bioaccumulate and toxicity; • potential environmental exposure – based on the level and pattern of use and/or on data from monitoring. 	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>Standards for high status or (if no standard for high status is specified) good status in Part C of Schedule 2 to the Scotland River Basin District (Standards) Directions 2021</p> <p>and in Part C of Schedule 2 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021 unless a separate standard for high status is specified.</p> <p>A standard for high status is only specified for ammonia in rivers and freshwater lochs. In all other cases, the standard for good equates to a no effects concentration identified by UK experts.</p>	No change

Table A2.4: Cases where the establishment of hydromorphological or physicochemical reference conditions was not possible

Condition for which a reference value has not been established	Surface water category for which the reference value has not been established	Reason reference value has not been established	Implications for assessments of the condition of the water environment
Salinity	Estuaries	High degrees of natural variability mean that it was not possible to establish reliable reference conditions	The salinity of estuaries could be significantly affected by changes to freshwater flow or tidal flow. The reference conditions we have established for freshwater flow and for physical condition ensure pressures that could affect salinity are reflected in our assessments of the condition of estuaries.
Transparency	Freshwater lochs; Estuaries; Coastal waters	High degrees of natural variability mean that it was not possible to establish reliable reference conditions	Changes in transparency can be caused by: <ul style="list-style-type: none"> • an increase in the biomass of phytoplankton resulting from nutrient enrichment. The reference conditions we have established for nutrient conditions and for phytoplankton in lochs, estuaries and coastal waters ensure pollution by nutrients is reflected in our assessments of the condition of the water environment; • the release into the water of fine sediments (a) from the bed, banks or shores as a result of engineering works in water bodies; or (b) urban and rural land management, including construction, agriculture and forestry. Our programme of measures (see Appendix 8) includes measures to control and minimise the risk of fine sediment releases as a result of such activities.

Table A2.4: Cases where the establishment of hydromorphological or physicochemical reference conditions was not possible continued

Condition for which a reference value has not been established	Surface water category for which the reference value has not been established	Reason reference value has not been established	Implications for assessments of the condition of the water environment
Thermal conditions	Estuaries	High degrees of natural variability mean that it was not possible to establish reliable reference conditions	The thermal condition of estuaries could be affected by changes to freshwater flow or tidal flow. The reference conditions we have established for freshwater flow and for physical condition ensure pressures that could affect thermal condition are reflected in our assessments of the condition of estuaries.
	Freshwater lochs	We have been unable to identify an ecologically-relevant reference value for thermal conditions in lochs as a result of the difficulty in establishing a relationship between the condition of water plants and animals and the complex thermal structure created by temperature gradients.	The thermal condition of lochs could be significantly affected by water impoundment and consequent changes to water flows and levels. The reference conditions we have established for water levels and physical condition ensure that pressures that could affect the thermal condition of lochs are reflected in our assessments of the condition of the water environment.

Table A2.5: Establishment of reference conditions for plants and animals in rivers

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Larger rooted or floating plants (macrophytes)	All	River Assessment Method, Macrophytes and Phytobenthos, – Macrophytes (River LEAFPACS)	No change
Small, bottom-living algae (phytobenthos)	All	River Assessment Method, Macrophytes and Phytobenthos, Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (River DARLEQ3)	No change
Bottom-living invertebrate animals	All	River Assessment Method, Benthic Invertebrate Fauna, Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT) An online version is available on the FBA website .	No change
	All sub-types identified in Schedule 1 to The Scotland River Basin District (Standards) Directions 2021 The sub-types collectively encompass all water bodies in Scotland	River Assessment Method, Benthic Invertebrate Fauna, Invertebrates (Anthropogenic Acidification): WFD Acid Water Indicator Community (WFD-AWIC)	No change
Fish	All	River Assessment Method, Fish Fauna, Fisheries Classification Scheme 2 (FCS2) Scotland	No change

Table A2.6: Cases where biological reference conditions for rivers have not been established

Water plant or animal for which a reference value has not been established	Reason reference value has not been established	Implications for assessments of the condition of the water environment
<p>Microscopic plants in the water column (phytoplankton)</p>	<p>High degrees of natural variability mean that it was not possible to establish reliable reference conditions. Scotland lacks the large, slow flowing rivers found in parts of continental Europe. Its relatively short, fast flowing rivers result in phytoplankton assemblages being absent or very short lived.</p>	<p>The reference conditions we have established for other water plants, physicochemical condition, river flows, and physical condition ensure that pressures that could affect any phytoplankton assemblages are reflected in our assessments of the condition of rivers.</p>

Table A2.7: Establishment of reference plants and animals in freshwater lochs

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Microscopic plants in the water column (phytoplankton)	All	Lake Assessment Method, Phytoplankton, Phytoplankton Lake Assessment Tool with Uncertainty Module (PLUTO)	No change
Larger rooted or floating plants (macrophytes)	All	Lake Assessment Method, Macrophytes and Phytobenthos, Macrophytes (Lake LEAFPACS2)	No change
Small, bottom-living algae (phytobenthos)	<p>All sub-types identified in Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And, identified in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland.</p>	Lake Assessment Method, Macrophytes and Phytobenthos, Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (Lake DARLEQ2)	No change

Table A2.7: Establishment of reference plants and animals in freshwater lochs continued

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Bottom-living invertebrate animals	All	Lake Assessment Method, Benthic Invertebrate Fauna, Chironomid Pupal Exuviae Technique (CPET)	No change
	<p>All sub-types identified Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland.</p>	Lake Assessment Method, Benthic Invertebrate Fauna, Lake Acidification Macroinvertebrate Metric (LAMM)	Revised

Table A2.7: Establishment of reference plants and animals in freshwater lochs continued

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Fish	<p>All sub-types identified Schedule 1 to the Scotland River Basin District (Standards) Directions 2021</p> <p>And in Schedule 1 to the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The sub-types collectively encompass all water bodies in Scotland</p>	<p>GB Lake Fish e-DNA Assessment Procedure</p>	<p>Newly established</p>

Table A2.8: Establishment of reference conditions for plants and animals in estuaries

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Microscopic plants in the water column (phytoplankton)	All	Transitional Water Assessment Method, Phytoplankton, Transitional Water Phytoplankton Tool	No change
Seaweeds (macroalgae)	All	Transitional Water Assessment Method, Macroalgae, Furoid Extent Tool	No change
	All	Transitional and Coastal Water Assessment Method, Macroalgae, Opportunistic Macroalgal Blooming Tool	No change
Seagrasses (angiosperms)	All	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool	No change
Bottom-living invertebrate animals	All	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index	No change
Fish	All	Transitional Water Assessment Method, Fish Fauna, Transitional Fish Classification Index	No change

Table A2.9 Establishment of reference conditions for plants and animals in coastal waters

Water plants or animals	Types for which reference conditions identified	Where the reference condition is defined	Summary of changes and updates to reference conditions since 2015
Microscopic plants in the water column (phytoplankton)	All	Coastal Water Assessment Method, Phytoplankton, Coastal Water Phytoplankton Tool	No change
Seaweeds (macroalgae)	All	Transitional and Coastal Water Assessment Method, Macroalgae, Opportunistic Macroalgal Blooming Tool	No change
		Coastal Water Assessment Method, Macroalgae, Macroalgae - Intertidal Rocky Shore Macroalgal Index	No change
Seagrasses (angiosperms)	All	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool	No change
Bottom-living invertebrate animals	All	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate fauna, Invertebrates in Soft Sediments, Infaunal Quality Index	No change
		Coastal Water Assessment Method, Benthic Invertebrate Fauna, Assessment of Imposex in Nucella Lapillus (Dog Whelks)	No change

Table A2.10: Identification of significant pressures on bodies of surface water

Summary of changes and updates since 2015

Over the period 2015 to 2021, we have improved our understanding of pressures and their impacts on bodies of surface waters. Among the reasons for this was the availability of a further six years of targeted environmental monitoring and developments in scientific knowledge of the environmental standards needed to protect aquatic plant and animals.

Pressures are identified as significant where they:

- have contributed to a breach of an environmental standard for good;
- are contributing to a risk that an environmental standard will be breached (e.g. contributing to an upward trend in the concentration of pollutants).

Information on all significant pressures and their impacts is included in the [Water Environment Hub](#) in the data maintained on each water body.

Appendix 5 identifies some of the work we will be doing over the period 2021 to 2027 to further improve our understanding of pressures on the water environment.

Type of pressure	Sources of information collected and held on the location and magnitude of pressure	Assessment of the effect of pressures (including cumulatively)	Assessment of the significance of pressures (including cumulatively)
Point source discharges	<ul style="list-style-type: none"> • Location and permitted pollutant content of discharges specified in the authorisations for those discharges; • Pollutant emission data supplied by operators of discharges as a condition of authorisation; • Audits of compliance with authorisation conditions by regulators; • Pollution emission data supplied for the purposes of the Scottish Pollutant Release Inventory; • Chemical investigation programmes in relation to waste water discharges; • Investigations to identify the sources of pollutants found in environmental monitoring results. 	Environmental monitoring of pollutant concentrations supplemented by water quality modelling and trend analyses.	Application of the relevant standards for physicochemical conditions and water plants and animals specified in the Scotland River Basin District (Standards) Directions 2021 And in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.10: Identification of significant pressures on bodies of surface water continued

Type of pressure	Sources of information collected and held on the location and magnitude of pressure	Assessment of the effect of pressures (including cumulatively)	Assessment of the significance of pressures (including cumulatively)
Diffuse source pollution	<ul style="list-style-type: none"> • Land use data combined with loading estimates for different land uses based on national research programme results; • Surveys of land management practices; • National pesticide usage surveys. 	Environmental monitoring of pollutant concentrations supplemented by water quality modelling and trend analyses.	<p>Application of the relevant standards for physicochemical conditions and water plants and animals specified in the Scotland River Basin District (Standards) Directions 2021</p> <p>And in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>
Water abstraction and flow regulation	<ul style="list-style-type: none"> • Location and rate of permitted abstractions specified in the authorisations for all abstractions of > 10m³ per day; • Actual rate of abstraction supplied by operators of large abstractions as a condition of authorisation; • Location and operating requirements specified in authorisations required for all impounding works; • Audits of compliance with authorisation conditions by regulators; • Location of abstractions of less than 10m³ per day for private supplies. 	Water flow and level modelling , taking account of information on the location and rates of abstraction, the results of rainfall and water flow and level monitoring – this includes information from the network of river flow gauging stations maintained by SEPA.	<p>Application of the relevant standards for flows and levels and water plants and animals specified in the Scotland River Basin District (Standards) Directions 2021</p> <p>And, specified in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>

Table A2.10: Identification of significant pressures on bodies of surface water continued

Type of pressure	Sources of information collected and held on the location and magnitude of pressure	Assessment of the effect of pressures (including cumulatively)	Assessment of the significance of pressures (including cumulatively)
Modifications to physical condition	<ul style="list-style-type: none"> • Remote sensing surveys; • Field surveys; • Details specified in authorisations for all modifications that have been made between 2005 and 2015; • Audits of compliance with authorisation conditions by regulators. 	Use of the information collected on all modifications to determine morphological condition values for each water body in accordance with the method set out in the Scotland River Basin District (Standards) Directions 2021 and in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021	Application of the standards for morphological condition specified in the Scotland River Basin District (Standards) Directions 2021 And in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Barriers to fish migration	<ul style="list-style-type: none"> • Location of authorised weirs and dams lacking provision for fish migration; • Audits of compliance with authorisation conditions by regulators; • Identification of other structures based on assessments by public bodies and by members of the Rivers and Fishery Trusts of Scotland. 	Assessment of the pass-ability of the structures to fish using national guidance /fish monitoring results.	Application of the standards for river continuity/fish specified in the Scotland River Basin District (Standards) Directions 2021 And specified in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Invasive non-native species	<ul style="list-style-type: none"> • Public body environmental monitoring programmes and surveys; • Information collected by voluntary organisations, research institutes. 	Risk assessments undertaken by the Great Britain Non-Native Species Secretariat Environmental monitoring programmes and surveys.	Application of the criteria specified in the Scotland River Basin District (Standards) Directions 2021 And specified in the Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Note to table A2.10:

1. References to authorisations mean the authorisations required under the controls identified in our programmes of measures (see Appendix 8).
2. Further information on authorisation requirements and compliance assessment for the main controls is available on [SEPA's website](#) and on the [Scottish Government's website](#).
3. The [environmental standards](#), including the [biological standards](#), used to assess whether pressures are significant were reviewed and updated where necessary during the period 2015 to 2021.

Information on land use patterns (e.g. see [Scotland's environment web](#); Land capability classification for agriculture; etc.) has been taken into account in assessments in various ways, including in estimating diffuse pollution pressures and identifying where pressures are likely to increase as a result of demographic changes or shifts in land use management practices.

Table A2.11 Assessment of impact on bodies of surface water

1. Identification of water bodies that are not at good status	
Approach	Further details
(a) We established and applied a framework of criteria and procedures to assess and classify the condition of all water bodies of surface water.	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
(b) We established a set of environmental standards and associated assessment methods for application within the classification framework.	Environmental standards The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
	Assessment methods Biological assessment methods; Chemical assessment methods
(c) We applied the framework to the results of environmental monitoring and modelling to classify the condition of all bodies of surface water and identify those that are not in a good condition.	Results for each water body are available on the Classification Hub
2. Identification of risks of deterioration	
(d) Analysis of proximity of water bodies to established populations of invasive nonnative species and the associated risk of invasion if the spread of the species is not prevented.	Information on water bodies identified as at risk is available on the Water Environment Hub

Table A2.12 Characterisation of groundwaters

1. Location and boundaries of bodies of groundwater			
<p>The number and location of bodies of groundwater has not changed since the second RBMP was published.</p> <p>Information on the location and boundaries of the bodies of groundwater is available on Water Environment Hub.</p>			
Summary of approach	Aquifer type	Number of bodies of groundwater	
<p>Boundaries were identified by:</p> <ul style="list-style-type: none"> • assigning groundwater to aquifer types reflective of groundwater flow characteristics and natural chemistry; • sub-dividing individual aquifers further (i.e. into more than one water body) where necessary to reflect differences in pressure on, or vulnerability of, different parts of the aquifers. Where aquifers were subdivided, the boundaries of the resulting water bodies follow surface water catchment boundaries or geological and structural features, such as faults and folds. <p>The approach included separation of bodies of groundwater into two layers: a shallow layer of superficial water bodies and a thicker layer of bedrock water bodies.</p> <p>Further information on the approach is available in, Scotland's aquifers and groundwater bodies published by the British Geological Society</p>	All	403	
	Bedrock	Permo-Triassic	10
		Carboniferous – not extensively mined for coal	40
		Carboniferous – extensively mined for coal	33
		Old Red Sandstone North	38
		Old Red Sandstone South	37
		Silurian-Ordovician	19
		Highland calcareous	10
		Precambrian North	26
		Precambrian South	31
		Igneous volcanic	30
		Igneous intrusive	5
		Igneous/sedimentary	9
		Shetland low permeability	11
Ayrshire basic	1		
Superficial	Quaternary, buried quaternary or weathered bedrock	103	

Table A2.12 Characterisation of groundwaters continued

2. Information on the characteristics of bodies of groundwater, including the pressures to which they are subject	
Characteristic	Source of information
Geological characteristics (aquifer type)	Scotland's aquifers and groundwater bodies
Hydrological characteristics	Scotland's aquifers and groundwater bodies
Natural chemistry	Scotland's aquifers and groundwater bodies
Annual recharge	Water Environment Hub
Overlying strata (and vulnerability to pollution)	Water Environment Hub
Dependent surface water bodies and wetlands	Water Environment Hub
Pressures to which groundwater body is subject	<ul style="list-style-type: none"> • Information is maintained by SEPA on the location and rates of abstraction of groundwater in copies of the authorisations required for all abstractions of 10m³ per day or more. • Diffuse sources of pollution have been identified using information on land use, the characteristics of the overlying strata and groundwater monitoring results. • Pollutant inputs from sources in contaminated ground have been identified using information on past land uses, surveys of land quality and groundwater monitoring. • Legacy impacts from abandoned underground mines have been identified using information from environmental monitoring programmes. • Information on all pressures contributing to a body of groundwater being in poor status or to a significant and sustained upward trend in pollutant concentrations is available on the Water Environment Hub
Connection to surface waters	The flow between groundwater and surface waters is taken into account in low flow models for associated bodies of surface water.

Table A2.13 Assessment of impact on bodies of groundwater

1. Identification of water bodies in a poor condition	
Approach	Further details
(a) We established and applied a framework of criteria and procedures to assess and classify the condition of all bodies of groundwater.	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
(b) We established a set of threshold values for use in helping to identify bodies of groundwater that may be at poor status. We reviewed and updated the threshold values during the period 2015 to 2021.	Threshold values The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
(c) We identified where the threshold values were exceeded using the results of monitoring and modelling.	In 2020, 64 bodies of groundwater in Scotland were identified as being in a poor condition. Further details for each water body are available on the Classification Hub
(d) Where we identified that a threshold value was exceeded, we carried out investigations and applied the criteria in the classification framework to determine whether the water body was in a good or poor condition.	
2. Identification of risks of deterioration	
(e) We analysed monitoring data from bodies of groundwater to identify any significant and sustained upward trends in the concentration of pollutants in groundwater.	In 2018 (the latest year for which data are available), we identified a significant and sustained upward trend in 14 bodies of groundwater. Further information on the water bodies concerned is available on the Water Environment Hub

Monitoring and classification

This part of the appendix, together with the information referred to on the [Water Environment Hub](#) and [Classification Hub](#) provides information on our monitoring programmes and on how we assess and classify the condition of the water environment.

For the production of this plan, we have applied any revised methods and standards which have been approved by Scottish Ministers following consultation in 2020-21. The 2014 directions on status and standards are in the process of being updated to incorporate those revisions and are due to be published shortly as the 2021 version. These will be linked into the relevant sections as soon as they are available.

Table A2.14: Establishment and implementation of monitoring programmes

Establishment of programmes of monitoring.	Water Environment and water Services (Scotland) Act 2003 The Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004 (legislation.gov.uk)
Content of the programmes.	The Water Environment (River Basin Management Planning: Further Provision) (Scotland) Regulations 2013 The Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004 (legislation.gov.uk)
Responsibility for preparing programmes.	SEPA
Responsibility for carrying out or securing the carrying out of the programmes.	SEPA
Date which programmes first commenced.	22 December 2006
Contact point for obtaining monitoring data gathered through the monitoring programmes. For information on the procedures for doing so, see Appendix 1.	SEPA

Table A2.15: Monitoring networks

The initial monitoring programmes for the purposes of the river basin management plans were established at the end of 2006.

Information on the establishment of the programmes was published in an [aquatic monitoring strategy](#) for the district.

The programmes are designed on the basis of:

- assessments of risk to our objectives for the water environment. These assessments take account of the results of monitoring programmes and analyses of information on pressures;
- information on when and where measures are being taken for the purposes of improving the condition of the water environment;
- reports of accidental pollution.

The initial programmes have been reviewed and updated on an annual basis accordingly.

The programmes will be comprehensively reviewed during the period 2021 to 2027. In particular, the review will ensure the programmes monitor the effectiveness of the measures taken under this plan to improve the condition of water bodies and protected areas.

Water category	Type of programme	Main purposes of programme		Maps of monitoring networks
Surface waters and groundwater	Surveillance	<ul style="list-style-type: none"> • Supplementing and validating impact assessments and informing the design of future monitoring programmes; • Assessing longterm changes, including those resulting from widespread human activities. 	<p>During the period 2021 to 2027, we will amend the monitoring network to shift effort from water bodies where we have established status to:</p> <ul style="list-style-type: none"> • supplementing and validating the outputs of our water quality models; • identifying and assessing emerging risks 	<p>Water Environment Hub</p>

Table A2.15: Monitoring networks continued

Water category	Type of programme	Main purposes of programme		Maps of monitoring networks
Surface waters and groundwater	Operational	<ul style="list-style-type: none"> • assessing the condition of water bodies that are under pressure; • assessing changes resulting from actions taken to improve or protect the condition of water bodies; • establish the presence of any long-term trends in the concentration of pollutants. 	<p>We will amend the network during the period 2021 to 2027 in order to:</p> <ul style="list-style-type: none"> • assess changes resulting from the programme of measures established in this plan; • improve understanding of the impacts of pressures (see Appendix 5). 	<p>Water Environment Hub</p>
	Investigative	<ul style="list-style-type: none"> • identifying the cause of impacts where these are not known; • ascertaining the magnitude and impacts of accidental pollution; • improving understanding of the impacts of pressures. 	<p>Where appropriate, we will use investigative monitoring during the period 2021 to 2027 to help improve our understanding of pressure and impacts - including in particular the improvements highlighted as needed in Appendix 5.</p>	<p>Dynamic and highly variable and hence not mapped.</p>

Table A2.15: Monitoring networks continued

Water category	Type of programme	Main purposes of programme		Maps of monitoring networks
Groundwater	Level monitoring	<ul style="list-style-type: none"> • assessing the quantitative status of bodies of groundwater; • identifying the available groundwater resource 	We will amend the network during the period 2021 to 2027 in order to assess changes resulting from the programme of measures established in this plan	Water Environment Hub
Protected areas	Specific programmes for protected areas are designed. These are integrated with the monitoring programmes outlined above wherever possible. Monitoring of wildlife protected areas that are at risk of not achieving their objectives is included in the operational monitoring programmes for the water bodies concerned.	<ul style="list-style-type: none"> • assessing the condition of protected areas; • identifying risks to the achievement of the protected areas objectives; • assessing the effectiveness of the measures taken to achieve the objectives for the areas. 	We will amend the network during the period 2021 to 2027 in order to assess changes resulting from the programme of measures established in this plan.	Water Environment Hub

Table A2.16: Assessment of the condition of the water environment

An overview of our approach to assessing the condition of the water environment is set out in Assessing Scotland's water environment – use of environmental standards, condition limits and classification schemes				
Condition	Assessment framework	Environmental standards or threshold values applied	Map of the results of monitoring programmes	Detailed results per water body, including level of confidence in results
Surface waters - ecological status	<p>The Scotland River Basin District (Status) Directions 2021</p> <p>The Solway Tweed River Basin District (Status) (Scotland) Directions 2021</p> <p>Specifications for chemical analysis and monitoring: https://www.gov.scot/publications/the-chemical-analysis-of-water-status-technical-specifications-scotland-no2-directions-2011/</p>	<p>The Scotland River Basin District (Standards) Directions 2021</p> <p>The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	Classification Hub	Classification Hub
Surface waters – ecological potential	<p>See appendix 3;</p> <p>Specifications for chemical analysis and monitoring: https://www.gov.scot/publications/the-chemical-analysis-of-water-status-technical-specifications-scotland-no2-directions-2011/</p>	See appendix 3	Classification Hub	Classification Hub

Table A2.16: Assessment of the condition of the water environment continued

Condition	Assessment framework	Environmental standards or threshold values applied	Map of the results of monitoring programmes	Detailed results per water body, including level of confidence in results
Surface water bodies that are not in good status or good potential because of the concentration of a specific pollutant.	<p>The Scotland River Basin District (Status) Directions 2021</p> <p>The Solway Tweed River Basin District (Status) (Scotland) Directions 2021</p> <p>Specifications for chemical analysis and monitoring: https://www.gov.scot/publications/the-chemical-analysis-of-water-status-technical-specifications-scotland-no2-directions-2011/</p>	<p>The Scotland River Basin District (Standards) Directions 2021</p> <p>The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	<p>Classification Hub</p>	<p>Classification Hub</p>
Surface waters - chemical status	<p>The Scotland River Basin District (Status) Directions 2021</p> <p>The Solway Tweed River Basin District (Status) (Scotland) Directions 2021</p> <p>Specifications for chemical analysis and monitoring: https://www.gov.scot/publications/the-chemical-analysis-of-water-status-technical-specifications-scotland-no2-directions-2011/</p>	<p>The Scotland River Basin District (Standards) Directions 2021</p> <p>The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	<p>Classification Hub</p>	<p>Classification Hub</p>

Table A2.16: Assessment of the condition of the water environment continued

Condition	Assessment framework	Environmental standards or threshold values applied	Map of the results of monitoring programmes	Detailed results per water body, including level of confidence in results
Groundwater – quantitative status	The Scotland River Basin District (Status) Directions 2021 The Solway Tweed River Basin District (Status) (Scotland) Directions 2021	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021	Classification Hub	Classification Hub
Groundwater – chemical status	The Scotland River Basin District (Status) Directions 2021 The Solway Tweed River Basin District (Status) (Scotland) Directions 2021	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021	Classification Hub	Classification Hub

Table A2.16: Assessment of the condition of the water environment continued

Condition	Assessment framework	Environmental standards or threshold values applied	Map of the results of monitoring programmes	Detailed results per water body, including level of confidence in results
<p>Long-term trends in concentration of priority substances</p>	<p>The water Environment (River Basin Management Planning: Further Provision) (Scotland) Regulations 2013;</p> <p>Specifications for chemical analysis and monitoring:</p> <p>https://www.gov.scot/publications/the-chemical-analysis-of-water-status-technical-specifications-scotland-no2-directions-2011/</p>	<p>The Scotland River Basin District (Standards) Directions 2021</p> <p>The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>		<p>No trends identified by 2020. A longer period of monitoring may be required to identify any trends.</p>

Table A2.16: Assessment of the condition of the water environment continued

Condition	Assessment framework	Environmental standards or threshold values applied	Map of the results of monitoring programmes	Detailed results per water body, including level of confidence in results
Groundwater – trends in pollutant concentrations	The Water Environment (River Basin Management Planning: Further Provision) (Scotland) Regulations 2013	<p>The starting point for trend reversal is where concentrations reach 75% of any threshold values established in the Scotland River Basin District (Standards) Directions 2021</p> <p>And in The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p>	Water Environment Hub	Water Environment Hub
Achievement of protected areas objectives	See appendix 4	See appendix 4	Water Environment Hub	Water Environment Hub

Table A2.17 Information on methodologies used for monitoring the impact of pressures on rivers

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Nutrient enrichment	Larger rooted or floating plants (macrophytes)	River Assessment Method, Macrophytes and Phytobenthos, – Macrophytes (River LEAFPACS)
		Small, bottom-living algae (phytobenthos)	River Assessment Method, Macrophytes and Phytobenthos, Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (River DARLEQ3)
		Reactive phosphorus concentrations	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
	Organic enrichment	Bottom-living invertebrate animals	River Assessment Method, Benthic Invertebrate Fauna, Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)
		Bacterial tufts	River Assessment Method, Macrophytes and Phytobenthos, Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (River DARLEQ3)
		Dissolved oxygen concentrations Biochemical oxygen demand	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.17 Information on methodologies used for monitoring the impact of pressures on rivers continued

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Acid deposition	Bottom-living invertebrate animals	River Assessment Method, Benthic Invertebrate Fauna, Invertebrates (Anthropogenic Acidification): WFD Acid Water Indicator Community (WFDAWIC)
		Fish	River Assessment Method, Fish Fauna, Fisheries Classification Scheme 2 (FCS2) Scotland
		pH and acid neutralising capacity	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
	Thermal discharges	Fish	River Assessment Method, Fish Fauna, Fisheries Classification Scheme 2 (FCS2) Scotland
		Water temperature	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.17 Information on methodologies used for monitoring the impact of pressures on rivers continued

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Point and diffuse inputs of toxic pollutants	Bottom-living invertebrate animals	River Assessment Method, Benthic Invertebrate Fauna, Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)
		Concentrations of specific pollutants and priority substances	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Modifications to physical condition		Morphological condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Fish	River Assessment Method, Fish Fauna, Fisheries Classification Scheme 2 (FCS2) Scotland
Barriers to fish migration		River continuity condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Fish	River Assessment Method, Fish Fauna, Fisheries Classification Scheme 2 (FCS2) Scotland
Water abstraction and impoundment		River flows	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Ecological indicators	River Assessment Method, Ecological indicators of severe water resources pressures
Invasive non-native species		Invasive species	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Other biological assessment methods listed above, as appropriate	

Table A2.18 Information on methodologies used for monitoring the impact of pressures on freshwater lochs

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Nutrient enrichment	Microscopic plants in the water column (phytoplankton)	Lake Assessment Method, Phytoplankton, Phytoplankton Lake Assessment Tool with Uncertainty Module (PLUTO)
		Larger rooted or floating plants (macrophytes)	Lake Assessment Method, Macrophytes and Phytobenthos, Macrophytes (Lake LEAFACS2)
		Small, bottom-living algae (phytobenthos)	Lake Assessment Method, Macrophytes and Phytobenthos, Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (River DARLEQ2)
		Bottom-living invertebrate animals	Lake Assessment Method, Benthic Invertebrate Fauna, Chironomid Pupal Exuviae Technique (CPET)
		Concentrations of total phosphorus	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Dissolved oxygen concentrations	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Concentrations of nitrogen	Lake Nitrogen
		Fish	GB Lake Fish e-DNA Assessment Procedure
	Acid deposition	Bottom-living invertebrate animals	Lake Assessment Method, Benthic Invertebrate Fauna, Lake Acidification Macroinvertebrate Metric (LAMM)
		Acid neutralising capacity	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.18 Information on methodologies used for monitoring the impact of pressures on freshwater lochs continued

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Point and diffuse inputs of toxic pollutants	Concentrations of specific pollutants and priority substances	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Modifications to physical condition		Morphological condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Water abstraction and impoundment		Water levels	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Morphological condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Invasive non-native species		Invasive species	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Other biological assessment methods listed above, as appropriate.	

Table A2.19: Information on methodologies used for monitoring the impact of pressures on estuaries

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Nutrient enrichment	Microscopic plants in the water column (phytoplankton)	Transitional Water Assessment Method, Phytoplankton, Transitional Water Phytoplankton Tool
		Seaweeds (macroalgae)	Transitional and Coastal Water Assessment Method, Macroalgae, Opportunistic Macroalgal Blooming Tool
		Seagrasses (angiosperms)	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool
		Concentrations of inorganic nitrogen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Concentration of dissolved oxygen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
	Organic enrichment	Bottom-living invertebrate animals	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index
		Concentration of dissolved oxygen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.19: Information on methodologies used for monitoring the impact of pressures on estuaries continued

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Point and diffuse inputs of toxic pollutants	Concentrations of specific pollutants and priority substances	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Bottom-living invertebrate animals	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index
		Seaweeds (macroalgae)	Transitional Water Assessment Method, Macroalgae, Furoid Extent Tool
Physical condition, including tidal regime and freshwater flow		Morphological condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Freshwater flow condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Bottom-living invertebrate animals	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index
		Seagrasses (angiosperms)	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool
		Fish	Transitional Water Assessment Method, Fish Fauna, Transitional Fish Classification Index
Invasive non-native species		Invasive species	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Other biological assessment methods listed above, as appropriate	

Table A2.20: Information on methodologies used for monitoring the impact of pressures on coastal waters

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Nutrient enrichment	Microscopic plants in the water column (phytoplankton)	Coastal Water Assessment Method, Phytoplankton, Coastal Water Phytoplankton Tool
		Seaweeds (macroalgae)	Transitional and Coastal Water Assessment Method, Macroalgae, Opportunistic Macroalgal Blooming Tool
			Coastal Water Assessment Method, Macroalgae, Macroalgae - Intertidal Rocky Shore Macroalgal Index
		Seagrasses (angiosperms)	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool
		Concentrations of inorganic nitrogen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Concentration of dissolved oxygen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
	Organic enrichment	Bottom-living invertebrate animals	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index
		Concentration of dissolved oxygen	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021

Table A2.20: Information on methodologies used for monitoring the impact of pressures on coastal waters continued

Pressure		Principal indicators of impact used	Method used, including, where applicable, information on the taxonomic level required and the calculation of confidence
Pressures on water quality - pollution	Point and diffuse inputs of toxic pollutants	Concentrations of specific pollutants and priority substances	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
Physical condition, including tidal regime		Morphological condition	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Bottom-living invertebrate animals	Transitional and Coastal Water Assessment Methods, Benthic Invertebrate Fauna, Infaunal Quality Index
		Seagrasses (angiosperms)	Transitional and Coastal Water Assessment Method, Angiosperms, Intertidal Seagrass Tool
Invasive non-native species		Invasive species	The Scotland River Basin District (Standards) Directions 2021 The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021
		Other biological assessment methods listed above, as appropriate.	

Table A2.21 Threshold values for assessing groundwater chemical status – 1

<p>The threshold values set out in this table and table A2.26 are established in The Scotland River Basin District (Standards) Directions 2021 and The Solway Tweed River Basin District (Standards) (Scotland) Directions 2021</p> <p>The changes and additions made to the threshold values in 2021 are described in the Scottish Government consultation on Protecting Scotland’s Groundwaters from Pollution</p>		
Risk indicated by a failure of the threshold value	Assessment statistic	Value/Method for deriving the threshold value
<p>Threshold values indicative of risks to the ecological or chemical quality of an associated surface water from point or diffuse source pollution.</p>	<p>(i) Mean concentration (mg/l) for nitrate(iii).</p> <p>(ii) As specified in Part C of Schedule 2 of the Standards Directions for the relevant chemical standard for the pollutant in the applicable surface water</p>	<p>(i) 18 for nitrate(iii).</p> <p>(iii) For other substances use the corresponding environmental standard identified in Part C of Schedule 2 of the standards directions.</p> <p>Threshold values for radioactive substances are based on dose and risk from ionising radiation, applied to representative persons (iv), (v), (vi), (vii).</p>
<p>Threshold value indicative of risks to the quality of a wetland directly depending on groundwater</p>	<p>As set out in Table A2.22 for nitrate. For other substances a value that represents significant damage to the wetland caused by the pollutant or group of pollutants reaching the wetland via groundwater. Threshold values for radioactive substances are based on dose and risk from ionising radiation, applied to representative persons (iv), (v), (vi), (vii).</p>	
<p>Threshold values indicative of risks to the quality of water being abstracted, or intended to be abstracted, for human consumption(i)</p>	<p>Maximum value</p>	<p>The threshold value should be determined using the hierarchy (viii). If no values can be derived using the hierarchy the threshold value should be set at the laboratory detection limit. Threshold values for radioactive substances are based on dose and risk from ionising radiation, applied to representative persons (iv), (v), (vi), (vii).</p>

Table A2.21 Threshold values for assessing groundwater chemical status – 1 continued

Risk indicated by a failure of the threshold value	Assessment statistic	Value/Method for deriving the threshold value
Threshold values indicative of risks to the quality of water being abstracted, or intended to be abstracted, for non-human consumption uses.	Statistic relevant to the value applied.	A value that represents an impairment of the particular non-human consumptive use of the water environment. Threshold values for radioactive substances are based on dose and risk from ionising radiation, applied to representative persons (iv), (v), (vi), (vii).
Threshold values indicative of risks of saline intrusion into the body of groundwater	Mean conductivity (micro-siemens/cm)	1,000 for electrical conductivity.
Threshold values indicative of other significant environmental risks including those affecting the ability of groundwater to support human uses	(i) Mean conductivity (micro-siemens/cm) for electrical conductivity. (iv) Annual mean	(i) 1000 for electrical conductivity. (ii) The threshold value should be set at 75% of the value determined using the hierarchy (viii). If no values can be derived using the hierarchy the threshold value should be set at the laboratory detection limit. Threshold values for radioactive substances are based on dose and risk from ionising radiation, applied to representative persons (iv), (v), (vi), (vii).

Note for table A2.21:

- (i) For the purpose of assessing risks to the quality of water being abstracted, or intended to be abstracted, for human consumption, the relevant thresholds apply to groundwater representative of the quality of the water being abstracted or intended to be abstracted.
- (ii) For the purpose of assessing other significant risks, the relevant electrical conductivity threshold value must be applied for the purposes of assessing the impact of mining on the chemical status of bodies of groundwater.
- (iii) For the purposes of assessing risks to the ecological or chemical quality of associated surface waters, the relevant threshold value for nitrate is applicable only where there is an associated failure of a nitrogen-related standard in an associated surface water.
- (iv) Review of Radioactive Waste Management Policy: Final Conclusions, (Cm2919), HMSO 1995.
- (v) The Environmental Authorisations (Scotland) Regulations 2018, Schedule 8.
- (vi) The 2007 Recommendations of the International Commission on Radiological Protection (ICRP 103) International Commission on Radiological Protection 2007.
- (vii) Radiation protection and safety of radiation sources: International Basic Safety Standards (General Safety Requirements Part 3) International Atomic Energy Agency 2014.
- (viii) Hierarchy to be applied when selecting a suitable value.
Apply in the following order
 - a) Groundwater Directive pesticide standard as set out in Annex 1 of the Groundwater Directive (if applicable).
 - b) Scottish drinking water standard as set out in The Water Intended For Human Consumption (Private Supplies) (Scotland) Regulations 2017 and The Public Water Supplies (Scotland) Regulations 2014.
 - c) Any other UK drinking water standard.
 - d) World Health Organisation (WHO) drinking water guideline value.
 - e) Other international drinking water value that has been derived in a manner consistent with WHO guidance.
 - f) Use of a published Health Criteria Value to derive a value following WHO guidance.If the values derived under (a) to (f) are above the effective solubility of the substance in groundwater, then set the value at the effective solubility.

Table A2.22 Threshold values for assessing groundwater chemical status – 2

Pollutant or indicator of pollution	Unit of measurement and associated assessment statistic	Groundwater dependent wetland type	Threshold values indicative of risks to the quality of groundwater dependent wetlands	
			Altitude of wetland above sea level (metres)	
			≤ 175	> 175
Nitrate	Annual mean concentration (mg/l NO ₃) in groundwater on which the wetland depends	Quaking bog	18	4
		Wet woodland	22	9
		Wet dune	13	13
		Fen (mesotrophic) and fen meadow	22	9
		Fen (oligotrophic) and wetland at tufa forming springs	20	4
		Wet grassland	26	9
		Wet heath	13	9
		Peatbog and woodland on peatbog	9	9
		Wetland directly irrigated by spring or seepage	9	9
		Swamp (oligotrophic)	18	18
		Swamp (mesotrophic) and reedbed	22	22

Note for table A2.22:

For the purpose of groundwater chemical status assessment, the above threshold values apply where:

- (i) the wetland concerned is significantly damaged;
- (ii) the characteristics of the damage are such that it may be due to nitrate reaching the wetland via groundwater.

For information on wetland types, see [The Scotland River Basin District \(Standards\) Directions 2021](#); [The Solway Tweed River Basin District \(Standards\) \(Scotland\) Directions 2021](#)

Table A2.23 Background information on the establishment of threshold values for assessing groundwater chemical status

Background information topic	Where information can be accessed
How EU guidelines have been followed in setting threshold values.	Page 6, Section 3 of the Groundwater chemical classification for the purposes of the Water Framework Directive and the Groundwater Directive , published by the UK Technical Advisory Group on the Water Framework Directive.
Application of the threshold values.	The values have been established at national level and apply to all bodies of groundwater in Scotland.
The relationship between the threshold values and background levels, other standards for water protection, information on hazardous properties and dispersion tendency.	Table A2.21 and The Scotland River Basin District (Status) Directions; SEPA Guidance WAT-PS-10, Assigning groundwater assessment criteria for pollutant inputs .
The number of bodies in poor chemical status.	Classification Hub
The characteristics of water bodies in poor chemical status.	Water Environment Hub See also Table A2.12 above.

Table A2.24: Background information on our method for assessing trends in the concentration of pollutants in groundwater

Background information topic	Where information can be accessed
How trend assessment from individual monitoring points is used in identifying significant and sustained upward trends in the concentration of any pollutant or reversal of that trend.	Page 4, Section 4 of the Groundwater trend assessment , published by the UK Technical Advisory Group on the Water Framework Directive.
The reasons for the starting points defined for trend reversal.	Page 2, Section 2 of the Groundwater trend assessment , published by the UK Technical Advisory Group on the Water Framework Directive.

Table A2.25: Information on performance criteria for methods of analysis used in chemical analysis

Information on performance criteria for chemical methods of analysis are not currently available due to the cyber-attack on SEPA which took place in late 2020. Performance statistics will be calculated and reported as analytical methods are reintroduced into SEPA's monitoring programmes.