Intercomparison of ecological potential for Rivers

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Table of contents

List of Figures

List of Tables

List of Abbreviations

AWB	Artificial water body
BQE	Biological quality element
CIS	Common Implementation Strategy
GEP	Good ecological potential
GES	Good ecological status
HMWB	Heavily modified water body
Hymo	Hydromorphology/Hydromorphological
MEP	Maximum ecological potential
RBD	River Basin District
RBMP	River basin management plan
SQE	Supporting quality element
QE	Quality element

1 Introduction

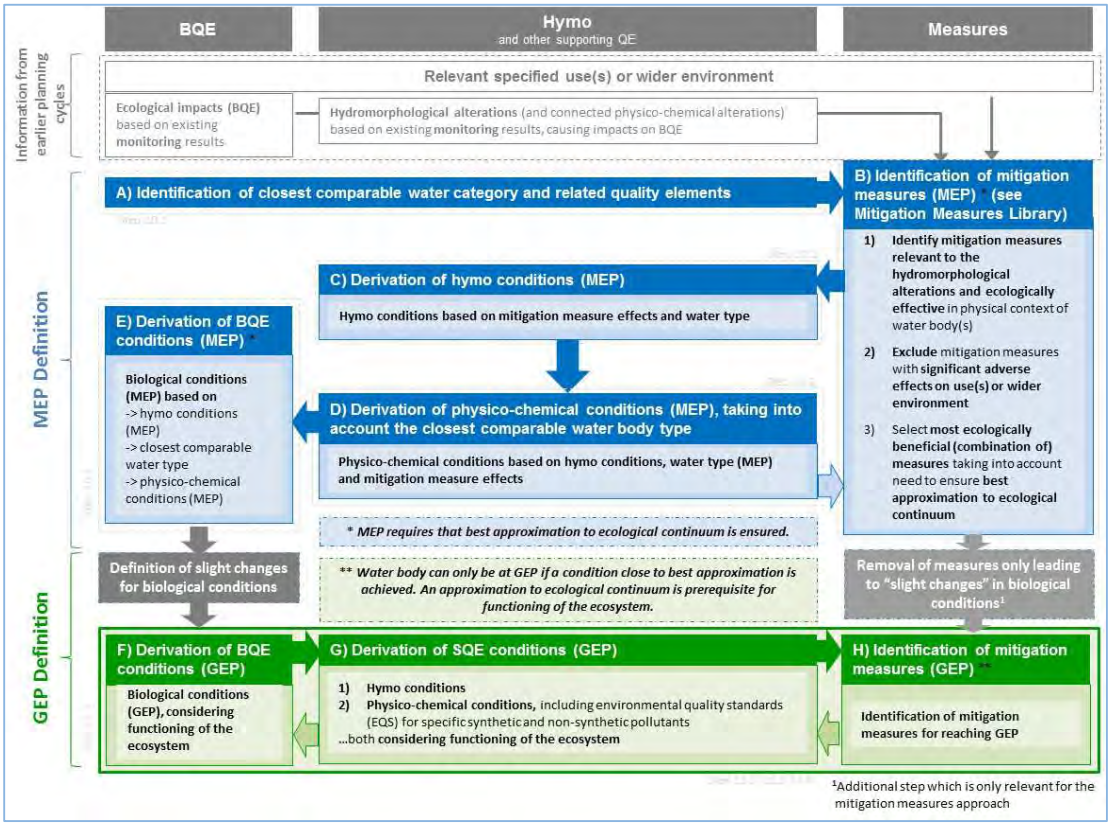
1.1 Background

The recently endorsed CIS Guidance no. 37 (December 2019) proposed a common methodological framework for defining and assessing the good ecological potential (GEP) of heavily modified water bodies (HMWB) in all water categories, as a main mechanism for assisting comparability of approaches between Member States.

The flow-chart below presents the step-wise framework of CIS Guidance no. 37 and shows two routes or approaches to follow this framework (the reference approach and the mitigation measure approach). Both approaches (two different routes in the step-wise framework) are acceptable and should lead to the same outcomes (ecological condition), provided there is good knowledge available on the links and interactions between biology, hydromorphology and mitigation effects from relevant measures. The process described in the flow-chart is relevant to all water categories (rivers, lakes, transitional and coastal waters) and closest comparable water body types.

The Guidance is accompanied by a European 'library' of emerging good practice mitigation measures for HMWB which was set up for the purpose of supporting the new Guidance.

Figure 1 Process with key steps for defining MEP and GEP showing comparability between the two approaches (reference approach and mitigation measures approach)



Notes: The complete step-wise approach anticipates that Member States have enough information and knowledge (Biological Quality Element, hydromorphological and physico-chemical data, mitigation measures library, ability to predict the effects of measures) to be able to follow the reference approach as set out in the WFD. In this case, all steps have to be followed to be in line with WFD requirements (route A →B →C →D →E →F →G →H).

As an alternative to the reference approach, Member States can use the mitigation measures approach. Such an approach is suggested in case it is not yet possible to predict the Maximum Ecological Potential (MEP) conditions for the BQEs due to a lack of knowledge or data. Under the mitigation measures approach, for the steps referring

to MEP definition, Member States should still follow steps A and B and should also go through steps C and D, insofar as the availability of information on hydromorphology and physico-chemical elements allows. Step D then feeds back into step B and the process continues from step B to step H and step G. The mitigation measures approach assumes then that the conditions for physico-chemical and biological elements for GEP are those deriving from the implementation of measures defined in step H. In summary, the route to be usually followed through the flow-chart, when applying the mitigation measures approach is A →B[→C →D →B] →H →G(→F).

1.2 Aims of the intercomparison

As for natural water bodies, the requirement for intercalibration of HMWB (WFD Annex V 1.4.1) implies that there is a need to ensure GEP classification methods are set in compliance with the WFD, and that classification results are comparable between EU Member States. Back in 2011 a concept paper on Intercalibration of GEP[1] was endorsed by the Water Directors, discussing possibilities **to fulfil the WFD legal requirement for intercalibrating ecological potential** and providing **recommendations** on assessing and improving comparability of ecological potential assessments. As a result, it was agreed that a process called "intercomparison" would be put in place to compare approaches for setting GEP in Member States, considering that the "intercalibration" of GEP as defined by the WFD and as performed for natural water bodies was not considered as feasible for HMWB at that time.

Section 7 of the Guidance no. 37 outlined the objectives of the intercomparison of ecological potential. The purpose is to describe and compare the national methods to establish maximum and good ecological potential (MEP and GEP) on the basis of the requirements of the WFD. The comparability of Member State approaches will be evaluated via a review procedure which will be undertaken by the GEP core group of ECOSTAT. This will allow to identify good practices, to support good implementation of the WFD requirements regarding GEP, to progress through comparable approaches and to identify differences in interpretation/implementation leading to a lack of comparability.

For this purpose, in 2020, the GEP core group of ECOSTAT supported by a team of consultants developed three distinct questionnaires (on the water categories Rivers, Lakes/Reservoirs and TraC) on the intercomparison of ecological potential with the following aims:

1. Firstly, collect information on the methods for definition and assessment of ecological potential used in the Member States for the 3rd river basin management plans (RBMPs), as a basis for understanding the different approaches used, and
2. Secondly, compare approaches for definition and assessment of ecological potential, which are relatively well-developed and to some extent comparable to the step-wise approach described in CIS Guidance no. 37.

Therefore, the intercomparison exercise is of value to all Member States despite varying degrees of progress in the development of methods for ecological potential definition and assessment. The intercomparison will allow exchange of knowledge and methodological developments between countries and thus support them in WFD implementation. It will also indicate progress in ecological potential definition and assessment according to the principles set in the WFD as well as remaining gaps and differences in interpretation.

1.3 Purpose and scope of the report

This report presents the results of the intercomparison of methods for defining and assessing ecological potential in the water category of River heavily modified water bodies.

The report presents and summarises the information provided by countries on the steps of the Guidance no. 37 GEP definition procedure which they use for the 3rd RBMPs and how they interpret and apply the steps in practice.

[1] https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/32886957-730f-4aea-a603-f763f391ab27/details

On the basis of the methodological information in the country questionnaires, the report aims at the following:

- To identify the steps of the Guidance no. 37 definition procedure which can be applied in the majority of countries and those which are only applied in few countries.
- To identify commonalities and differences between Member States in the interpretation and implementation of the various steps, supporting the identification of comparable or non-comparable approaches. In this context, the report discusses the extent to which MS implement the WFD requirements according to Guidance no. 37 and how (to the extent that the available information in the intercomparison questionnaires allows to do so). In this context, we focus more on the process (whether or not MS have been able to address relevant steps and aspects) rather than on specific outcomes in the specific HMWB examples and case studies.
- To present examples of the country approaches and methods.
- To identify the main gaps, unclear issues and challenges faced by the MS. This includes the identification of steps that cannot be followed by a majority of Member States and a description of relevant justifications provided.
- To provide recommendations on the main aspects on which MS need to take action and the main aspects where further information provision, discussion and guidance development at the level of ECOSTAT is needed.

1.4 Structure of report

Chapter 2 introduces and briefly describes the questionnaire on the intercomparison of ecological potential for rivers that countries filled in in autumn 2020. It also gives an overview of countries that returned the questionnaire.

Chapter 3 introduces in brief the HMWB examples/case studies which countries referred to when providing their responses on their methods in the questionnaires.

Chapter 4 describes the criteria selected for the intercomparison review carried out by the GEP core group of ECOSTAT and the scoring system applied.

Chapter 5 gives a first overview of all methods reported, indicating which overall approach is used (reference approach, or mitigation measures approach, or combination), the status of development of the methods and the overview of steps which countries reported to have equivalents on.

Chapter 6 to chapter 10 present the main findings from the filled-in questionnaires on the different steps of the ecological potential definition methods and the results of the intercomparison exercise.

Chapter 11 summarises some of the main lessons learned on strengths and weaknesses of methods to define ecological potential currently in use, as indicated by countries themselves.

The concluding chapter 12 summarises key conclusions on country methods and the extent to which they cover the steps of the procedure laid out in Guidance no. 37, based on the information provided in the filled-in questionnaires.

Annex 1 lists the references and sources to the methods reported by the countries. Annex 2 provides the original (empty) questionnaire on Rivers.

Appendices:

There are also two separate documents as Appendices to the report.

Appendix 1 presents all the original responses given by countries in their questionnaire. Each step of the main report has an equivalent section in Appendix 1.

Appendix 2 presents the case studies used by several Member States to respond to the questionnaire.

Note on tables illustrated in report (main part and in the Appendix):

Tables in the report only include information on countries that provided a response on a particular aspect of the questionnaire. Countries that have not responded to the questionnaire or have not provided step-specific information using a selected HMWB example are not listed in the various tables of the report.

Note on methods' information:

It is also noted that all information in the report on the methods for ecological potential definition is related to the status of the methods as of autumn 2020 (submission of intercomparison questionnaires). The status of the methods could not be fully reflected in the report for countries that did not provide a case study to illustrate their method (despite having methods in place). We are aware that at the time of publication, methods have been updated for certain countries (e.g. methods of Latvia and Lithuania for rivers), however a full overview of methods' updates is not possible to be presented.

Disclaimer:

It is acknowledged that some questionnaire responses may have become outdated since the time of filling in the questionnaires, e.g. responses concerning the selection of measures for particular case studies which may have changed during the development of the river basin management plans.

2 Questionnaire on Intercomparison of Ecological Potential

2.1 Scope of questionnaire

The questionnaire on the intercomparison of ecological potential of HMWB for Rivers was circulated as an Excel document to ECOSTAT in July 2020 and responses were collected between October 2020 and January 2021.

All Member States which designated and classified HMWB rivers in the 3rd RBMP cycle were requested to fill in this intercomparison questionnaire. Member States were instructed to fill in the questionnaire with reference to the **methodologies** which they apply for ecological potential definition and assessment **in preparation of their 3rd RBMPs.**

The questionnaire was designed in a way to allow all Member States to respond, taking into account the fact that some Member States have less developed methods than others. Responding to the questionnaire did not necessarily involve responding to all questions. This depended on the degree to which the method corresponded to the different steps of the CIS Guidance no. 37.

Use of classified HMWB to illustrate methods for definition and assessment of ecological potential:

The questionnaire provided a common template to provide clear explanations of the methods used for ecological potential definition and assessment in the 3rd RBMPs, using selected HMWB examples (case studies) to better illustrate the different steps.

The selected examples should be HMWB that have been classified but they do not have to be fully developed ideal case studies on the definition and assessment of ecological potential. For countries with less developed methods for the 3rd RBMPs, the selected HMWB examples can be HMWB which have been classified using another preliminary approach. In any case, the examples provided are assumed to reflect the most common methodology within a country, although other methods might additionally be in place.

If a country has only recently developed a new method which will soon be applied though for classifying HMWB in the 3rd RBMPs, it was possible to illustrate the method using information from an early application or partial application of the method on a selected HMWB example. If a new method is in early stages of development (e.g. application in test cases not started yet) and it is not planned to use it in the 3rd RBMPs, the questionnaire should have been filled with reference to the method used for classifying the HMWB in the 3rd RBMPs.

Countries were also advised to choose HMWB examples that are affected by at least one of the most common physical modifications identified for HMWB rivers across Europe. The identification of the most common physical modifications based on an earlier ECOSTAT activity in spring 2020 is described in section 6 Pre-step. Designation of HMWB & information from earlier planning cycles.

2.2 Structure of the intercomparison questionnaire

The questionnaire on the intercomparison of ecological potential of HMWB for Rivers includes 18 sections in an Excel spreadsheet (with approximately 150 distinct questions). The types of questions are a combination of close-ended questions (i.e. with predefined answers) and open-ended questions (i.e. as free text description).

The following are the main blocks of the questionnaire:

- **Section 1** (General information on method used for definition and assessment of ecological potential) which should be filled in by all countries which have designated HMWB in the specific water category.
- **Section 2** (Description of method in open format) which should be filled in by countries whose method does not include any step equivalent to CIS Guidance Document no. 37.

- **Sections 3 and 4** (on the context and designation of the HMWB example) which should be filled in by countries whose method for ecological potential definition and assessment has one or more steps equivalent to the steps described in the CIS Guidance Document no. 37 and which could provide a HMWB example.
- **Sections 5 to 17** (on each step of the ecological potential definition procedure) which should be filled in by countries whose method for ecological potential definition and assessment has one or more steps equivalent to the steps described in the CIS Guidance Document no. 37 and which could provide a HMWB example.

  Sections 5 to 17 of the intercomparison questionnaire were developed, following the structure of the steps proposed for defining and assessing ecological potential in CIS Guidance Document no. 37.
- **Section 18** (Lessons learned) to be filled in by all countries.

The empty form of the questionnaire on the intercomparison of ecological potential of HMWB for Rivers can be viewed in Annex 2 of the report.

Overview of questionnaire sections

1 General information on method used for GEP definition
2 Description of method in case of no equivalent steps to CIS 37
3 Description of HMWB selected for this questionnaire
4 Pre-step. Designation of HMWB & information from earlier planning cycles
5 Step A. Identification of closest comparable water category
6 Step B1. Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body
7 Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment
8 Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum
9 Step C. Derivation of hydromorphological conditions for MEP
10 Step D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type
11 Step E. Derivation of BQE conditions for MEP
12 Step F. Derivation of BQE conditions for GEP
13 Step G. Derivation of supporting quality element conditions for GEP
14 Step H. Identification of mitigation measures for GEP
15 Monitoring to assess whether GEP is being achieved
16 Are there GEP measures that are disproportionally expensive or infeasible?
17 Implement GEP measures and monitor effects on BQEs and supporting quality elements
18 Lessons learned & further developments

2.3 Responses from European countries

A total of 26 countries filled in and returned the intercomparison questionnaire of ecological potential of HMWB for Rivers. The following table provides an overview with country abbreviations in alphabetical order. Three EU Member States (BE, MT and SI) and Turkey did not respond to the Rivers questionnaire.

Two of the responses from IS and BG only included very brief information to indicate the lack of method or early stage of development, without providing any further methodological details. These two countries therefore do not appear in the detailed analysis of methods presented in this report.

As explained in section 3, the vast majority (20) of the countries could fill in the questionnaire with reference to a specific HMWB example/case study to illustrate the application of their methods. No case studies could be provided for six countries.

Table 1 Overview of submitted questionnaires

	Submission of Rivers questionnaire	Questionnaire filled in with reference to specific HMWB example/case
AT	Submitted	Yes, example/case study provided
BE	Not submitted	
BG	*Submitted (only brief information in section 1 of questionnaire)*	No example/case study provided
CY	Submitted	Yes, example/case study provided
CZ	Submitted	Yes, example/case study provided
DE	Submitted	Yes, example/case study provided
DK	Submitted	Yes, example/case study provided
EE	Submitted	Yes, example/case study provided
EL	Submitted	No example/case study provided
ES	Submitted	Yes, example/case study provided
FI	Submitted	Yes, example/case study provided
FR	Submitted	Yes, example/case study provided
HR	Submitted	Yes, example/case study provided
HU	Submitted	Yes, example/case study provided
IE	Submitted	No example/case study provided
IS	Submitted *(only brief information in section 1 of questionnaire)*	No example/case study provided
IT	Submitted	No example/case study provided
LT	Submitted	Yes, example/case study provided
LU	Submitted	Yes, example/case study provided
LV	Submitted	Yes, example/case study provided
MT	Not submitted	
NL	Submitted	Yes, example/case study provided
NO	Submitted	Yes, example/case study provided
PL	Submitted	Yes, example/case study provided
PT	Submitted	No example/case study provided
RO	Submitted	Yes, example/case study provided

SE	Submitted	Yes, example/case study provided
SI	Not submitted	
SK	Submitted	Yes, example/case study provided
TR	Not submitted *(lack of data and incomplete methodologies)*[2]	
Total number	**26 questionnaires**	**20 examples/case studies**

[2] The method for ecological potential definition and assessment for rivers and lakes/reservoirs has been under development in Turkey. Likewise, development methodology of HMWB is in the early stage.

3 Examples/case studies on intercomparison of ecological potential for rivers

As explained in section 2.1, the ecological potential intercomparison questionnaire was mainly filled in with reference to a specific classified river HMWB example from each country. This should help to better illustrate how the different steps of the procedure for defining ecological potential are applied in practice using the relevant national methods.

The vast majority of countries (20) were able to contribute a HMWB example/case study to illustrate the application of their methods. HR provided as example a group of water bodies with shared physical modifications instead of a single HMWB. LT filled in the questionnaire with reference to all water bodies which correspond to HMWB designation criteria in the country.

Six countries could not illustrate their method by means of a specific HMWB example, in most cases due to the method still being in early stages of development.

Table 2 Overview of countries that have / have not provided a HMWB case study

Countries with a HMWB example/case study	Countries without a HMWB example/case study
AT, HR, CY, CZ, DK, EE, FI, FR, DE, HU, LV, LT, LU, NL, NO, PL, RO, SK, ES, SE	BG: Method in development, no case study contribution possible EL: Since the method for GEP definition is in very early stages of application, no specific HMWB example is provided. Any water body designated as HMWB because of the impacts by upstream reservoirs/dams for any storage purposes is considered as ex-ample for the development and application of the GEP definition method IS: no method IE: method in development IT: Due to Covid pandemic and time constraints PT: No case study as method not fully developed yet

The following table gives a brief overview description of the HMWB examples used in the intercomparison questionnaires with reference to the main uses, physical modifications, key river characteristics and ecological status/potential classification. It is noted that none of the HMWB examples used for the Rivers water category are in good ecological potential.

A detailed overview of the main physical alterations and water uses for which the selected HMWB examples were designated for is given in section 6 of this report. In Appendix 1 (separate document), detailed information is given on the HMWB examples including simple sketches or maps of the case studies, as provided by country experts.

Table 3 Overview description of the HMWB case studies

Country case	Main uses and physical modifications	Key river characteristics	Ecological status at designation and classified ecological potential of HMWB
AT (Danube between	Chain of impoundments – 3 hydropower plants in 3	Very Large River – Danube	Bad ecological status (very low biomass, moderate

Krems and Vienna)	separate WBs, each impoundment 25 - 30 km Run-of-river hydropower, > 50 MW capacity Navigation (waves on the shoreline) and flood protection (rip rap, dams) as additional pressures	Braided or sinuous, large floodplains Within natural fish zone Potamodromous fish species	deviation in species composition and age structure) Ecological Potential is „moderate or worse“ (final decision pending)
CY	Main modifications: Impoundments due to dam construction Main uses irrigation and water supply	Low land intermittent stream Only the investigated WB is within natural fish zone Historical evidence for the presence of Anguilla anguilla	Moderate status HMWB is at less than GEP
CZ	Main modifications channel straightening & deepening, barriers with impoundment, bank protection and embankments Main uses flood protection and urbanisation River sandwiched between road and railway	Medium-sized stream in the hills Within natural fish zone Potamodromous fish species	Moderate status based on benthic invertebrates as well as on fish HMWB is at less than GEP (moderate)
DE (Wagenfelder Aue)	Main modifications: Channel straightening & deepening, barriers causing impoundment), Channel protection works, maintenance Main uses: Recreation, flood protection	Mid-sized sand and loam-dominated lowland streams Within natural fish zone Diadromous and potamodromous fish species	Ecological status: poor (fish poor, benthic invertebrates poor) Ecological Potential: poor - moderate (fish moderate, benthic invertebrates poor - moderate)
DK (Pumpekanal Kløv Å)	Main modifications presence of pumping station, a culvert over 20 metres in length and also straightened. Main uses irrigation, drainage	River in northern Jutland Within natural fish zone	Poor status HMWB is at less than GEP (moderate)
EE (Siberi)	Main modifications: Drained water body with channel straightening & deepening and barriers causing impoundment Main use is drainage	Lowland, small catchment Outside natural fish zone	Moderate status for fish HMWB is at less than GEP

ES (River Manzanares)	Main physical modifications: Dam and reservoir, alterations on the banks of the reservoir have altered the riverside area and the stabilization of the riverbed, also affecting its depth and width. Main uses flood protection and water supply	Low-mineralized continental Mediterranean river axes, snow/rainfall-fed, sandy riverbed within natural fish zone Potamodromous fish species	Poor status HMWB is at less than GEP
FI (Iijoen alaosa)	Seven hydropower plants; five are large and absolute obstacles for upward migration (fall height varies between 16 m and 21 m); run-of river hydropower River completely lost natural riffle-pool variation and it is heavily constructed and strongly regulated During the construction of hydropower plants natural river bed has been cleaned, embanked and protected with rock material (slope revetment). Submerged weirs in dry channels / old river beds. earlier massive clearing for timber floating	very large peatland/organic rivers within natural fish zone diadromous and potamodromous fish species	Moderate status HMWB is at less than GEP (moderate)
FR	Main modifications: Channelisation, straightening, bed stabilisation, bank reinforcement Main use flood protection	Rhone and Coastal Mediterranean Small river, single channel, partly confined intermittent gravel bed river within natural fish zone Potamodromous fish species	Bad ecological status HMWB is at less than GEP (moderate)
HR (group of small altered streams)	Eight water bodies have common physical modifications, small altered streams with altered morphology and longitudinal flow connection	Danube Small lowland rivers with gravel and pebble substrate within natural fish zone	six water bodies - bad ecological status; four water bodies- poor ecological status The assessment of the ecological potential is not

	Main uses flood protection and drainage	potamodromous fish species	available because the method is in development.
HU (Általér)	Main modifications: Channel straightening & deepening, bank protection, barriers creating reservoir, maintenance Main uses: Recreation, drainage, urbanisation	lowland - calcareous - medium to fine substratum - small catchment - small slope degree hymo type: not or partly confined, single-thread and straight-sinuous within natural fish zone	Poor ecological status
LT	No single case, all water bodies which correspond to HMWB designation criteria including straightened rivers HMWB for hydropower cascades	Lowland altitude, small and medium catchment area, calcareous geology	HMWB is at less than GEP
LU (HMWB on Mosel)	Main modifications: Channel straightening & deepening, barriers causing impoundment, bank protections , channel protection works Main uses, hydropower plant with hydropeaking, maintenance, ports Main uses: navigation, hydropower, urbanisation Run-of-river hydropower plants with capacity 2 to 10 MW	large lowland stream, stretched to sinuous channel with side channels, mainly rough gravel-bed river within natural fishzone diadromous and potamodromous fish species	Poor ecological potential
LV (Sesava)	Main modification channel straightening & deepening Main use is drainage	Lowland, low energy medium river with sand and silt as sub-strate within natural fish zone water body is naturally unsuitable for migratory fish.	Bad status based on macroinvertebrates HMWB is at less than GEP (moderate)
NL (River Boven Dommel)	In catchment, a lot of agricultural and urban areas with WWTPs, several historical water mills Main modifications: Channel straightening & deepening, barriers causing impoundment, bank protections	small slow flowing lowland river on sand within natural fish zone Potamodromous and diadromous fish species	Moderate ecological status HMWB is at less than GEP (moderate)

	Main use flood protection and drainage		
NO (Vetlefjordselvi)	Main physical modifications are bank protections: Structures for flood defence or to stop erosion There is also impact from hydropower with hydropeaking Main uses hydropower and flood protection Storage hydropower plants, > 50 MW capacity Example Vetlefjordselvi is a river in which there has been made an effort to meet present day standards and methods to make an optimal plan for mitigating measures by competent research institutes and consultants. This is typically more common in larger rivers with Atlantic salmon or sea trout, and not so representative for inland rivers.	Small, very low alkalinity, clear, low-altitude Within natural fish zone, sea trout	Moderate ecological status HMWB is at less than GEP (moderate)
PL (Jeziorka od Rowu Jeziorki do ujścia)	Main modifications channel straightening & deepening, barriers with impoundment, bank protection and embankments Main uses: Flood protection, water supply and urbanisation	Plain river Within natural fish zone Historical presence of migratory fish	Moderate status due to macrophytes, fish and benthic invertebrates HMWB is at less than GEP (moderate)
RO (Feernic)	Main physical modification by transversal barriers (3 weirs with height between 0.6-1.6 m) ; no impoundment Bank protections Main use flood protection	In hilly or plateaus area, riverbed with a mosaic structure mainly of sand, gravel Within natural fish zone Potamodromous fish species	Poor status based on fish fauna first (poor status) and phytobenthos (moderate) HMWB is at less than GEP (moderate)
SE (Umeälven)	Main modifications: Channel straightening & deepening and dam	Lowland river, siliceous, large catchment area	Probably poor or bad ecological status.

	causing reservoir upstream of dam Main use is hydropower Storage hydropower plants, > 50 MW capacity	within natural fish zone Diadromous fish species	HMWB is at less than GEP (poor potential)
SK (Danube at Gabčíkovo HPP and Čunovo weirs)	Main modifications channel straightening & deepening, barriers with impoundment, bank protection, embankments and channel protection works Main uses navigation and hydropower Main HPP on bypass canal; further system of weirs on the Danube, run-of-river type; main HPP >50 MW, other HPP Čunovo 10 to 50 MW	Very large river - upper Danube sub-type Within natural fish zone Migratory fish species	Moderate status HMWB is at less than GEP (moderate potential)

4 Intercomparison review by GEP core group of ECOSTAT

As outlined in Guidance no. 37, the comparability of Member State approaches for defining ecological potential is to be evaluated, requiring some form of independent review (similar to the review panel established for the intercalibration exercise). For the purpose of the intercomparison exercise presented in this report, it was decided for the GEP core group of ECOSTAT to function as reviewers, based on their knowledge and understanding of the CIS Guidance no. 37 principles.

4.1 Criteria

To this purpose, relevant members of the GEP core group have developed a set of criteria, based on Guidance no. 37, for each step to assess whether national methods for defining and assessing ecological potential for rivers are comparable to the principles set out in Guidance no. 37. The list of criteria per step is presented in Table 4 below. The intention was to select a small number of criteria per step and for the criteria to be verifiable based on the information requested in the intercomparison questionnaires. In addition to the step-specific criteria, there are also "overall criteria" defined, which are of relevance for several steps in the definition of ecological potential. These "overall criteria" concern the use of BQE assessment methods sensitive to hydromorphology, the consideration of the best approximation to ecological continuum and the consideration of objectives in water bodies upstream and downstream of the HMWB.

The assessment of each criterion is based on responses provided by countries in the questionnaires. As such, the intercomparison review provides an overview of the extent to which the methods applied by each country meet the selected criteria, based only on these country responses. It was not feasible to take account of additional (and possibly more detailed) sources of information beyond the intercomparison questionnaires, to judge whether country methods meet the criteria set for the intercomparison.

The GEP core group also assumed that the HMWB examples used to illustrate the methods are appropriate cases that reflect the general methodology applied for ecological potential definition within a country (method used in HMWB example is representative of method used elsewhere in the country).

Table 4 Criteria per step to intercompare national methods for defining ecological potential for rivers

Step	Intercomparison criteria
Overall criteria with relevance for several steps in methodology	1. BQE assessments methods sensitive to the hymo alterations are used 2. The achievement of objectives in water bodies downstream and upstream of the selected HMWB are considered (related to Art. 4.8) 3. Explanation how best approximation to ecological continuum was taken into account
Pre-step. Designation of HMWB	1. Principles of Guidance 4 used for designation including review of the designation for the new planning cycle 2. Use(s) are identified 3. Physical modifications that led to the designation are identified and relevant hydromorphological and physicochemical alterations are quantified using appropriate methods 4. Effect on hymo sensitive BQEs identified and quantified
Step A. Closest comparable water category	1. Comparable water category derived from the original water category (i.e. prior to modification). For the rivers GEP questionnaire cases, it is expected that the comparable water category would be a river.
Step B1. Relevant mitigation measures	1. Use of a national or European mitigation measures library to guide the selection process of relevant mitigation measures. 2. There is a specific methodology for selection of mitigation measures set in a consistent way at national / regional level 3. Relevant mitigation measures are identified for MEP (not only for GEP)

	4. A broad range of mitigation measures are considered to select relevant measures (state of the art) 5. No relevant measures are excluded at this stage without justification
Step B2. Significant adverse effect on use or wider environment	1. There is a specific methodology with criteria for assessing significant adverse effect on use set in a consistent way at national / regional level 2. Method addresses all uses relevant for designation and wider environment 3. The criteria used for assessment of significant adverse effect on use relate to broader public interest. 4. The scale of the assessment of significant effect is indicated. 5. The method uses thresholds to decide whether an effect is significant or not (in case no thresholds are used, justification and explanation of approach is given)
Step B3. Most beneficial measures	1. Indication is provided of mitigation measures selected as most ecologically beneficial (combination of) measures for MEP 2. Availability of sufficient data/information about measure effects on ecological functioning 3. If there is insufficient information and/or data, a precautionary approach is taken by including most relevant mitigation measures on the list
Step C. Hydromorphological conditions for MEP	1. Hydromorphological conditions for MEP for the HMWB are derived 2. There is a specific methodology for deriving hymo conditions for MEP 3. The derivation of hymo conditions for MEP is based on the hydromorphological conditions in the water body altered by the physical modification and the expected effects of the set of mitigation measures (for MEP) on the hymo conditions (in case of no equivalent to step B (identification of MEP measures), this criterion is considered “not met”)
Step D. Physico-chemical conditions for MEP	1. Physico-chemical conditions for MEP for the HMWB are derived 2. There is a specific methodology for deriving physicochemical conditions for MEP 3. Physico-chemical conditions for MEP result from the hymo conditions at MEP and a prediction of the effects of the mitigation measures (for MEP) on physico-chemical parameters 4. Physicochemical conditions at MEP are defined as the values in the associated original natural river type or closest comparable water body type, and any exceptions to this are justified in line with Guidance no. 37
Step E. BQE conditions for MEP	1. BQE conditions for MEP are derived for relevant BQEs (using hymo sensitive biological assessment methods) and justification is given if BQEs relevant for the water category are not considered 2. There is a specific methodology for deriving biological conditions for MEP 3. Effects of the hymo modifications and the effects of the MEP mitigation measures on BQEs are considered (so knowledge about the effects of both modifications and of measures on biology are necessary)
Step F. BQE conditions for GEP	1. BQE conditions for GEP are derived for relevant BQEs (using hymo sensitive biological assessment methods) and justification is given if BQEs relevant for the water category are not considered 2. There is a specific methodology for deriving biological conditions for GEP including slight changes (and explanation how slight changes are interpreted)
Step G. Supporting quality element conditions for GEP	1. Hydromorphological quality element conditions for GEP are derived 2. There is a specific methodology for deriving hymo conditions for GEP 3. Hydromorphological quality element conditions are based on the BQE conditions for GEP (step F) or on the assumed implementation of the mitigation measures for GEP (step H) or both 4. Physico-chemical conditions for GEP for the HMWB are derived

	5. Physico-chemical conditions at GEP are defined as the values in the associated original natural river type or closest comparable water body type, and any exceptions to this are justified in line with Guidance no. 37
Step H. Mitigation measures for GEP	1. Mitigation measures for GEP are selected based on the derived conditions for biological and supporting quality elements (step F, G) OR on the set of mitigation measures identified for MEP (step B) (if hymo conditions not defined for GEP under step G, not possible to "fully meet" step H, unless Prague approach is used) 2. It is explained how "slight changes" are interpreted (removing any measures which only lead to slight changes in biological conditions) *(only relevant for mitigation measures approach)*
Monitoring to assess whether GEP is being achieved	1. Monitoring results of biological quality elements are used to determine the current class of ecological potential 2. Ecological potential is classified based on hymo sensitive BQE assessment methods 3. If proper assessment of BQEs is not yet possible, hydromorphological (and physico-chemical) quality elements are used as proxies to classify ecological potential *(if this is yes, step should be marked in Yellow representing that the criteria are "partly met")*
GEP measures disproportionally expensive or infeasible?	1. Assessment of disproportionate costs or infeasibility of mitigation measures are clearly carried out during PoM/RBMP planning (where implementation may not be possible due to disproportionate costs or infeasibility and may lead to less stringent objectives), and NOT in the selection of measures to define and achieve GEP 2. In case one or more GEP measures were ruled out because they are disproportionally expensive or infeasible, clear information is provided on whether remaining measures are still sufficient to achieve GEP
Implement GEP measures & monitor effects	1. Evidence is collected from monitoring on the success of mitigation measures implemented in the RBMP programme of measures

4.2 Scoring

A scoring system has been developed to judge whether a country is fully meeting, partly meeting or not meeting the criteria selected for each step.

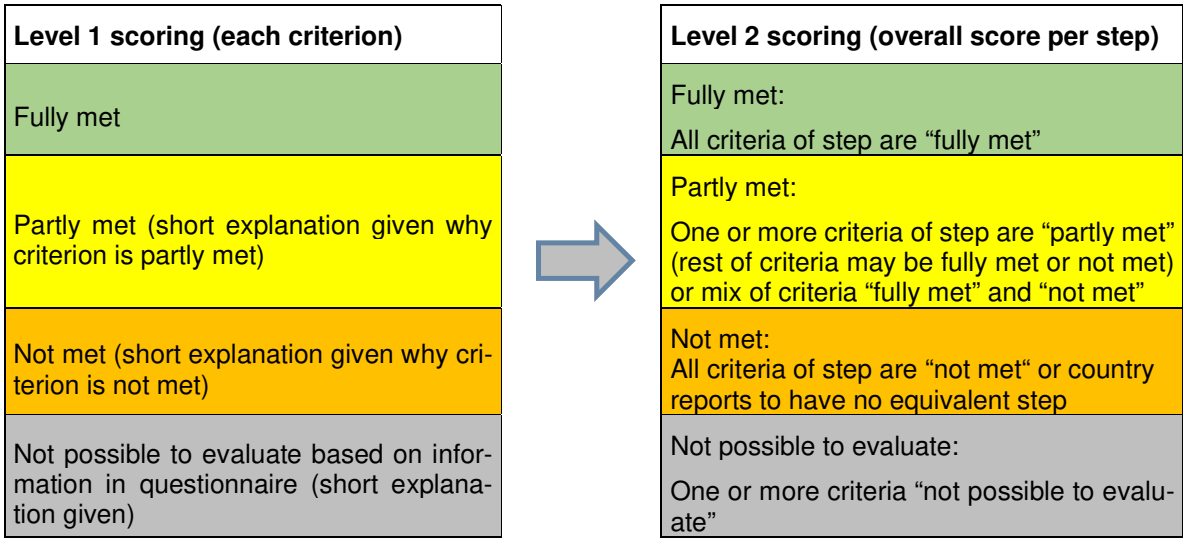
The scoring system is developed in two levels (see Figure 2 below):

- Level 1: Scoring of each criterion in step
- Level 2: Overall scoring on step, based on the scoring of the individual criteria

The scoring to each criterion and step has been assigned by members of the GEP core group using expert judgement. For a transparent intercomparison, justifications are provided when a country is partly meeting or not meeting a certain aspect/criterion.

For countries which could not provide a HMWB case study to illustrate their methods in the questionnaires, the scoring on several criteria and steps was inconclusive (grey) due to the lack of information comparable to other countries.

Figure 2 Scoring of intercomparison criteria per step and overall scoring of steps



4.3 Intercomparison results

The intercomparison scoring for the different criteria and steps is presented for each step separately (see intercomparison sub-sections on each step in chapters 6 to 9). The results are presented in the form of tables including the scoring of each country for the respective step. The tables provide short justifications on the aspects that are considered partly met or not met, based on the information provided in the questionnaires.

The intercomparison scoring for the “overall criteria” which are of relevance for several steps in the definition of ecological potential is presented in chapter 10.

5 Overview of methods

Approaches for ecological potential definition

The majority of European countries indicated to follow the mitigation measures approach or a combination of the reference and mitigation measures approaches in order to define ecological potential for rivers in the 3rd RBMPs. The steps of the mitigation measures and the reference approaches are described in Chapter 5.3.1 and 5.3.2 of CIS Guidance Document no. 37.

Four countries indicate to follow the reference approach.

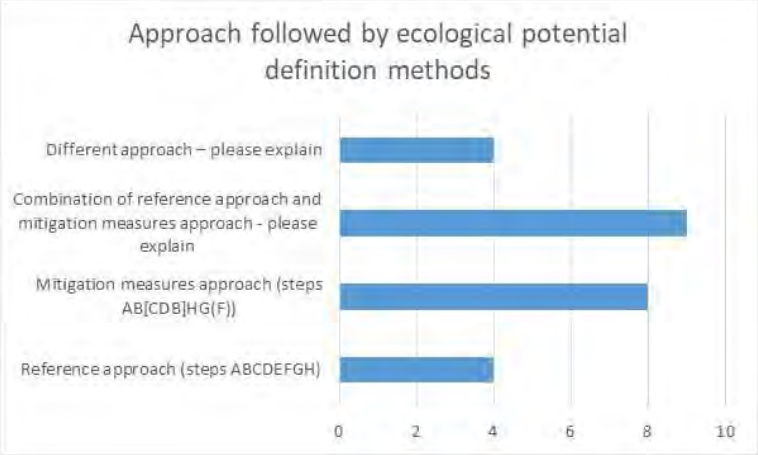
Four countries use other approaches, which are briefly described in Table 6.

Table 5 Approaches followed by ecological potential definition methods

1,3 Which approach for ecological potential definition do the methods follow?	
Reference approach (steps ABCDEFGH)	CZ, EE, DE, LV
Mitigation measures approach (steps AB[CDB]HG(F))	FI, EL, HU, IE, NL, NO, ES, SE
Combination of reference approach and mitigation measures approach - please explain	AT, BG, IT, LT, LU, PL, PT, RO, SK
Different approach – please explain	HR, CY, DK, FR

Note: Status of the methods as of autumn 2020

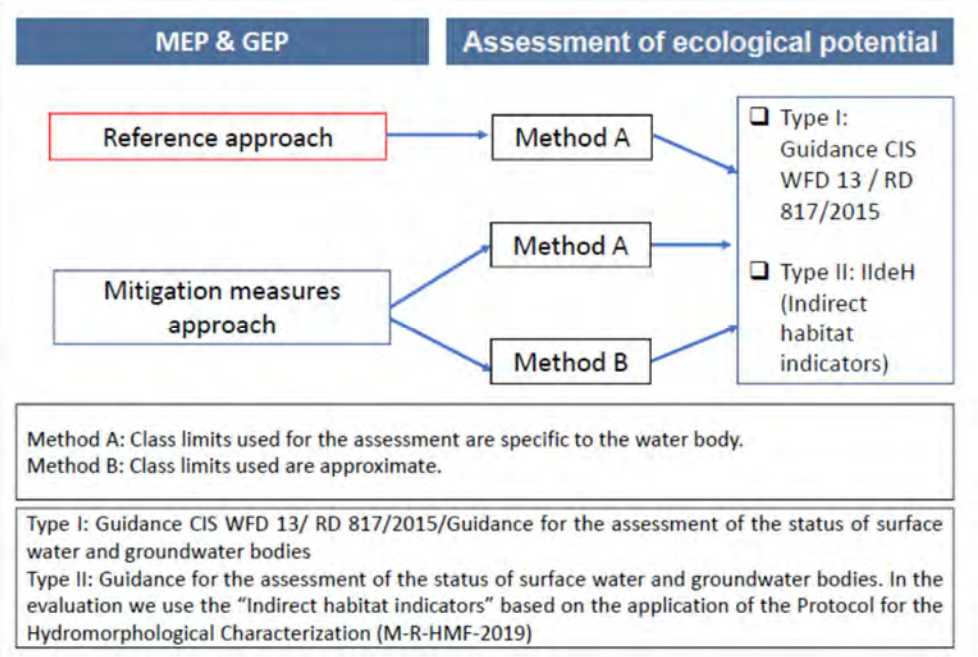
Figure 3 Approaches followed by ecological potential definition methods



The following Table 6 gives brief explanations and descriptions provided by countries on the approach used to define ecological potential in their 3rd RBMPs.

Table 6 Explanations on route or approach used for defining ecological potential

Explanations on route or approach used for defining ecological potential	
Reference approach (steps ABCDEFGH)	
CZ	We used the reference approach but only partly - steps A, C only in a simplified form for the 3rd RBMP, E, F, G and H partly and only for 3rd RBMP.
DE	All steps included within the methodology are defined in a standardised and comparable manner using "HMWB case groups", which are like a HMWB Typology. These case groups are a combination of hydromorphological pressures/alterations (grouped, considering the uses according to Art 4(3)) and river typology for natural rivers (closest comparable river types). For specific cases where general case groups cannot sufficiently represent the water body characteristics and the related ecological potential accordingly, individual definitions of

	the relevant steps are possible (with detailed justification). As this is a general principle of the methodology to cover exceptional cases, it is not mentioned in each step description within the intercomparison questionnaire.
Mitigation measures approach (steps AB[CDB]HG(F))	
ES	Depending on the level of knowledge and the information available (BQE, hydromorphological and physico-chemical data, mitigation measures library, ability to predict the effects of measures), the method gives the possibility to River Basin Districts of using the reference approach or the mitigation measures approach. However, in most river basin districts, the lack of in-detail data on the interaction between hydrology, geomorphology and ecology has meant that most of them selected the mitigation measures approach. Below is an extract of the Spanish Ministry´s technical guidance on the issue, which illustrates the scheme we currently use for the assessment: 
NO	Ecological potential is defined by the mitigating measures considered necessary to achieve best possible ecological status without substantially affecting water use. As we use the mitigation method, we focus primarily on the measures and not so much on defining what conditions the measures will lead to when we set up the objectives in the water bodies. Biology and improved habitats are of course a relevant issue when the measures are planned, but are not visualized in the objectives of the water body.
NL	The NL does not explicitly derive MEP as such. As the mitigation measures approach is used, the key is that all measures are taken which are 1) ecological and cost effective, 2) have no significant impact on use. In practice the water managers and competent authorities set by this way directly 1) the measures needed to achieve GEP, 2) determine the related biological –and if relevant ecological- values for each HMWB and elements by using measure-effect relationships. Those GEP values are thus also reported on quality element and water body level. In conclusion, following this method achievement of WFD-proof GEP is guaranteed, and there is no urgent need or function of setting a MEP value.
SE	We have national guidance on both methods but the HMWB example selected for the intercomparison makes use of the mitigation measure approach.
Combination of reference approach and mitigation measures approach	
AT	The Austrian methodology follows the mitigation measures approach with elements of the reference approach. For the biological quality elements, limit values (based on reference

	conditions) or guideline values for specific types of HMWBs have been defined. These describe the biological goals and help to assess the ecological effect and select the relevant measures. Examples can be found in the national guidelines (https://info.bmlrt.gv.at/themen/wasser/wisa/ngp/entwurf-ngp-2021/hintergrunddokumente/methodik/hmwb_2021.html)
BG	The Guidance document no. 37 is the basis for the development of BG GEP method definition, included in the terms of reference of a project dedicated to this activity.
IT	The reference approach was followed for Invertebrates and Macrophytes. The mitigation measures approach was followed for fish. For diatoms the GES values were used as it was assumed that the diatom method is not sensitive to hydromorphological alterations.
LT	The definition of GEP for HMWB and AWB has been made primarily using Prague approach and secondary - the reference-based approach (the definition of GEP was tested by field surveys using comparison of natural water bodies and HMWB of the same water body type). The necessary steps have been applied to define the GEP – the identification of mitigation measures, which do not have adverse effect, the definition of MEP and GEP, the identification of mitigation measures, which are needed to support the achievement of GEP. Possible impact of mitigation measures was tested by field surveys. A tender for the revision of morphology is ongoing, thus there might be some changes.
LU	The method is based on the WFD guidelines, precisely on the guidelines as described in CIS guidance Nr.4 (reference approach) and Nr.37 and the mitigation measures approach ("Prager Maßnahmenansatz"). Regarding the low number of HMWB in LU, we analyse each HMWB individually and thus determine an individual MEP/GEP for each HMWB by applying a combined approach of the reference based and mitigation measures methods, focused on adequate monitoring programs, in order to assess a GEP for each HMWB. As opposed to the applied methods of other EU member states, which consider a GEP for a number of HMWB, based on collective datasets and pressure types, the applied method for LU refers to each single HMWB, via individual analyses regarding the main pressures of the corresponding HMWB (hydromorphological alterations). The most sensitive BQE "fish" to hydromorphological alteration, is currently used for the assessment of reference values with regard to GEP, for future evaluation of MEP/GEP the BQE "macroinvertebrates" will be added to the monitoring programs. The method comprises information concerning the future investigating monitoring program, which will be required for the determination of GEP for each HMWB. Since we only designated eight natural water bodies as HMWB, we developed a national method for the individual assessment of MEP/GEP for each HMWB. This method is a combination of the reference based approach and the mitigations measures approach (Schmutz et Vogel, 2015), with the focus on the second approach (mitigation measures). For each HMWB, the approach includes basically two major steps: **1. Implementation of the combined reference and mitigation measures approach.** Due to the actual available database in LU, the combined approach is applied to each HMWB: a) Identification of the pressures for each HMWB b) Application of the catalogue of measures (RBMP LU) regarding hydromorphological alteration c) Identification of measures required for both the MEP and GEP for each HMWB, which are required to improve the status of the BQE on one hand, but do not compromise the use of the HMWB on the other hand. d) Evaluation of the effect of each measure e) Determination of both reference (MEP) and target (GEP) values for the biological quality element (BQE) which is/are most sensitive on hydromorphological alteration. The biological target values for GEP are derived from the reference values determined for the MEP. **2. Validation of the values for MEP and GEP** determined in step 1 by refining the reference based approach by means of an investigating monitoring. This exercise aims at validating the approximation/assessment of MEP and GEP established in step 1. This evaluation is based

	on a biological monitoring (most hymo-sensitive BQEs: fish, macroinvertebrates) in order to assess first MEP and then derive GEP for each HMWB. This step includes also an evaluation of the effect of the measures related to the hydromorphological pressures. At this stage, the following evaluations of the 2-steps-approach described above are finalized respectively in development for each HMWB: 1. Validation of the designated HMWBs according to hydromorphological monitoring data (finalized) 2. Identification of the most sensitive BQEs regarding different pressure types (finalized) 3. Correlation analyses between hydromorphological conditions and BQEs (finalized) 4. Evaluation of hydrological conditions in HMWB (finalized) 5. Monitoring programs for each HMWB (in development) 6. Identification of general mitigation measures for each HMWB (finalized) Two of the eight HMWBs represent reservoirs as a result of impounded rivers. The method described here is the national method, which is also applied to assess the MEP/GEP of these reservoirs. Since there are no natural lakes in LU, there are no reference conditions of natural lake types available at this stage. For this reason, targeted and comprehensive biological monitoring should contribute to the definition of "reference" conditions in order to determine MEP and GEP for these two reservoirs. Due to this situation, the questionnaire for lakes/reservoirs is not filled in for LU, because basically the same national approach is applied for both rivers and reservoirs, except, that the reference conditions for the reservoirs are determined by means of biological monitoring data.
PL	The steps included in method are AB(CE)HGF
PT	HMWB rivers are classified through the assessment systems applicable to the most similar natural waterbody and those results are subjected to expert judgment, based on knowledge on the existent alterations and on the efficiency of mitigation measures.
RO	Ecological potential is defined using a hybrid approach which combines the reference approach and the Prague approach (based on the identification of mitigation measures). The combined method has as basis the undertaking of key steps, the sequence and correspondence of which follows the steps recommended in the Guidance Document no. 37.
SK	Ecological potential for **hydromorphological QE**s defined using "mitigation measures approach". Ecological potential for other - **BQE**s , **Ph-CH** QEs – defined using "reference approach"
Different approach	
CY	Method according to Guidance Document No.4 but assessment of HMWBs differentiates based on the mitigation measures approach (Prague approach). The ecological potential derives from the percentage of the proposed measures implemented.
DK	The methodology groups HMWB according to hydromorphological alterations and subsequently applies BQE to define MEP and GEP for the water body.
FR	While waiting to be able to define classes of ecological potential according to a WFD-compatible approach, the evaluation of the ecological potential is defined by a mixed method crossing data for BQEs, physico-chemical quality elements, and an analysis of the remaining hydromorphological pressures after the realization of the mitigation measures. In this method only the phytobenthos quality element is used, because it is assumed to be least sensible to hydromorphological alteration. As such, GEP for this BQE corresponds to the same values as the very good or good ecological status of a natural water body.
HR	Due to a relatively large number of heavily modified (222) and artificial (54) water bodies of rivers and identical purposes and hydromorphological modifications, we have decided for an approach defining the MEP of the hydromorphological quality elements for the groups or "types" of water bodies.

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

Status of methods development

Concerning the status of development of the methods reported, the following is noted:

- In more than half of the countries (15 of 24), the reported methods are the official methods adopted for defining ecological potential in the country.
- In almost half of the countries (10 of 24), the methods are already developed and being used for the 3rd RBMPs.
- In one third of the countries (8 of 24), although the methods are developed, they are still being tested in pilot cases but the methods will soon be applied in the 3rd RBMPs.
- In some of the countries (7 of 24), the methods were still in early stages of development and application in test cases had not started yet at the time of filling in the intercomparison questionnaire.

Further explanations on the status of methods development are provided in Appendix 1 to this report.

In almost all countries responding to the questionnaire, the method used for defining ecological potential is applied in the whole country (national level), with the exception of two countries, that indicate using the method at regional/basin level:

- NL: The method is applied by every water authority individually. Ecological potential is defined per waterbody and per ecological quality element.
- ES: Depending on level of knowledge and information available (BQE, hydro-morphological and physico-chemical data, mitigation measures library, ability to predict the effects of measures), the method gives the possibility to River Basin Districts of using the reference approach or the mitigation measures approach.

Table 7 Status of methods development

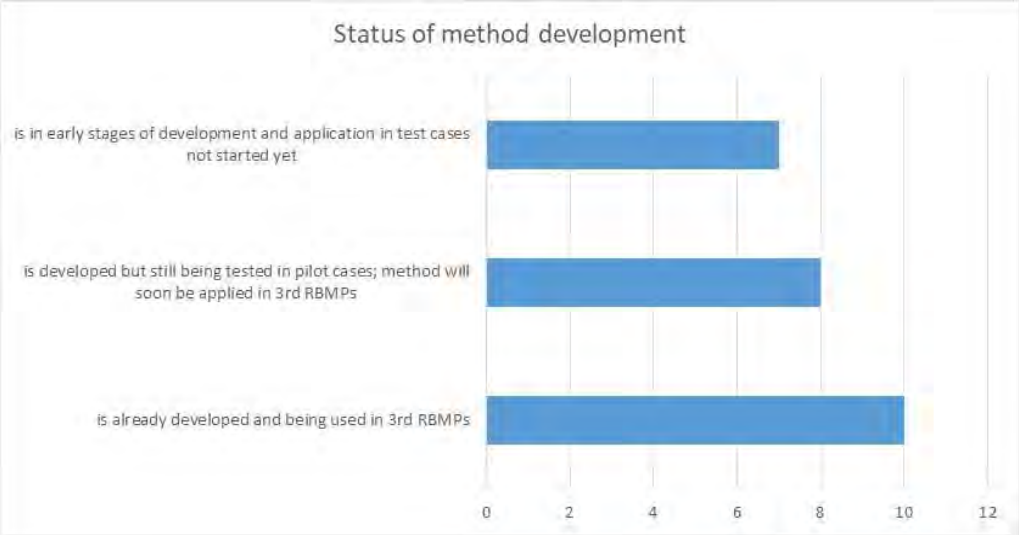
1,1 Status of method development	
Official method in the country	HR,CZ,EE,FI,FR,DE,HU,IT,LT,LU,NL,NO,PL,ES,SE, SK
Method already developed and being used in 3rd RBMPs	CZ,FI,FR,DE,IT,NL,NO,PL,RO
Method developed but still being tested in pilot cases; it will soon be applied in 3rd RBMPs	AT,HR,CY,EE,HU,LV,LT,PT
Method is in early stages of development and application in test cases not started yet	BG,EE,EL,IS,IE,LU
Other	DK, SK

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

Note on SK (Other): Method for fish already finalized, but will be applied in the following planning cycle.

Figure 4 Status of methods development



All countries that responded to the Rivers intercomparison questionnaire report that their methods include or plan to include one or more steps that are equivalent to the different steps described in the CIS Guidance Document no. 37.

None of the countries reported not to use any equivalent step to those described in the Guidance.

The steps reported to have an equivalent in the methods of the large majority of countries are step A and step B1 for MEP definition, steps F, G, H for GEP definition and the use of monitoring to classify ecological potential and assess the effects of implemented measures.

The steps reported to have an equivalent in a lower number of country methods are the steps B2, B3, C, D and E (related to the assessment of measures, the derivation of hymo, physicochemical and biological conditions for MEP definition) and the check of whether GEP measures are disproportionally expensive or infeasible.

Table 8 Overview of step equivalence reported for country methods per step

Step from CIS Guidance no. 37	Number of countries	Countries
Step A. Identification of the closest comparable water category		
Equivalent step	24	
NO equivalent step	-	
Step B1. Identify mitigation measures for MEP		
Equivalent step	20	
NO equivalent step	4	HR, CZ, DK, PT
Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment		
Equivalent step	17	
NO equivalent step	7	HR, CY, CZ, DK HU, PT, SK
Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum		

Equivalent step	18	
NO equivalent step	6	HR, CY, CZ, DK, HU, PT
Step C. Derive hydromorphological conditions for MEP		
Equivalent step	16	
NO equivalent step	8	CY,CZ,FR,EL,NL,NO,PL,PT
Step D. Derive physico-chemical conditions for MEP, taking into account the closest comparable water body type		
Equivalent step	15	
NO equivalent step	9	CY,CZ,DK,FR,LU, NL,NO,PL,PT
Step E. Derive BQE conditions for MEP		
Equivalent step	17	
NO equivalent step	7	CY, FR, HU, IE, NL, NO, PT
Step F. Derive BQE conditions for GEP		
Equivalent step	20	
NO equivalent step	4	CY, IE, NO, PT
Step G. Derive supporting quality element conditions for GEP		
Equivalent step	20	
NO equivalent step	4	CY, DK, NO, PT
Step H. Identify mitigation measures for GEP		
Equivalent step	22	
NO equivalent step	2	DK, PT
Monitoring to assess whether GEP is being achieved		
Equivalent step	23	
NO equivalent step	1	IE
Are there GEP measures that are disproportionally expensive or infeasible?		
Equivalent step	18	
NO equivalent step	6	DK, FI, HU, NL, PT, SK
Implement GEP measures and monitor effects on BQEs and supporting quality elements		
Equivalent step	21	
NO equivalent step	3	HU, IE, PL

Note: Table shows information on countries that provided a response on the use of the steps in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

Less than half of the countries (10 of 24) claim to have equivalents for all steps of Guidance no. 37 on MEP and GEP definition (steps A to H) (see green cells in table below).

Table 9 Overview of step equivalence reported for methods per country & per step

	Designation	MEP Definition							GEP definition			Implementation		
	Pre-Step Designation	Step A. Closest comparable water category	Step B1. Relevant mitigation measures	Step B2. Sgnificant adverse effect on use or wider environment	Step B3. Most beneficial measures (best approximation ecological continuum)	Step C. Hydromorphological conditions for MEP	Step D. Physico-chemical conditions for MEP	Step E. BQE conditions for MEP	Step F. BQE conditions for GEP	Step G. Supporting quality element conditions for GEP	Step H. Mitigation measures for GEP	Monitoring to assess whether GEP is being achieved	GEP measures disproportionally expensive or infeasible?	Implement GEP measures & monitor effects
Austria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Partly	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cyprus	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Czechia	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Denmark	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes
Estonia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
France	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Greece	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hungary	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Latvia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lithuania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Luxembourg	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes
Norway	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes
Poland	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Portugal	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	No	Yes
Romania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slovakia	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Yes	Method is reported to have an equivalent step
No	Method is reported to have no equivalent step
	Method is still in early stages of development

Note: Status of the methods as of autumn 2020

6 Pre-step. Designation of HMWB & information from earlier planning cycles

6.1 Introduction to step

In this pre-step, information on the assessment of biological and hydromorphological impacts from the designation phase of HMWB and existing monitoring results is used to support the subsequent steps of defining MEP and GEP.

The information below focuses on the designation phase of HMWB, especially on the identification and assessment of hydromorphological impacts and alterations linked to relevant specific use(s) causing failure of good status and causing a change in character. This should be based on the application of suitable methods for the assessment of hydromorphological quality elements, capable to detect hydromorphological modifications and inform solid links to the sensitive biological quality elements.

6.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- In the large majority of countries (20), the designation of HMWB is based on the principles and steps of the CIS Guidance Document No. 4, adopted by the Water Directors in 2003. Also in most countries (18), the designation of HMWB had already been reviewed for the 3rd planning cycle at the time of filling in the intercomparison questionnaires, while for five countries this review was still outstanding.
- The assessment of whether the water body is substantially changed in character, according to WFD Article 2(9), takes place in the majority of countries (18) based on the use of specific thresholds and criteria (e.g. percentage of water body length or surface area irreversibly affected). Non-quantified criteria (e.g. simple presence of a dam) or expert judgement on case-by-case basis without criteria are also used in a few countries (4-5 countries) but usually in combination with the use of specific thresholds and other criteria. Specific hydromorphological assessment methods are used by approximately half of countries (11 countries) to assess substantial changes in character at the HMWB designation phase, even though such methods may be used for other parts of WFD implementation.
- All countries have been able to identify the physical modifications in their specific HMWB cases that typically were multiple physical modifications.[3]
- All countries have identified the relevant uses for designating their specific HMWB cases, and in more than half of the cases, there were multiple relevant uses.
- All countries have identified the hydromorphological supporting elements directly or indirectly changed as a result of the physical modifications in their specific HMWB cases. Almost all countries (19 of 20 HMWB cases) provided a description of the nature of the changes with a varying level of detail, in many cases lacking any quantitative assessment.

[3] Countries were asked to indicate the main physical modification(s) that led to the designation of the selected HMWB, choosing from a list of "most common" physical modifications for European HMWB rivers. The most common physical modifications for HMWB rivers were selected on the basis of ECOSTAT country responses to a mini-questionnaire that was circulated for this purpose in spring 2020. For European HMWB rivers, the most common physical mofidications identified through that ECOSTAT survey were:

- Channel straightening & channel deepening
- Dam, weir, barrage or other transversal structure - river stretch with reduced flow velocity (im-poundment), no lake
- Bank protection (bank-perpendicular e.g. groynes, or bank-parallel, submerged or partly sub-merged, e.g. training walls, rip-raps, gabions)
- Dam, weir, barrage or other transversal structure -reservoir/lake upstream of dam
- Embankments, levies, dykes
- Channel protection works (e.g. revetments)

- Most countries (17 of 20 HMWB cases) have been able to identify the physico-chemical supporting elements affected directly by the physical modifications or indirectly due to changes in the hydromorphological character of the water body in their specific HMWB case. For most physico-chemical supporting elements, the vast majority of selected HMWB examples reported no effects or only minor effects by the physical modifications. Only for thermal conditions, oxygenation and nutrient conditions, some countries (7-9) reported moderate or major effects.
- All countries have identified at least one BQE adversely affected in their specific HMWB case. Fish fauna is the BQE for which major effects are reported in most countries (18), while for a few countries (3), there are moderate effects on fish. Also for benthic invertebrate fauna, major or moderate effects are reported for all HMWB cases in the intercomparison. For macrophytes, about half of countries (10 out of 20) reported major or moderate effects for their HMWB examples, while for phytoplankton and phytobenthos usually minor or no effects were reported. For phytoplankton and macrophytes, some countries reported the lack of suitable data or lack of relevance of these BQEs for the selected HMWB rivers. Finally, most countries (16 of 20) also provided a qualitative description of the main ecological impacts in terms of changes in species diversity and abundance.
- The overall ecological status class of the HMWB when assessed using methods for natural water bodies of the same type was moderate or worse, in all HMWB examples in the intercomparison.
- The availability of detailed monitoring data on hydromorphological conditions shows a mixed picture with three-quarters of countries (14 of 20) having had access to such data, and one-quarter of the countries reporting the lack of such data (5 of 20). The availability of monitoring data on BQEs seems slightly better than for hymo conditions, as more countries (more than two-thirds, 17 of 20) reported to have access to such data.
- In addition to monitoring, more than two-thirds of the countries (16 of 20) report that biological assessment methods used at designation are sensitive to hymo alterations in rivers. The scope of information though provided in the questionnaires did not allow verifying the extent to which the applied methods are indeed fully sensitive to hymo alterations, e.g. in some cases only sensitivity to general degradation in rivers is mentioned (e.g. HR, RO).[4] In a few cases, explicit statements on methods or metrics sensitivity is made, e.g. for CZ (some metrics of the assessment method of benthic invertebrates and fish are known to be sensitive to hymo alterations of rivers), FR, the NL and SK. The use of proxy methods which are based on hydromorphological assessment methods seems to be the exception reported by very few countries (3).
- Mitigation measures were in place prior to designation of the water body as HMWB only in a few countries (7 of 20), e.g. AT where measures concerning lateral connectivity were implemented.
- The selected examples of only four countries (LV, LU, NL, SK) are of transboundary nature and actions to coordinate the process of harmonization on status/potential assessments are only mentioned in the case of SK (SK/HU Transboudary Commission).

Unclear issues / gaps

- Some countries are still missing well developed systems for classification of hydromorpholgical conditions (e.g. NO).

[4] Cf. also with conclusions of CIS Workshop on Classification and Hydromorphology, in Tallinn.

Table 10 Use of biological assessment methods sensitive to hydromorphological alterations in rivers at the stage of HMWB designation

4,14 Have biological assessment methods been used which are sensitive to hydromorphological alterations in rivers?		
Response	**Country**	**Explanations**
Yes	AT, HR, CY, CZ, DK, EE, FI, FR, DE, EL, HU, IT, LV, NL, NO, PL, RO, SK	CZ: Some of the metrics which are part of the assessment method of benthic invertebrates and fish are known to be sensitive to hymo alterations of rivers. DE: Biological assessment methods are used for fish and benthic invertebrates which are sensitive to hymo alterations in rivers. DK: BQE for fish, invertebrates and macrophytes are sensitive to hymo alterations in rivers. In the given example, status is unknown for fish and macrophytes, whereas status is moderate for invertebrates. EE: Same method is used as for natural waterbodies. EL: The assessment methods are based on the methodologies for benthic invertebrates (Hellenic Evaluation System – HESY2) and fish (He.F.I.: Hellenic Fish Index) that are intercalibrated for rivers. FI: Overall, sensitive methods are used. In the specific case study provided, although the methods are available, they had not been used due to disappearance of suitable habitats. FR: Biological assessment methods are used for fish and benthic invertebrates which are sensitive to hymo alterations in rivers. HR: Biological assessment methods are used for fish, macrophytes and benthic invertebrates which are sensitive to general degradation in rivers, and not specifically to hydromorphological alterations. HU: fish method sensitive for hymo alteration IT: Biological assessment methods are used for benthic invertebrates and macrophytes which are sensitive to hymo alterations in rivers. LV: Partly. Macroinvertebrate data are available. Fish were not monitored but continuity is not the main problem in this water body. NL: The metrics for macro invertebrates and fish are hymosensitive. Because an empirical/statistical model is available the contribution of different pressures (assuming a causer - effect relationship) and/or the effect of restoration measures in the steering variables or pressure decrease can be estimated quantitatively. A detailed report on this model will be soon published. NO: The population of sea trout is affected by the regulation.

		PL: Biological assessment method was used at the designation step as screening method: if the quality class of fish and benthic invertebrates were Good or Very Good, the WB was designated as natural. It was not the case for the selected HMWB. RO: Biological assessment methods used for fish and benthic invertebrates are sensitive to general degradation, especially morphology. The biological assessment is complemented by hydromorphological assessment. SK: Special classification schemes were derived EP assessment based on benthic invertebrates - focused on relevant metrics/indexes (reflecting hymo impacts like substrate, flow velocity, zonation ...conditions). Fish-method for EP assessment was finalized, but will be applied in the following planning cycle
No but proxy methods which are based on hydromorphological assessment methods have been used	LT, ES, SE	SE: Fish have been classified by expert judgement, supported by HyMo.
No		

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

6.3 Intercomparison of country methods

Criteria:

1. Principles of Guidance 4 used for designation including review of the designation for the new planning cycle
2. Use(s) are identified
3. Physical modifications that led to the designation are identified and relevant hydromorphological and physicochemical alterations are quantified using appropriate methods
4. Effect on hymo sensitive BQEs identified and quantified

Key observations:

- For the majority of countries (with the exception of six), it is concluded that they do not fully meet all the criteria set for the intercomparison of this pre-step on designation.
- The main deficiencies relate to the lack of quantification of hydromorphological alterations, gaps in the hydromorphological monitoring and the use of expert judgement to assess hydromorphological alterations and effects on BQEs without further explanation of how exactly expert judgement is applied.

Table 11 Pre-step Designation of HMWB: Intercomparison of country methods

MS	Step reported by MS as present (Yes) or absent (No)	Criterion 1	Criterion 2	Criterion 3	Criterion 4	OVERALL STEP EVALUATION -
Austria	Yes					
Belgium	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Partly	provisional designation, not clear if good status is achievable		alteration not quantified		
Cyprus	Yes	No review for 3rd cycle		alterations not quantified, no hymo monitoring		
Czechia	Yes			alteration not quantified, no hymo monitoring		
Denmark	Yes	No review for 3rd cycle		alteration not quantified, no hymo monitoring		
Estonia	Yes			alteration not quantified, no hymo monitoring	all BQEs claimed to be affected but appears expert judgment only	
Finland	Yes					
France	Yes			based on expert judgment		
Germany	Yes					
Greece	Yes			alterations not quantified, no information on morphology	not clear whether effect on most sensitive BQE (fish) has been quantified	
Hungary	Yes				Not clear whether methods are hymo sensitive, use of	

					expert judgment	
Iceland	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Provisional designation	No evidence due to lack of case study	No evidence due to lack of case study		no information on designation due to lack of case study
Italy	Yes		National method fulfills criterion, not possible to check application due to lack of case study	National method fulfills criterion, not possible to check application due to lack of case study	National method fulfills criterion, not possible to check application due to lack of case study	National method fulfills all criteria, not possible to check application due to lack of case study
Latvia	Yes					
Lithuania	Yes	no review for 3rd cycle		hymo monitoring in place but it is not clear if/how hymo alterations were quantified	hymo conditions used as proxy instead of BQEs	
Luxembourg	Yes				use of expert judgment	
Malta	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes			Hymo alteration is not quantified with the objective to quantify and/or to assess for lower than 'high' status. No reports available on the level of alteration according to criteria (no high status bodies are available). However, for modelling the biological effect of		

				measures many quantified hymo data is available		
Norway	Yes			designation based on qualitative rather than quantitative evaluation of hymo modifications		
Poland	Yes			Hymo OK, based on hymo river index. Physico-chemical conditions assumed to be not altered - tbc		
Portugal	Yes	incomplete method				no information on designation, lack of case study
Romania	Yes			hymo alteration (river continuity) is quantified; unclear if quantitative data available on morphological effects on riparian zone structure		See criterion 3
Slovakia	Yes					
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes					
Sweden	Yes	SE indicates principles have been used 'partly'		only qualitative description, physico-chemical not addressed due to lack of data	identified but not quantified	
Turkey	N/A	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7 Definition of MEP

7.1 Step A. Identification of closest comparable water category

7.1.1 Introduction to step

This step involves the identification of the most comparable water category (e.g. lake, river, transitional or coastal water) which should in general be derived from the original water category (i.e. prior to modification). If a change in category is necessary due to the modifications, the most comparable category should be chosen, e.g. for a reservoir created on a former river, the most comparable water category would be a lake.

7.1.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- All countries (24 countries with a method) report having an equivalent to step A on the identification of closest comparable water category in their methods.
- In all the reported intercomparison case studies, the selected HMWB was a river which remained a river category.
- The criterion of retention time was used by several countries to distinguish between maintaining the river category and changing to a lake category.

Unclear issues / gaps

- None

7.1.3 Intercomparison of country methods

Criteria used:

1. Comparable water category derived from the original water category (i.e. prior to modification). For the rivers GEP questionnaire cases, expected that the comparable water category would be a river.

Key observations:

- All countries that claim to have an equivalent step meet the criteria that reflect the basic principles of Guidance no. 37. In one case, no conclusion could be made due to the lack of relevant information.

Table 12 Step A: Intercomparison of country methods

	Step A. Closest comparable water category		
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**OVERALL STEP EVALUATION -**
Austria	Yes		
Belgium	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A
Croatia	Yes		

	Step A. Closest comparable water category		
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**OVERALL STEP EVALUATION -**
Cyprus	Yes		
Czechia	Yes		
Denmark	Yes		
Estonia	Yes		
Finland	Yes		
France	Yes		
Germany	Yes		
Greece	Yes	Despite lack of case study, approach described	
Hungary	Yes		
Iceland	N/A	N/A	N/A
Ireland	Yes	Not possible to judge due to lack of case study	
Italy	Yes	Despite lack of case study, approach described	
Latvia	Yes		
Lithuania	Yes		
Luxembourg	Yes		
Malta	N/A	N/A	N/A
Netherlands	Yes		
Norway	Yes		
Poland	Yes		
Portugal	Yes	Despite lack of case study, approach described	
Romania	Yes		
Slovakia	Yes		
Slovenia	N/A	N/A	N/A

	Step A. Closest comparable water category		
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**OVERALL STEP EVALUATION -**
Spain	Yes		
Sweden	Yes		
Turkey	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7.2 Step B1. Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body

7.2.1 Introduction to step

Step B1 is the first step in selecting mitigation measures for defining MEP. It involves identifying the mitigation measures that are relevant to the type of hydromorphological alterations or impacts causing failure in achieving good status. Guidance no. 37 recommends using a mitigation measures library to guide the selection process. A European library of mitigation measures is available with Guidance no. 37.

The information below focuses on whether countries considered specific measures to improve the conditions of the selected HMWB, and whether countries have considered upstream and downstream water bodies when selecting mitigation measures.

7.2.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- Most countries (20 of 24 countries with a method) report having a step to identify mitigation measures for MEP. Some countries do not (yet) define MEP, but first identify all mitigation measures that could be relevant to achieve GEP (e.g. FR, NL).
- Many countries (9) indicate having a national mitigation measures library to guide the identification of mitigation measures (e.g. AT, FI, DE, EL, HU, IT, LU, RO, ES, SK). Two countries reported using the European mitigation measures library (e.g. CY, LV).

Box 1 Examples of country approaches to identify mitigation measures for MEP

Finland considers all possible measures for hydromorphology that do not have significant adverse effects on use and that guarantee ecological continuum and take into account sustainable/viable populations of fish and other biota that are adjusted/"naturalized" and reproduce naturally. Direct fish management measures as well as fishing are left out.

Norway: A method for identifying mitigation measures exists for rivers with anadromous salmonids. The method combines looking at measures related to managing the hydropower plant with habitat measures, trying to focus on both aspects to gain optimal conditions for fish in the different rivers and the different hydropower plants. This method is fairly new, and not yet used in all rivers. The method has a holistic approach, looking for bottlenecks that prevent good ecological conditions and pinpointing the most relevant and efficient measures for ecological status and continuum. In this method most feasible measures are taken into account and assessed to see how effective they are to improve ecological conditions.

Romania: A national catalogue of mitigation / restoration measures (updated 2020) is used for the selection of the most ecologically effective measures. As a general approach, each mitigation measure from the catalogue has been assessed in relation to the expected effects on quality element level (biological, hydromorphological and physico-chemical elements). The national catalogue includes information on types of hydromorphological pressures, drivers, category of mitigation measures, type of mitigation measures/description of measures, estimated efficiency on BQEs and supporting QEs.

- For more than half of the HMWB examples in the intercomparison (13 out of 20 countries with a case study) the objectives of downstream and upstream water bodies have been considered when identifying relevant mitigation measures for MEP. Improvement in the HMWB can improve river dynamics and continuum, with benefits for sediment transport, species and habitat diversity, and/or fish migration, which in turn should allow to improve the status of upstream and downstream and/or to classify them as natural water bodies after implementation of restoration measures. Some countries mention the existence of important protected natural habitats upstream and downstream.
- Countries that did not consider upstream and downstream water bodies report the following reasons: the selected water body doesn't significantly affect upstream and/or downstream water bodies (e.g. no or only a very short river reach upstream) and the upstream and downstream water bodies are in good status.

Box 2 Examples of country approaches for considering upstream and downstream water bodies

Slovakia: The main aim is to provide river continuity (in sediment transport, species and habitat diversity, fish migration) and minimize the negative impacts of HMWB on two neighbouring water bodies. These are classified as natural water bodies after implementation of restoration measures.

Spain: Consideration has been based on the value and evolution of the hydromorphology, physico-chemical and biological indicators in the water bodies upstream and downstream of the selected HMWB. Mitigation measures have been selected which contribute to the improvement of the river dynamics and the ecological status of upstream and downstream water bodies.

- For the HMWB examples selected for the intercomparison, the following are some key observations on the selected mitigation measures for MEP:
    - About two-thirds of the countries with a case study have identified fish migration aids (15 countries out of 20), riparian habitat enhancement (15) and improvement of in-channel diversity (14) as relevant measures.
    - About half of the countries identified increase habitat diversity (12), environmental flow (11), sediment management (10) and vegetation management (10) as relevant measures.
    - About one third of the countries identified floodplain/lateral connectivity improvement (9), river bed rehabilitation (7), and ecologically optimized maintenance (6) as relevant measures.
    - The other measures were identified as relevant by fewer than five countries.

- Table 13 presents examples of concrete measures identified by countries and their expected benefits. Not all countries defined concrete practical measures when defining MEP for the HMWB examples provided for the intercomparison. Those countries with relatively few HMWB on their territory define concrete measures for MEP for each individual HMWB (e.g. LU). Some of the countries that group HMWB for the purpose of MEP definition such as DE and HR stay at a more general level when defining measures for MEP. For these countries, more specific measures are identified when selecting measures to reach GEP during river basin management planning.

Table 13. Concrete measures provided for each group of MEP mitigation measures, and their expected benefits

	Examples of concrete measures	Example expected benefits
Fish migration aids	Near-natural by-pass channel (AT, EE) Fish pass (EE, FI, FR, HU, LT, LU; NO) Weir removal (FR) Fish access to tributaries (EL, SE) Removal of migration obstacles when not associated to a reservoir (LT) Fish ponds (LT) Fish screens (LU, NO)	Create new habitats also for spawning, juveniles, rheophilic species (AT) The fish pass must be improved to meet updated standards. At present juvenlie fish is transported to the water body upstream to further improve survival rates. The water body upstream has higher temperature. A barrier is present to prevent fish from entering the turbines (NO) Improve the longitudinal connectivity (RO) Fish migration from the Middle Danube upstream to upper Danube reaches (SK)
Environmental flow	Adapt HP controls / license requirements (EE, LT, ES) E-flow for two natural river sections with low minimum flow (FI) Any actions to preserve the environmental flow to ensure GEP (EL) Management of weirs and sluices (LU) Environmentally designed discharges to secure optimal conditions for the population of fish and other quality elements taking into account the annual cycle of the sea trout from spawning to smoltification and migration both up and down the river (NO) Minimum flow in the natural channel (SE) Release water from the upstream dam to enhance river habitats (CY)	This water body is proposed for revision in the upcoming RBMPs. In a revision environmental flow and other relevant mitigation measures will be assessed by the competent authority in a cost-benefit analysis (NO) Improving of flow conditions within the main Danube channel including side arm system (currently regulated discharges) (SK)
Sediment management	Reduce fine sediment input (EE) Small local siltings (FI) Removing concrete and recreating a gravel bed (FR) Reintroduction of sedimentary materials downstream of the dam, in accordance with the characteristics of the ecological regime of flows (ES) Counteract elevated erosion (SE) Flushing of silted gravel banks and juvenile salmon habitat (i.e. harrowing imitating the effects of natural floods) (NO)	Restore sediment structure suitable for spawning and juvenile habitats (NO) Decrease of negative impacts of intensive sedimentation in reservoir and degradation of the river bed downstream of HPP (SK)
Modification or management of operations or structures (e.g. sluices)	Changed license term to avoid rapid changes in water levels (hydropeaking) (NO, SK) Management of weirs and sluices (LU) Changes to weir height (RO)	Improvement of variability of flow conditions and sediment management (SK)

	Examples of concrete measures	Example expected benefits
	Supply blocks, gravel, dead wood and other habitat structures (SE)	
Riparian habitat enhancement	Remove rip rap (AT) Flatten shore zones (AT, EE, HU) Plant riparian vegetation (FR, LV, LT, PL, RO) Giving more space to the river (FR) Plant in the neighborhood of weirs (RO) Improvement of the morphology of the bed and banks to facilitate the development/planting of riverside vegetation (ES) Management of buffer zones in agricultural lands (LV) Creation of diversified side arms to create spawning sites and young fish habitats (LU) Remove alien and invasive species and plant local riparian species (CY)	
Improvement of in-channel diversity	Introducing type specific substrate / gravel /boulders (EE, FR, LT, LU, NO, SE) Add large woody debris anchored in the river bed (FR, LT, SE) Removal of old submerged weirs (FI) Removal of artificial obstacles (LT) Removal of rip rap (FR, LU) Dug holes (LT) Creation of groynes (LU) Creation of bank terraces (CY) Reducing the possibility of aggradation of the bed and needed frequency of dredging (allow natural erosion) (HU)	Improve spawning conditions (NO) Enhancement of morphology (PL) SK partial removal of bank revetment; artificial bedload releases: re-establishment of sediment transport; groynes modification (size and shape)
Ecologically optimised maintenance	Selective cuts (EE) Fish introduction for natural reproduction (FI) Dredging / vegetation management (HU) Native species restoration (SK)	
Increase habitat diversity; River depth and width variation improvement	Removal of bank revetment / rip rap / defence structures (AT, LT, SK) Flatten shore zones (AT) Near-natural/optimised slope (EE) Passive restoration strategy with floods (FR) Addition of gravel / boulders (FR, LV, LT, SK) More space to river (HU) Minor remeandering (LT) Groynes modification (SK) Re-introducing riparian species and removing invasive species (CY)	Enhancement of morphology (PL) Improvement of habitat diversity (FR, SK)
Floodplains/off-channel/lateral connectivity improvement	Near natural bypass channels (AT) Reconnect backwaters / additional channels (AT, EE, FI, SE) Habitat restoration at the fringe of selected parts of the river beds (FI, ES) More space to river (HU) Morphological renaturalization of riverbed (ES) Riparian areas (ES) Artificial watering channel into floodplain (AT)	Protect side arm system against biotic and abiotic degradation (SK) Decrease of river bed erosion (SK)

	Examples of concrete measures	Example expected benefits
	Reestablishment of lateral connectivity (SK) Reconnect tributaries in upstream areas (SE)	
Channel enhancement	Meander river course within secondary floodplain (EE) Add large woody debris (FR) Removal of bank revetment (SK) Modfication of in-stream structures (SK) Side arms reconnection (SK)	
Vegetation management / rehabilitation	Developing flood plain forest / vegetation / restore riparian vegetation (EE, FR, HU, RO) Removal of plants / weed cutting (RO, LV) Re-introducing riparian species and removing invasive species (CY)	Rare native species rehabilitation (SK)
Reduction negative effects of impoundment	Near-natural by-pass channel (AT, EE) Fish pass and fish screens (EE) Improving in-channel habitats (EE) Sediment management (SK)	
Construction/technical measures to mitigate negative effects of hydropeaking	Turbine exchange (EE)	
River bed rehabilitation	Increase current speed and diversity (EE) Mechanical break-up (EE) Removal of bank revetment / concrete (FR, SK) Artificial bedload supply / add gravel / boulders (EE, FR, LT, SK) Add wood logs (LT) Dug holes (LT) Widening the channel (ES) Re-profiling slopes (ES), Reconnecting the riverbed with abandoned meanders and side arms (ES) Regenerating bars and islands (ES, EE) Modification of in-stream structures (SK) River depth and width variation improvement. (HU)	Improvements to the planform, longitudinal profile or local slopes (ES)
Re-opening of subsurface rivers (in pipes)	Reopening of closed streams (SK, NO)	Increase available area for spawning and juvenile phase (NO)
Rehabilitation of physicochemical alteration, including mitigation of downstream effects	Surface water intake from the dams (NO)	Mitigate impacts of colder temperatures in river (NO)
Improvement of sediment connectivity in between lake and river		Decrease of fine sediment deposition; decrease of the river bed incision downstream of HPP (SK)
Ecologically optimised fisheries management	Fish introduction to recreate natural reproduction cycles (FI) Banning trout fishing (NO) Partial elimination of alien species (SK)	Providing optimal conditions for native species (SK)
Other	Improve habitats in tributaries, create new habitats in near natural bypass channel (AT) Stabilisation of lateral erosion process (compacted soil, fascines, gabions mattresses) (RO)	

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.
Note: Status of the methods as of autumn 2020

Unclear issues / gaps

- Guidance no. 37 recommends selecting relevant mitigation measures on the basis of an assessment of their potential benefits in improving specific supporting quality elements and BQEs. Not enough information is available in the questionnaire to assess whether, and how, countries carried out such an assessment when selecting the MEP mitigation measures.
- For several countries, it is unclear if measures are already ruled out at this Step B1 due to significant adverse effects on use, which is normally part of the next Step B2.
- Some countries without an equivalent step B1 report selecting mitigation measures based on economic feasibility, which is normally not part of MEP definition but part of river basin management planning (see chapter 9.2) (e.g. DK, PT).
- In Appendix 1 to this report, a first comparison of the selection of mitigation measures for MEP for specific hydromorphological alterations is provided. However, it remains unclear if the selection of mitigation measures for MEP is comparable between countries. There is the need to go further with the intercomparison by using generic / comparable cases and peer-to-peer exchanges.
- Further work could include identifying good practice on how to design a national library of mitigation measures and compare approaches between countries.

7.2.3 Intercomparison of country methods

Crtieria:

1. Use of a national or European mitigation measures library to guide the selection process of relevant mitigation measures.
2. There is a specific methodology for selection of mitigation measures set in a consistent way at national / regional level
3. Relevant mitigation measures are identified for MEP (not only for GEP)
4. A broad range of mitigation measures are considered to select relevant measures (state of the art)
5. No relevant measures are excluded at this stage without justification

Key observations:

- Although the majority of countries (20 of 24) report to have an equivalent to step B1 in their methods, the intercomparison indicates that only six of these demonstrate that they meet all criteria set based on the Guidance no. 37 principles for this step.
- Most countries with an equivalent step only partly meet the criteria and, in a few cases, information was insufficient to make a concluding judgement.
- The main deficiencies relate to the lack of reference to the use of a mitigation measures library (national or CIS), the use of expert judgement without clear criteria for selecting relevant mitigation measures, the lack of mention of appropriate hydromorphological assessment methods (linked to the designation phase) that are also key for an informed decision on relevant mitigation measures as well as the lack of considering the objectives of upstream and downstream water bodies (too water body-specific approach for selecting relevant measures).

Table 14 Step B1: Intercomparison of country methods

	Step B1. Relevant mitigation measures						
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**Criterion 4**	**Criterion 5**	**OVERALL STEP EVALUATION -**
Austria	Yes	National mitigation measures library	Individually applied on each WB, the decision depends on the local conditions. Involvement of different experts (ecology, nature protection, flood control, groundwater) and stakeholders				
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	No						
Cyprus	Yes	CIS mitigation measures library	Expert judgement without criteria etc.	Hymo alterations not quantified, no hymo monitoring		Continuity measures in WB and up-/downstream excluded without plausible justification	
Czechia	No						
Denmark	No						
Estonia	Yes	Unclear whether national list in use or case specific list for WB in RBMP	Expert judgement without criteria etc.	Hymo alterations not quantified, no hymo monitoring			

Finland	Yes	National mitigation measures library					
France	Yes	No library so far (further development announced)	Expert judgement without criteria etc. (further development announced)	No official MEP but same content; Hymo alterations based on expert judgement			
Germany	Yes	National mitigation measures library					
Greece	Yes	Indicative list of potential measures per alteration	Not clear if based on list for typical modifications (e.g. WB downstream of dams)	Hymo alterations not quantified	Unclear, measures not described in detail (e.g. on hydropeaking)		
Hungary	Yes	Mitigation measures library (national and CIS)	Selection unclear (expert judgement on national level and regional stakeholder engagement); method under development				
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes						No information, lack of case study
Italy	Yes	National mitigation measures list (further development announced)	Expert judgement on national level linked to guidance	No detailed information on single measures	No information, lack of case study	No information, lack of case study	
Latvia	Yes	Mitigation measures library (unclear if national or CIS)	Expert judgement without criteria etc.		Except from lateral connectivity improvement		
Lithuania	Yes	Unclear if library in use	Likely to be based on expert judgement without criteria etc.	Unclear if/how hymo alterations were quantified	No lateral connectivity and up-/downstream measures		

Luxem-bourg	Yes	National Catalogue of Measures	Individually applied on each WB due to only 8 hmwb				
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nether-lands	Yes						No MEP measures are derived
Norway	Yes	National mitigation measures library	Only continuity for (mi-gratory) fish considered	Hymo alterations not quantified (only conti-nuity considered)		Not clear how they can rule out sedi-ment management	
Poland	Yes	National mitigation measures library	Expert judgement on national level with cri-teria (components of the hydromorphologi-cal index) and infor-mation from local river administrator				
Portugal	No						
Romania	Yes	National mitigation measures library	Hymo alterations only considering continuity	Hymo alterations only considering continuity	Modifications and measures only on a small scale due to continuity		
Slovakia	Yes	National and CIS miti-gation measures li-brary	expert judgement with-out criteria				
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes	National and CIS miti-gation measures li-brary	Regional (basin) level either reference or mit-igation measures ap-proach depending on knowledge etc.				

Sweden	Yes	Unclear if library used	Both methods for reference and mitigation measure approach	Hymo alterations not quantified	Unclear according to up-/downstream measures	Unclear according to up-/downstream measures	
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A No answer

The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7.3 Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment

7.3.1 Introduction to step

The next step after creating an initial list of mitigation measures for MEP is to exclude measures that have significant adverse effects on use(s) (SAEOU) or the wider environment. According to CIS Guidance Document No.4, MEP represents the maximum ecological quality that could be achieved for a HMWB once all mitigation measures that do not have significant adverse effects on use or on the wider environment have been applied.

The following issues are considered as necessary to be addressed in order to achieve a transparent and clear process for assessing significant adverse effects:

- Issue 1: Define the key uses and the scope of wider environment interests
- Issue 2: Define the benefits of the key uses and of wider environment
- Issue 3: Define in generic terms the types of effects of measures on the key uses and the wider environment
- Issue 4: Define the scale of assessment of significant adverse effects for each key use and the wider environment
- Issue 5: For each key type of adverse effect, define criteria for assessing adverse effects and when relevant thresholds of significance

7.3.2 Key findings from the questionnaires

Summary of common aspects and differences between Member States

- Although many countries (17 of 24) report having an equivalent step in their ecological potential methods, only 11 report having a general or national method in place to assess adverse effects of mitigation measures. Five countries have such method for all uses and the wider environment, and 6 countries have a method for some but not all uses and the wider environment.
- Most countries with a method report using expert judgement on a case-by-case basis as the main methodological approach to assessing SAEOU. Some of those countries (i.e. FR, LV, IE, NO) may also use stakeholder engagement to support the assessment of SAEOU. Quantitative and semi-quantitative approaches are reported by RO, AT, ES, SE, LT, and by PL which uses multi-criteria analysis.
- National guidance on specific parts of the assessment exists (e.g. for methods of FI, FR, IT). In FR, experts can rely on a table listing for each type of HMWB, the hydromorphological characteristics of the water body which are mandatory to ensure the usage that defined the waterbody as HMWB. Finland has a national guidance to explain how to assess SAEOU, and it includes examples, concerning hydropower and flood protection, to demonstrate the overall process. This can be applied to other uses as well.
- Mitigation measures appear to be ruled out very early in some countries (e.g. DE, CZ, FI, LV, RO), through an initial screening of mitigation measures. For instance, in CZ, mitigation measures are not proposed if SAEOU is apparent from the onset.
- Some countries have established that some mitigation measures cannot be ruled out due to SAEOU. For instance, in LT, a fish pass and soft renaturalisation are considered having no significant effect on use and should not be ruled out for this reason.
- The NL does not explicitly derive MEP and MEP mitigation measures as such. Water managers and competent authorities set directly the measures needed to achieve GEP, therefore it is assumed that assessment of significant adverse effects reported under B2 relates to GEP measures.
- Very few countries (6 countries) have methods that clearly define and quantify types of benefits provided by different water uses and the wider environment. Similarly, very few (6 countries)

have methods that define different types of adverse effects. Examples of benefits and adverse effects are provided in Table 15. The compiled list of reported benefits and adverse effects presents a range of economic, social and environmental factors.

Table 15. Types of benefits of water use and adverse effects of mitigation measures

Water use	Benefits	Adverse effects
Navigation	• Transport of goods, passengers • Jobs/employment, value added • Reduced GHG emissions compared to road • Reduced congestion (road capacity issue) • Tourism related passenger transport	• Disruption to movement of vessel (if mitigate water levels (and dredging if an issue) or reduce depth of river channel (if dredging is an issue) • Reduction of transport tonnages / abandonment of freight shipping • Reduction of security for persons or goods transport • Reduction/discontinuation of passengers/tourist shipping • Conflicts with GHG emissions reduction targets
Flood protection	• Protection of settlements (households, businesses) • Protection of infrastructure and traffic route • Protection of agricultural areas	• Impact on the hydraulic performance of a flood relief scheme (e.g., reduce conveyance / raise flood levels) • Increased flood risk for surrounding areas and infrastructure • Loss of available land area • Risk for people / Endangerment of human life
Storage for hydropower	• Electricity generation (base load) • Flexibility (control energy, peak load production) • Regional or national energy supply security • Regional or national network security	• Reduction in total energy production • Reduction of electricity production (base load) beyond the annual natural fluctuation range • Loss/reduction of peak power generation • Loss of flexibility in providing control and reserve power • Reduction of the regional/national security of supply (security risk) • Economic loss • Reduction of storage capacity • Possible elimination of wetlands • Flood risk • Conflicts with GHG emissions reduction targets
Storage for irrigation	• Agricultural production	• Reduction / loss of irrigation possibility • Reduction of agricultural production volume • Reduction of the agricultural production area • Loss of water supply security, impact on high/middle/low-income crops
Storage for water supply	• Security of supply • Affordable supply of water • Supply with high water quality	• Reduction/loss of supply security • Deterioration of drinking water quality • Increase in supply costs • Possible elimination of wetlands/recreation that have developed due to water storage
Recreation	• Recreation, tourism, leisure activities • Jobs/employment, value added • Angling/fishing	• Loss of recreation (e.g. linked to water storage) • Loss/reduction of regionally important water sports opportunities (e.g. surfing, sailing, kayaking) • Loss of EU bathing area
Drainage	• Protection of agricultural areas • Agricultural production or farm income	• Reduce drainage efficiency and conveyance • Change in production conditions • Reduction of the agricultural production area

	• Productivity (harvest) of reclamated arable land	
Urbanisation		• Increase in flood risk • Public sense of safety and land use • Reduce land for urban needs, impact to infrastructure • Planning restrictions
Wider environment	• Ecosystem protection, healthy environment, biodiversity • Natura 2000 sites, protected species, nationally and locally important sites and wider biodiversity	• Impact on climate change and CO2 emissions • Release of hazardous substances • Endangerment of the achievement of objectives Natura 2000 areas • Endangerment of the achievement of objectives of international protected areas (RAMSAR, National Park) • Effect on species listed in the Catalogue of Threatened Species • Endangering the impairment of designated archaeological and/or cultural assets

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

- Very few countries have defined specific criteria to assess significant adverse effects on use:
  - Five countries have, in their national method, quantifiable criteria to assess significance of the adverse effects. They have economic ones (e.g. % economic loss), but also use social (e.g. loss of jobs) and environmental criteria (e.g. conflicts with CO2 reduction targets) (see Table 16).
  - 11 countries do not have, in their national method, any criteria to assess the significance of adverse effects.
- Overall, there are very few cases of clear thresholds for assessing the significance of adverse effects, with only three countries providing examples (i.e. LT, RO, SE) for hydropower, flood protection, irrigation and recreation. Three countries report generic thresholds that they apply across uses.
- The scale at which significant adverse effect is assessed varies between countries, from national to the regional, local (flood risk area, hydropower plant) and water body scale. Several countries assess significance simultaneously at multiple scales (e.g. AT, DE, IE) while others may select one scale (e.g. ES and PL assess at water body level, and SE at national level).

Table 16. Example of criteria used for assessing significance of adverse effects on use

Water use	Criteria used
Navigation	% of national annual tonnage (AT) % of the annual number of persons transported regionally (local for lakes) (AT) Security of navigation (AT, DE) Conflicts with CO2 reduction targets (AT) Navigable days (DE) Tourism (IE) Loss of jobs (RO)

Flood protection	Flood risk / level of flood protection (AT, DE, IE) Agricultural production (IE) Increase the damages related to buildings, agricultural lands, roads, railways, bridges (RO)
Storage for hydropower	Loss of electricity production (DE, IE) % loss of national annual electricity production (AT) % loss of national annual peak electricity production (AT) % loss of local/national flexibility (AT) Loss of energy production on the level of unit of HPP and complex of HPP (RO) Loss of electricity benefits, calculated by multiplying total cascade HP capacity (in kW) and the selling price (LT) Conflict with CO_2 reduction targets (AT
Storage for irrigation	% reduction – regional level (AT) Loss of agricultural production (absolute value) (RO) Functioning of irrigation (DE
Storage for water supply	Local necessity for water treatment (AT) Security of supply (DE) Water supply (IE) Loss of jobs (RO)
Recreation	Impact on regional tourism e.g. % reduction of seasonal overnight stays, number or % loss of tourism jobs (AT) Changing recreation places LT) Functioning of leisure infrastructure (days of use) (DE) Loss of jobs (RO)
Drainage	% reduction – regional level (AT) Functioning of drainage (DE) Loss of agricultural production (IE, LT) Loss of agricultural production benefits, measures as the value of lost productivity by standard mean prices due to worsened reclaimed land properties (LT) Loss of jobs (RO)
Urbanisation	Impacts on infrastructure, home, business (IE) Condition of buildings and infrastructure (DE) Loss of jobs (RO)
Wider environment	Conflicts with CO2 reduction targets (AT) Functioning of ecosystem (DE) Objectives of protected areas (DE) Conservation/condition of natural and cultural heritage (DE) Loss of jobs (RO)

Note: Status of the methods as of autumn 2020

- Four countries (out of 20 which provided HMWB examples in the intercomparison) have excluded mitigation measures due to SAEOU. Six countries did not rule out measures at this step, although some report that they did not consider some measures from Step B1 if they appeared to have SAEOU (e.g. FI, RO). Other countries did not carry out this step because they are still developing the method.

Gaps, unclear issues and needs for further guidance

- Given the relatively low response rate in this section of the questionnaire, few countries appear able to fully carry out this step in a transparent and structured way. Most countries do not systematically assess and quantify SAEOU.
- In the event of a mitigation measure failing due to SAEOU, it is unclear if countries systematically abandon the measure, or consider redesigning the measure with differing intensity or consider other combination of measures.
- Step B2 is among the steps for which countries raise the need for more guidance, in particular on how to decide which adverse effects are significant and which not (and at which scale). More practical and detailed methods or approaches for setting criteria and assessment of significant adverse effects and benefits would be useful. Overall, there is a need for methodologies, more quantified approach, criteria and thresholds that can guide comparable decisions on SAEOU for the same sector.

7.3.3 Intercomparison of country methods

Criteria used:

1. There is a specific methodology with criteria for assessing significant adverse effect on use set in a consistent way at national / regional level
2. Method addresses all uses relevant for designation and wider environment
3. The criteria used for assessment of significant adverse effect on use relate to broader public interest.
4. The scale of the assessment of significant effect is indicated.
5. The method uses thresholds to decide whether an effect is significant or not (in case no thresholds are used, justification and explanation of approach is given)

Rules were established to assess when a criterion was met, partly meet, not met or when it was unclear. Rules are presented after Table 17 below. Additional explanations for the results are provided in Table 17.

Key observations:

- Although many countries report having an equivalent step in their ecological potential methods (17 of 24), the intercomparison indicates that none demonstrated that they meet all criteria selected for this step based on the Guidance no. 37 principles. For four countries, it is concluded that they partly meet the criteria set for this step.
- It was not possible to assess the coherence of the methods with the selected criteria due to lack of information in the questionnaire for the majority of countries with an equivalent step (13 out of 17). Often, expert judgement was refered to without further explanation.
- The main deficiencies were the lack of clear explanation on the criteria used to assess significant adverse effect on use, on when an adverse effect on use is considered as significant, and whether this assessment is focused on the general public interest rather than on individual, private interest.

Table 17 Step B2: Intercomparison of country methods

MS	Step reported by MS as present (Yes) or absent (No)	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	OVERALL STEP EVALUATION
Austria						Not possible for all uses, for some uses a general justification at national level. For several uses, any impact is considered as significant	
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	No						
Cyprus	No						
Czechia	No						
Denmark	No						
Estonia	Yes			Not enough information to judge	No indication of scale in the reply		
Finland	Yes	A generic guidance appears to be available, but it is not clear what the criteria used to assess SAEOU are and whether they are applied consistently across cases in the country	Not possible to judge as no information in the detailed table for the other uses	Not enough information to judge	Evaluated at local (water body), regional and national level. Typically, evaluation is restricted in the present situation to local and regional level (e.g. hydropower and floods)	Thresholds vary case-by-case based on expert judgment	
France	Yes	No criteria, not enough explanation (expert judgement and reference to guidance)	Not enough information to assess	Not possible to judge, as expert judgement used	No indication of scale in the reply	Not possible to judge, as expert judgement used	
Germany	Yes	Consistent-national methodology in place with HMWB case-group			Assessment is done at national scale	No explanation on approach	

		specific list of measures					
Greece	Yes			Not possible to judge, as expert judgement used	No indication of scale in the reply		
Hungary	No						
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Not enough explanation (expert judgement)		Not possible to judge, as expert judgement used		Unclear, e expert judgement used	
Italy	Yes	Indicate that there are ranks and guidance at national level	Only some uses but not all		National scale	Ranks mentioned ranks are used but no description of approach	
Latvia	Yes			Not possible to judge, as expert judgement used	Not indicated		
Lithuania	Yes		Only some but not all	For the use of hydropower, this seems to relate to individual interest	Not indicated	Unclear when it is considered significant	
Luxembourg	Yes	Unclear	Only some but not all		Not indicated		
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes[5]	Provides explanation but no clear criteria		Not possible to judge, as expert judgement used	Water body level	A factsheet per WB explains which uses are affected and to what extent, but it is not clearly explained how it differentiates between significant/not significant, esp. in cases where decision is not more difficult.	
Norway	Yes	There is a method for	Method only	Not possible to judge	Water body level		

[5] No MEP measures are derived.

		hydropower which is the main pressure in most HMWBs – but no criteria provided in additional table	developed for hydropower				
Poland	Yes		Same criteria seem to apply to all uses	For several uses based on public interest, but for some other, the criteria are related to economic loss of users connected with the given hydromorphological alteration.	Water body	The method has a ranking approach with different criteria, but each criterion is ranked based on expert judgement	
Portugal	No						
Romania	Yes	It is indicated that some measures are excluded from the beginning as they have significant adverse effect on use, but it is unclear how this is done in the process. It would be useful to have clarification from Romania.	Only some but not all	For more complete assessment, more details needed on how the 2% threshold per plant is applied in specific cases to ensure the assessment focuses on the public interest		Approach presented with thresholds. However, it is not clear why certain measures are left out from the beginning in the general approach, and thus why thresholds may not be applied for certain measures.	
Slovakia	No				Not indicated		
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes			For several uses based on public interest, but for some uses unclear indicators .			
Sweden	Yes		Only for hydropower, not for other uses	Not enough detail on the approach to judge		But note that the reply is	

						incomplete (only 1,5 TWh)	
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

Rules for assessing each criterion:

- For criterion 1: There is a specific methodology with criteria for assessing significant adverse effect on use set in a consistent way at national / regional level
    - Green: country says there is an approach, that there is a methodology/guidance to ensure consistent approach across WBs and presents criteria and how they are assessed
    - Yellow: country has an approach and presents it, but it does not present clear criteria for assessing adverse effect on use or a consistent approach at national/regional approach
    - Orange: country does not provide any approach
    - Grey: country says there is an approach/methodology/guidance but does not explain it (e.g. only states expert judgement) - this does not allow us to say if the approach is consistent or not.
- For criterion 2: Method addresses all uses relevant for designation and wider environment
    - Green: country has answered yes to all uses in question 7.1 and provides information on all uses in additional table
    - Yellow: country has answered yes to some but not all uses in question 7.1 and provides additional information. It is also yellow for countries answering yes to all uses to question 7.1 but does not provide information on all uses in additional table
    - Orange: country has answered no to question 7.1
    - Grey: country has answered yes to question 7.1 but did not fill in the additional table
- Criterion 3: The criteria used for assessment of significant adverse effect on use relate to broader public interest
    - Green: criteria used clearly relates to broader public interest (e.g. loss of production at national or regional level) and not to the interest of a specific individual or company.
    - Yellow: country has a mix of criteria some of which relate clearly to the broader public, others clearly to individual interest
    - Orange: criteria used relates to the economic interest of specific individuals or companies. Economic loss of individual companies / entities is not considered as a “broad interest”.
    - Grey: not possible to judge based on the information in the questionnaire. For instance, it may be mentioned that loss of production is considered but it does not specify whether it relates to the national or regional level (broader public interest) as opposed to the individual level of a company or entity.
- Criterion 4: The scale of the assessment of significant effect is indicated.
    - Green: indicated
    - Orange: not indicated or unclear

- Criterion 5: The method uses thresholds to decide whether an effect is significant or not (in case no thresholds are used, justification and explanation of approach is given)
    - Green: threshold used or at least some quantification of the significance of adverse impact, which helps to go beyond very qualitative expert judgement and a clear explanation on how they differentiate significant impact on use from not significant
    - Yellow: Same as above, except that there are no clear explanation on how they differentiate significant adverse effect on use vs not significant
    - Orange: no threshold and no quantification of significance use, and no mention of expert judgement or other methodology used
    - Grey: cases where country only mentions "expert judgement" or refers to additional guidance documents without explaining the approach in the questionnaire

7.4 Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum

7.4.1 Introduction to step

Having excluded from the initial list of potential mitigation measures, those measures that would have a significant adverse effect on use or the wider environment, the next step is to select the measure or combination of measures that deliver the best improvement in ecological function and address all relevant hydromorphological alterations, taking into account the need to ensure best approximation of ecological continuum.

Overall, mitigation measure(s) selected for the definition of MEP and GEP are assumed to deliver sufficient improvements to aspects of ecological functioning. Improvements to ecological functioning should clearly relate to the key impacts of the physical modifications.

7.4.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (18 of 24) report to have an equivalent to step B3 to select the most ecologically beneficial (combination of) measures taking into account the need to ensure best approximation to ecological continuum. The methods of six countries do not have an equivalent step.
- For two-thirds of HMWB examples in the intercomparison (15 of 20) information was provided on the mitigation measures finally selected as the most ecologically beneficial for MEP, while for a few examples these were not yet possible to define.
- Most of the countries that reported on the mitigation measures finally selected for their HMWB example were also able to explain how the need to ensure best approximation to ecological continuum was taken into account for the selection. For a few of the HMWB examples, an explanation on how to account for the best approximation to ecological continuum was not provided.
- Only for a few countries though (5 countries), enough information and data were available to assess whether the measures selected for MEP can deliver sufficient improvements to ecological functioning. For several countries, such information and data were either partly or not at all available.

Table 18 Final selection of MEP mitigation measures based on sufficient data concerning ecological improvements and the need to ensure best approximation to ecological continuum

	Yes	No	Other
8,2 Country **indicated which of the mitigation measures were finally selected** as the most ecologically beneficial (combination of) measures for the MEP of the selected HMWB	AT, EE, FI, FR, DE, EL, LV, LT, LU, NO, PL, RO, SK, ES, SE	HR, CY, CZ, DK, HU (no final selection yet at national level), NL (no MEP defined)	
8,3 Country had **enough information and data available to assess whether the measures selected for MEP can deliver sufficient improvements to ecological functioning**	DE, HU, NO, RO, SK	AT, EE, FR, ES, SE	FI, LV, LT, LU, PL
8,4 Country **explained how the need to ensure best approximation to ecological continuum was taken into account** for the selection of MEP mitigation measures for this HMWB	AT, EE, FI, FR, DE, EL, LV, LT, LU, NO, PL, RO, SK, ES	HR, CY, CZ, DK, HU, , NL, SE	

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response or did not provide a HMWB example/case study.

Note: Status of the methods as of autumn 2020

- Approaches for selecting the most ecologically beneficial measures for MEP range from the use of expert advice, combined with stakeholder engagement, to the use of rankings of expected effects in national measures libraries. For some cases, it was explicitly indicated that final measures selection is based on assessment work done at the specific WB level, taking into account field data, biotic and abiotic monitoring, the relevance of different BQEs and simulations of effects of measures on hydromorphology.
- Concerning the way in which the need to ensure best approximation to ecological continuum is taken into account, the explanations provided are not very detailed vis-à-vis the principles laid out in Guidance no. 37. Some countries explained that this is based on expert assessment, while for the majority of HMWB examples, reference is made to the fact that continuity measures and other measures that improve the ecological continuum have been considered. Only a few countries explained in more detail relevant principles used, e.g.:
    - FR: Restoring ecological longitudinal continuity is a priority in France. To ensure best approximation to ecological continuum, French legislation specifies that "measures may be necessary to ensure in particular ecological continuum, even when the good potential of a body of water has been reached, in order, in particular, to respect the objective of non-degradation of this water body or to respect or achieve good status / potential for other water bodies".
    - RO: The concept of best approximation to ecological continuum is taken into account in the Romanian method, being in line with the WFD requirements and recommendation of Guidance no. 37. Migration of biota and sediment transport are considered as a key element in relation to river connectivity. For achieving ecological continuum, specific issues are considered: whether there is an ecological benefit or a need to restore continuity in order to support upstream and downstream water bodies in achieving their

environmental objectives (especially for migratory fish, e.g. outside of natural fish zones).

Table 19 Interpretation of best approximation to ecological continuum at MEP

	8,4 Explanations on how the need to ensure best approximation to ecological continuum was taken into account
AT	Restoring continuity is one of the main measures
DE	Measure selection from relevant case group contains best approximation to ecological continuum for this type of HMWB on a general level The selection of MEP measures could be specified for each single water body, but for practical reasons this is not relevant, because the basis to develop the PoM are the GEP measures.
EE	Expert assessment.
EL	Measures which are able to significantly improve ecological continuum are selected from step B1.
ES	The Protocol for the Hydromorphological Characterization (M-R-HMF-2019) takes into account all WFD hydromorphological elements, including continuity.
FI	Mitigation measures for MEP include fish passes and restoration of low water containing river bed parts that both improve ecological continuum
FR	Restoring ecological longitudinal continuity is a priority in FR. In this case, all the 8 weirs of this HMWB needed to be removed. To ensure best approximation to ecological continuum, French legislation also specifies that "measures may be necessary to ensure in particular ecological continuum, even when the good potential of a body of water has been reached, in order, in particular, to respect the objective of non-degradation of this water body or to respect or achieve good status / potential for other water bodies".
LV	Expert assessment (Consultations with fish experts were organized).
LT	Expert assessment (Scientific experts proposed the necessary measures to ensure that)
LU	The need to restore ecological continuum in the selected HMWB is assessed to be one of the most important mitigation measure, as the HMWB is fundamentally altered due to its use as navigation channel an urbanised environment
NO	It was taken into account, ecological continuum in this river is important for maintaining a strong stock of sea trout.
PL	The need was taking into account on the basis of 1 component of the hydromorphological index, which reflects the pressure from barriers.
RO	The concept of best approximation to ecological continuum is taken into account in the RO method, being in line with the WFD requirements and recommendation of the Guideline no. 37. In the framework of RO method, migration of biota and sediment transport are also considered as a key element in relation to river connectivity. For achieving ecological continuum, there are also considered specific issues: whether there is an ecological benefit or a need to restore continuity in order to support upstream and downstream water bodies in achieving their environmental objectives (especially for migratory fish- e.g. outside of natural fish zones). In the selected HMWB example, the need to ensure best approximation to ecological continuum was taken into account. For the measures which hinder the river connectivity, mitigation measures from the catalogue have been selected.
SK	Mitigation measures to ensure continuity both for organisms and sediments play the key role to achieve MEP

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response or did not provide a HMWB example/case study.

Note: Status of the methods as of autumn 2020

Unclear issues / gaps

- SE recommended that methods and knowledge on how to get information to ensure best approximation to ecological continuum should be an important part of ECOSTAT future work. It is hard to take this aspect into account for the selection of MEP mitigation measures in a transparent way.
- Also FI notes that more practical descriptions would be helpful for “ecological continuum“, “best approximation of ecological continuum” and “close to best approximation of ecological continuum”, and the differences therein.
- Other difficulties reported for the selection of the most ecologically beneficial measures include:
    - Full information only possible via the use of extensive technical data. This can be done during elaboration of specific technical projects before starting practical implementation of measures (so at a later stage).
    - Difficulty to estimate the effect of the measures e.g. on the fish species community and how long the restoration and repopulation will take.
    - There is enough information to predict that the measures selected for MEP will drive to a large improvement of the ecological functioning, but it is difficult to assess, in advance, which will be the time lapse until its consecution, and the trajectory followed by the WB functioning.
    - There is need for thorough research to anticipate possible wider impacts of certain mitigation measures.
    - Links between hydromorphology and biology have not been quantified, thus not yet possible to model the biological response to the measures.

7.4.3 Intercomparison of country methods

Criteria:

1. Indication is provided of mitigation measures selected as most ecologically beneficial (combination of) measures for MEP
2. Availability of sufficient data/information about measure effects on ecological functioning
3. If there is insufficient information and/or data, a precautionary approach is taken by including most relevant mitigation measures on the list

Key observations:

- The majority of countries (18 of 24) report to have an equivalent to step B3. The intercomparison though indicates that only five countries demonstrate that they meet the criteria set based on the Guidance no. 37 principles for this step.
- For several countries with an equivalent step, information in the questionnaire was not sufficient to make a judgement, and for some, only part of the criteria are met. This mainly relates to the lack of sufficient information about measure effects on ecological functioning and lack of evidence that a precautionary approach is then applied including most relevant mitigation measures on the MEP list, until better knowledge is made available.

Table 20 Step B3: Intercomparison of country methods

Step B3. Most beneficial measures (best approximation ecological continuum)					
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**OVERALL STEP EVALUATION -**
Austria	Yes		AT indicated difficulty to estimate effect of measures on fish species community and how long restoration and repopulation will take	Not relevant, as there was sufficient information	
Belgium	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A
Croatia	No				
Cyprus	No				
Czechia	No				
Denmark	No				
Estonia	Yes	Could not be provided, 3rd RBMP was still being drafted	Not possible to judge based on information provided	Not possible to judge, approach not described, just reference to expert assessment	
Finland	Yes		Done using expert judgement on the improvements of the number and quality of habitats, but also modelling, research results and areal estimates are utilised if available.	Seems to be the case	
France	Yes	Measures indicated but MEP officially not defined	Assessment of measure effectiveness not done yet, still knowledge gaps on measures for selected HMWB	Seems to be the case, as despite knowledge gaps, all measures from B1 are included	
Germany	Yes			Not relevant, as there was sufficient information	
Greece	Yes	Application of method not started	No response	No relevant information	

Hungary	No	No final selection yet at national level	No final assessment available yet.		
Iceland	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	No response as no case study, at the moment this is based on expert judgement	Not yet possible to model biological response to measures	Not possible to judge based on information provided	
Italy	Yes	No response as no case study	No response	Not possible to judge based on information provided	
Latvia	Yes		More complete information at later stage of technical project elaboration before practical implementation of measures	Not possible to judge based on information provided	
Lithuania	Yes		Refers to expert advice but not possible to judge if adequate to assess expected measure effects	Not possible to judge based on information provided	
Luxembourg	Yes		Not much biological data available	Seems to be the case on the basis of proxy data	
Malta	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes	No response, no MEP measures derivation	No MEP measures derivation	No MEP measures derivation	
Norway	Yes	Some measures already proposed and others still to be assessed in a revision	Answered yes, but data/information is apparently concentrated on hydrology and sea trout	Not relevant, as there was sufficient information	
Poland	Yes		Only refers to simulations on reaction of a hymo index to measures	Not possible to judge based on information provided	
Portugal	No				
Romania	Yes			Not relevant, as there was sufficient information	
Slovakia	Yes			Not relevant, as there was sufficient information	
Slovenia	N/A	N/A	N/A	N/A	N/A

Spain	Yes		ES indicated difficulty to assess time lapse until improvements and trajectory followed by the WB functioning	Not relevant, as there was sufficient information	
Sweden	Yes		Gaps in monitoring	Seems to be the case, as despite knowledge gaps, all measures from B1 are included	
Turkey	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7.5 Step C. Derivation of hydromorphological conditions for MEP

7.5.1 Introduction to step

Step C (Derivation of hydromorphological conditions for MEP): The derivation of hydromorphological conditions for MEP should be based on the hydromorphological conditions in the water body altered by the physical modifications linked to the use and a prediction of the effects of the set of mitigation measures (for MEP) on hydromorphological conditions. MEP hydromorphological conditions are impacted by physical modifications. The values for the biological and general physico-chemical quality elements at MEP depend on the MEP hydromorphological conditions. The hydromorphological conditions may resemble those of a different type compared to the natural water body type before the physical modification. Thus, the hydromorphological conditions defined for MEP can be used to identify or derive the closest comparable water body type, which is in particular relevant for defining the MEP conditions for biological quality elements and those physico-chemical parameters which are affected by the hydromorphological conditions.

7.5.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- An equivalent to Step C to derive hymo conditions for MEP is reported to be included in the methods of the majority of countries (16 of 24), but several countries (8 of 24) still do not include this step in their methods. The countries that do not derive hymo conditions for MEP either follow the mitigation measures approach, or in general do not define MEP, or do not have enough evidence to relate their hymo assessment systems to MEP conditions.
- Various approaches are used to derive hymo conditions for MEP including in some cases, the simple use of expert opinion. In other cases, qualitative verbal descriptions of main effects on hydromorphology and relevant habitats are used, or approximation of MEP hymo conditions to conditions at good status in a similar river type.

- Some countries use more quantified estimates based on research and modelling (e.g. of hymo effects from applying the most effective measures for particular BQEs) to derive MEP hymo conditions. At least two countries report that hymo conditions corresponding to MEP are derived after determining the classification of certain BQEs.
- For the specific HMWB examples selected for the intercomparison, only half of the countries (11 of 20 with examples) could actually derive hymo conditions for MEP.
- The following aspects are considered by a similar number of countries for deriving MEP hymo conditions: the current hymo conditions altered by the physical modifications (13 countries), the reference conditions of the original water body type (11 countries) and the prediction of the expected effects of MEP mitigation measures on hymo conditions (10 countries).
- For two-thirds of the selected HMWB examples (13 of 20 examples), a response was provided on the derivation of the closest comparable water body type. In all these cases, it was indicated that the closest comparable water body type was derived from the original water body type (prior to the physical modification).

Unclear issues / gaps

- The prediction of the expected effects of MEP mitigation measures to derive hymo conditions for MEP is an aspect that may require more specific guidance and exchange of approaches used in countries, as most countries can only consider this aspect in a rough/descriptive way.
- The definition of the closest comparable water body type is in many cases not easy to do or not done appropriately, especially where national typologies do not take into account hydromorphological criteria. This could be an item for future work of ECOSTAT.

Box 3 Examples of country approaches to derive hydromorphological conditions for MEP

Spain: The hydromorphological conditions in the current situation and taking into account the effects of mitigation measures for maximum ecological potential are evaluated through the national hydromorphological assessment method.

Sweden: MEP is the ecological condition when all reasonable measures have been implemented. This means that the MEP must correspond to the highest ecological status that can be achieved in HMWB if all the mitigation measures regarding hydromorphological conditions are consistent with the heavily modified characteristics of the water body once all mitigation measures have been taken to ensure the best approximation to ecological continuum. Significant adverse effects on hydropower are such improvement measures that lead to the values of hydropower no longer being maintained. The starting point for the necessity measures shall be improvements in the BQEs.

7.5.3 Intercomparison of country methods

Criteria:

1. Hydromorphological conditions for MEP for the HMWB are derived
2. There is a specific methodology for deriving hymo conditions for MEP
3. The derivation of hymo conditions for MEP is based on the hydromorphological conditions in the water body altered by the physical modification and the expected effects of the set of mitigation measures (for MEP) on the hymo conditions (*in case of no equivalent to step B (identification of MEP measures), this criterion is considered "not met"*)

Key observations:

- Although the majority of countries (16 of 24) report to have an equivalent to step C in their methods, the intercomparison indicates that only five of these demonstrate that they meet the criteria set based on the Guidance no. 37 principles for this step.

- Most countries with an equivalent step only partly meet the criteria or do not meet the criteria or information was insufficient to make a judgement.
- The main deficiencies relate to the lack of consideration of the effects of MEP mitigation measures on hymo conditions, which is the common step at the basis of GEP derivation for both the reference approach and the mitigation measures approach (or any combination of those).

Table 21 Step C: Intercomparison of country methods

	Step C. Hydromorphological conditions for MEP				
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**OVERALL STEP EVALUATION -**
Austria	Yes	Yes	Yes. (verbal description of effects)	Yes	
Belgium	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A
Croatia	Yes	Yes		Not clear. Mitigation measures not considered but hymo changes	Not clear. Mitigation measures not considered but hymo changes
Cyprus					
Czechia					
Denmark	Yes	Methodology not available.	Partly met. Methodology not available yet	Methodology in progress and not accounting for expected effects of mitigation measures	Methodology not accounting for expected effects of mitigation measures
Estonia	Yes	Methodology not yet applied	Partly met. Methodology not yet implemented	Partly met. Methodology not finalised yet.	Partly met. Methodology not implemented yet.
Finland	Yes	Methodology not appropriate (too rough)	Partly met. Methodology reported only refers to hydrological conditions and is based on rough expert judgment.	Partly met. Methodology reported only refers to hydrological conditions.	Partly met. Methodology reported only refers to hydrological conditions. Monitoring of HyMo will be complemented in near future with morphological conditions.
France	No				
Germany	Yes	Yes	Yes	Yes	
Greece	No				
Hungary	Yes	Yes	Yes	Yes	
Iceland	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Method not yet developed	Method not yet developed	Method not yet developed	
Italy	Yes	No cases provided.	Not possible to evaluate from the available information	Yes	Not possible to evaluate from reported information

Latvia	Yes	Yes (preliminary expert judgment)	Methodology not yet developed	Methodology not developed and expert judgment not accounting for expected effects of mitigation measures	Methodology not developed and expert judgment not accounting for expected effects of mitigation measures
Lithuania	Yes	Yes	Not possible to evaluate from the reported information whether the indicated method considers effects of mitigation measures on hymo conditions for GEP	Not possible to evaluate from the reported information whether the indicated method considers effects of mitigation measures on hymo conditions for GEP	Not possible to evaluate from the reported information whether the indicated method considers effects of mitigation measures on hymo conditions for GEP
Luxembourg	Yes	Partly met.	Hymo conditions for MEP are not derived.	Hymo conditions for MEP are not derived.	Hymo conditions for MEP are not derived.
Malta	N/A	N/A	N/A	N/A	N/A
Netherlands	No				
Norway	No				
Poland	No				
Portugal	No				
Romania	Yes	Yes	Yes. But not clear how it works from the description provided	Not possible to evaluate from the reported information ((question in 9.3 is NA)) whether the indicated method considers effects of mitigation measures on hymo conditions for MEP	Not possible to evaluate from the reported information (question in 9.3 is NA) whether the indicated method considers effects of mitigation measures on hymo conditions for MEP
Slovakia	Yes	Yes	Yes	Yes	
Slovenia	N/A	N/A	N/A	N/A	N/A
Spain	Yes	Yes	Yes		
Sweden	Yes	Step not applied to the case study	Yes	Partly met. It is in the method but not evident in the case.	Partly met. It is in the method but not evident in the case.
Turkey	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7.6 Step D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type

7.6.1 Introduction to step

The physico-chemical conditions for MEP result, inter alia, from the hydromorphological conditions at MEP and a prediction of the effects of the mitigation measures (for MEP) on physico-chemical parameters, which is comparable to an assessment of the remaining impacts. The identification of the closest

comparable water body type is a supportive tool in this context. For physico-chemical parameters, the closest comparable water body type is in general the original natural water body type prior to physical modification. For those physico-chemical parameters that are significantly modified by the hydromorphological alterations causing the heavily modified character, and that cannot be mitigated, other types should be considered (the closest comparable natural water body type, or combinations of water body types). Requirements for specific synthetic pollutants at MEP are the same as those for natural water bodies.

7.6.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- An equivalent to Step D to derive physicochemical conditions for MEP is reported to be included in the methods of the majority of countries (15 of 24), but several countries (8) still do not include this step in their methods. Many countries that do not derive physicochemical conditions for MEP follow the mitigation measures approach.
- No major differences are noted in the approach which countries take to this step, as the majority indicates that physicochemical conditions at MEP are defined as the values in the associated original natural river type (by some countries, further specified as the same physicochemical conditions as for high status of the natural river type). Exceptions are made if knowledge is gained that the values should be different than for natural water bodies.
- For the specific HMWB examples selected for the intercomparison, only half of the countries (10 of 20 with examples) could derive physicochemical conditions for MEP. The aspect that was considered in most cases (10) for deriving MEP physicochemical conditions was the closest comparable water body type. In a smaller number of cases (6), the effects of the modifications and effects of the MEP mitigation measures on physicochemical elements were considered.

Unclear issues / gaps

- No particular unclear issues or gaps

Box 4 Examples of country approaches for deriving physicochemical conditions for MEP

Estonia: At least N, P, pH, t °C, oxygen are evaluated. Experts can add quality elements for evaluation. No differences in classification values compared to natural water bodies. There can be slight difference compared to natural water bodies considering the changes in physical conditions.

Romania: For HMWBs, assessment methods for physico-chemical quality elements have been developed. For rivers, all general physico-chemical elements/parameters are assessed in terms of ecological potential, except those which are not relevant (for example transparency). The natural water type which most closely resembles the heavily modified is taken into account. For physico-chemical parameters, the physico-chemical conditions for HMWBs are the same as for the original/corresponding natural water body type (before physical modifications).

7.6.3 Intercomparison of country methods

Criteria:

1. Physico-chemical conditions for MEP for the HMWB are derived
2. There is a specific methodology for deriving physicochemical conditions for MEP
3. Physico-chemical conditions for MEP result from the hymo conditions at MEP and a prediction of the effects of the mitigation measures (for MEP) on physico-chemical parameters

4. Physicochemical conditions at MEP are defined as the values in the associated original natural river type or closest comparable water body type, and any exceptions to this are justified in line with Guidance no. 37

Key observations:

- Although the majority of countries (15 of 24) report to have an equivalent to step D in their methods, the intercomparison indicates that only about half of these demonstrated that they meet the criteria set based on the Guidance no. 37 principles for this step.
- At least half of the countries with an equivalent step, only partly meet the criteria. For some countries, information was insufficient to make a judgement.
- The main deficiencies relate to lack of consideration of the effects of the MEP hymo conditions or of the effects of MEP mitigation measures or both on physico-chemical parameters. An explanation for this is that some countries have methologies under development or new methologies and the application has not yet started. It could also be due to the lack of monitoring. An improvement is expected when countries have monitoring data in place and therefore can use the new methodologies.

Table 22 Step D: Intercomparison of country methods

	Step D. Physico-chemical conditions for MEP					
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**Criterion 4**	**OVERALL STEP EVALUATION -**
Austria	Yes					
Belgium	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Yes	Yes	Under development	Missing prediction of the effects of the mitigation measures (for MEP) on physico-chemical parameters	Yes	
Cyprus	No					
Czechia	No					
Denmark	No					
Estonia	Yes	The overall methodology (national regulation from April) not implemented yet.				
Finland	Yes		Finland uses mitigation			

	Step D. Physico-chemical conditions for MEP					
			measures approach.			
France	No					
Germany	Yes					
Greece	Yes	The application of the methodology has not started yet. No case study provided.				
Hungary	Yes					
Iceland	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes					Method not yet developed
Italy	Yes	No case study				Lack of information in questionnaire
Latvia	Yes			Effects of hymo modifications on physico-chemical elements not considered		
Lithuania	Yes					
Luxembourg	No					LU approach does not consider the assessment for physico-chemical conditions for MEP
Malta	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	No					
Norway	No					
Poland	No					
Portugal	No					
Romania	Yes					
Slovakia	Yes			The method does not consider this		
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A

	Step D. Physico-chemical conditions for MEP					
Spain	Yes			in development, based on 2nd cycle monitoring information, physicochemical conditions for MEP will be derived considering MEP hymo conditions and effects of MEP mitigation measures		
Sweden	Yes	Not derived for case				
Turkey	N/A	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

7.7 Step E. Derivation of BQE conditions for MEP

7.7.1 Introduction to step

The derivation of biological quality element conditions for MEP is based on the identification of the closest comparable water type, the predicted hydromorphological and physico-chemical conditions (for MEP) and a prediction of the values for BQEs based on methods used for status assessment. When deriving BQE conditions for MEP, it is also critical to make sure that best approximation of ecological continuum has been taken into account in step B.

7.7.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (17 of 24) report to have or plan to have an equivalent to step E on the derivation of BQE conditions for MEP in their methods. Seven countries do not cover this step yet. In the practical application of the step in the HMWB examples in the intercomparison, the derivation of BQE conditions for MEP was only possible for half of them (11 of 20 cases). Most countries without an equivalent step E follow the mitigation measures approach and/or their methods are still in development and may include such a step when completed in the future. It is noted though that even for countries using the mitigation measures approach, the lack of derivation of biological conditions for MEP is not acceptable in the long term. According

to CIS Guidance no. 37, the mitigation measures approach also requires deriving BQE conditions for MEP.

- The aspects most frequently considered in countries' methods for deriving BQE conditions for MEP are the closest comparable water body type (13 countries) and a prediction of the effects of the hymo modifications on BQEs based on known or assumed pressure-impact relationships (13 countries). Most countries use both these aspects in a combined way in their methods.
- The effects of the MEP mitigation measures on BQEs are considered by a smaller number of countries (7) when deriving BQE conditions for MEP and usually in combination with the closest comparable water body type and/or the effects of hymo modifications on BQEs.
- Overall, it is noted that if at this stage only the effects of modifications are considered but not the effects of MEP mitigation measures, then BQE conditions for MEP basically reflect the recent, heavily modified situation but not a water body with all measures implemented from step B of CIS Guidance no. 37.

Table 23 Aspects considered for deriving BQE conditions for MEP

11,5 Aspect for deriving BQE conditions for MEP	Countries
Closest comparable water body type	AT, HR, CZ, DK, EE, LV, LT, PL*, RO, SK, ES, DE, LU
Effects of the hymo modifications on BQEs	AT, HR, CZ, DK, EE, FI, IT, LV, LT, RO, SK, ES, DE, LU
Effects of the mitigation measures for MEP on BQEs	AT, EE, FI, IT, LT, ES, DE, LU
Other aspects	DK (Effects of physico-chemical conditions on BQE)

*Note * In the Polish approach, for the MEP, the effect of mitigation measures on the hydromorphological index used for the designation was simulated, but not the effect of mitigation measures on BQE. The effect of mitigation measures on BQE was considered for the GEP because in practice, the lower limit for GES in the given type of waters will be adopted as MEP limit.*

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

- When countries use the closest comparable water body type for deriving BQE conditions for MEP, they usually refer to the associated natural river type, e.g. "MEP of BQEs defined as the value obtained from the natural benchmark stations", "use of the reference conditions of the original water body type" and "use of the lower limit for GES in the given type of waters as MEP limit".
- The BQEs for which conditions for MEP could be derived in the majority of HMWB intercomparison case studies were fish and benthic invertebrates. These are also the BQEs for which threshold values of ecological potential could most frequently be set in country methods. In some countries, there are also methods to define MEP conditions for macrophytes, e.g. IT takes into account the impact of hymo alterations on the trophy of water bodies. Other countries though, e.g. LV and LT, indicate macrophytes as not sensitive to hymo alterations and therefore not used in MEP definition.

Table 24 BQEs for which conditions for MEP could be derived in the HMWB examples

11,3 BQEs for which conditions for MEP could be derived in the HMWB examples						
	Benthic invertebrates	Fish fauna	Macrophytes	Phytobenthos	Phytoplankton	Explanations by countries
AT	X	X	X	X	X	partly EQR and guide values for benthic invertebrates; description on metric level, no EQR possible for fish; EQR for macrophytes, phytobenthos, phytoplankton
CZ	X	X				methodology for the assessment of EP fish was used only for the 2nd RBMPs, an updated methodology should be developed next year.
DE	X	X				Other BQEs are also included but same values used as for good status.
EE	X	X	X		X	
FI	X	X	X			roughly analysed the change (5-level scale 0-4)
IT	X		X	X		
LV	X	X				
LT		X		X		
LU		X				So far for the BQE fish, but in the frame of the investigative monitoring, the MEP/GEP will also be assessed on the basis of the BQE macroinvertebrates
PL	x	x	x	x	x	
RO	X	X		x		
SK	X	X				Method for fish was not used in the 3rd RBMP. The fish-method was finalized in summer 2021, but will be used in the following planning cycle. Concerning macrophytes, in free-flowing sections not relevant because of rip-rap impact. In sections with impoudments macrophytes reflect negative effects and are intended to be included in potential assessment.
SE		X				
SUM	10	12	5	5	3	

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response or did not provide a HMWB example/case study.

Note: Status of the methods as of autumn 2020

Box 5 Examples of country approaches for deriving BQE conditions for MEP

Italy: For **invertebrates** and **macrophytes** the reference approach is used. For **fish**, a national list of measures has been defined that depends on the use of the HMWB. The lists are shown in attachment 2 of DD 341 / STA of 2016. These lists are applied by local authorities to assess the state of implementation of the measures at the level of HMWB. This assessment must be carried out according to a guided procedure (PDG-MMI) including the phases defined in the methodology of the DD 341 / STA decree. Local authorities are therefore required to send data so that the national experts can identify the biological conditions that define the MEP for fish. Furthermore, as specified in the above-mentioned decree DD 341/STA, the lists of measures can also be used by local authorities to select the appropriate measures to reach the GEP (if a HMWB/AWB is below good potential)

Macrophytes - MEP conditions for macrophytes, referring to each designation case, were set based on two different situations. In a first situation, where the impact of the main physical modification(s) that led to the designation is expected not to affect the IBMR_RQE index, used for macrophyte classification, MEP values equal reference values for ecological status; other metrics will be needed to take into account hydromorphological alteration not impacting on the trophy. For the remaining designation cases, where the impact of the main physical modification(s) that led to the designation is expected to affect the trophy of the water body, and consequently the IBMR_RQE index, MEP values are set as REF_values multiplied for a coefficient based on the intensity of the alteration that would still be present after the realization of the measures. The appropriateness of the coefficient should be confirmed with case-specific information deriving from monitoring and modified if necessary.

Invertebrates - MEP conditions for benthic macroinvertebrates are set based on two alternative options. Option 1 relates MEP values to pre-modification reference conditions (for the corresponding river type, and for each invertebrate metric). For a series of HMWB designation cases, where the impact of the main physical modification(s) that led to the designation is expected to affect weakly the BQE or contrasting evidence is provided, MEP values equal reference values (sub-option A). For the remaining designation cases, where the impact of the main physical modification(s) that led to the designation is expected to clearly affect BQE, MEP values are set as REF_values*0.85 (sub-option B). When Option 1 is applied, its appropriateness should be afterwards confirmed with measure-related, case-specific information. If needed, MEP values have then to be refined. Option 2 assumes sufficient data are available for both mitigation measures and biological response and MEP values are defined based on dedicated and detailed analysis (spatial approach). Ideally, data collected under Option 1 should progressively lead to fully apply Option 2.

Unclear issues / gaps

- Step E on the derivation of BQE conditions for MEP is among the steps of CIS Guidance no. 37, for which several countries would like to have more practical guidance and examples about. This is usually seen in combination with the need for more practical guidance for step F on BQE conditions for GEP.
- Step E is indicated as especially problematic for the mitigation measures approach where steps C-D-E are initially not addressed; this is done only after GEP conditions are set for supporting and biological elements.
- Data scarcity on the responses between hydromorphology and biology and lack of full understanding of the effects of hydromorphology and associated measures on biology (e.g. mentioned by ES, IE).

7.7.3 Intercomparison of country methods

Criteria:

1. BQE conditions for MEP are derived for relevant BQEs (using hymo sensitive biological assessment methods) and justification is given if BQEs relevant for the water category are not considered
2. There is a specific methodology for deriving biological conditions for MEP

3. Effects of the hymo modifications and the effects of the MEP mitigation measures on BQEs are considered (so knowledge about the effects of both modifications and of measures on biology are necessary)

Key observations:

- 17 of 24 countries report to have or plan to have an equivalent to step E on the derivation of BQE conditions for MEP in their methods. However, only three countries demonstrate to meet the criteria set for the intercomparison on this step, based on the Guidance no. 37 principles.
- Most countries only partly meet the criteria set for this step. The main deficiencies concern the lack of derivation of BQE conditions for the most hydromorphology-sensitive BQEs, unclear methodology descriptions and justifications and the lack of consideration of the effects of MEP mitigation measures on BQEs.

Table 25 Step E: Intercomparison of country methods

	Step E. BQE conditions for MEP				
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**OVERALL STEP EVALUATION** -
Austria	Yes				
Belgium	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A
Croatia	Yes	in development	in development	in development	in development
Cyprus	No				
Czechia	Yes	macrophytes still in development	methodology outlined but not yet applied	mitigation measures not considered	
Denmark	Yes	in development, no BQE data in case study	methodology outlined but not yet applied	mitigation measures not considered	
Estonia	Yes	in development, using values for natural waters for now	in development, using values for natural waters for now	in development, using values for natural waters for now	in development, using values for natural waters for now
Finland	Yes		measure based approach - MEP conditions predicted		measure based approach - MEP conditions predicted. Methodology involving expert judgement
France	No				
Germany	Yes			dependent on correct application of previous steps	

Greece	Yes	application of method not started yet	dependent whether it will be possible to identify comparable natural type	MEP mitigation measures not considered	
Hungary	No				No MEP conditions, measure based approach
Iceland	N/A	N/A	N/A	N/A	N/A
Ireland	No				
Italy	Yes		description of methodology is not clear about some key details that determine the outcome - especially how effects of mitigation measures are estimated	MEP values for invertebrates initially set at an arbitrary 0.85*natural value based on expert judgment. MEP values for macrophytes not set in a transparent way. This may be OK as a first estimate but needs to be improved subsequently.	
Latvia	Yes		no specific methodology - uses same as for natural waters	mitigation measures not considered	
Lithuania	Yes		not clear how the statistical approach can be used to quantify BQE conditions specific for the modifications linked to the use	not clear how the statistical approach can be used to take into account mitigation measures	
Luxembourg	Yes	fish only (further BQEs to be added later)	water body specific approach		
Malta	N/A	N/A	N/A	N/A	N/A
Netherlands	No				
Norway	No				
Poland	Yes	All BQEs considered not only hymo sensitive ones	not clear if modified WB corresponds to natural type	effect of measures not considered	
Portugal	No				
Romania	Yes			effect of MEP mitigation measures not taken into account	

Slovakia	Yes	invertebrates only, fish method in reported case studyin development for 3rd RBMP.[6] Macrophytes excluded because of rip-rap impact	for invertebrates only for now	for invertebrates only for now	
Slovenia	N/A	N/A	N/A	N/A	N/A
Spain	Yes	in development	in development	in development	
Sweden	Yes	fish only, no explanation for exclusion of other BQEs	information not provided	information not provided	
Turkey	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

[6] In the meantime, fish method has been finalised and will be applied.

8 Definition of GEP

8.1 Step F. Derivation of BQE conditions for GEP

8.1.1 Introduction to step

Good ecological potential is defined in WFD Annex V 1.2.5 as an ecological state in which "there are slight changes in the values of the relevant biological quality elements as compared to the values found at maximum ecological potential".

With respect to "slight changes", HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP. Slight change cannot be equivalent to a complete/temporary absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone). Slight changes to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, "slight change" means that a condition close to best approximation of ecological continuum should be ensured (instead of best approximation).

8.1.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (20 of 24) report to have an equivalent to step F to derive BQE conditions for GEP. Also for the majority of HMWB examples in the intercomparison (15 of 20 examples), BQE conditions for GEP could be derived.
- In terms of the classes of ecological potential assessed, all countries have in common that they classify "good" and "moderate" ecological potential. The classes of maximum, poor and bad ecological potential are not assessed in all countries, for different reasons. MEP is in some countries not part of their method, and therefore not classified.

Table 26 Classes of ecological potential assessed in country methods

12,2 Which classes of ecological potential do you assess?						
	Maximum	Good	Moderate	Poor	Bad	Comments
AT	X	X	X			use "moderate or worse"
CZ		X	X	X	X	
DE	X	X	X	X	X	
DK	X	X	X	X	X	
EE	X	X	X	X		
EL	X	X	X			
ES		X	X	X	X	Use "Good and Above Potential" (Decree 817/2015)
FI		X	X	X	X	Poor/bad: On the basis of water quality, not on the mitigation measures.
FR		X	X	X	X	In the national method, class of "good" ecological potential is "good or more"
HR	X	X	X	X	X	
HU		X	X			Maximum: Sometimes it can be given by extrapolation, but it is questionable, because of

						the nonlinearity and low R2 values of the models Good: Since G/M boundaries are the most important we focused on these.
IT	X	X	X	X	X	Poor and bad, only where Reference Approach is used
LV	X	X	X	X		Bad: In general, hymo modification level in LV is too low to develop "bad" class boundary
LT	X	X	X	X	X	
LU	X	X	X	X	X	
NL		X	X	X	X	
PL	x	x	x	x	x	
RO	X	X	X			
SK	X	X	X	X	X	
SE	X	X	X	X	X	
SUM	14	20	19	16	14	

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020.

- The methods for deriving the classes of ecological potential are diverse across countries with the majority (13 countries) using assessment methods of natural water bodies with adapted metric values and/or adapted classes.
    - The BQEs for which metrics are adapted differ between countries, e.g. in CZ, adaptation of metrics used for benthic invertebrates, fish and phytoplankton was made for HMWB rivers. In LT, threshold values of ecological potential are set for fish and macrozoobenthos-based indices. Phytobenthos is considered in some country responses as almost not sensitive to hymo and threshold values are set the same as for ecological status (e.g. in LT, FR).
    - In some countries, models or calculation formulas are used to calculate BQE conditions (e.g. NL, BQE conditions are calculated with the model WFD Explorer; PL uses a mathematical formula which sets the rules for calculating the lower GEP limit).
    - Some countries use the moderate status class boundary as GEP boundary for specific BQEs. E.g. in the method of LV and based on statistical analysis, the moderate status class boundary is used as GEP boundary for macroinvertebrates. Also in DK, GEP for macroinvertebrates in HMWB is equated to moderate status in natural river bodies. The remaining BQEs are applied using the same classes as for natural river bodies.
- Only a few countries (4) report to have developed new assessment methods for heavily modified water bodies.
    - In at least two countries, this is linked to the use of groups/types of HMWB to derive class boundaries for ecological potential. In HR, due to the large number of HMWB and AWB, groups or “types” of HMWB are developed. BQE conditions for GEP will be derived by equidistant distribution of five class boundaries between MEP and the worst recorded value for the group/type of HMWB. In DK, hymo conditions are used to group HMWB rivers into types and these types will be used to identify boundary values for MEP and then the remaining class boundaries.

- In the method of SK, BQE conditions for GEP are derived from MEP (using lower percentile), based on the derivation of special schemes with new metrics (reflecting hydromorphological impacts).

- Several countries (7) use expert judgement to derive classes of ecological potential, in combination with their assessment methods for heavily modified water bodies. This may be the case for particular BQEs, e.g. in LV, GEP conditions for fish are described based on expert judgement (contrary to macroinvertebrates for which a class boundary derivation based on statistical analysis was possible). Expert judgement may also be used to further correct estimated threshold values, as reported by LT ("the estimated threshold values for fish and macro-invertebrate indices were further corrected by expert judgment").
- According to CIS Guidance no. 37, the intercomparison should address how Member States define "slight" changes for biological conditions (when using reference approach) and/or removal of mitigation measures only leading to "slight" changes in biological quality element values (when using mitigation measures approach).
    - The information provided by most countries is not very concrete about the interpretation of "slight changes" concerning composition, abundance and diversity of BQEs, the ratio of different taxa or aspects considered for a functioning ecosystem at GEP.
    - The information provided indicates that often the interpretation of "slight changes" in the values of BQEs compared to the values found at MEP is based on a combination of expert judgement and the analysis of available data.
    - Few qualitative interpretations are provided, e.g. AT considering all effects that could change EQR values or metric values not to be minor. In the majority of countries, a direct linkage is made to the interpretation of slight changes used for natural water bodies either using the same classes for some BQEs or lowering by one class for certain BQEs (e.g. good potential for invertebrates equated to moderate status) or deriving another statistically- or mathematically based relationship (e.g. in the Polish method, on average GEP = GES * 0,89).
    - Most countries that used the mitigation measures approach did not explain if and how they interpret "slight changes" in the context of measure selection for GEP. In cases where some information is provided, reference is made to "excluding measures with minor impact" (FI), "all feasible measures to obtain as high as possible ecological quality" (NL) and "GEP is all realistic mitigation measures without adverse effect" (NO). For one method, it is even explicitly mentioned that they do not remove measures leading only to slight changes to define the GEP measures as ecological potential is derived based on the percentage of implementation of defined measures taking into account weighting factors (CY).

Table 27 Interpretation of „slight changes"

Country	12,7 Approach on interpretation and application of "slight changes" in the values of BQEs as compared to the values found at MEP
AT	We consider all effects that could change EQR values or metric values not to be minor. For fish decision support tool is available for typical cases.
CZ	Benthic invertebrates: As part of the development of the method for evaluating the ecological potential of biological quality components, the relationships of biological metrics used for the assessment of ecological status with individual hydromorphological parameters were tested. It was assumed that the selected metrics most responsive to hydromorphological changes cannot reach the highest reference values due to the eligible water use, and that they can only take lower values, which represent the MEP. When developing the methods, there was not enough data to determine the difference between hydromorphological conditions in MEP and in natural WB, so based on expert judgement and partial data analysis it was decided that the difference corresponds to one class in the classification of selected metrics of biological components. The same for the GEP.
DE	Based on assessment method for NWB

DK	GEP for invertebrates in HMWB is equated to moderate status in natural river bodies. The remaining BQEs are applied using the same classes as for natural river bodies.
EE	Similar with natural conditions but due to change in water regime the change can occur.
ES	By applying a combination of available data and expert judgement
FI	GEP assessed using MEP as "reference condition" for the respective HMWB. In GEP there are only slight changes in BQE compared to MEP. The estimation for rivers is done roughly using expert judgement for all BQE's. In the case of our selected HMWB case study 'lijoen alaosa', by excluding measures with minor impact, the overall difference in the effect of MEP-measures to GEP-measures is minor.
FR	France has not yet done this for hymo sensitive BQEs only for phytobenthos where they use the same method as for NWB
HU	We applied Alternative Prague Approach. In the case of this approach the way of defining GEP is not the "slight changes" approach. We tried to derive MEP from the results of comparisons between Natural and HMWBs
IE	No equivalent step, following the mitigation measures approach. The method is in development.
IT	Invertebrates - Same as for non-heavily modified WBs
LV	It was defined using statistical analysis and expert judgement based on monitoring data.
LU	This question is not clear. The assessment of BQE values for the selected HMWB is still in progress
NL	No explicit derivation of MEP
PL	“Slight changes” depend on the level of modification after implementing mitigation measures. Mathematically GEP cannot be equal to or worse than the moderate ecological status boundaries. On average GEP = GES * 0,89.
RO	The values of the parameters/metrics must be less severe than the same parameters / metrics of the BQEs that characterize comparable natural water bodies
SK	The GEP boundaries were lowered (using lower percentile) and these are achievable in few cases / GEP is more "realistic" ambition than MEP (=rather theoretical best value/ achievable in ideal conditions, mainly after using mitigation measures)
SE	Expert judgement

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

- In the specific HMWB cases in the intercomparison, the BQEs for which GEP conditions could be derived most frequently (14 cases) were benthic invertebrates and fish (similar to the BQEs for MEP under step E). GEP conditions for macrophytes and phytobenthos were derived in less cases (6 and 9 respectively). Different reasons for this included the lack of reliable data, the lack of sensitivity to hymo alterations and low representativeness of indicators in HMWB. FR (whose new method for ecological potential is still in development) uses at present only phytobenthos to set BQE conditions for GEP and, as phytobenthos is almost not sensitive to hydromorphology, uses the same conditions for GEP as for good ecological status for this BQE. For the same reason of non-sensitivity, other countries exclude phytobenthos from the setting of BQE conditions for GEP and use other sensitive BQEs in particular fish and benthic invertebrates.

Table 28 BQEs for which BQE conditions for GEP been derived for the selected HMWB

12,5 For which BQE, have BQE conditions for GEP been derived for the selected HMWB?						
	Benthic invertebrates	Fish fauna	Macrophytes	Phytobenthos	Phytoplankton	Notes
AT	X	X	X	X	X	
CZ	X	X				Methodology for the assessment of EP fish was used only for the

						second river basin management plans, an updated methodology should be developed next year.
DE	X	X				Other BQEs are also included but same values used as for good status.
DK	X					
EE	X	X			X	
FI	X	X	X	X		
FR				X		Current method defines GEP biological values only for phytobenthos. As phytobenthos is almost not sensitive to hydromorphological conditions, the same thresholds as for the assessment of ecological status are considered for phytobenthos evaluation.
HU	x	x	x	x	x	
IT	X		X	X		
LV	X	X				
LT	X	X		X		
LU		X				Benthic invertebrates: In the frame of the investigating monitoring to validate the assessed GEP/MEP, this BQE will be included with the objective to assess MEP/GEP also for benthic invertebrates
NL	X	X	X	X		BQE conditions derivation for macrophytes and phytobenthos is combined. Also, the NL does not have an assessment method for phytoplankton for rivers
PL	x	x	x	x	x	
RO	X	X		X		
SK	X	X				Method for fish already finalized Conditions for GEP derived and ready for benthic invertebrates and fish
SE		X				
SUM	14	14	6	9	4	

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response or did not provide a HMWB example/case study.

Note: Status of the methods as of autumn 2020

Box 6 Examples of country approaches for deriving BQE conditions for GEP

Netherlands: The model WFD-explorer used in the NL is a helpful model to derive EQRs for GEP. It is widely accepted and applied in the NLs, also for analyses on national scale. A specific strength of the method is the relation between environmental variables and ecological quality (expressed as EQRs).

Slovakia: SK has developed special classification schemes for indicative BQEs with metrics reflecting hymo impacts - for several different types /categories of HMWB.

Germany: Germany derived BQE conditions for GEP in rivers based on assessment systems for natural water bodies for benthic invertebrates and fish as most hymo-sensitive BQE. This enables a standardised assessment using a typology developed, i.e. a combination of both use/modifications and groups of river types or individual water types. The biological values set for MEP based particularly on habitat conditions at MEP determine the GEP values as slight changes considered within the multimetric indices. While for invertebrates, the existing assessment system has been adopted e.g. by HMWB type-specific adjustment of anchor values, the fish assessment uses HMWB type-specific coenosis defined for MEP based on reference conditions of the related natural water types.

Unclear issues / gaps

- Step F on the derivation of BQE conditions for GEP is among the steps of CIS Guidance no. 37, for which several countries would like to have more practical guidance and examples about. This includes the need for guidance on deriving BQE values for GEP and on evaluating slight changes.
- At present, defining thresholds for BQE values seems very complicated, due to the numerous and different combinations of natural contexts and types of hydromorphological modifications. The statistical populations are then too limited in number to be able to statistically define biological thresholds (comment FR). For the intercomparison case study provided by FR, it did not seem realistic to derive BQE conditions for GEP, even with detailed monitoring data.
- AT explicitly comments that minor effects on BQEs are difficult to assess.
- Data scarcity on the responses between hydromorphology and biology hampers the derivation of BQE conditions for GEP (e.g. ES, IE).
- Overall, it is noted that step E and step F occur towards the end of the ecological potential definition process and it is therefore especially difficult (or even impossible) to apply if the previous steps are not followed. The key to all approaches is the correct identification of mitigation measures excluding those with significant adverse effects on use taking into account the best approximation to ecological continuum (step B). BQE conditions for MEP and GEP are then derived by evaluating the impact of the physical modification mitigated as far as possible (MEP) or slight deviations from those conditions (GEP). In theory, step E and step F should be straightforward if (a) the supporting element conditions for MEP or GEP have been defined and (b) we know the relationship between hydromorphological conditions and BQE (pressure/impact).

8.1.3 Intercomparison of country methods

Criteria:

1. BQE conditions for GEP are derived for relevant BQEs (using hymo sensitive biological assessment methods) and justification is given if BQEs relevant for the water category are not considered
2. There is a specific methodology for deriving biological conditions for GEP including slight changes (and explanation how slight changes are interpreted)

Key observations:

- 20 of 24 countries report to have an equivalent to step F on the derivation of BQE conditions for GEP in their methods. However, only two countries demonstrate to meet the criteria set for the intercomparison on this step, based on the Guidance no. 37 principles.
- Most countries either partly meet or do not meet the criteria set for this step. The main deficiencies concern the derivation of BQE conditions only for part but not all relevant and hymosensitive BQEs, the lack of adequate justifications of the approach used for deriving GEP biological conditions including the lack of interpretation of slight changes (sometimes with simple reference to expert judgement).

Table 29 Step F: Intercomparison of country methods

MS	Step reported by MS as present (Yes) or absent (No)	Criterion 1	Criterion 2	OVERALL STEP EVALUATION -
Austria	Yes			
Belgium	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A
Croatia	Yes	in development	in development	in development
Cyprus	No			
Czechia	Yes	macrophytes still in development	no interpretation of slight changes	
Denmark	Yes	only macroinvertebrates, not clear if method is hymo sensitive	GEP in HMWB = moderate status in natural rivers without further justification	
Estonia	Yes	in dev, using values for natural waters for now	in dev, using values for natural waters for now	in dev, using values for natural waters for now
Finland	Yes		interpretation of slight largely based on expert judgment	
France	Yes	only GEP for phytobenthos (not hymo sensitive)	same as GES	
Germany	Yes			
Greece	Yes	application of method not started	no explanation on slight	
Hungary	Yes	Hymo sensitivity of each BQEs has been statistically evaluated.	no interpretation of slight, approach to derive GEP conditions, unclear how GEP conditions were linked to exclusion of measures	
Iceland	N/A	N/A	N/A	N/A
Ireland	No			

Italy	Yes	see step E	same as in natural waters, but mitigation measures not considered in step F	depends on correct application of step E where there are some issues for IT
Latvia	Yes		same as in natural waters, but mitigation measures not considered in step F	depends on correct application of step E which is a problem for LV
Lithuania	Yes		see previous step	
Luxembourg	Yes	see previous step	not answered (but it appears they derive slight in a similar way as in natural WBs)	
Malta	N/A	N/A	N/A	N/A
Netherlands	Yes		Slight not interpreted in this step but in the exclusion of mitigation measures step	
Norway	No			To achieve GEP a minimum of biological and hymo conditions have to be present (functional aquatic ecosystem). All BQEs that were there originally have to be present and ecological conditions to sustain life cycle have to be present.
Poland	Yes	All BQEs considered not only hymo sensitive ones. Methodology explained in step F of the questionnaire is for hymo method not BQE method	A formula provides a specific methodology for defining GEP BQE values and for slight change	
Portugal	No			
Romania	Yes		some explanation given but not explained how slight changes have been defined	
Slovakia	Yes	Invertebrates only, in reported case study, fish method was still in development for 3rd	GEP boundaries for relevant BQEs were derived using lower percentile, but no further explanation on slight changes	

		RBMP.[7] Macro-phytes excluded be-cause of rip-rap im-pact		
Slovenia	N/A	N/A	N/A	N/A
Spain	Yes	in development	in development	
Sweden	Yes	fish only, no expla-nation for exclusion other BQEs	expert judgment	
Turkey	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

8.2 Step G. Derivation of supporting quality element conditions for GEP

8.2.1 Introduction to step

The derivation of supporting quality elements (SQE) for GEP entails hydromorphological conditions and physico-chemical conditions. The hydromorphological conditions have to be consistent with the biological values set for GEP. For physico-chemical conditions, the same values should be met as for good ecological status of the original natural water body type, except if the parameter is impacted by the hydromorphological alteration having led to HMWB designation (e.g. changed water temperature due to hydropeaking).

8.2.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (20 of 24) report to have an equivalent to step G. In a few countries, the step is only partly covered, e.g. CZ derived physico-chemical conditions for GEP but not hydromorphological conditions.
- For the majority of HMWB examples (13), hymo quality element conditions for GEP were derived based on estimations of the effects from the assumed implementation of GEP measures on hymo quality elements, excluding those delivering only "slight changes" to biological conditions. This is the case for countries using the mitigation measures approach but also a combined approach of the reference and mitigation measures routes. The derived hymo conditions are in some cases general descriptions of the estimated effects and, in others, described by means of indicators of hydromorphological assessment methods.
- In only few cases (5), hymo quality element conditions were derived from the predicted BQE conditions for GEP (reference approach route) and, even in these cases, the derivation was often combined with estimates of the effects of the GEP measures.

[7] In the meantime, fish method has been finalised and will be applied.

- In addition, ecological functioning, taking into account the need to ensure close to best approximation of ecological continuum, was considered in more than two-thirds of the HMWB examples (15 of 20) when deriving hymo conditions for GEP, followed by a consideration of hydromorphological conditions for MEP (step C) (10 of 20 examples) and, in less cases (8 of 20), the difference between BQE conditions of MEP (step E) and GEP (step F).
- Concerning physicochemical quality element conditions for GEP, for the majority of countries, these are derived using the same thresholds for GEP as for physicochemical quality elements at GES of the original natural river type. Several countries mention taking also the following into account: the effects of measures, the derived BQE conditions for GEP or determination of specific parameters based on the analysis of available data.
- In most HMWB cases in the intercomparison (15 of 20), the physicochemical quality element conditions for GEP corresponded to the values for good status of the original natural river type for all parameters. Only for three HMWB examples, the physicochemical quality element conditions for GEP did not correspond to one or more parameters (e.g. nutrients, oxygen regime) which were impacted by the physical modifications of the HMWB.

Unclear issues / gaps

- No particular issues identified so far.

Box 7 Examples of country approaches for deriving supporting quality element conditions for GEP

France: Physico-chemical quality elements are taken into account in the same way as if the HMWB was a natural water body, i.e. with the same thresholds as for the assessment of ecological status. Furthermore, the national method requires to reduce the hydromorphological pressures so that the remaining pressures (except the ones that are directly linked to the use that defined the waterbody as HMWB, as impact on use is taken into account) are "low or non-existent".

8.2.3 Intercomparison of country methods

Criteria:

1. Hydromorphological quality element conditions for GEP are derived
2. There is a specific methodology for deriving hymo conditions for GEP
3. Hydromorphological quality element conditions are based on the BQE conditions for GEP (step F) or on the assumed implementation of the mitigation measures for GEP (step H) or both
4. Physico-chemical conditions for GEP for the HMWB are derived
5. Physicochemical conditions at GEP are defined as the values in the associated original natural river type or closest comparable water body type, and any exceptions to this are justified in line with Guidance no. 37.

Key observations:

- Although the majority of countries (20 of 24) report to have an equivalent to step G, only five countries demonstrate meeting all the criteria set for the intercomparison of this step, based on the Guidance no. 37 principles.
- For more than half of the remaining countries, no judgement could be made due to lack of relevant information in the questionnaire on certain aspects.
- Six of the countries with an equivalent to step G meet only part of the criteria due to the lack of a fully developed methodology to derive hymo conditions for GEP. For most countries, criteria are met on the derivation of physicochemical conditions at GEP.

Table 30 Step G: Intercomparison of country methods

MS	Step reported by MS as present (Yes) or absent (No)	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	OVERALL STEP EVALUATION -
Austria	Yes	Yes	Yes	Yes	Yes	Yes	
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Yes	Yes (Assumption that GEP conditions equate Moderate ES)	Methodology not developed.	Neither criteria is met.	Yes	Yes	
Cyprus	No						
Czechia	Yes	Hymo conditions for GEP are not derived	No methodology declared.	Hymo conditions for GEP are not derived	Yes	Not possible to evaluate due to missing information in both relevant parts of Steps D and G.	
Denmark	No						
Estonia	Yes	Yes	Not possible to evaluate from reported information.	Both F and H reported	Yes	Not possible to evaluate from reported information	Not possible to evaluate from reported information
Finland	Yes	Hymo EQ conditions are not derived but an indirect index.	Not possible to evaluate. Reported methodology only refers to hydrological conditions.	Hymo EQ conditions are not derived but an indirect index.	yes	yes	Not possible to evaluate. Reported methodology only refers to hydrological conditions. Monitoring of morphological conditions will be improved for next planning period
France	Yes	Not possible to evaluate from reported information	Not possible to evaluate from reported information	Yes	yes	yes	Not possible to evaluate from reported information
Germany	Yes	Yes	Yes	Yes	Yes	Yes	
Greece	Yes	Not possible to evaluate from	Not possible to evaluate from reported information	Not possible to evaluate from reported information	yes	yes	Not possible to evaluate from reported information

		reported information					
Hungary	Yes	Method still under development	Method still under development	Yes	Yes	Yes	Not possible to evaluate from reported information, inconclusive
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Method not yet developed	Method not yet developed	Method not yet developed	Method not yet developed	Method not yet developed	Method not yet developed
Italy	Yes	Not possible to evaluate from reported information	Not possible to evaluate from reported information	Yes	Yes	Yes	Not possible to evaluate from reported information
Latvia	Yes	Yes	Method not yet developed	Preliminary assessment based on expert judgment. Method not yet developed	Yes	Yes	
Lithuania	Yes	Yes	Not possible to evaluate from reported information	Yes	Yes	Yes	Not possible to evaluate from reported information whether there is a method for GEP hymo conditions
Luxembourg	Yes	Not possible to evaluate from reported information	Not possible to evaluate from reported information	Face value	Yes	Yes	Not possible to evaluate from reported information whether there is a method for GEP hymo conditions
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes	Hymo EQ conditions are not derived.	No specific methodology in place.	Hymo EQ conditions are not derived.	Yes	Yes	Partly met. Hymo EQ conditions are not derived.
Norway	No		Hymo-conditions have to support the biological criteria for GEP				
Poland	Yes	Yes (hymo QE conditions derived based on a simulation of the effects of assumed implementation of GEP	Yes (based on HIR method, Hydromorphological Index for Rivers)	Yes (hymo QE conditions for GEP derived based on simulation of the effects from the assumed implementation of GEP measures on hymo QEs (Step F). Result is the	Yes	Yes	

		measures on hymo QEs)		maximum hydromorphological index value (HIRmax), from which the BQE boundaries will be derived)			
Portugal	No						
Romania	Yes	Yes	Partly met as it is not clear how it relates to mitigation measures to GEP	Yes	Yes	Yes	Partly met as it is not clear how it relates to mitigation measures to GEP
Slovakia	Yes	Yes	Yes	Yes	Yes	Yes	
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes	Yes	Yes	Yes	Yes	Yes	
Sweden	Yes	Not possible to evaluate from reported information	Not possible to evaluate from reported information	Yes	Yes	Yes	
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

8.3 Step H. Identification of mitigation measures for GEP

8.3.1 Introduction to step

In this step, the mitigation measures for reaching GEP are identified. Depending on approach taken by the countries (i.e. reference vs mitigation measures approaches), the method for identifying measures for GEP may differ. According to the reference approach, the mitigation measures within GEP are those needed to achieve the derived biological conditions and conditions for the supporting quality elements for GEP. Following the mitigation measures approach, mitigation measures for GEP are obtained after removing, from the set of mitigation measures identified for MEP, any measures which only lead to slight changes in biological conditions (alone or in combination). Conditions for supporting quality elements and BQEs are then derived.

8.3.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- Almost all countries (22 of 24 with a method) report to have an equivalent step to identifying mitigation measures for GEP.
- The basis for selecting GEP measures varies between the case studies used for the questionnaire (see Table 31):
    - Most of the countries (14 out of 20 with a HMWB example) used the set of mitigation measures for MEP, mainly countries following a mitigation measures approach or a different approach.
    - About a third of countries (6 out of 20) used the derived biological conditions and conditions for supporting quality elements for GEP. Most of these countries report using the reference approach.
    - Three countries use both the list of mitigation measures identified for MEP and the derived conditions for BQEs and SQEs for GEP (i.e. EE, DE, LU).
    - Two countries (i.e. FR, NL) report using expert judgement. FR for instance identifies GEP measures based on the expected improvement on the ecological functioning of the HMWB.

Table 31. Basis for identifying the mitigation measures for GEP

14,2 Mitigation measures for GEP for the selected HMWB have been identified based on:			
	Reference approach	**Mitigation measures approach**	**Other approach**
the derived biological conditions and conditions for supporting quality elements for GEP (step F and G of reference approach route)	CZ, EE, DE, LV		LT, LU
the set of mitigation measures identified for MEP (step B of mitigation measures approach route)	EE, DE	FI, HU, EL, NO, ES, SE	AT, CY, LU, PL, RO, SK
Other		NL	FR

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response or did not provide a HMWB example/case study.

Note: Status of the methods as of autumn 2020

- The most common mitigation measures identified for GEP are fish migration aids, with about two-third of countries including these measures in their definitions. This is followed by improvements of riparian habitat, habitat diversity and in-channel diversity measures, which have been identified by about half of countries.

Box 8 Examples of country approaches for selecting GEP measures

Italy: The GEP measures are selected based on BQE classification, including benthic invertebrate and fish. A comprehensive list of mitigation measures for five uses has been pre-defined and ranked. Competent Authorities selects the appropriate set of measures to reach GEP on the basis of such guided assessment procedure.

Poland: First, a list of measures was set on the basis of the hydromorphological modification. The list was reviewed by representatives of local rivers administrators. On the basis of these responses and expert judgement, a final list of measure was set up. Finally, the effects of these measures on the hydromorphological index were simulated.

Romania: The mitigation measures for GEP are obtained from the set of mitigation measures identified for MEP, after removing the measures/any measure which lead to slight changes /improvements in biological conditions.

- Several types of measures were included in MEP but not in GEP of several HMWB cases, in particular sediment management, followed by floodplains/off-channel/lateral connectivity improvements and modification in the operations of structures.
- Some countries have set general rules to select mitigation measures for GEP. For instance, in FI, measures that contribute to ecological continuum should always be included if their contribution can improve natural life cycle of biota. EL applies a mitigation hierarchy: priority is given to measures that address the hydromorphological alteration such that the biological quality elements can recover naturally (alone or in combination with other measures).
- The following observations can be made on the comparison of MEP and GEP measures:
    - Several countries (13 out of 20 with a HMWB example) had different lists of measures between MEP and GEP. Reasons for explaining differences between the list of MEP and GEP measures varied. Some countries (taking either the reference approach or other approach) indicate that not all MEP measures were necessary to achieve BQE values for GEP. Other countries (taking a mitigation measures or other approach) assume that some of the measures only deliver slight improvements to ecology.
    - In fewer cases (four countries), the two lists were the same, but only the intensity of the measures differed significantly, for instance in terms of area covered (e.g. AT, DE). Only one country indicated that the MEP and GEP lists were exactly the same (LT).
    - Two countries (i.e. NO, PL) indicated that measures were excluded based on an assessment of significant adverse effects on use. For instance, in NO, which follows the mitigation measures approach, GEP equals all realistic mitigation measures that do not have an adverse effect on use or the wider environment.
    - Some countries pointed out that they only identify measures for GEP (and did not have a list for MEP) (e.g. CZ, NL and possibly LT).

Box 9 Examples of country approaches for moving from MEP to GEP measures

Germany: The measures for GEP generally differ from the ones for MEP in quantity (e.g. area of a measure), because the biological conditions to be achieved for GEP are less ambitious (the selection of single measures and their quantification is relevant in the subsequent step of "implementing GEP measures and monitoring effects").

Unclear issues / gaps

- Several countries indicated that their method is still in development and could therefore not answer the questions on this step (e.g. IE).
- Several countries mention the use of expert knowledge when selecting measures for GEP without further specifying the criteria used (e.g. IE, PL).
- In Appendix 1 to this report, a first comparison of the selection of mitigation measures for GEP for specific hydromorphological alterations is provided. However, it remains unclear if the selection of mitigation measures for GEP is comparable between countries. There is the need to go further with the intercomparison by using generic / comparable cases and peer-to-peer exchanges.

8.3.3 Intercomparison of country methods

Criteria:

1. Mitigation measures for GEP are selected based on the derived conditions for biological and supporting quality elements (step F, G) OR on the set of mitigation measures identified for MEP (step B) *(if hymo conditions not defined for GEP under step G, not possible to "fully meet" step H, unless Prague approach is used)*
2. It is explained how "slight changes" are interpreted (removing any measures which only lead to slight changes in biological conditions) *(only relevant for mitigation measures approach)*

Key observations:

- Almost all countries with a method (22 of 24) report to have an equivalent step to identifying mitigation measures for GEP. However, the intercomparison indicates that only five countries demonstrated that they meet the criteria set based on the Guidance no. 37 principles for this step.
- More than half of the countries with an equivalent step, only partly meet the criteria. For three countries, it is concluded that none of the relevant criteria are met and for another four countries, the judgement is inconclusive due to lack of information, lack of case study or lack of application of the method.
- The main deficiencies relate to lack of clarity on the approach and route followed to derive GEP measures (either from the MEP measures or from the derived conditions of BQEs and supporting quality elements), sometimes linked to the use of expert judgement without further explanations.
- Further, a clear gap for countries that follow the measures-based approach is the lack of explanations on how slight changes, with links to BQEs and supporting quality elements, are taken into account when selecting GEP measures. Relevant information demonstrating the use of relevant principles in Guidance no. 37 could not be found in the responses of the respective countries.

Table 32 Step H: Intercomparison of country methods

	Step H. Mitigation measures for GEP			
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**OVERALL STEP EVALUATION**
Austria	Yes		The effect of measures/hydromorphological changes and resulting habitats on BQEs is estimated (specific method for fish populations). It is noted though that estimation of minor effects is very difficult.	
Belgium	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A
Croatia	Yes			
Cyprus	Yes	Environmental flows excluded because drought conditions did not allow their implementation	Implementation of MEP measures at 70% considered 'slight change' - not linked to BQEs	
Czechia	Yes	Neither approach followed	not relevant (reference approach)	
Denmark	No			
Estonia	Yes	Combination of both approaches	not relevant (reference approach)	
Finland	Yes	Based on MEP measures	Slight change' means that ecological status improves only slightly and only rarely leads to change in the class (estimated EQR change <0.1).	
France	Yes	None of the two approaches - GEP measures selected so that the remaining pressures are low or non-existent. In practice, GEP measures chosen are all the mitigation measures relevant to mitigate the hymo alterations, minus: those that would not be ecologically effective in the case of the WB, or would have a negligible impact; those that are not technically feasible;	MEP is not defined	

		those that would have a significant adverse effect on use“		
Germany	Yes		not relevant (reference approach)	
Greece	Yes			application of method not started yet
Hungary	Yes	Based on MEP measures, not clear whether it is correct to exclude 'unfeasible' measures	not explained	
Iceland	N/A	N/A	N/A	N/A
Ireland	Yes			method not yet developed
Italy	Yes	Based on predicted BQE conditions (assuming BQE GEP conditions are correctly derived and BQE conditions can be adequately predicted)	Not possible to derive based on information provided	Methodology OK in theory, but no case study presented
Latvia	Yes	based on predicted BQE conditions using expert judgment	not relevant (reference approach)	
Lithuania	Yes	reference approach but not clear how GEP conditions are predicted	GEP is described in terms of minimal measures but not clear how this is linked with slight change	
Luxembourg	Yes	Combination of both approaches	not explained	
Malta	N/A	N/A	N/A	N/A
Netherlands	Yes	Expert judgment with the help of model WFD-explorer	Exclusion of measures with significant adverse impact on use in this step	
Norway	Yes	Other approach (GEP depends on ‘realistic mitigation measures not having SAIOU)	Exclusion of measures with significant adverse impact on use in this step	
Poland	Yes	Initial selection based on expert judgment followed by model-based assessment of the impact	Not applicable, MEP defined in another way (assumed that MEP = GES)	
Portugal	No			
Romania	Yes	measure based approach	Impact of cumulative measures estimated, but not clear what is considered slight change	

Slovakia	Yes	GEP measures identified based on the set of measures identified for MEP. Selection of measures was also based on sensitive BQEs assessment results and their requirements (expert judgement). Combination of both approaches.	hymo conditions for GEP – compared and harmonized with sensitive BQEs assessment results and demands, but not clear what is considered slight change	
Slovenia	N/A	N/A	N/A	N/A
Spain	Yes	Measures aimed at hymo conditions consistent with improved ecology/BQEs, not clear whether this is expert judgement based or using quantitative predictions (may change to green if additional explanations are given)	no consideration of slight change	
Sweden	Yes	method not clear	no consideration of slight change	
Turkey	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

Criterion 1 – Explanation of colour scoring:

	clear procedure quantifying expected impact of measures
	method unclear or pure expert judgment approach without further explanation
	approach not following requirements of Step H
	Insufficient information

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

9 Implementation of measures to achieve GEP

The implementation of the measures to reach the objective for the HMWB (defined GEP) should be distinguished from the identification of measures for defining the GEP objective. These are two different processes related to measures for GEP, though both are closely interconnected. A distinction between these two processes is crucial for the management of HMWBs and for ensuring a more transparent and common understanding of whether GEP can be reached or not.

The identification and planning of measures to mitigate the ecological effects of hydromorphological modifications (i.e. for defining and thereby predicting GEP) takes place prior to updating RBMPs, as described in the previous sections. The final decision on whether it will be possible to implement all measures, out of those which are needed to achieve GEP, takes place for single water bodies and is an individual River Basin Management decision in the context of the programme of measures (objective setting in the RBMP). If several of the measures for GEP are de-selected for implementation at this stage because they are infeasible or disproportionally expensive, and the possibility of achieving GEP is compromised, an exemption (Article 4.5) from GEP should be considered.

9.1 Monitoring to assess whether GEP is being achieved

9.1.1 Introduction to step

Monitoring should be used to estimate the current ecological potential class of a HMWB. The main decisive elements are the biological quality elements that determine the class of ecological potential. These are supported by hydromorphological and physico-chemical quality elements. If a proper assessment based on biological quality elements is not yet possible (e.g. due to a lack of hydromorphology-sensitive methods), monitoring of hydromorphological (and physico-chemical) quality elements can be used as a proxy. Monitoring of the ecological condition of the HMWB is also used to assess the effects of any (existing) mitigation measures already in place and the need for further mitigation measures to achieve GEP. In case of lack of existing monitoring, appropriate site-specific monitoring needs to be set up in order to assess whether the expected mitigation from the measures already in place has been delivered and whether GEP is being achieved.

9.1.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (23 of 24) report to be using or planning to use monitoring of quality elements to assess whether GEP is being achieved. Some other approaches mentioned include the use of expert judgement, modelling and grouping (SE) and monitoring at the mitigation measures level (not at BQE level) (FI). In the context of the HMWB examples in the intercomparison, it was often made explicit that monitoring at this stage of the process does not show yet the final effects of mitigation measures to be implemented for GEP, as many measures are not yet in place or are at the stage of early implementation.
- For most of the HMWB examples (16 of 20), monitoring and assessment of BQEs with hydromorphology-sensitive methods was used. However, it is not possible to verify the extent of the sensitivity of the methods with the information provided in the questionnaires. From the limited information provided, it is concluded that in some cases this refers to site-specific investigations, e.g. concerning fish migration, and in other cases to the use of monitoring that is designed to reflect hydromorphological heterogeneity (choice of hymo parameters, sampling points, use of hymo-sensitive BQEs like fish and invertebrates).
- For about one-third of the HMWB examples (7 of 20), monitoring and assessment of BQEs without hymo-sensitive methods was used, but for most cases, this is in combination with other hymo-sensitive methods.
- None of the countries reported to use solely monitoring and assessment of hymo and physico-chemical quality elements as proxy. Although the use of such monitoring is reported for at least

half of the HMWB examples (11 of 20), it was in all cases combined with the use of BQE monitoring.

- In terms of the classification outcome of the current ecological potential, none of the HMWB examples selected for the intercomparison in the Rivers water category is currently at GEP. Most of the HMWB examples are classified as less than GEP. For two of the HMWB examples, no classification outcome was indicated (no decision taken yet).

Unclear issues / gaps

- SE commented that monitoring to assess whether GEP is being achieved is difficult.

Table 33 Monitoring and assessment method for classifying ecological potential

15,2 What kind of monitoring and assessment methods were used to classify the current ecological potential?		
Methods	**Countries**	**Explanations**
Monitoring and assessment of **BQEs with hydromorphology-sensitive methods**	AT, CY, CZ, DK, EE, FI, FR, LV, NL, NO, PT, RO, SK, DE, HU, LU	FI (Not yet RBM level monitoring, but several studies in process e.g. concerning the fish migration.) NL (Several hydromorphological parameters are listed during monitoring of BQEs. Monitoring of BQEs also accounts for hydromorphological heterogeneity at monitoring points, for example sampling all present habitat-types at a monitoring point for invertebrates.) NO (Both stocks of fish (sea trout) and invertebrates are monitored. Both are considered to be relevant to monitor in regulated rivers.) PT (At the moment, quality elements are assessed following the same assessment methods applicable to natural WB) RO (the BQEs methods are sensitive to general degradation and morphological alterations) LU (The assessment and validation of GEP/MEP will be realised including both BQEs, fishes and macroinvertebrates. The assessment method for the BQE fish used for the evaluation of GES currently intercalibrated is less hymo sensitive than the intercalibrated assessment method for the BQE macroinvertebrates used for the evaluation of GES. Therefore the different metrics of the BQE fish were considered instead of the overall index for the BQE fish)
Monitoring and assessment of **BQEs without hydromorphology-sensitive methods**	CY, FR, LV, LT, PT, ES, LU	PT (At the moment, quality elements are assessed following the same assessment methods applicable to natural WB) LU (The assessment and validation of GEP/MEP will be realised including both BQEs, fishes and macroinvertebrates. The assessment method for the BQE fish used for the evaluation of GES currently intercalibrated is less hymo sensitive than

		the intercalibrated assessment method for the BQE macroinvertebrates used for the evaluation of GES. Therefore the different metrics of the BQE fish were considered instead of the overall index for the BQE fish)
Monitoring and assessment of **hydromorphological (and physico-chemical) quality elements**	CY, FR, LV, LT, NL, NO, PT, RO, DE, HU, LU	CY (Physicochemical only) NO (Water flow and temperature is continuously monitored) PT (At the moment, quality elements are assessed following the same assessment methods applicable to natural WB) HU (BQE methods were primarily developed to measure the impact of organic and inorganic pollution. Specific biological methods for hymo alterations were not developed. However there are some BQE which indicate the undesirable hymo conditions)

Note: Table shows information on countries that provided a response on this issue in the questionnaire. Countries missing from table did not provide a response.

Note: Status of the methods as of autumn 2020

9.1.3 Intercomparison of country methods

Criteria:

1. Monitoring results of biological quality elements are used to determine the current class of ecological potential
2. Ecological potential is classified based on hymo sensitive BQE assessment methods
3. If proper assessment of BQEs is not yet possible, hydromorphological (and physico-chemical) quality elements are used as proxies to classify ecological potential (if this is yes, step should be marked in Yellow representing that the criteria are “partly met”)

Key observations:

- Almost all countries (23 of 24) report to be using or planning to use monitoring of quality elements to assess whether GEP is being achieved. The intercomparison indicates that for about two-thirds of these countries, the criteria set based on the Guidance no. 37 principles for this step are met.
- For some countries, information was insufficient to make a judgement on whether the relevant criteria set for intercomparing this step are or will be met.

Table 34 Step Monitoring to assess if GEP is being achieved: Intercomparison of country methods

	Monitoring to assess whether GEP is being achieved				
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**Criterion 3**	**OVERALL STEP EVALUATION -**
Austria	Yes	Too early, not monitored yet as measures not completely implemented	But not classified yet	Not relevant (proper assessment of BQEs possible)	Planned but not implemented yet
Belgium	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A
Croatia	Yes	No answer	No answer	No answer	No answer
Cyprus	Yes		Use of macroinvertebrates which are considered hymosensitive	Not relevant (proper assessment of BQEs possible)	
Czechia	Yes			Not relevant (proper assessment of BQEs possible)	
Denmark	Yes			Not relevant (proper assessment of BQEs possible)	
Estonia	Yes	Not yet monitored because measures not all implemented		Not relevant (proper assessment of BQEs possible)	Planned but not implemented yet
Finland	Yes		Although FI does not have comprehensive monitoring and assessment of BQEs with hymosensitive methods, several studies are under process (e.g. concerning fish migration)	Not relevant (proper assessment of BQEs possible)	
France	Yes	In national method,	Only phytobenthos	Supporting elements monitored	

		monitoring is done using fish, invertebrates, macrophytes and phytobenthos, but assessment is done with phytobenthos only. In the case study used for this questionnaire, other BQEs (fish and invertebrates) were also used to assess the effectiveness of mitigation measures, but this is not systematically done for all HMWBs.		and hymo used as proxy	
Germany	Yes	Use of both BQE and hymo		Not relevant (proper assessment of BQEs possible)	
Greece	Yes				Application of method has not started yet
Hungary	Yes			Not relevant (proper assessment of BQEs possible)	
Iceland	N/A	N/A	N/A	N/A	N/A
Ireland	No				
Italy	Yes				Not possible to evaluate in detail due to lack of case study. Explanation provided that GEP is evaluated on the basis of monitored quality elements in the general method.
Latvia	Yes	Monitoring used but not clear if BQE			Cannot judge, they replied yes to everything

		monitoring, as they answered yes to every-thing			
Lithuania	Yes	Not yet moni-tored because measures not all imple-mented			
Luxem-bourg	Yes		Not sure how to interpret		Method under de-velopment, not used yet
Malta	N/A	N/A	N/A	N/A	N/A
Nether-lands	Yes		Use of BQE + hymo	Not relevant (proper assess-ment of BQEs pos-sible)	
Norway	Yes		Use of BQE + hymo	Not relevant (proper assess-ment of BQEs pos-sible)	
Poland	Yes	Monitoring takes account of BQEs	Ecological poten-tial is classified based on hymo sensitive BQE	Not relevant (proper assess-ment of BQEs pos-sible)	
Portugal	Yes	Use of BQE + hymo + phys-ico-chemical el-ements	Hymo-sensitive BQE used (ma-croinvertebrates and fish), as well as other BQE (to assess other quality aspects, as eutrophica-tion)	Not relevant (proper assess-ment of BQEs pos-sible)	
Romania	Yes		Use of BQE + hymo	Not relevant (proper assess-ment of BQEs pos-sible)	
Slovakia	Yes			Hymo & physico-chemical in few cases, where BQE assessment not possible	
Slovenia	N/A	N/A	N/A	N/A	N/A
Spain	Yes		Currently devel-oping hymo sen-sitive BQE as-sessment meth-ods	Use of indirect habitat indicators	

Sweden	Yes				No monitoring in place
Turkey	N/A	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

9.2 Are there GEP measures that are disproportionally expensive or infeasible?

9.2.1 Introduction to step

River Basin Authorities may want to assess whether some of the GEP measures identified in step H are disproportionately expensive (e.g. because the investment costs of measures are high) or infeasible. If one or more of the selected GEP measures have been excluded according to cost considerations or infeasibility, it has to be checked whether the remaining measures are still sufficient to achieve the biological conditions at GEP. If this is not the case, a review and possibly re-design of the measures will be needed to avoid the need to use exemptions: for example, selecting another combination/intensity of measures may deliver the desired ecological improvement.

9.2.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- Three-quarters of countries (18 of 24) report to have an equivalent step in their approach. However, few countries appear to have developed or applied methods for assessing disproportionate costs on measures to achieve GEP.
- One quarter of countries (6) indicated not having this step, although this step should be implemented when setting objectives during RBMP planning.
- Half of countries with an equivalent step (9 out of 18) assess disproportionality or infeasibility of measure when mitigation measures are to be implemented within the programme of measures to achieve GEP.
- The other countries assess disproportionality and infeasibility at a different stage. Several countries report assessing disproportionality at an earlier stage, when defining mitigation measures in their national library (e.g. CZ), or when defining MEP or GEP (i.e. FR, EL, LV, PL). Other countries which do not have an equivalent step also report considering economic feasibility when selecting MEP or GEP measures (e.g. DK, FI, PT).
- The large majority of countries with a case study (12 out of 20) do not report any GEP measures that were demonstrated to be disproportionally expensive in the selected HMWB examples and none of the countries report GEP measures that were technically infeasible.
- Two countries indicated that some GEP measures had been demonstrated to be disproportionately expensive. These measures were river depth and width variation improvement (e.g. developing near-natural slope), minimum flow in the natural channel, improve upstream continuity for biota, improve downstream continuity for biota, and reconnecting tributaries.
- Some countries indicated that ruling out measures due to disproportionality or infeasibility was yet unclear due to on-going assessments and methodological development (e.g. IE, NL, NO).

Unclear issues / gaps

- For most countries, methods for assessing disproportionate cost are still being tested and implemented, so little can so far be learned.
- In many cases, it is not clear when disproportionate cost and infeasibility were taken into account, e.g. during river basin management planning, or actually before or during MEP and/or GEP definition.
- For many countries, responses in this section were unclear and/or incoherent. Further work is needed to reach more common understanding of this step.

9.2.3 Intercomparison of country methods

Criteria:

1. Assessment of disproportionate costs or infeasibility of mitigation measures are clearly carried out during PoM/RBMP planning (where implementation may not be possible due to disproportionate costs or infeasibility and may lead to less stringent objectives), and NOT in the selection of measures to define and achieve GEP
2. In case one or more GEP measures were ruled out because they are disproportionally expensive or infeasible, clear information is provided on whether remaining measures are still sufficient to achieve GEP

Key observations:

- Out of the 18 countries which report to have an equivalent to this step, the intercomparison could confirm for only about half of them, that the criteria set based on the Guidance no. 37 principles are met. For the remaining countries, information in the questionnaires was either insufficient to make a judgement or it demonstrated that one or both of the criteria are not met.
- For four countries, it is concluded that the assessment of disproportionate costs or infeasibility of measures is not carried out during PoM/RBMP planning, as described in Guidance no. 37.

Table 35 Step GEP measures disproportionally expensive of infeasible: Intercomparison of country methods

	GEP measures disproportionately expensive or infeasible?			
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**Criterion 2**	**OVERALL STEP EVALUATION -**
Austria	Yes		Not relevant, no measures ruled out.	
Belgium	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A
Croatia	Yes	No information is given in this section.	No information is given in this section.	

Cyprus	Yes		No measures ruled out but assessment still in progress	
Czechia	Yes		Not possible to evaluate since this evaluation has not been finished yet.	
Den-mark	No			
Estonia	Yes			
Finland	No			
France	Yes		Not relevant, no measures ruled out.	
Ger-many	Yes		Not relevant, no measures ruled out.	
Greece	Yes	Assessment carried out dur-ing selection of measures to define GEP (step B1)	Not relevant, no measures ruled out.	
Hungar y	No			
Iceland	N/A	N/A	N/A	N/A
Ireland	Yes			No conclusive in-formation is given except for infor-mation that method is in de-velopment.
Italy	Yes		Could not be evaluated due to lack of case study	
Latvia	Yes		Not relevant, no measures ruled out	
Lithua-nia	Yes		Not relevant, no measures ruled out.	
Luxem-bourg	Yes	No information is given in this section.	No information is given in this section.	
Malta	N/A	N/A	N/A	N/A
Netherl ands	No			Indicated that question of dis-proportionality or feasibility can be answered after 2027 using the maximum exten-sions of dead-lines and the method of back-casting of achievement of objectives

Norway	Yes		Not possible to evaluate due to pending potential revisions to evaluate disproportionate costs	
Poland	Yes	Economic elements taken into account when assessing SAEOU of measures but not clear if this entails an assessment of disproportionate cost of the measures themselves at the stage of MEP/GEP setting	Not relevant, no GEP measures ruled out.	
Portugal	No			
Romania	Yes		Not relevant, no measures ruled out.	
Slovakia	No			
Slovenia	N/A	N/A	N/A	N/A
Spain	Yes		Not relevant, no measures ruled out.	
Sweden	Yes			
Turkey	N/A	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

9.3 Implement GEP measures and monitor effects on BQEs and supporting quality elements

9.3.1 Introduction to step

All GEP measures that can be applied and are assumed to be sufficient to achieve GEP biological conditions are then implemented. The effects of the implemented GEP measures on BQEs and supporting quality elements should subsequently be monitored and the ecological potential of the water body should be classified accordingly.

If GEP is achieved based on the monitoring results, no further mitigation measures are needed.

If monitoring results indicate that the mitigation measures have such an effect on quality elements that the water body reaches good ecological status, the water body cannot be considered as heavily modified and should be re-designated as a natural water body with good status as its environmental objective. If the monitoring indicates that the mitigation measures are not sufficient to achieve good status, the designation of the water body as HMWB remains valid and the defined GEP remains as its environmental objective.

If monitoring shows that expected GEP conditions are not achieved after the implementation of all measures, then the reasons (see above) for this need to be clarified, and it is possible that the combination or intensity of measures will need to be refined. Therefore, the implementation of measures to achieve GEP should be seen as an iterative process, starting with typical measures normally expected to mitigate a certain hydromorphological pressure-impact (see the European mitigation measure library which is a supporting tool to this document) that are known to be effective in most situations. These can be subject to future refinement or even the implementation of additional measures later on, taking into account the monitoring results.

9.3.2 Key findings from the questionnaires

Summary of common aspects & differences in interpretation and implementation of step

- The majority of countries (21 of 24) report to monitor the effects of implemented GEP measures on BQEs and supporting quality elements, with the exception of five countries partly because their overall method or their GEP measures are still under development.
- For several of the HMWB examples in the intercomparison, all GEP mitigation measures are being implemented as part of the RBMP programmes of measures, while for others, it is noted that some measures are still in discussion or that measures are still in the planning phase (awaiting the finalization of the 3rd RBMPs).
- For several of the HMWB examples in the intercomparison (8 of 20), some evidence from monitoring is already collected on the success of mitigation measures and on the extent of improvement in terms of BQEs or supporting quality elements. For some cases it is indicated that measures are still being implemented (or will be implemented) and monitoring evidence on measure effects is not available yet.
- For almost all the HMWB examples, no changes have been made yet to the mitigation measures based on evidence from monitoring but there are several lessons learned already, e.g.: concerning the effectiveness of the measures on particular BQEs, the need for further measures, factors to be considered for selecting monitoring points and issues that should be considered concerning other types of pressures.
- Overall, the feedback from the implementation of GEP mitigation measures is very important in order to understand what is working and what is not working. It is very important to have long-term monitoring to be able to carry out an evaluation of effectiveness of the measures put in place.

Unclear issues / gaps

- Latvia: Similar implemented measures (within all territory of LV) are fragmentary applied in different areas, sometimes the scale is too small to assess effect of measure.

9.3.3 Intercomparison of country methods

Criteria:

1. Evidence is collected from monitoring on the success of mitigation measures implemented in the RBMP programme of measures

Key observations:

- Although the majority of countries (21 of 24) report to monitor the effects of implemented GEP measures on BQEs and supporting quality elements, it is concluded that the criterion set for the intercomparison is at present met in seven of these countries. The criterion is only partly met or not met for nine countries. This is mainly because the reported monitoring is of limited range or not implemented yet or because no evidence on success of measures could be collected yet.

- For five countries, no relevant information or insufficient information was provided to make a judgement.

Table 36 Step Implement GEP measures & monitor effects: Intercomparison of country methods

	Implement GEP measures & monitor effects		
MS	**Step reported by MS as present (Yes) or absent (No)**	**Criterion 1**	**OVERALL STEP EVALUATION -**
Austria	Yes		
Belgium	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A
Croatia	Yes	A method is still under development. No description of approach in development or information to clarify if any kind of monitoring is done meanwhile.	
Cyprus	Yes		
Czechia	Yes	Monitoring is only done in a limited range.	
Denmark	Yes	Methodology is still being finalised. The waterbody is monitored by the National Monitoring Programme, but as no mitigation measures have been implemented yet, there is no evidence of success at this point	
Estonia	Yes	No monitoring evidence has been collected yet.	
Finland	Yes		
France	Yes		
Germany	Yes	Measures and monitoring not yet implemented.	
Greece	Yes	Monitoring will be undertaken within the next monitoring cycle.	
Hungary	No		
Iceland	N/A	N/A	N/A
Ireland	No		
Italy	Yes		Not possible to evaluate in detail due to lack of case study.
Latvia	Yes	Monitoring not directly addresses GEP measures.	
Lithuania	Yes	Measures still are being implemented, monitoring is ongoing, no evidence yet	
Luxembourg	Yes	No monitoring yet, measures are still being implemented.	
Malta	N/A	N/A	N/A
Netherlands	Yes		
Norway	Yes		
Poland	No		

Portugal	Yes	No information is given in this section.	
Romania	Yes	No information is given in this section.	
Slovakia	Yes	Few positive effects of applied hymo measures were reflected and assessed also on BQEs	
Slovenia	N/A	N/A	N/A
Spain	Yes		
Sweden	Yes	No information is given in this section.	
Turkey	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

10 Overall criteria with relevance for several steps in methodology

In addition to the step-specific intercomparison presented in the previous sections, this section presents the outcome of the intercomparison on "overall criteria" based on Guidance no. 37, which are of relevance for several steps in the definition of ecological potential. These "overall criteria" concern the use of BQE assessment methods sensitive to hydromorphology, the consideration of the best approximation to ecological continuum and the consideration of objectives in water bodies upstream and downstream of the HMWB.

Criteria used:

1. BQE assessments methods sensitive to the hymo alterations are used
2. The achievement of objectives in water bodies downstream and upstream of the selected HMWB are considered (related to Art. 4.8)
3. Explanation how best approximation to ecological continuum was taken into account

Key observations:

- About half (10) of the countries use BQE assessment methods sensitive to hymo alterations. For five countries, it is concluded that they partially meet this criterion because they have methods in place for some but not all hymo-sensitive BQEs. For some countries (5), the intercomparison of this criterion was inconclusive due to the lack of relevant information on the sensitivity of the methods used to hymo alterations.
- One-third (8) of the countries demonstrated that they adequately consider the achievement of objectives in water bodies downstream and upstream of the selected HMWB (related to WFD Art. 4.8). For about half of countries though (11), the intercomparison of this criterion was inconclusive due to the lack of relevant information in the questionnaire, while in some cases (5), it was concluded that this aspect was not taken into account when defining MEP and GEP for the specific HMWB.
- Two-thirds (8) of the countries adequately explained how best approximation to ecological continuum was taken into account when defining MEP and GEP. For the majority of cases though (13), information in the questionnaires was not sufficient to reach a conclusion on this aspect. In a few cases (3), it was concluded that this criterion is partly met, for example because assessment is based on longitudinal continuity only or is focused on long-distance migratory fish.

Table 37 Overall criteria with relevance for several steps: Intercomparison of country methods

MS	Criterion 1	Criterion 2	Criterion 3
Austria			
Belgium	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A
Croatia	Biological assessment methods are sensitive to general degradation in rivers, not specifically to hymo alterations	No relevant information	No explanation provided but indicated that most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum will be identified for each individual WB following the identification of the ecological potential

Cyprus	For part of sensitive BQEs (invertebrates)	Upstream and downstream HMWBs (dams) were in a good or better status and were not considered for the identification of mitigation measures	No information provided
Czechia		No relevant information	No information provided
Denmark	Information only provided on sensitivity of BQEs, not on the methods used	Not yet, but plans to do so once method for defining GEP is completed and implemented	No information provided
Estonia	No specific information on hymo sensitivity of methods, only that same methods are used as for NWB	Responded positively but no relevant explanatory information provided how	Only mentioned that expert assessment is used.
Finland	BQE methods used and under development (fish, benthic invertebrates and macro-phytes) are hymo-sensitive		
France	Currently only use phytobenthos which is not sensitive to hymo alterations	Interactions between HMWB with upstream and downstream WBs are taken into account in national method, and an analysis is carried out at catchment scale	Restoration of ecological continuum carried out in case study at catchment scale
Germany			
Greece		Not clearly explained how objectives of upstream/downstream WBs are considered when selecting measures	No clear explanation of considering up-/downstream objectives when selecting measures (see Art 4(8) in previous criterion)
Hungary	For part of sensitive BQEs (fish)	Not clearly explained how objectives of upstream/downstream WBs are considered when selecting measures	No explanation provided
Iceland	N/A	N/A	N/A
Ireland	No information provided	No information provided	No information provided
Italy	For part of sensitive BQEs (macroinvertebrates, macrophytes)	No information provided	No information provided

Latvia	Unclear (macroinvertebrate data available but not explained if method is sensitive to hymo)	It is explained that selected WB doesn't significantly affect other WBs	Only mentioned that expert assessment is used.
Lithuania	Proxy methods based on hymo assessment	Responded negatively and no information provided	No lateral connectivity measures and identification of up-/downstream measures regarding Art 4(8)
Luxembourg	For part of sensitive BQEs (macroinvertebrates; fish method less hymo sensitive)		
Malta	N/A	N/A	N/A
Netherlands		No information provided	No specific explanation provided
Norway	No specific information on hymo sensitivity of available methods	Responded positively but not clearly explained how objectives of upstream/downstream WBs are considered when selecting measures	Focus on (long distant) migratory fish which do not contain complete type-specific biocoenosis needed for MEP/GEP
Poland	NWB assessment methods with modified reference boundaries to accommo-date the hymo alteration; method used for fish, benthic macroinvertebrates and macrophytes, with response to variation of the hydromorphological index value (HIR).	Responded positively but not clearly explained how objectives of upstream/downstream WBs are considered when selecting measures	When defining measures for GEP, actions aimed at enabling the migration of fauna and availability of spawning and breeding are taken into account
Portugal	Yes (macroinvertebrates and fish)	No information provided	No information provided
Romania			Assessment is only based on longitudinal continuity (that cannot sufficiently cover habitats, morphodynamic, etc.)
Slovakia	Method for both relevant sensitive BQEs ready (invertebrates & fish)		
Slovenia	N/A	N/A	N/A
Spain	Proxy methods based on hymo assessment[8]		By using a protocol for Hydromorphological Characterization, it is assessed if measures selected for MEP will be able to mitigate any obstacles to migration or connectivity (of biota,

[8] Currently developing hymo sensitive BQE assessment methods (fish, invertebrates, macrophytes, etc.) within 2020-2023 work programme.

			sediment and water) and potentially improve the quality, quantity and range of habitats affected by the physical modifications
Sweden	Proxy methods based on hymo assessment	Responded negatively and no information provided	Lacking methods and knowledge on how to get information to ensure best approximation to ecological continuum
Turkey	N/A	N/A	N/A

Note: Status of the methods as of autumn 2020

N/A	No answer
	The method is still in early stages of development. Note: EL, IE, LU report that method is in early stage of development but they will apply or are already applying method in 3rd RBMPs.

11 Lessons learned by countries on their methods

Countries were asked to comment on the key lessons they learned from applying their methods on ecological potential definition for rivers.

Strengths of methods which countries bring forward include, among others, the ability of the methods to allow transparent description of GEP, feasibility of applicability on entire river network, sensitivity of method to hydromorphology and ability to evaluate effects of different scenarios of measures.

However, several challenges still lie ahead. Taking into account country responses and the main findings of the questionnaire analysis, the main weaknesses that still need to be tackled include:

- High complexity of methods and requirement for a lot of information and expertise for methods application (often lack of data and knowledge, difficult to communicate and cooperate with stakeholders due to complicated methods).
- Most methods involve a definition of GEP for each HMWB individually, making it a great challenge to apply the method for all HMWB and achieve comparable results (large amount of resources needed). Some methods use groups of HMWB or a specific HMWB typology that enable a more efficient and standardized application.
- Estimation of ecological effects of mitigation measures is difficult, but possible based on comprehensive monitoring data (some countries also refer to model uncertainties).
- GEP definition for BQEs in a quantitative way is challenging, but possible particularly if assessment systems for natural water bodies are used as basis to be adapted.
- There is still a need for sufficient biological and field hydromorphological data.
- Significant adverse effects of mitigation measures on use are difficult to assess; more quantitative approaches may be beneficial.
- Minor effects of mitigation measures on BQEs are difficult to define as key step required for the mitigation measures approach.
- Decisions on the extent of mitigation measures are difficult to make.
- Implementation of mitigation measures in practice expected to be a great challenge; so far, only few mitigation measures implemented.
- Thee is need for long term monitoring to evaluate effectiveness of mitigation measures put in place.
- Strengthening the link/knowledge between hydromorphological conditions and BQE conditions is of high importance and relevance.
- In some cases, there is still a need for a better developed system for classification of hydromorphological conditions.
- Hydromorphological assessment, at the basis of HMWB designation and mitigation measures effects estimation, is still not carried out in an adequate way or overlooked.
- Some approaches seem to rely on simplistic assumptions equating some ecological status classes to ecological potential classes with no proof of evidence or scientific basis.
- Multistressor situations on most rivers present a great challenge, but do not prevent a standardized assessment of HMWB and implementation of efficient mitigation measures

The detailed responses provided by countries on lessons learned, strengths and weaknesses can be viewed in Appendix 1 to this report.

Needs for further guidance

Finally, countries were asked to indicate which steps of the approach on ecological potential definition that is proposed in CIS Guidance no. 37, they would like to have more practical guidance and examples on.

The steps explicitly indicated as in need for more guidance are mainly:

- Step B2 on how to decide which adverse effects are significant and which not on the use. More practical and detailed method for setting criteria and assessment of significant adverse effects and benefits would be useful.
- Steps E and F on deriving biological conditions for GEP and MEP
- Step G on deriving supporting quality element conditions for GEP (in particular hymo elements)
- Step H on the identification of mitigation measures for GEP

At least two countries (FI, SE) referred to the need for further guidance and explanation on the terms of “ecological continuum“, “best approximation of ecological continuum” and “close to best approximation of ecological continuum”.

Also, more case studies would be very useful which take into account all the steps of the Guidance no. 37 including case studies in water bodies with multiple pressures.

12 Key conclusions on the intercomparison of the definition of ecological potential for Rivers

This report and its appendices provide an overview of the methods in place in European countries (as of autumn 2020) to define ecological potential of HMWB rivers. The information on methods is based on the responses provided by countries in the intercomparison questionnaires for rivers, with details on the different steps outlined in CIS Guidance no. 37. In addition to summarising the approaches used, this report presents the outcomes of an initial intercomparison review of the methods carried out by members of the GEP core group of ECOSTAT, taking the information provided by countries at face value.

Overall, the response rate from countries has been high with a total of 26 countries returning the intercomparison questionnaire for rivers (no response from three EU Member States). Although the level of detail of information in the responses varies to a great degree, the high response rate shows that methods to define ecological potential for rivers are in place or being developed in almost all Member States.

As of autumn 2020, work on developing methods for the ecological potential of rivers was still ongoing in many countries. In half of the countries, methods were developed and being used for the 3rd RBMPs. The other half of the countries were still in the phase of pilot testing their methods or even earlier stages of development.

Countries have been asked to indicate whether their methods have steps equivalent to those described in Guidance no. 37 for defining ecological potential. Less than half of the countries (10 of 24) report to have equivalents to all steps of Guidance no. 37 on MEP and GEP definition (steps A to H) but most countries (16 of 24) report to cover all steps on the implementation of measures to achieve GEP, as described in Guidance no. 37.

The intercomparison of country methods based on criteria set by the GEP core group to reflect key principles of the Guidance for the different steps shows the following:

- In general, hydromorphological assessment, which is at the basis of HMWB designation and mitigation measures effects estimation, is still not carried out in an adequate way or overlooked. In some countries, there is still a need for a better developed system for the classification of hydromorpholgical conditions.
- For step A in the identification of MEP (identification of closest comparable water category), no major deficiencies have been identified, as this seems to be straightforward for the river HMWB cases provided as examples.
- For most steps on the definition of MEP and GEP (steps B to H), only few countries fully meet the criteria set for the intercomparison. At the same time, only for few countries, it was concluded that they do not meet any of the criteria for particular steps. For most countries, a partial fulfillment of the criteria is concluded or the intercomparison review was inconclusive due to the lack of information in the responses.
- Main weaknesses identified in the steps on defining MEP involve the lack of clear explanations on the criteria used to assess significant adverse effect of mitigation measures on use; lack of sufficient information about measure effects on ecological functioning which has implications for the selection of most ecologically beneficial measures for MEP; lack of consideration of the effects of MEP mitigation measures on hymo conditions, physico-chemical parameters as well as on BQEs conditions at MEP. While most countries use a standardised mitigation measures library or list as basis for measure identification, missing standards for selection of measures and case-by-case decisions due to expert judgement without guidance or criteria impede a comparable definition of MEP. Further, hydromorphological assessment methods are key to quantify modifications and justify selections of measures to define MEP.
- Main weaknesses in the steps on defining GEP involve the derivation of BQE conditions only for part but not all relevant and hymo-sensitive BQEs as well as the lack of interpretation of “slight changes” when defining BQE conditions. Further, there is lack of fully developed

methodologies to derive hymo conditions for GEP; lack of clear approaches on how GEP measures are selected with frequent reference to the use of expert judgement as well as the lack of explanations on how “slight changes” are taken into account for GEP measures selection (the latter only relevant for the mitigation measure approach).

- For the steps on the implementation of measures to achieve GEP (from assessment of current potential, to assessment of disproportionate costs and technical infeasibility and monitoring to assess effectiveness of implemented measures), it is concluded that a higher number of countries meet the key criteria set for the intercomparison. Hydromorphological and BQE monitoring is key to show effects of mitigation measures and evaluate methods and GEP definition.
- Some unclear issues and challenges linked to the steps on the implementation of measures to achieve GEP involve the lack of clear information on the extent to which BQE monitoring is used to assess current ecological potential (before any further measures implementation). Also a few countries seem to assess disproportionality of costs or technical infeasibility of measures during the process of defining MEP and GEP (and not as part of PoM/RBMP planning), which merits further clarification and discussion.

Table 38 Steps reported in methods (top) & intercomparison based on Guidance 37 (bottom)

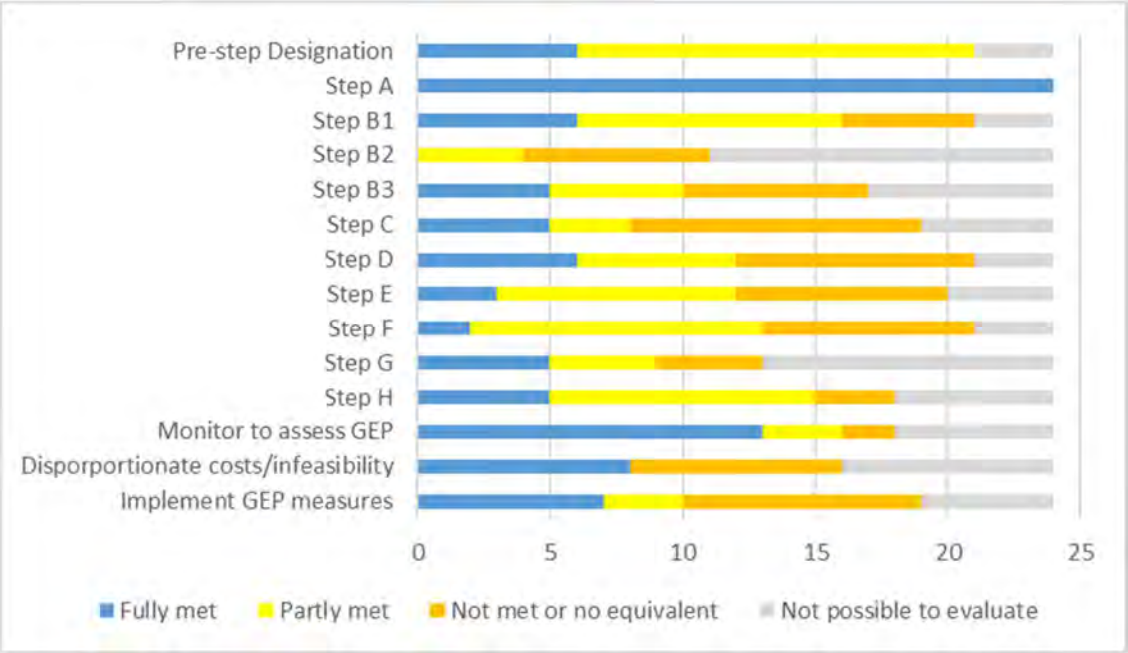
	Designation	MEP Definition							GEP definition			Implementation		
	Pre-Step Designation	Step A. Closest comparable water category	Step B1. Relevant mitigation measures	Step B2. Sgnificant adverse effect on use or wider environment	Step B3. Most beneficial measures (best approximation ecological continuum)	Step C. Hydromorphological conditions for MEP	Step D. Physico-chemical conditions for MEP	Step E. BQE conditions for MEP	Step F. BQE conditions for GEP	Step G. Supporting quality element conditions for GEP	Step H. Mitigation measures for GEP	Monitoring to assess whether GEP is being achieved	GEP measures disproportionally expensive or infeasible?	Implement GEP measures & monitor effects
Austria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Partly	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cyprus	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Czechia	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Denmark	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes
Estonia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
France	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Greece	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hungary	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Latvia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lithuania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Luxembourg	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes
Norway	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes
Poland	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Portugal	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	Yes
Romania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slovakia	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Yes	Method is reported to have an equivalent step
No	Method is reported to have no equivalent step
	Method is still in early stages of development

	Designation	MEP Definition							GEP definition			Implementation		
	Pre-Step Designation	Step A. Closest comparable water category	Step B1. Relevant mitigation measures	Step B2. Sgnificant adverse effect on use or wider environment	Step B3. Most beneficial measures (best approximation ecological continuum)	Step C. Hydromorphological conditions for MEP	Step D. Physico-chemical conditions for MEP	Step E. BQE conditions for MEP	Step F. BQE conditions for GEP	Step G. Supporting quality element conditions for GEP	Step H. Mitigation measures for GEP	Monitoring to assess whether GEP is being achieved	GEP measures disproportionally expensive or infeasible?	Implement GEP measures & monitor effects
Austria	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Belgium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	Partly	Yes	No	No	No		Partly			Partly				
Cyprus	Partly	Yes	Partly	No	No	No	No	No	No	No	Partly	Yes		Yes
Czechia	Partly	Yes	No	No	No	No	No	Partly	Partly		No	Yes		No
Denmark	Partly	Yes	No	No	No	No	No	Partly	No	No	No	Yes	No	Partly
Estonia	Partly	Yes	Partly			Partly	Partly	No	No		Yes	Yes	Yes	
Finland	Yes	Yes	Yes		Partly	Partly	Yes	Yes	Partly		Yes		No	Yes
France	Partly	Yes	Partly		Partly	No	No	No	No		No	Party	No	Yes
Germany	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Greece	Partly	Yes	Partly			No	Partly	Partly	No				No	No
Hungary	Partly	Yes		No	No	Yes	Yes	No	Partly		Partly	Yes	No	No
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland		Yes						No	No			No		No
Italy		Yes						Partly	Partly					
Latvia	Yes	Yes	Partly			No	Partly	Partly	Partly	Partly	Partly		Yes	No
Lithuania	Partly	Yes	Partly	Partly			Yes		Partly		Partly	Partly	Yes	Partly
Luxembou	Partly	Yes	Yes		Partly	No	No	Partly			Partly			
Malta	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Netherlar	Partly	Yes	No		No	No	No	No	Partly	Partly	Partly	Yes	No	Yes
Norway	Partly	Yes	Partly		Partly	No	No	No	No	No		Yes		Yes
Poland	Partly	Yes	Yes	Partly		No	No	Partly	Partly	Yes	Yes	Yes		No
Portugal		Yes	No	No	No	No	No	No	No	No		Yes	No	
Romania	Partly	Yes	Partly	Partly	Yes		Yes	Partly	Partly	Partly	Partly	Yes	Yes	
Slovakia	Yes	Yes	Partly	No	Yes	Yes	Partly	Partly	Partly	Yes	Partly	Yes	No	Partly
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spain	Yes	Yes	Yes		Yes	Yes				Yes	Partly	Partly	Yes	Yes
Sweden	Partly	Yes	Partly		Partly	Partly	Partly		Partly		Partly	No	Yes	
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	3	0	3	13	7	4	3	4	3	11	6	6	8	7

	Yes, Fully met: All criteria of step are "fully met"
	Partly met: One or more criteria of step are "partly met" (rest of criteria may be fully met or not met)
	Not met: All criteria of step are "not met" or country reports to have no equivalent step
	Not possible to evaluate: One or more criteria "not possible to evaluate"
	Method is still in early stages of development

Figure 5 Numbers of countries which fully meet, partly meet or do not meet the criteria set for the intercomparison of methods for each step



Possible follow-up

This initial intercomparison of ecological potential definition methods for rivers was fruitful in uncovering the overall progress of countries in designing and implementing national approaches for ecological potential definition. Results indicate a clear need to continue the intercomparison work and encourage more peer-to-peer exchanges between national experts, in order to ensure the development of comparable methods in line with the principles set out in Guidance no. 37. Particular steps and aspects of the Guidance were found to potentially be fruitful areas of further work, which could be the focus of specific working groups in ECOSTAT:

- "*Modifications and mitigation measures*": the intercomparison presented in this report showed the heterogeneity in MS consideration of the use of appropriate hymo assessment when identifying modifications or the effects of measures and the difficulty to assess the coherence of country approaches in selecting mitigation measures. This requires consideration of multiple factors, in particular the type of modifications, water body types and type of uses. A working group could investigate how MS consider the hymo effects of mitigation measures and how and when particular mitigation measures should be considered in GEP definition.
- "*Hydromorphological sensitive BQE assessment methods*": the intercomparison showed that the lack of approaches and methods for assessing BQE conditions at GEP and MEP levels was one of the areas for which countries would welcome further exchange, support and guidance.
- "*Consideration of SAEOU and costs in measures selection*": the economic dimensions of ecological potential definition was one of the least developed part of countries responses in the questionnaire. Further work and communication is needed on defining the role of the assessment of significant adverse effects on use as opposed to the assessment of costs in the selection of mitigation measures for reaching GEP. In addition, guidance is needed on the methods and approaches for assessing significant adverse effects on use for MEP and GEP definition, for instance the type of criteria that should be considered, the scale of analysis and how to decide when an adverse effect is significant.

13 References

1. Guidance Document no. 37, Steps for defining and assessing ecological potential for improving comparability of Heavily Modified Water Bodies, 2019.
2. Guidance Document no. 37 - Mitigation Measures Library, 2019.
3. Pollard, P. 2011. Concept paper Good ecological potential – Recommendations on assessing and improving comparability. Final version endorsed by Water Directors at their meeting on 8-9 December 2011 in Warsaw.
4. Working Group ECOSTAT report on Common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies. Part 1: Impacted by water storage
5. WG ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies. Part 2: Impacted by flood protection structures
6. WG ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies. Part 3: Impacted by drainage schemes
7. Workshop Report, Workshop on mitigation measures and GEP for Inland Navigation water use. 29th – 30th June 2017, Brussels

14 Annex 1: Key references and sources to the methods reported

The following table provides links to the documents that describe the country methods for HMWB designation and ecological potential definition (links to English translations where possible).

AT	https://www.bmlrt.gv.at/wasser/wisa/fachinformation/ngp/ngp-2015/hintergrund/methodik/HMWB.html ; https://www.bmlrt.gv.at/wasser/wisa/fachinformation/ngp/ngp-2015/hintergrund/methodik/hmwb_kuenstliche.html
CY	http://www.moa.gov.cy/moa/WDD/wfd.nsf/all/8EB76C35352171EEC225844F002355A5/$file/6_Oristikos_prosdiorismos_HMWB_AWB_Jul_2015.pdf?openelement
CZ	HMWB designation: https://heis.vuv.cz/data/webmap/datovesady/projekty/ramcovasmernicevoda/default.asp?lang=&tab=5&wmap= (H. Prchalová: Aktualizace metodiky určení silně ovlivněných vodních útvarů. VÚV TGM, v.v.i. pro MŽP, 2019.) EP definition - BQE: https://www.mzp.cz/C1257458002F0DC7/cz/prehled_akceptovanych_metodik_tekoucich_vod/$FILE/OOV-Metoda_hodnoceni_ekologickeho_potencialu-20140821.pdf EP definition - physico-chemical parameters: https://heis.vuv.cz/data/webmap/datovesady/projekty/ramcovasmernicevoda/default.asp?lang=&tab=5&wmap= (P. Rosendorf: Metodika hodnocení všeobecných fyzikálně-chemických složek ekologického potenciálu útvarů povrchových vod kategorie řeka. VÚV TGM, v.v.i. pro MŽP. Aktualizace 2019.)
DE	Assessment of ecological potential (Full report, german): www.laenderfinanzierungsprogramm.de/static/LFP/Dateien/LAWA/AO/o-1-13-endbericht.zip Assessment of ecological potential (Short summary, english, Chapter 3.7, p. 135): https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2018-12-07_texte_104-2018_aeshna.pdf Designation of HMWB/AWB (Full report, german): Empfehlung zur Ausweisung HMWB/AWB im zweiten Bewirtschaftungsplan in Deutschland (Stand 13.08.2015): https://www.wasserblick.net/servlet/is/142651/WRRL%202.4.1_HMWB%20-%20Aktualisierung%2008-2015_final.pdf?command=downloadContent&filename=WRRL%202.4.1_HMWB%20-%20Aktualisierung%2008-2015_final.pdf -> Methods also relevant for 3rd RBMP
DK	Determination of ecological potential in AWB/HMWB (full report in Danish, English summary see p. 6) Teknisk grundlag for fastlæggelse af økologisk potentiale i kunstige og stærkt modificerede vandløb. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 24 s. - Videnskabelig rapport nr. 400: https://dce2.au.dk/pub/SR400.pdf
EE	Ecological potential definition can be found in national regulation "The list of bodies of surface water, teh procedure for assessment of quality classes of bodies of surface water and values of quality element of water bodies not included to bodies off surface water" [In EEn] https://www.riigiteataja.ee/akt/121042020061 ; HMWB designation method is described in "Vesikonna tunnuste analüüs" [In EEn] https://www.envir.ee/sites/default/files/Vesi/Veemajanduskavad/VMK_2021_2027/Alusuuringud/i_vesikonna_tunnuste_analuus_kujundatud_vaatamiseks.pdf
EL	A methodology for the designation of HMWB & AWB (including the definition of GEP), based on the CIS GD No.4, has been developed during the 2nd planning cycle. and is available in the follwing link: http://wfdver.ypeka.gr/el/management-plans-gr/methodologies-gr/ (only in greek language).
ES	https://www.miteco.gob.es/es/agua/temas/
FI	(1) https://www.ymparisto.fi/download/noname/%7B46EB0A9F-7DE2-47DA-AEE7-C11A4DBDBBC3%7D/158922 ; (2) https://helda.helsinki.fi/bitstream/handle/10138/306745/SYKEra_37_2019.pdf?sequence=1&isAllowed=y (2)https://helda.helsinki.fi/bitstream/handle/10138/41788/OH_7_2012.pdf
FR	https://www.legiFR.gouv.fr/eli/arrete/2018/7/27/TREL1819388A/jo/texte
HU	https://www.vizugy.hu/vizstrategia/documents/988BF7DB-B869-46C6-9463-E9E4BFC81D2A/1_4_hatteranyag_EM_M_modszer.pdf The full description is still not aviable in english yet.
IS	HMWB designation method is in development. Preliminare list of HMWB has been proposed (only available in ISic).
IE	NA

IT	https://www.minambiente.it/pagina/normativa-tecnica-l-identificazione-e-la-classificazione-dei-corpi-idrici-fortemente
LT	Attached to the questionnaire
LU	1. Methodische Vorgehensweise zum Festegen des "Guten Ökologischen Potenzials" für erheblich veränderte Wasserkörper in Luxemburg (Schmutz & Vogel, 2015) **Link**: http://geoportail.eau.etat.lu/pdf/plan de gestion/Hintergrunddokumente/Methodische Vorgehensweise zum Festlegen des HMWB in Luxembur_Vogel und Schmutz.pdf 2. Maßnahmenempfehlungen für erheblich veränderte Wasserkörper (HMWBs) in Luxemburg (Schmutz & Vogel, 2019) **Link**: not published yet, will be published in the next RBMP 2021 (cf. attached file to the email)
NL	https://www.waterkwaliteitsportaal.nl/WKP.WebApplication/Beheer/Data/Publiek?viewName=Bronbestanden&year=2019&month=December
NO	HMWB designation and boundaries for GEP: http://www.vannportalen.no/globalassets/nasjonalt/dokumenter/veiledere-direktoratsgruppa/01_2014_smvf-veileder.pdf Method for identifying mitigation measures in rivers with anadromous salmonids: https://www.nina.no/archive/nina/PppBasePdf/temahefte/053.pdf National framework for prioritizing hydropower licenses for revision: NVE (miljodirektoratet.no)
PL	The review and verification of methodologies for the designation of HMWB and AWB along with their preliminary and final designation" – Summary of final methodology for the determination of HMWB and AWB along with the concept of ecological potential determination. Study contracted by the National Water Management Holding Polish Waters (pl. Państwowe Gospodarstwo Wodne Wody Polskie), 2018
PT	Not yet available
RO	The methodology has been included in the frame of background documents in the WISE reporting. The document addressing the up-dated ecological potential definition has been recently elaborated and will be publicly available in the draft of 3rd RBM Plan.
SE	Regulation 1: https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/foreskrifter/register-vattenforvaltning/kartlaggning-och-analys-av-ytvatten-hvmfs-201720.html Regulation 2: https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/foreskrifter/register-vattenforvaltning/klassificering-och-miljokvalitetsnormer-avseende-ytvatten-hvmfs-201925.html National guidance: https://www.havochvatten.se/planering-forvaltning-och-samverkan/vattenforvaltning/nationell-vagledning/kraftigt-modifierade-vatten.html https://viss.lansstyrelsen.se/ReferenceLibrary/54310/Åtgärdsplan%20för%20Umeälvens%20avrinningsområde.pdf
SK	invertebrates method for EP assessment http://www.vuvh.sk/Documents/NRL/METODIKA_FINAL.pdf fish method for EP assessment: https://www.vuvh.sk/Documents/NRL/APVV160253_Metoda_hodnotenia_ekologickeho_potencialu.pdf https://www.vuvh.sk/Documents/NRL/APVV160253_Metodika_na_stanovenie_miery.pdf

15 Annex 2: Empty questionnaire

CIS ECOSTAT
European country Questionnaire on intercomparison of Ecological Potential of HMWB

The present questionnaire on the intercomparison of ecological potential has been developed by the GEP core group of ECOSTAT and its aims are to:
- Firstly, collect information on the methods for definition and assessment of ecological potential used in the Member States for the 3rd river basin management plans (RBMPs), as a basis for understanding the different approaches used,
- Secondly, compare approaches for definition and assessment of ecological potential, which are relatively well-developed and to some extent comparable to the step-wise approach described in CIS Guidance no. 37 (https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/d1d6c347-b528-4819-aa10-6819e6b80876/details).
It is expected that the experts who fill in the questionnaire are already familiar with the new CIS Guidance no. 37 on defining and assessing ecological potential.
Please read the instructions circulated together with the questionnaire, before replying to the different questionnaire sections.

This Questionnaire A collects information on the surface water category of **Rivers.** Separate questionnaires will be made available for collecting information on Lakes/reservoirs (Questionnaire B) and on Transitional/Coastal waters (TraC) (Questionnaire C).
Please note: If the selected HMWB is a reservoir, i.e. previously a river which now resembles a lake water category, responses should be provided in Questionnaire B “Lakes/Reservoirs” and not in Questionnaire A “Rivers”.

The questionnaire provides a common template to document the methods used for ecological potential definition and assessment in the 3rd RBMPs, using selected HMWB examples (case studies) to better illustrate the different steps. The selected examples should be HMWB that have been classified but they do not have to be fully developed ideal case studies on the definition and assessment of ecological potential. For countries with less developed methods for the 3rd RBMPs, the selected HMWB examples can be HMWB which have been classified using another preliminary approach.

Section 1 (General information on method used for definition and assessment of ecological potential) should be filled in by all countries which have designated HMWB in the specific water category.
After Section 1, two options are possible:
- If your method for ecological potential definition and assessment has one or more steps equivalent to the steps described in the CIS Guidance Document no. 37: you should fill in

Sections 3 and 4 (on the context and designation of the HMWB example) and Sections 5 to 17 (on each step).
- If your method does not include any step equivalent to CIS Guidance Document no. 37: you are asked to describe your approach in Section 2 of the questionnaire.
Section 18 (Lessons learned) should be filled in by all countries.

If you can provide more than one example of classified HMWB in the same water category (e.g. two examples of River HMWB with focus on different physical modifications), please fill in a separate questionnaire for each example.

In case you require further advice, please contact: eleftheria.kampa@ecologic.eu & wouter.van-de-bund@ec.europa.eu
Please return the filled-in questionnaire by 5th October **2020** at the latest to: eleftheria.kampa@ecologic.eu

Questionnaire on intercomparison of Ecological Potential of HMWB
Questionnaire A "Rivers"

For more in formation refer to the "Read Me" section

0,0	Country	
0,1	Contact Person	

1 - General Information

1 - General information on method used for GEP definition

ID	Question	Options	Answer	Explanation
1,1	The method for ecological potential definition and assessment for rivers which is described in this questionnaire:	is the official method in the country		
		is already developed and being used in 3rd RBMPs		
		is developed but still being tested in pilot cases; method will soon be applied in 3rd RBMPs		
		is in early stages of development and application in test cases not started yet - please explain if method will be applied in 3rd RBMPs		
		other		
1,2	Level of application of ecological potential definition method for rivers:	*select one answer from the options on the right*		

	1,3	Which approach for ecological potential definition does your method follow? *See instructions document for an overview of the reference approach and mitigation measures approach. For more detailed description, see Chapter 5.3.1 and 5.3.2 of CIS Guidance Document no. 37*	*select one answer from the options on the right*		
	1,4	Key references	Please provide links to the documents that describe your method for HMWB designation and ecological potential definition (also links to English translations if possible)		
	1,5	Does your ecological potential definition method include one or more steps that are equivalent to the different steps described in the CIS Guidance Document no. 37?	Yes – Please fill in next questions for each step separately		
			No, method has no equivalent steps – Please describe your approach in the Section 2 of this questionnaire		
	1,6	Step A. Identification of the closest comparable water category ***Step A. If this step is not covered by your method yet, please describe how you***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 5		

		plan to approach this WFD issue/principle in your method in the future and any challenges you may face			
			No, our method has no equivalent step – Please explain to the right		
	1,7	Step B1. Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body ***Step B1. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 6		
			No, our method has no equivalent step – Please explain to the right		

	1,8	Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment ***Step B2. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 7		
			No, our method has no equivalent step – Please explain to the right		
	1,9	Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum ***Step B3. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 8		
			No, our method has no equivalent step – Please explain to the right		

	1,10	Step C. Derivation of hydromorphological conditions for MEP ***Step C. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 9		
			No, our method has no equivalent step – Please explain to the right		
	1,11	Step D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type ***Step D. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 10		
			No, our method has no equivalent step – Please explain to the right		

	1,12	Step E. Derivation of BQE conditions for MEP ***Step E. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 11		
			No, our method has no equivalent step – Please explain to the right		
	1,13	Step F. Derivation of BQE conditions for GEP ***Step F. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 12		
			No, our method has no equivalent step – Please explain to the right		
	1,14	Step G. Derivation of supporting quality element conditions for GEP ***Step G. If this step is not covered by your method yet, please***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 13		

		describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face			
			No, our method has no equivalent step – Please explain to the right		
	1,15	Step H. Identification of mitigation measures for GEP ***Step H. If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 14		
			No, our method has no equivalent step – Please explain to the right		
	1,16	Monitoring to assess whether GEP is being achieved ***If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 15		

			No, our method has no equivalent step – Please explain to the right		
	1,17	Are there GEP measures that are disproportionally expensive or infeasible? ***If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 16		
			No, our method has no equivalent step – Please explain to the right		
	1,18	Implement GEP measures and monitor effects on BQEs and supporting quality elements ***If this step is not covered by your method yet, please describe how you plan to approach this WFD issue/principle in your method in the future and any challenges you may face***	Yes, our method has an equivalent step – Please also fill in questionnaire Section 17		
			No, our method has no equivalent step – Please explain to the right		

2 - Description of method in case of no equivalent steps to CIS no. 37

ID	Question	Options	Answer	Explanation
2,1	Description of method	Please describe your method for ecological potential definition and assessment, in case your method has no step equivalent to CIS Guidance no. 37		

3 - Description of HMWB selected for this questionnaire

3 - Description of HMWB selected for

ID	Question	Options	Answer	Explanation
3,1	Simple sketch of the selected HMWB example and its neighbouring water bodies.	Provide simple sketch with short description in words in separate file (Word, PPT or pdf) Indicate and number the distinct water bodies relevant for the decision-making on ecological potential definition ("WB 1, WB 2, WB 3 ...")		
3,2	Size (area or length) of water bodies in example/case study (refer to sketch)	Please refer to sketch		
3,3	Name of RBD	Provide name of RBD		
3,4	Which water body/bodies has/have been designated as HMWB in this case study?	Clearly indicate water body/bodies Example: e.g. water bodies 1-4 designated as HMWB; water bodies 5-7 as natural water bodies		
3,5	What is the current ecological potential or ecological status of the	Example: e.g. water bodies 1 and 2 good potential, water bodies 3 and 4 moderate potential, water bodies 5-7 good status		

		water bodies identified in this example/case study?			
	3,6	If the case study includes more than one HMWB, which HMWB has been selected as an example to describe ecological potential definition in this questionnaire?	Indicate selected HMWB		
	3,7	Water body type of selected HMWB (pre-modification reference condition)	Provide general description of river type		
	3,8	Please describe the selected HMWB according to WFD Typology Descriptors:	Ecoregion - *See Ecoregions shown on map A in WFD Annex XI*		
	3,9		Altitude / altitude class		
	3,10		Geology		
	3,11		Catchment area / catchment area class		
	3,12	Has typology system B been used for the characterization of the selected HMWB *If yes, please respond to the next question*	*select one answer from the options on the right*		
	3,13	If system B has been used, describe your river type	Example: e.g. Glacial-fed, small, intermittent gravel bed river		
	3,14	Has a river hydromorphological type been defined?	*select one answer from the options on the right*		

		If yes, please respond to the next question			
	3,15	If a hydromorphological type has been defined, please describe it	Example: e.g. single channel, sinuous, partly-confined gravel-bed river		
	3,16	Is the selected HMWB and neighbouring water bodies within natural fish zone or outside natural fish zone?	Example: e.g. WB 1, 2 - outside natural fish zone, WB 3,4,6, within natural fish zone		
	3,17	Biocoenotic region (cf Rhithron-Potamon concept)	Epirhithral		
			metarhithral		
			hyporhithral		
			epipotamal		
			metapotamal		
			hypopotamal		
	3,18	Are migratory fish species (diadromous or potamodromous species) relevant in the selected HMWB and in neighbouring water bodies? If yes, which species? * ***It should be noted that continuity measures are relevant for all fish species (not just medium/long distant migrators) and also for other biota (e.g. benthic invertebrates)***	Example: e.g. WB 3-5: Potamodromous		

	3,19	Are any protected habitats or species present? Is selected HMWB and neighbouring water bodies in WFD protected areas (Annex IV) e.g. Natura 2000?	Example: e.g. WB 3-6 in Natura 2000 area		
	3,20	What other key pressures (except hydromorphological ones) affect the selected HMWB?	Briefly name other key pressures		
	3,21	Other relevant information on the area surrounding the selected HMWB (e.g. type of land use on river banks and floodplain)	Example: e.g. forest or roads and railways		

Questionnaire Block: Steps for the definition of ecological potential

4 - Pre-step. Designation of HMWB & information from earlier planning cycles

4 - Pre-step. Designation of HMWB & information from ear-

ID	Question	Options	Answer	Explanation
4,1	Have the principles and steps of the CIS Guidance Document No.4 been used for the designation of the HMWB?	*select one answer from the options on the right*		
4,2	Has the designation of the HMWB been reviewed for the new (3rd) planning cycle? *(For more information, see check-list of issues for such a review in section 4.2 of CIS Guidance Document no. 37)*	*select one answer from the options on the right*		
4,3	How has it been assessed whether the water body is substantially changed in character (WFD Article 2(9)) (change in character must be extensive/widespread and profound)?	Use of specific thresholds and criteria (e.g. percentage of water body length or surface area irreversibly affected)		
		Use of specific hydromorphological assessment methods		

			Presence of structures without quantified criteria (e.g. presence of a dam)		
			Use of expert judgement on case-by-case basis without criteria		
			Other – please explain		
	4,4	Have any mitigation measures been in place prior to designation of the water body as HMWB?	*select one answer from the options on the right*		
	4,5	Is the selected HMWB a transboundary water body? *If yes, please respond to the next question*	*select one answer from the options on the right*		
	4,6	If selected HMWB is transboundary, has any action been taken to coordinate HMWB designation and definition of MEP/GEP with the neighbouring country(s)?	*select one answer from the options on the right*		
	Physical modifications and their effects				
	4,7	What is (are) the main physical modification(s) that led to the designation of the selected HMWB? Please choose from the "most common" physical modifications for rivers. If the main physical	***Most common physical modifications:***		

		modifications of your selected HMWB are not covered by the most common, please choose from “others”.			
			Channel straightening & channel deepening		
			Dam, weir, barrage or other transversal structure - river stretch with reduced flow velocity (impoundment), no lake		
			Bank protection (bank-perpendicular e.g. groynes, or bank-parallel, submerged or partly submerged, e.g. training walls, rip-raps, gabions)		
			Dam, weir, barrage or other transversal structure -reservoir/lake upstream of dam		
			Embankments, levees, dykes		
			Channel protection works (e.g. revetments)		
			Other physical modifications:		
			Selective bed stabilisation works (e.g. retention check dams or ground sills for erosion control)		
			Crossing structures (sub-surface: e.g. culverts)		
			Transversal structure for water abstraction without significant impoundment (e.g. weir, pumping station)		
			Hydropower plant with hydropeaking operation		

			Maintenance with habitat alteration and physical disturbance in the channel and riparian areas (e.g. through removal of sediments, removal of woody debris, removal of riparian vegetation)		
			Longitudinal structure for water abstraction (e.g. overflow weir, wells for bank filtration)		
			Laminar bed stabilisation works (e.g. armouring for erosion control)		
			Channel widening (e.g. through excavation)		
			Port, harbour, marina infrastructure (e.g. pontoons, moorings)		
			Additional flow from intra- or inter-catchment transfers		
	4,8	Which hydromorphological supporting elements have been directly or indirectly changed (adversely affected) as a result of the main physical modification(s)? Estimate the level of the effect of the main physical modification(s) for the different elements listed and provide a qualitative description of the main hydromorphological alterations.	Hydrology: quantity and dynamics of flow		
			Hydrology: connection to groundwaters		
			River continuity		
			Morphology: river width and depth		

			Morphology: river bed structure		
			Morphology: riparian zone structure		
			Please provide a qualitative description of the main hydromorphological alterations to the right *Example: e.g. Increased flow velocity with reduced flow diversity; Reduced hydromorphological dynamics (river and floodplain); Altered instream habitats; Altered substrate conditions (reduced diversity and dynamics, increased fine sediment input); altered hydrological conditions due to groyne fields; reduced bank diversity due to rip-rap etc*		
	4,9	What physico-chemical supporting elements have been adversely affected directly by the main physical modification(s), or indirectly as a result of changes to the hydromorphological character of the water body? Estimate the level of the effect of the main physical modification(s) for the different elements listed and provide a qualitative description of the main physico-chemical alterations.	Thermal conditions		
			Oxygenation		
			Salinity		

			Acidifcation		
			Nutrient conditions		
			Specific pollutants		
			Please provide a qualitative description of the main physico-chemical alterations to the right *Example: e.g. Increased water temperature, reduced oxygen concentration*		
	4,10	Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Estimate the level of the effect of the main physical modification(s) for the different elements listed and provide a qualitative description of the main ecological impacts.	Phytoplankton		
			Macrophytes		
			Phytobenthos		
			Benthic Invertebrate fauna		
			Fish fauna		
			Several/all BQE very likely affected, by expert judgement		

			Please provide a qualitative description of the main ecological impacts to the right *Example: e.g. Reduced species diversity (e.g. fish, benthic invertebrates); Reduced abundance / loss of rheophilic species (e.g. fish); Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of floodplain related species (e.g. fish)*		
	4,11	What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	*select one answer from the options on the right* Please also explain - e.g. the overall ecological status was "bad" based on benthic invertebrates (bad status), fish (poor status)		
	4,12	Is detailed monitoring data available on hydromorphological conditions and has overall hydromorphological status been assessed?	*select one answer from the options on the right* Please also explain - e.g. There are detailed monitoring data available on hydromorphological conditions such as flow, instream morphological features, substrate conditions etc, and overall hydromorphological status has been assessed as bad.		
	4,13	Is detailed monitoring data available on BQEs?	*select one answer from the options on the right* Please also explain - e.g. There are detailed monitoring data available on biological quality elements, providing detailed knowledge of the biological impacts especially on benthic invertebrates and fish.		

	4,14	Have biological assessment methods been used which are sensitive to hydromorphological alterations in rivers?	*select one answer from the options on the right* Please also explain - e.g. Biological assessment methods are used for fish and benthic invertebrates which are sensitive to hymo alterations in rivers.		
	Water uses				
	4,15	Which water use(s) was the selected HMWB mainly designated for?	Navigation; ports		
			Flood protection		
			Hydropower		
			Irrigation		
			Water supply		
			Recreation		
			Drainage		
			Urbanisation		
			Other		
	4,16	Which other water uses are present in the selected HMWB?	Navigation; ports		
			Flood protection		
			Hydropower		
			Irrigation		
			Water supply		
			Recreation		
			Drainage		
			Urbanisation		
			Other		
	Navigation - If selected HMWB is used for navigation, please provide information on the following:				

	4,17	Purpose of navigation	Commercial		
			Recreational		
			Military		
			Other		
	4,18	Intensity of navigation	Example: e.g. average number of ships, tonnage per day, number of passengers per day		
	4,19	Other relevant information	Please enter your text response on the right		
	Flood protection - If selected HMWB is used for flood protection, please provide information on the following:				
	4,20	Purpose of flood protection	Protection of urban areas		
			Protection of agricultural areas		
			Protection of infrastructure and traffic routes		
			Protection of cultural heritage		
			Other - please explain		
	4,21	Level of flood protection provided	Example: e.g. protection against a 50-year or 100-year flood		
	4,22	Other relevant information	Please enter your text response on the right		
	Storage for hydropower - If selected HMWB is used for hydropower, please provide information on the following:				
	4,23	Type of plant	*select one answer from the options on the right*		
	4,24	Head (m)	Please enter your text response on the right		
	4,25	Installed capacity (MW) (indicate range / choose from the categories provided)	*select one answer from the options on the right*		
	4,26	Other uses benefiting from storage scheme (e.g. irrigation, recreation)	Please enter your text response on the right		

	4,27	Other relevant information on the HP scheme	Please enter your text response on the right		
	Storage for water supply and/or irrigation scheme - If selected HMWB is used for water supply and/or irrigation scheme, please provide information on the following:				
	4,28	Abstracted volume (annual)	Please differentiate between water supply and irrigation, if necessary Example: e.g. 45 Mm3 per year for domestic water supply 30Mm3; 15Mm3 for irrigation)		
	4,29	Population supplied from storage scheme	Please enter your text response on the right		
	4,30	Agricultural area supplied from storage scheme	Please enter your text response on the right		
	4,31	Other users supplied with water from storage scheme	Please enter your text response on the right		
	4,32	Other relevant information on the water supply scheme	Please enter your text response on the right		
	Recreation - If selected HMWB is used for recreation, please provide information on the following:				
	4,33	Description of recreational use of water with relevance to the physical modifications of the HMWB	Please enter your text response on the right		
	Drainage - If selected HMWB is used for drainage, please provide information on the following:				
	4,34	Purpose of drainage	Land improvement and reclamation for agriculture		
			Land improvement for forestry		
			Land improvement for urban development		
			Protection of infrastructure and traffic routes		
			Other – please explain		

	4,35	Type of drainage infrastructure	Example: e.g. surface drainage, drainage ditch, culverts, subsurface drainage (tile drains, rubble drains or mole drains)		
	4,36	Other relevant information	Please enter your text response on the right		
	Urbanisation - If selected HMWB is used for urbanisation, please provide information on the following:				
	4,37	Description of urbanisation with relevance to the physical modifications of the HMWB	Please enter your text response on the right		

5 - Step A. Identification of closest comparable water category

ID	Question	Options	Answer	Explanation
5,1	Briefly explain your general method / approach to define what the closest comparable water category is.	Please enter your text response on the right		
5,2	What is the closest comparable water category for the selected HMWB in your case study?* ***ATTENTION:** If the selected HMWB is a reservoir, i.e. was a river which now resembles a lake water category, responses should be provided in Lakes/Reservoirs*	*select one answer from the options on the right*		

		questionnaire (see instructions to questionnaire)			

6 - Step B1. Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body

6 - Step B1. Identify mitigation measures

ID	Question	Options	Answer	Explanation
6,1	Briefly explain your general method / approach to identify mitigation measures for MEP	Please enter your text response on the right		
6,2	Which potential groups of mitigation measures were identified as appropriate for improving the conditions of the selected HMWB?	Fish migration aids		
		Environmental flow		
		Sediment management		
		Modification or management of operations or structures (e.g. sluices)		
		Riparian habitat enhancement		
		Improvement of in-channel diversity		

			Ecologically optimised maintenance		
			Increase habitat diversity; River depth and width variation improvement		
			Floodplains/off-channel/lateral connectivity improvement		
			Channel enhancement		
			Vegetation management / rehabilitation		
			Reduction negative effects of impoundment		
			Construction/technical measures to mitigate negative effects of hydropeaking		
			River bed rehabilitation		
			Re-opening of sub-surface rivers (in pipes)		
			Rehabilitation of physicochemical alteration, including mitigation of downstream effects		
			Improvement of sediment connectivity in between lake and river		
			Ecologically optimised fisheries management		
			Other – ***to be defined in explanation***		
	6,3	Were any of the potential groups of measures (see previous question) not expected to be relevant and ecologically effective in addressing the key ecological impacts in this water body?	Example: e.g. Group 1 Fish migration aids were not expected to deliver any significant ecological benefit due to a very short river reach within the fish zone upstream. Therefore they were left out from the selection of potential mitigation measures for MEP.		

	6,4	For each group of potential mitigation measures for MEP: What concrete practical measures did you consider for the MEP of the selected HMWB? How were these practical measures expected to contribute to improving hydromorphological conditions and conditions for BQEs?	Fish migration aids *Example: e.g. near-natural by-pass channel, fish pass and fish screen*		
			Environmental flow		
			Sediment management		
			Modification or management of operations or structures *Example: e.g. sluices*		
			Riparian habitat enhancement *Example: e.g. flatten shore zones, plant trees*		
			Improvement of in-channel diversity *Example: e.g. introducing large woody debris*		
			Ecologically optimised maintenance		
			Increase habitat diversity; River depth and width variation improvement		
			Floodplains/off-channel/lateral connectivity improvement		
			Channel enhancement		
			Vegetation management / rehabilitation		
			Reduction negative effects of impoundment		

			Construction/technical measures to mitigate negative effects of hydropeaking		
			River bed rehabilitation		
			Re-opening of sub-surface rivers (in pipes)		
			Rehabilitation of physicochemical alteration, including mitigation of downstream effects		
			Improvement of sediment connectivity in between lake and river		
			Ecologically optimised fisheries management		
			Other		
	6,5	Has the achievement of objectives in water bodies downstream and upstream of the selected HMWB been considered when identifying relevant mitigation measures for MEP (according to WFD Art. 4(8))? *Explain how.*	*select one answer from the options on the right*		
	6,6	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

7 - Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment

7	ID	Question	Options	Answer	Explanation

	7,1	Do you have a general or national method in place to assess adverse effects of mitigation measures on use or wider environment in your country?	*select one answer from the options on the right*		
	7,2	Does your method define the benefits of different water use(s) and the wider environment?	*select one answer from the options on the right*		
	7,3	Does your method define and quantify different types of adverse effects of mitigation measures on different water uses and wider environment?	*select one answer from the options on the right*		
	7,4	Does your method include specific criteria to define what is significant and what is not significant for each type of adverse effect?	*select one answer from the options on the right*		
	7,5	If your method does not include any specific criteria, how do you decide which adverse effects are significant and which are not significant? What is taken into account?	Please enter your text response on the right		
	7,6	For the selected HMWB: Were any of the mitigation measures identified in Step B1 excluded from MEP, because	*select one answer from the options on the right*		

		they have significant adverse effect on use (i.e. the uses for which the water body is designated and any other relevant uses) or wider environment?			
	7,7	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

8 - Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum

8 - Step B3. Select most ecologically

ID	Question	Options	Answer	Explanation
8,1	Briefly explain your general method / approach for selecting the most ecologically beneficial measures and taking into account the need to ensure best approximation to ecological continuum	Please enter your text response on the right		
8,2	Which of the mitigation measures were finally selected as the most ecologically beneficial (combination of) measures for the MEP of the selected HMWB?	Please enter your text response on the right		

	8,3	Did you have enough information and data available to assess whether the measures selected for MEP can deliver sufficient improvements to ecological functioning?	*select one answer from the options on the right*		
	8,4	How was the need to ensure best approximation to ecological continuum taken into account for the selection of MEP mitigation measures for this HMWB?	Please enter your text response on the right		
	8,5	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

9 - Step C. Derivation of

9 - Step C. Derivation of hydromorphological conditions for MEP

ID	Question	Options	Answer	Explanation
9,1	Briefly explain your general method / approach to derive hydromorphological conditions for MEP	Please enter your text response on the right		
9,2	Was it possible to derive the hydromorphological conditions for MEP for the selected HMWB?	*select one answer from the options on the right*		

	9,3	Have the following aspects been considered for deriving hydromorphological conditions for MEP for the selected HMWB?	Current hymo conditions altered by physical modifications		
			Prediction of the expected effects of mitigation measures defined for MEP		
			Reference conditions of the original water body type		
			Other aspects - Please explain		
	9,4	Have the derived hydromorphological conditions for MEP been used to identify or derive the closest comparable water body type for the selected HMWB? Please explain how	Yes – Please explain		
			No, other aspects were used to identify or derive the closest comparable water body type		
			No, no closest comparable water body type could be derived		
	9,5	The closest comparable water body type for the selected HMWB has been derived from the following:	Original natural water body type (prior to the physical modification)		
			Different water body type, after adopting the changed hymo conditions due to the HMWB modifications		
	9,6	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

10 - Step D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type

10 - Step D. Derivation of physico-chemical conditions for

ID	Question	Options	Answer	Explanation
10,1	Briefly explain your general method / approach to define physico-chemical conditions for MEP	Please enter your text response on the right		
10,2	Was it possible to derive the physico-chemical conditions for MEP for the selected HMWB?	*select one answer from the options on the right*		
10,3	Have the following aspects been considered for deriving physico-chemical conditions for MEP for the selected HMWB?	Closest comparable water body type		
		Effects of the modification(s) on physico-chemical elements		
		Effects of the mitigation measures for MEP on physico-chemical elements		
		Other aspects - Please explain		
10,4	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

11 - Step E. Derivation of BQE conditions for MEP

11 - Step E. Derivation of BQE conditions for MEP

ID	Question	Options	Answer	Explanation
11,1	Briefly explain your general method / approach to derive BQE conditions for MEP	Please enter your text response on the right		
11,2	Was it possible to derive BQE conditions for MEP for the selected HMWB? If not, please explain why.	*select one answer from the options on the right*		
11,3	For which BQE, have conditions for MEP been derived?	Benthic invertebrates		
		Fish fauna		
		Macrophytes		
		Phytobenthos		
		Phytoplankton		
		None		
11,4	Are all BQE covered which are relevant for the water category of the selected HMWB? If not, please explain why.	*select one answer from the options on the right*		
11,5	Have the following aspects been considered for deriving BQE conditions for MEP for the selected HMWB?	Closest comparable water body type		
		Effects of the hydromorphological modifications on BQE		

			Effects of the mitigation measures for MEP on BQE		
			Other aspects - Please explain		
	11,6	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

12 - Step F. Derivation of BQE conditions for GEP

12 - Step F. Derivation of BQE conditions for GEP

ID	Question	Options	Answer	Explanation
12,1	Briefly explain your general method / approach to derive BQE conditions for GEP.	Please enter your text response on the right		
12,2	Which classes of ecological potential do you assess?	Maximum		
		Good		
		Moderate		
		Poor		
		Bad		
12,3	How did you derive/define the classes of ecological potential (maximum, good, moderate, poor, bad)?	Assessment method of natural water bodies with adapted classes (e.g. good potential instead of moderate status)		
		Assessment method of natural water bodies with adapted metric values and/or class boundaries		
		New assessment method for heavily modified water bodies		
		Expert judgement		
		Other (please explain)		

	12,4	Was it possible to derive BQE conditions for GEP for the selected HMWB?	*select one answer from the options on the right*		
	12,5	For which BQE, have BQE conditions for GEP been derived for the selected HMWB?	Benthic invertebrates		
			Fish fauna		
			Macrophytes		
			Phytobenthos		
			Phytoplankton		
			None		
	12,6	Are all BQE covered which are relevant for the water category of the selected HMWB? If not, please explain why.	*select one answer from the options on the right*		
	12,7	How have “slight changes” in the values of BQEs been interpreted and applied as compared to the values found at MEP?	Please enter your text response on the right		
	12,8	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

13 - Step G. Derivation of supporting quality element conditions for GEP

13 - Step G. Derivation of supporting quality element conditions for GEP	ID	Question	Options	Answer	Explanation
	13,1	Briefly explain your general method / approach to derive derive supporting quality element conditions for GEP	Please enter your text response on the right		
	13,2	Hydromorphological quality element conditions for the GEP of the selected HMWB have been derived based on the following:	The BQE conditions for GEP (step F of reference approach route)		
			The effects from the assumed implementation of the mitigation measures for GEP on hymo quality elements, excluding those delivering only “slight changes” to biological conditions (step H of mitigation measures approach route)		
			Other – please explain		
	13,3	Have the following aspects been considered for deriving hydromorphological conditions for GEP of the selected HMWB?	Difference between BQE conditions of MEP (step E) and GEP (Step F)		
			Consideration of hydromorphological conditions for MEP (step C)		
			Consideration of ecological functioning, taking into account the need to ensure close to best approximation of ecological continuum		
			Other aspects		
	13,4	Do physicochemical quality element conditions for GEP of the selected HMWB correspond to the values for	Yes, they correspond for all parameters		

		good ecological status of the original natural river type?			
			No, they do not correspond for one or more parameters which are impacted by the hydromorphological alteration leading to HMWB designation		
			Other, explain		
	13,5	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

14 - Step H. Identification of mitigation

14 - Step H. Identification of mitigation measures for GEP

ID	Question	Options	Answer	Explanation
14,1	Briefly explain your general method / approach to identify mitigation measures for GEP	Please enter your text response on the right		
14,2	Mitigation measures for GEP for the selected HMWB have been identified based on the following:	the derived biological conditions and conditions for supporting quality elements for GEP (step F and G of reference approach route)		
		the set of mitigation measures identified for MEP (step B of mitigation measures approach route)		
		Other – please explain		
14,3	Which are the specific practical mitigation measures selected for	Fish migration aids *Example: e.g. near-natural by-pass channel, fish pass and fish screen*		

		GEP of the selected HMWB?			
			Environmental flow		
			Sediment management		
			Modification or management of operations or structures *Example: e.g. sluices*		
			Riparian habitat enhancement *Example: e.g. flatten shore zones, plant trees*		
			Improvement of in-channel diversity *Example: e.g. introducing large woody debris*		
			Ecologically optimised maintenance		
			Increase habitat diversity; River depth and width variation improvement		
			Floodplains/off-channel/lateral connectivity improvement		
			Channel enhancement		
			Vegetation management / rehabilitation		
			Reduction negative effects of impoundment		
			Construction/technical measures to mitigate negative effects of hydropeaking		
			River bed rehabilitation		
			Re-opening of sub-surface rivers (in pipes)		
			Rehabilitation of physicochemical alteration, including mitigation of downstream effects		
			Improvement of sediment connectivity in between lake and river		

			Ecologically optimised fisheries management		
			Other		
	14,4	To what extent is the list of GEP mitigation measures for the selected HMWB similar to the list of MEP mitigation measures?	The list of GEP measures is the same as for MEP but the GEP measures significantly differ from the MEP measures in intensity (extent)		
			The list of GEP measures is different than the list of measures for MEP, because certain MEP measures are not needed for GEP		
			Other, explain		
	14,5	If the list of GEP measures for the selected HMWB differs from the list of MEP measures (under step B), this is the case because:	Not all MEP measures are likely to be necessary to achieve BQE values for GEP		
			Certain MEP measures are assumed to deliver only slight improvements to ecology		
			Other reason – please explain		
	14,6	What is the spatial extent of the selected GEP mitigation measures for defining GEP of the selected HMWB?	Whole water body, 100% of length		
			Proportion of water body length/area – Please explain and indicate value e.g. 50 %		
			All potentially suitable locations for habitat enhancement		
			Proportion of potentially suitable locations for habitat enhancement – Please explain and indicate value e.g. 50 %		

			Others		
	14,7	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

Questionnaire Block: Implementation of measures to achieve GEP

15 - Monitoring to assess whether GEP is being achieved

15 - Mon-itoring to

ID	Question	Options	Answer	Explanation
15,1	Has the ecological condition of the selected HMWB already been monitored to assess whether the expected mitigation from existing measures has been	*select one answer from the options on the right*		

		delivered and whether GEP is being achieved?			
	15,2	What kind of monitoring and assessment methods were used to classify the current ecological potential?	Monitoring and assessment of BQEs with hydromorphology-sensitive methods		
			Monitoring and assessment of BQEs without hydromorphology-sensitive methods		
			Monitoring and assessment of hydromorphological (and physico-chemical) quality elements		
	15,3	How has the ecological potential of the selected HMWB been classified?	Selected HMWB is currently at GEP, therefore no further mitigation measures are implemented		
			Selected HMWB is at less than GEP, and GEP mitigation measures need to be implemented		
			Not possible to classify – please explain		
	15,4	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

16 - Are there GEP measures that are disproportionally expensive or infeasible?

16 - Are

ID	Question	Options	Answer	Explanation
16,1	Were there GEP measures for the selected HMWB that were	Yes - please explain which measures from the GEP list were disproportionally expensive		

		demonstrated to be disproportionally expensive?			
			No, none		
			Unclear – please explain		
	16,2	Were there GEP measures that were demonstrated to be infeasible?	Yes - please explain which measures from the GEP list were infeasible and give reasons of the infeasibility		
			No, none		
			Unclear – please explain		
	16,3	Do you assess whether measures are disproportionately expensive or infeasible at this stage in the process, i.e. when mitigation measures are to be implemented within the programme of measures to achieve GEP?	*select one answer from the options on the right*		
	16,4	If you do not assess whether measures are disproportionately expensive or infeasible at this stage in the process, please indicate when this assessment takes place	At an earlier stage in the process of defining and assessing ecological potential – Please explain		
			At a later stage in the process of defining and assessing ecological potential – Please explain		
			Other – Please explain		

	16,5	In case one or more GEP measures were ruled out because they are disproportionally expensive or infeasible, were the remaining measures still sufficient to achieve GEP?	Yes, remaining measures were sufficient to achieve GEP		
			No, remaining measures were not sufficient to achieve GEP but measures have been reviewed and re-designed to deliver GEP		
			No, remaining measures were not sufficient to achieve GEP and HMWB was classified as less than GEP (application of Art. 4.5 exemption)		
			Unclear – please explain		
	16,6	Were there questions you could not answer in relation to this step? If so, please explain.	Please enter your text response on the right		

17 - Implement GEP measures and monitor effects on BQEs and supporting quality elements

17 - Implement GEP

ID	Question	Options	Answer	Explanation
17,1	Which GEP measures for the selected HMWB have been or are being implemented as part of the RBMP programmes of measures?	Please enter your text response on the right		
17,2	Has any evidence from monitoring been collected already on their success?	Please enter your text response on the right		

	17,3	Have any changes been made to the mitigation measures on the basis of evidence from monitoring?	Please enter your text response on the right		
	17,4	Have other lessons been learned from monitoring?	Please enter your text response on the right		

18 - Lessons learned & further developments

18 - Lessons learned & further developments

ID	Question	Options	Answer	Explanation
18,1	What are your key lessons learned from applying your method on ecological potential definition on HMWB in your country?	Please enter your text response on the right		
18,2	Strengths of your method for ecological potential definition	Please enter your text response on the right		
18,3	Weaknesses of your method for ecological potential definition	Please enter your text response on the right		
18,4	Which steps of the approach on ecological potential definition, that is proposed in CIS Guidance no. 37, would you like to have more practical guidance and examples on?	Please enter your text response on the right		

	18,5	If you have started developing a new method to be applied in the future (after the 3rd RBMPs), please explain whether you intend to use CIS Guidance no. 37 in your new method or any alternative approach you are proposing.	Please enter your text response on the right		

7,8 Please fill in the table below for the uses considered in your general or national method on the assessment of significant adverse effects:

Water uses	What benefits from this use have you defined?	What types of effects of measures on this use have you defined?	What criteria are used for assessing each adverse effect on this use?	At which level/scale does the assessment take place?	When is an adverse effect significant? What threshold is used to decide whether the effect is significant or not?
Navigation					
Flood protection					
Storage for hydropower					

Storage for irrigation					
Storage for water supply					
Recreation					
Drainage					
Urbanisation					
Wider environment					