Intercomparison of ecological potential for Transitional and Coastal waters (TraC)

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Authors: Jelmer Cleveringa (Arcadis), Eleftheria Kampa (Ecologic Institute)

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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
QE	Quality element
SQE	Supporting quality element
TraC	Transitional and coastal waters

1 Introduction

1.1 Aims of intercomparison of ecological potential of HMWB in all water categories

CIS Guidance no. 37 (December 2019; [1]) 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 mechanism for improving compliance and consistency and assisting comparability of approaches between Member States. The main steps of the stepwise methodological framework of Guidance no. 37 are shown in the figure below. The CIS Guidance no. 37 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 [2].

The requirement for intercalibration of HMWB (WFD Annex V 1.4.1) implies that there is a need to ensure GEP classification methods comply with the WFD, and that classification results are comparable between EU Member States. Back in 2011 a concept paper on Intercalibration of GEP [3] 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.

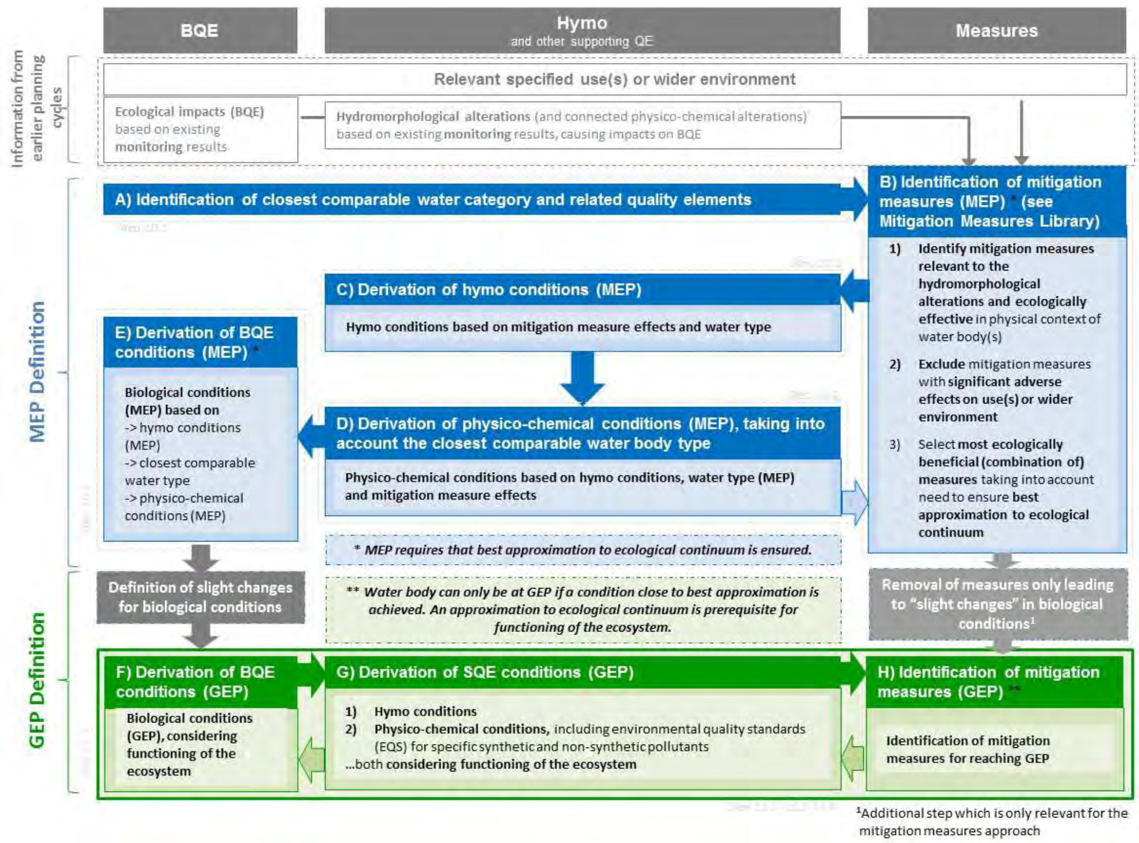
Section 7 of the Guidance no. 37 outlined the objectives of the intercomparison of ecological potential. The purpose is to describe and compare the national methods used to establish maximum and good ecological potential (MEP and GEP) on the basis of the requirements of the WFD. The comparability of Member State approaches will be facilitated by a review procedure which will be undertaken by the GEP core group of ECOSTAT. This will identify good practices, support good implementation of the WFD requirements regarding GEP, recognize progress through comparable approaches and 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 Transitional and Coastal Waters (TraC) for 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 stepwise 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.

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 stepwise 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 intercomparison for TraC heavily modified water bodies (compared to water categories Rivers, Lakes/Reservoirs)

From the outset of the intercomparison process it was clear that the information on ecological potential methods for TraC HMWB would differ from the information for the two other categories (Rivers, Lakes/Reservoirs). The reasons for the difference are threefold:

- There is a large natural diversity in transitional and coastal water bodies. The hydromorphological (including the sediment dynamics), biological and chemical characteristics vary to large degree, not only between but also within countries.
- There is a broad range of modifications that have led, alone or in-combination, to the designation of TraC water bodies as heavily modified.

- There is a limited number of HMWB in TraC in total in many Member States (some Member States do not have TraC waters).

The three aspects together make it difficult to compare the outcomes of the ecological potential definition for the few case studies provided in the TraC intercomparison questionnaires. Please note that this relates to the number of methodologies and cases in relation to the diversity of TraC waters and modifications.

Furthermore, a preliminary questionnaire in early 2020 on the methodologies for ecological potential definition had already revealed that the actual number of Members States that had a methodology in place or in an advanced stage of development for TraC HMWB was limited. To anticipate the limited number of respondents and the restricted information on ecological potential methods for TraC HMWB, the approach for their intercomparison differs from the approach used for Rivers and Lakes/Reservoirs.

1.3 Delineation of TraC waters and relation to HMWB designation and common physical modifications for TraC HMWB

The delineation and designation of water bodies as HMWB precede the stage of definition and assessment of ecological potential. In the intercomparison questionnaire for TraC HMWB, no questions have been included on the aspects of delineation and designation, contrary to the questionnaires on rivers and lakes/reservoirs. However, some remarks on the impact of delineation and designation are useful to understand the impact of these stages later on.

The delineation of coastal and transitional water bodies has resulted in very different sizes of water bodies for the Member States. Some water bodies are small and encompass a single bay (kilometer) while other water bodies are (very) large and cover an entire stretch of shoreline or a complete estuary (tens of kilometers). In general, these water bodies incorporate modifications that relate to their uses. The relative impact of the modifications is related to the size of the water body and that relates to the designation or not as HMWB. A modification of similar size (harbor, reclamation, …) may affect the entire water body or it may only impact on a small proportion of a large stretch of coast. In the first case, the modification is likely to lead to a designation as heavily modified, while in the second case this is less likely. In other cases, one modification (for instance the construction of a storm-surge barrier) dominates over the presence of other modifications (harbor infrastructure, embankments). Such diversity makes intercomparison difficult and hinders the transfer of insights from case studies to other situations.

In preparation for the intercomparison of methods for ecological potential definition, a preparatory mini-questionnaire on the nature of the modifications was sent out to ECOSTAT in early 2020. The main goal of this mini-questionnaire was to identify the most common physical modifications for TraC HMWB across European countries. The responses indicate that the most common physical modifications for TraC HMWB, being common in 40% or more of the countries, are:

- Constructed or raised dyke / levee / embankments
- Dredged for navigation, flood conveyance / maintenance dredging
- Revetment, erosion protection, reinforcement
- (Re)claimed land, reclamation
- Breakwater, groynes, jetties, piers

Slightly less common modifications, being common in 20-30% of the countries, are:

- Quay walls, vertical piling, docks
- Dams, sluices, weirs, barriers, barrages

1.4 Purpose and scope of this report

This report presents the results of the intercomparison of methods for defining and assessing ecological potential of heavily modified water bodies in Transitional and Coastal Waters (TraC).

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

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

- To give a preliminary description of approaches and methods used for defining GEP in TraC HMWB by the Member States.
- To identify whether and where there are commonalities and differences between Member States in the interpretation and implementation of the various steps of the Guidance no. 37 definition procedure for TraC HMWB.
- To identify the main gaps, unclear issues and challenges faced by the Member States. This includes the identification of steps that cannot be followed yet and a description of the explanations provided.
- To provide recommendations on the main aspects on which Member States need to take action and the main aspects where further information provision, discussion and guidance development at the level of ECOSTAT is needed for TraC HMWB.

It is noted that besides this intercomparison report for TraC HMWB, specific information on the hydromorphological assessment and monitoring methods in coastal and transitional waters with relevance for different steps in the ecological potential definition procedure can be found in [4].

1.5 Structure of report

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

Chapter 3 gives an overview of the methods reported, indicating which overall approach is used (reference approach, or mitigation measures approach, or combination) and the status of development of the methods.

Chapter 4 introduces in brief the HMWB examples/case studies which countries referred to when providing their responses on their methods in the TraC questionnaires for ecological potential definition.

Chapter 5 provides information on whether the national methods for defining ecological potential for TraC have equivalents to the steps outlined in CIS Guidance no. 37, including the pre-step for designation of HMWB and steps for defining MEP and GEP. It also informs on challenges highlighted in relation to the application of particular steps.

Chapter 6 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 7 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 includes descriptions of the TraC examples/cases provided in the questionnaires. Annex 2 provides the original responses of countries on distinct steps of the process for defining ecological potential for TraC. Annex 3 presents the blank questionnaire for TraC.

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

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 specific information are not listed in the relevant tables of the report.

It is also noted that all information in the report on the methods for ecological potential definition reflects the status of the methods as of autumn 2020 (submission of intercomparison questionnaires). We are aware that at the time of publication, methods may have been updated for certain countries, 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 for TraC HMWB

2.1 Scope of questionnaire

The questionnaire on the intercomparison of ecological potential of HMWB for TraC was circulated as a Word document to ECOSTAT in September 2020 and responses were collected between November 2020 and January 2021.

All Member States which designated and classified HMWB TraC in the 3rd RBMP cycle were requested to fill in this intercomparison questionnaire. The questionnaire was designed in a way to allow all Member States to respond, considering the fact that some Member States have less well-developed methods than others. The questionnaire was specifically written for TraC waters. It differs from the questionnaires for rivers and lakes/reservoirs because the results from the preparatory mini-questionnaire indicated that the methodologies for TraC waters were typically ad hoc or not mature (or comprehensive) enough to allow at this stage for the in-depth questions that comprise the questionnaires for rivers and lakes/reservoirs.

The responses to the questionnaire did not necessarily involve all questions. This depended on the degree to which the method corresponded to the different steps of the CIS Guidance no. 37.

2.2 Structure of intercomparison questionnaire for TraC

The questionnaire on the intercomparison of ecological potential of HMWB for TraC includes three sections in a Word document. 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).

1. The first section focuses on general information about the official methods for designation of TraC HMWB and the definition of ecological potential.
2. The second section is directed to the method (existing method, a new method or a reasonably mature method under development) for ecological potential definition in TraC HMWBs. The questions in this section reflect the steps of the CIS Guidance Document no.37 on the definition of ecological potential.
3. The third section of the questionnaire is dedicated to a case study of a particular TraC HMWB example, based on an existing, new or reasonably mature in-development method.

The empty form of the questionnaire on the intercomparison of ecological potential of HMWB for TraC can be viewed in Annex 3 of this report.

2.3 Responses from European countries

A total of 16 countries filled in and returned the intercomparison questionnaire of ecological potential of HMWB for TraC. The following table provides an overview with countries in alphabetical order.

Four countries (PL, LV, EE, SE) have not designated HMWB in their coastal and transitional waters and have therefore no method.

As explained in section 4, only a limited number of countries (7) were able to fill in the questionnaire with reference to a specific HMWB example/case study to illustrate the application of the method. No case studies could be provided by the remaining countries.

Table 1 Overview of submitted questionnaires

		Submitted TraC questionnaire	Reference to specific HMWB example/case	Notes
AT	Austria			No TraC water bodies
BE	Belgium	Not submitted		

		Submitted TraC questionnaire	Reference to specific HMWB example/case	Notes
BG	Bulgaria	Not submitted		Method in early stages of development
HR	Croatia	Yes	Yes	
CY	Cyprus	Yes		
CZ	Czechia			No TraC water bodies
DK	Denmark	Yes	Yes	
EE	Estonia			No transitional water bodies; no coastal water bodies designated as HMWB.
FI	Finland	Yes	Yes	
FR	France	Yes		
DE	Germany	Not submitted		
EL	Greece	Yes		
HU	Hungary			No TraC water bodies
IS	Iceland	Yes		
IE	Ireland	Yes		
IT	Italy	Yes		
LV	Latvia			No HMWB designations in TraC water bodies
LT	Lithuania	Yes	Yes	
LU	Luxembourg			No TraC water bodies
MT	Malta	Yes	Yes	
NL	Netherlands	Yes	Yes	
NO	Norway	Yes		
PL	Poland			No HMWB designations in TraC water bodies
PT	Portugal	Yes		
RO	Romania	Yes		
SK	Slovakia			No TraC water bodies
SI	Slovenia	Not submitted		
ES	Spain	Yes	Yes	
SE	Sweden			No HMWB designations in TraC water bodies
TK	Turkey	No response possible		
Total number of responses		**16**	**7**	

3 Overview of methods for definition of ecological potential in TraC HMWB

Status of method development & reflection of CIS Guidance no. 37

Eight European countries have a method already developed or being developed to define ecological potential for TraC HMWB for the 3rd RBMPs. The methods of six out of these eight countries were developed in previous river basin planning cycles, and for some of these (4) updates will be or have been made for the 3rd cycle. Five other countries are still developing methods to define ecological potential in TraC HMWB but these are not likely to be ready to be applied in the 3rd RBMPs. For one country, no method exists but will be developed for the 4th cycle.

Countries were also asked whether their existing methods reflect the contents of the new CIS Guidance no. 37 or whether they intend to use the Guidance when they update their method or develop a new one. The majority of countries whose method is in early stage of development or not started yet, indicate that they plan to use the principles in CIS Guidance no. 37. Similarly, for most methods existing from previous cycles, it is indicated that they have been or will be revised to reflect the contents of CIS Guidance no. 37.

Table 2 Status of method development

Q1 Situation with regard to definition of ecological potential for TraC HMWBs	
An official method was developed during previous river basin planning cycles and this will be used, unchanged, for the 3rd RBMPs	DK, NO
An official method exists from previous river basin planning cycles and will be/has been updated for the 3rd RBMPs	FI, EL, NL, RO
A method is developed but is still being tested in pilot cases; it is intended that the method will be applied in 3rd RBMP	HR, IE, LT
A method is in the early stages of development but is not likely to be ready to be applied in 3rd RBMPs	BG, IS, CY, FR, MT
No method exists but one will be developed for the 4th RBMP	PT
Other	IT*, ES**

Note: Status of the methods as of autumn 2020

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.

** IT: The "other" response of Italy relates to the methodology that is being presented to local authorities and an operational program that is currently being implemented.*

*** ES: The "other" response from Spain relates to the method provided by the Basque regional authority for the determination of GEP.*[1]

[1] Sources on Basque method: Borja, A., M. Elliott, 2007. What does `good ecological potential' mean, within the European Water Framework Directive? Marine Pollution Bulletin, 54: 1559-1564.

Borja, Á., G. Chust, A. del Campo, M. González, C. Hernández, 2013. Setting the maximum ecological potential of benthic communities, to assess ecological status, in heavily morphologically-modified estuarine water bodies. Marine Pollution Bulletin, 71: 199-208.

Table 3 Method reflection of the contents of CIS Guidance no. 37

Q3 Method reflection of the contents of CIS Guidance no. 37	
Existing method pre-dates the publication of CIS Guidance no. 37	DK, NL, EL, FI, NO
Existing method has been or will be revised to reflect the contents CIS Guidance no. 37	LT*, FI**, RO, EL***
New method has been developed in accordance with CIS Guidance no. 37	
It is intended to use CIS Guidance no. 37 when a new method is developed	IE, PT, CY, FR, MT, IT
Unclear whether CIS Guidance no. 37 will be used	HR****

Note: Status of the methods as of autumn 2020

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.

** LT: The criteria for the physico-chemical QEs (total nitrogen, total phosphorus and chlorophyll „a") are going to be revised next year, the applicability of the CIS Guidance no. 37 in this process is going to be assessed*

*** FI: The method mainly follows Guidance no 37. There are some slight differences.*

**** EL: The existing general method was developed in accordance with CIS GD No.4 but it reflects the contents of the CIS GD No.37. The update of the method for TraC HMWBs will be made in accordance with CIS GD No.37.*

***** HR: The method is developed only for six out of 15 candidates for HMWB, and for relevant biological quality elements. The method should be developed for other HMWBs, and it is not decided yet whether to use CIS Guidance no. 37 approach.*

Obstacles in the development of a TraC-method for ecological potential definition

Countries were also asked to comment about particular issues and obstacles they are facing when developing or planning to develop a TraC method for ecological potential definition. Obstacles mentioned include technical difficulties followed by a limited number of TraC HMWBs in the country. The diversity of TraC water bodies is also mentioned (wide diversity of physical/biological characteristics of TraC HMWB), as well as legal issues (not further specified in questionnaire response).

Approaches for ecological potential definition for TraC HMWBs

The majority of countries that answered this question follow the mitigation measures approach (7 of 13), or a combination of the mitigation measures approach with the reference approach (3 of 13). Only two countries indicate to use the reference approach to define ecological potential for TraC HMWB.

Table 4 Approaches to define the ecological potential in the national methods

Q4 Which approach for ecological potential definition do/will the methods follow?	
The reference approach is used (steps ABCDEFGH)	DK, ES
The mitigation measures approach is used (steps AB[CDB]HG(F))	FI, FR, EL, IE, MT, NL, NO
A combination of reference approach and mitigation measures approach is used	HR, IT, RO
A different approach is used	LT*

Note: Status of the methods as of autumn 2020

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.

** In Lithuania a different combined approach is used for defining the ecological potential, because there are no similar natural water bodies to the Klaipeda Strait (the only HMWB in the transitional water category) and the state of the Klaipeda Strait before modifications is unknown. Due to the hydromorphological alteration (embankments, dredging), no benthic QEs and criteria are applied for the GEP assessment, but only water physico-chemical QEs are taken into account (total nitrogen, total phosphorus, chlorophyll „a" and specific pollutants). The criteria for the physico-chemical QEs are used as those defined for the adjacent natural transitional water bodies, taking into account the variability of salinity The criteria for the physico-chemical QEs (total nitrogen, total phosphorus, chlorophyll „a") are going to be revised next year, but it is not certain that they will be included in the 3rd RBMP.*

Origin of TraC method compared to river methods

The majority (8) of the methods for ecological potential definition for TraC HMWBs are in essence similar to the methodologies used for rivers. Malta indicates that its method is conceptually different, which is related to the absence of rivers in Malta. The explanation for the three countries that have responded with "other" is given below Table 5.

Table 5 Origin of TraC method compared to river methods

Q6 Background of method	
The method is the same as applied to rivers but adapted to TraC waters	FI, FR, EL, IE, IT, NL, NO, RO
The method is or will be conceptually different from the method applied to rivers	MT
Other	HR*, DK**, LT***

Note: Status of the methods as of autumn 2020

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.

** Croatia: The assessment method in TraC waters is the same as for natural water bodies, only class boundaries are changed (eventually). Mitigation measures are considered in the method.*

*** Denmark: The method is applied to coastal waters only.*

**** Lithuania: The criteria for the physico-chemical QEs are used as those defined for the closest natural transitional water bodies, taking into account the variability of salinity. The criteria for marine and freshwater masses have been defined based on historical data, modeling, relation with phytoplankton, the criteria for mixed masses have been set based on the expert judgement.*

Extent of application of methods

The majority of countries (8) intend to apply the existing or evolving method for ecological potential definition for TraC HMWB at national level. Three countries apply the method reported in the questionnaires in part of the country (regional/basin level).

Table 6 Extent of application of methods

7 Extent of application of method development	
The method will be applied in the whole country (national level)	DK, FI, FR*, EL, IE, IT, MT, RO, NO

The method will be applied in part of the country (regional/basin level)	CY, HR, ES (Basque)
Other	LT**

Note: Status of the methods as of autumn 2020

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.

** France hopes to apply the method in the whole country, but it must take into account local/regional TraC WB particularities (wide diversity of TraC water body types at national scale, for example Mediterranean lagoons vs Atlantic macro- and meso-tidal environment).*

*** Lithuania: The method for assessment of GEP applies to the Klaipėda Strait, which is the only one HMWB in the TW category. There are no similar natural water bodies to the Klaipeda Strait.*

4 Examples/case studies on intercomparison of ecological potential for TraC

A limited number of six countries were able to contribute a HMWB example/case study to illustrate the application of their methods to define ecological potential for TraC. The other countries that reported having methods developed or in early stage of development could not illustrate yet their method by means of a specific HMWB example.

Table 7 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
HR, DK, LT, MT, NL, ES, FI	PT, RO, EL, IE, IT, NO, BG, IS, CY, FR

The following table gives a brief overview description of the TraC HMWB examples used in the intercomparison questionnaires with reference to the main uses, physical modifications, and ecological status/potential classification. Detailed descriptions of the HMWB examples/case studies are provided in Annex 1 of this report.

Table 8 Overview description of the HMWB case studies.

Country case	Main uses	Physical modifications	Ecological status at designation and classified ecological potential of HMWB
HR: Coastal water Port of Split O313-STLP	Substantially changed in character due to presence of structures without quantified criteria (use of expert judgement on case-by-case basis without criteria) Navigation (port) & Recreation (marinas; infrastructure) & Urbanisation including industry	Dredged for navigation, flood conveyance / Maintenance dredging Breakwater, groynes, jetties, piers Quay walls, vertical piling, docks (Re-)nourished: sand, mud Intakes, outfalls Hydromorphological changes in the Port of Split are the result of port activity, which includes the construction of the coast - piers and breakwaters, which affects the dynamics of water exchange, navigation, pollution and sediment uplift and siltation of the water column due to shipping.	Physico-chemical supporting elements that have been adversely affected by the main modification are increased turbidity, temperature and nutrients. Decreased dissolved oxygen. Selected BQEs were phytoplankton and macroalgae. Changes in phytoplankton abundance following changes in nutrients and/or turbidity; Reduced abundance / loss of (migratory) fish species; Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of angiosperms (seagrass) **Moderate ecological status** based on phytoplankton (good) and macrophytes (moderate). **Moderate potential**, the MEP corresponds to reference conditions in the closest comparable natural water body.

Country case	Main uses	Physical modifications	Ecological status at designation and classified ecological potential of HMWB
DK: Coastal water Ringkøbing Fjord	Flood protection, specifically protection of land reclamation by diking and drainage for agricultural use	Dam, sluice, weir, barrier, barrage The water exchange (between the North Sea and the Fjord) and the salinity of Ringkøbing Fjord is strongly influenced by the daily operation of the sluice, indicating that the ecosystem of the fjord is impacted as a result of the sluice and the operation of the sluice. The existing control of the sluice is assessed and found substantial. The effect of removal of the sluice has not been investigated further. It is assessed that GES cannot be reached unless the sluice is removed or kept open. Operational control of the sluice aiming at a certain salinity level in the fjord has been practice prior to the WFD	Physico-chemical supporting elements that have been adversely affected by the modification are decreased salinity and increased nutrient level. Main ecological impacts are a high phytoplankton biomass (chlorophyll-a) level, reduced Angiosperm distribution (depth limit), shift in benthic invertebrate community. **GEP=poor status**
LT: HMWB – Klaipeda Strait (WB1) Transitional water	The Klaipėda Strait with its modifications has served for the navigation and industrial purposes many decades Substantially changed in character due to presence of structures without quantified criteria (use of expert judgement on case-by-case basis without criteria) Navigation (port) & Urbanisation including industry	Constructed or raised dyke / levee / embankments Dredged for navigation, flood conveyance / Maintenance dredging Quay walls, vertical piling, docks The main modifications of the Klaipeda Strait: Dredging up to 12 m depth in 1990; reconstruction of piers in 2001-2002; dredging up to 15 m depth in the northern entrance channel and 12 m depth in the southern entrance channel in 2004; dredging up to 15.5 m depth throughout the navigation channel and the widening the turn circle; planning dredging up to 17 m depth in December 2020- 2021	Physico-chemical supporting elements that have been adversely affected by the main modification are Salinity, temperature and nutrients – due to the transitional character of the Klaipeda Strait and marine-freshwater water masses mixing; turbidity and specific pollutants – during the dredging, temporary alterations. Due to the dredging activities and unstable bottom environment biodiversity of zoobenthos is scarce (in the Klaipeda Strait mostly settle Oligochaeta, Polychaeta and Chironomidae). Criteria for zoobenthos and macrophytes QEs are not used for GEP assessment. The Klaipeda Strait is a fish migration route; dredging of port is forbidden during the fish migration period. No criteria for the hydromorphological supporting ele-

Country case	Main uses	Physical modifications	Ecological status at designation and classified ecological potential of HMWB
			ments and therefore no assessment of GEP with respect to hydromorphology **The ecological potential and ecological status vary between years from moderate to bad**
MT: MTC 105 - il-Port il-Kbir and il-Port ta' Marsamxett	Malta's Grand Harbour has been used as a port for centuries. The changes to the character of this series of bays and submerged valley systems is readily apparent in the extreme, particularly in comparison to pristine stretches of Malta's coastline. Consequently, no quantitative method/thresholds were needed with regards to its designation as a HMWB. Substantially changed in character due to presence of structures without quantified criteria (use of expert judgement on case-by-case basis without criteria) Navigation (port), Recreation (marinas; infrastructure) & Urbanisation including industry	Constructed or raised dyke / levee / embankments Dredged for navigation, flood conveyance / Maintenance dredging Revetment, erosion protection, reinforcement; (Re)claimed land, reclamation; Breakwater, Groynes, jetties, piers; Quay walls, vertical piling, docks; Pipelines, cables, etc.; Intakes, outfalls MTC 105 has been significantly altered from its natural state. The extent of the effect of the main physical modifications can likely be considered limited to the immediate harbour (/inlet) areas and possibly to the directly adjacent outer coastline. As harbours, numerous interventions are in place such as breakwaters, underwater tows and berms. All of these developments are by their very nature designed to alter hydromorphological conditions in the harbour areas. Specifically, they change the wave climate to improve conditions for the passage and mooring of vessels. They also likely lead to increased residence time and reduce water circulation and mixing. Most of the coastline within the harbours has also been artificialized through various modifications. These include developments such as	The supporting physico-chemical parameters related to nutrients, revealed that MTC 105 is particularly vulnerable to nutrient enrichment. However, longer-term data would need to be collated in order to be in a better position to confirm status (as per Malta's 2nd RBMP). It is posited that due to anthropogenic hydromorphological alterations, water residence times may be increased, and that circulation and mixing may be reduced, thus leading to an accumulation of nutrients within the sheltered and semi-enclosed harbour areas. The data collected so far indicates that the BQEs have not been adversely affected. However, re-designation of HWMBs and realignment of future monitoring programs may yield results of greater spatial resolution. The measures relevant to hydromorphological changes in these port areas that were identified under the first RBMP (2010-2015) as those that would not have an adverse effect on the wider use of the port were as follows: 1. Strengthen the existing environmental and planning regulatory processes to cater for the objectives of the WFD 2. The development and implementation of planning and environmental guidance on major coastal engineering works 3. Develop and implement a protocol for the disposal or reuse of dredged material from harbours.

Country case	Main uses	Physical modifications	Ecological status at designation and classified ecological potential of HMWB
		quays, jetties, piers, slipways, dry-docks and concrete platforms within the ports of Marsamxett and the Grand Harbour for various port related uses (transport, energy, defense, shipping, ship repair, marinas, etc.)	The overall ecological status (class) using methods for natural water bodies of the same type would be good **Moderate ecological potential**
NL: Haringvliet West Transitional water	Substantially changed in character due to presence of structures with-out quantified criteria: storm-surge barrier Flood protection and fresh water for drinking water and irrigation	Dam with one –way opening to let out river water and to prevent floods from sea under stormy conditions Constructed or raised dyke / levee / embankments; Revetment, erosion protection, reinforcement; (Re)claimed land, reclamation; Breakwater, groynes, jetties, piers; Dam, sluice, weir, barrier, barrage The dam is the main modification, the other changes are relatively minor (although still having effect)	Physico-chemical supporting elements that have been adversely affected by the main modification are increased turbidity, increased/decreased salinity. Main ecological impacts are Changes in phytoplankton abundance following changes in nutrients and/or turbidity; Reduced abundance / loss of (migratory) fish species; Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of angiosperms (seagrass) **The overall ecological status was "bad"** based on benthic invertebrates (bad status), fish (poor status)
ES (Basque) Oiartzun estuary Transitional water body	Substantially changed in character, determined by the use of specific thresholds and criteria (e.g. percentage of water body irreversibly affected). Assessment with use of expert judgement on case-by-case basis without criteria Navigation (port), Recreation (marinas; infrastructure)	Constructed or raised dyke / levee / embankments; Dredged for navigation, flood conveyance / Maintenance dredging; (Re)claimed land, reclamation; Quay walls, vertical piling, docks. Nearly 100% of the surface has been modified	Physico-chemical supporting elements that have been adversely affected by the main modification are due to the increased residence time, and the artificial deepening of the estuary. Therefore, salinity has increased (the total volume, related to the low river flow has increased), hence, oxygen has decreased, and turbidity increased. This, in addition to the waste discharges for years, affected the system. After the removal of discharges the situation has improved, but some changes (e.g. salinity) will be permanent. Due to the increasing residence time, phytoplankton abundance has increased, following changes in nutrients and/or turbidity after removal of the discharges; in general, resident fish have increased, since the estuary was previously intertidal and now has a

Country case	Main uses	Physical modifications	Ecological status at designation and classified ecological potential of HMWB
			large volume of water; for benthic invertebrates there was an increase of abundance of tolerant species, but this is changing after the removal of discharges and have recovered at some extent. There is also a change in the benthic community composition, from typical from intertidal habitats to subtidal It is supposed to have been in good status in the 19th century The overall ecological status when assessed using methods for natural water bodies of the same type would be „poor“. **The current ecological potential is moderate**
FI: WB1 Satama ja Ruissalon salmet Coastal Water	Substantially changed in character, determined by the use of specific thresholds and criteria (e.g. percentage of water body irreversibly affected). Navigation (port),	Dredged for navigation, flood conveyance / Maintenance dredging; Revetment, erosion protection, reinforcement; Breakwater, groynes, jetties, piers Loss and disturbance of natural habitats due to artificial structures in the port area (moderate/ major effect). Dredging in the port area and ship routes (major effect). Shipping affects the waterbody causing erosion (moderate/major effect), resuspension and transportation of sediments.	Physico-chemical supporting elements that have been adversely affected by the main modification are increased turbidity due to shipping. Nutrients and oxygenation more affected by wastewaters from the WWTP. There are contaminants in sediments, but their concentrations don’t exceed the national limits. Several/all BQE very likely affected, by expert judgement. Phytoplankton is in poor status, but mainly affected by nutrient loading from the WWTP and from river Aurajoki. Macroalgae nor monitored but likely adversely affected. Benthic fauna in good status in the waterbody, but likely affected in the port area. The overall ecological status when assessed using methods for natural water bodies of the same type would be „poor“, based on phytoplankton. **Ecological potential: poor**

5 Addressing the steps of CIS Guidance no. 37 for ecological potential definition

This section provides information on whether the national methods for defining ecological potential for TraC have equivalents to the steps outlined in CIS Guidance no. 37, including the pre-step for designation of HMWB and steps for defining MEP and GEP.

5.1 Pre-Step: Designation of HMWB

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.

According to responses to the TraC intercomparison questionnaire, the designation of TraC HMWB has followed the principles and steps of CIS Guidance Document no. 4 in most countries with such designations. Three countries (CY, IT and MT) indicated to have partly used the CIS Guidance Document no. 4.

The designation of TraC HMWB has been or will be reviewed for the new (3rd) river basin planning cycle by eight countries (of the 13 countries responding to this question).

Review of the designation in the 3rd planning cycle	
Yes	DK, FI, EL, IE, MT, NL, NO, RO
No	CY, FR, IT, LT, PT

Note: Status of the methods as of autumn 2020

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.

5.2 Steps for definition of MEP/GEP & implementation of measures to achieve GEP

5.2.1 Overview of step equivalence in methods

Most countries with a method to define ecological potential for TraC HMWB report having several steps that are equivalent to the steps of CIS Guidance Document no.37 for MEP/GEP definition and the implementation of measures to achieve GEP. The steps that have an equivalent in a lower number of country methods are the steps D and E on the derivation of physico-chemical and biological conditions for MEP definition as well as the check of GEP measures in terms of cost proportionality and technical infeasibility.

An overview of the number and abbreviations of countries that have or do not have an equivalent step in their method is given in Table 9 below.

Table 10 presents the reported step equivalence for each country separately. According to this table, three countries (EL, IT, RO) report having equivalents to all steps of Guidance no. 37 on MEP and GEP definition (see green cells in table). Also, Croatia and Denmark report having equivalent to all steps except one (step D on physico-chemical conditions for MEP in Croatia and step B2 on significant adverse effects in Denmark).

Table 9 Overview of countries with methods reported to have (Yes) or have not (No) an equivalent step

Step from CIS Guidance no. 37	Number of countries	Countries
Step A. Identification of the closest comparable water category		
Equivalent step	10	HR, IT, RO, DK, FI, EL, IE, LT*, NL, ES
NO equivalent step	1	NO
Step B1. Identify mitigation measures for MEP		
Equivalent step	9	HR, IT, RO, DK, FI, EL, IE, NL, NO
NO equivalent step	1	ES
Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment		
Equivalent step	8	HR, IT, RO, FI, EL, IE, NL, NO
NO equivalent step	2	DK, ES
Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum		
Equivalent step	9	HR, IT, RO, DK, FI, EL, IE, NL, NO
NO equivalent step	1	ES
Step C. Derive hydromorphological conditions for MEP		
Equivalent step	8	HR, IT, RO, DK, FI, EL, IE, ES
NO equivalent step	2	NL, NO
Step D. Derive physico-chemical conditions for MEP, taking into account the closest comparable water body type		
Equivalent step	6	IT, RO, DK, FI, IE, EL
NO equivalent step	4	HR, NL, NO, ES
Step E. Derive BQE conditions for MEP		
Equivalent step	7	HR, IT, RO, DK, FI, EL, ES
NO equivalent step	3	IE, NL, NO
Step F. Derive BQE conditions for GEP		
Equivalent step	8	HR, IT, RO, DK, FI, EL, IE, NL, ES
NO equivalent step	2	NO
Step G. Derive supporting quality element conditions for GEP		
Equivalent step	8	HR, IT, RO, DK, FI, EL, IE, NL
NO equivalent step	2	NO, ES
Step H. Identify mitigation measures for GEP		
Equivalent step	9	HR, IT, RO, DK, FI, IE, EL, NL, NO
NO equivalent step	1	ES
Monitoring to assess whether GEP is being achieved		

Equivalent step	8	HR, IT, RO, DK, FI, EL, NL, ES
NO equivalent step	2	IE, NO
Are there GEP measures that are disproportionally expensive or infeasible?		
Equivalent step	7	HR, IT, RO, DK, EL, IE, NL*, NO
NO equivalent step	3	FI, NL*, ES
Implement GEP measures and monitor effects on BQEs and supporting quality elements		
Equivalent step	8	IT, RO, DK, FI, EL, NL, NO, ES
NO equivalent step	2	HR, IE

Note: Status of the methods as of autumn 2020

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.

** LT: Only provided a response on step A.*

**NL The "Yes" answer to the question whether there GEP are measures that are disproportionally expensive or infeasible relates to future (2027 and later) plans.*

Table 10 Overview of step equivalence reported for methods per country & per step

	MEP definition							GEP definition			Implementation		
	Step A. Closest comparable water category	**Step B1. Relevant mitigation measures**	**Step B2. Ssignificant 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. Derivation of BQE conditions for GEP**	**Step G. SQE conditions for GEP**	**Step H. Mitigation measures for GEP**	**Monitoring to assess whether GEP is being achieved**	**GEP measures that are disproportionally expensive or infeasible?**	**Implement GEP measures & monitor effects on BQEs and SQEs**
Norway	No	Yes	Yes	Yes	No	No	No	No	No	Yes	No	Yes	Yes
Croatia	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Denmark	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Greece	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lithuania	Yes												
Netherlands	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Romania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spain (Basque)	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes
Nr. responses	11	10	10	10	10	10	10	10	10	10	10	10	10

Yes	Method is reported to have an equivalent step
No	Method is reported to have no equivalent step

Note: Status of the methods as of autumn 2020; 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.

5.2.2 Challenges on the use of specific steps

Countries that have an existing method, a new method or a reasonably mature method under development for ecological potential definition of TraC HMWBs were asked to provide short descriptions of their approach for applying particular steps equivalent to Guidance no. 37.

The original responses provided by countries per step can be viewed in Annex 2 of this report.

Overall, the number of descriptive responses per step was rather low to be able to draw generic conclusions on how particular steps are being interpreted in country methods or on the degree of their comparability. However, countries have indicated steps of Guidance no. 37 where more practical guidance and examples for TraC HMWB would be helpful. The main challenges mentioned for particular steps were the following[2]:

- Difficulties related to the assessment and quantification of the nature, extent and intensity of the physical modifications and their impact on BQEs.
- Challenges in the derivation of BQE conditions for MEP and GEP (steps E and F).
- More practical additional guidance and examples needed on steps related to the derivation of supporting quality element conditions and in particular of hydromorphological conditions to support GEP values for biological quality elements (step C, step G). It is not clear how to define GEP for hydromorphological conditions in a situation where the hydromorphology will remain modified hindering the development of benthic life.
- Challenges in assessing the relevance of mitigation measures.
- CIS Guidance no. 37 could describe the process more precisely, and in particular the 'close to best approximation of ecological continuum' could be more elaborated upon.
- Case studies in water bodies with multiple pressures (hymo and physico-chemical ones) would be very useful, taking into account all steps of Guidance no. 37.
- There is a need for more practical guidance and examples in particular for the implementation of the mitigation measure approach (all steps according to Guidance no. 37 from the alteration/pressure analysis, to the measures identification and GEP classification).

[2] Based on questionnaire question "*Which (if any) steps of the approach to ecological potential definition that is proposed in CIS Guidance no. 37, would you like to have more practical guidance and examples on for TraC HMWB's?* ".

6 Lessons learned by countries on the use of their methods

Countries were asked to comment on the key lessons learned from applying their methods so far on ecological potential definition for TraC HMWB, including strengths and weaknesses.

Strengths of methods which countries bring forward include the ability of the mitigation measures approach to identify socioeconomically viable mitigation measures to achieve GEP and to provide transparency on what is expected from the mitigation measures taken (e.g. in NL, MT, NO). Other countries refer to the ability of the method to relate to indicators and procedures used for natural water bodies (e.g., DK, IT).

However, several **challenges** still lie ahead and the main ones that still need to be tackled are listed below. It is noted though that these challenges are reported by the individual Member States and may be relevant only for their specific situation.

- Difficulties in the characterization and designation of HMWB
- Lack of well-developed systems for classifying hydromorphological conditions.
- Lack of sufficient knowledge on the links between hydromorphology and ecology in TraC waters. Water body monitoring (including where mitigation measures have been implemented) can enhance knowledge on these links as well as support the classification and assessment of ecological potential.
- Difficulty to disentangle hydromorphological pressures from other pressures in TraC water bodies.
- Variability in the GEP assessment due to unstable environment.
- Difficulties in estimating effects of mitigation measures. As an example, NL mentions that for transitional waters only expert judgement could be used (simply too few water bodies to use regression analysis or other statistical techniques. Also, the historical data are insufficient as major physical changes in the water system are made in their delta since the Middle Ages).
- Difficulty in implementing measures in TraC HMWB (practical conditions, scope of measures, costs).
- Complexity of mitigation measures approach raising difficulties even to experts to understand the logic and challenges in cooperation with stakeholders to interpret GEP.

The detailed responses provided by countries on lessons learned, strengths and weaknesses can be viewed in Annex 2 of this report.

7 Intercomparison discussion on the definition of ecological potential for TraC

7.1 Discussion

This report presents a preliminary description of approaches and methods used for defining GEP in TraC HMWB by the Member States (as of end 2020). The information in the responses varies to a great degree. A full intercomparison of the methods used to define the ecological potential for TraC similar to that for rivers and lakes/reservoirs is at the current stage not possible due to:

- The differences in the stage of development of the methods.
- The differences in the methods themselves, including the amount of data and information that is available for the assessments.
- The differences between the natural physical characteristics of water bodies, between types of modifications and between their impacts.

The number of HMWB examples/case studies provided by countries in the TraC intercomparison questionnaires is very limited. The case studies do contain valuable examples on the methods for the assessment of the ecological potential. Despite the limited number of cases, the diversity of the water bodies in the case studies is very large. This further highlights the broad range of TraC HMWB and the origin of their modification(s). The information in some of the case studies is very detailed (as in contrast to the information in some of the questionnaires).

Overall, the key messages that can be derived from the TraC intercomparison are:

- Fully developed methods for the definition of ecological potential of TraC HMWB are lacking in a relatively large number of Member States.
- The methods that have been developed and applied differ to a considerable extent.
- Most developed methods do follow several steps of CIS Guidance no. 37.
- The mitigation measures approach is favored over the reference method approach by most of the countries with an existing method or relatively mature method still in development.

Understanding the motivation for the selection of the approach by the Member States was not the aim of the questionnaire. It is therefore not possible to present the arguments for this selection. It is noted, however, that the use of the mitigation measures approach follows from a lack of reference water bodies, either because the hydromorphological and other characteristics of that water body are unique (e.g. case from Lithuania) or because the modification is unique (e.g. case from Netherlands). For the Member States that have or will have a method under development, more examples of the mitigation measures approach application may be most helpful.

Possible bias in the TraC case studies: The case studies presented by the Member States do not fully represent the most common physical modifications that have been identified in the preparatory mini-questionnaire filled in by ECOSTAT in spring 2020. Especially case studies with constructed or raised dyke / levee / embankments seem to be underrepresented in the HMWB examples provided for the intercomparison, as are case studies with revetments, erosion protection, reinforcement and (re)claimed land, reclamation. This may be due to the complete lack of case studies from larger estuaries that are in use for shipping, land reclamation and flood protection (amongst others) like the Elbe, Scheldt, Seine, Taag, etc. in the case studies provided in the intercomparison questionnaires. The same holds for coastal stretches with fluvial impact (deltaic areas of the Po, Rhone, Ebro etc.).

The case studies that have been presented by the Member States may not provide the required information for, or be representative of, large estuaries and other transitional water bodies.

Delineation and designation: Some of the problems in the intercomparison of ecological potential may result from the original (or reviewed) delineation and designation of the water bodies. Three of the case studies provided concern water bodies with harbors. For many coastal and transitional water bodies, the presence of harbors of similar or large size has not been recognized as the primary reason to designate them as heavily modified. The total size of the water body in comparison to the size of the harbor can be the reason for the differences in designations. The presence and impact of a major port will be relatively larger when the coastal water has been split into smaller water bodies. In other cases, one or multiple modifications (for instance the construction of a storm-surge barrier) dominate over the presence of a harbor.

Several obstacles arise from differences in delineation and designation. For instance, the scale at which the definition of the ecological potential takes place varies with the size of the water body. Further, examples/case studies may not be transferable to water bodies with a (very) different scale.

7.2 Conclusions and recommendations

The results from the intercomparison questionnaires on ecological potential definition in TraC HMWB allowed for the preliminary identification of some gaps, unclear issues and challenges faced by the Member States. These issues though will be clearer when the methods development have further progressed in a larger number of countries. The large number of Member States with a method ‘under development’ which have not specified their issues is an indicator of the challenges that TraC water bodies still present.

The responses in the questionnaires stress the need for further examples and illustrations of all steps of Guidance no. 37 at the level of ECOSTAT for TraC HMWB, in particular addressing the most common physical modifications present in this water category across Europe.

Focus should be on the mitigation measures approach as that seems best suited for TraC HMWB.

Attention should be paid to the absence of case studies with large estuaries and other transitions from the fluvial domain to the coast.

8 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, 2020.
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. Phelan, N., Rumley, J., Salas Herrero, F.2021.Hydromorphological assessment and monitoring methodologies in coastal and transitional waters. JRC technical report (in press)

9 Annex 1: TraC HMWB examples/cases

The information on the cases provided by the Member States have been included in this annex.

9.1 Croatia - Coastal Water Body Split Harbour (O313-STLP)

Coastal water bodies: 1. Port of Split, O313-STLP 2. The central part of the Kaštela bay, O313-KZ 3. The channel of Brač and Split, O423-BSK	
Size (area, length) of water bodies in example/case study (refer to sketch)	*O313-STLP = 0,63 km²* *O313-KZ = 34,09 km²* *O423-BSK = 614,11 km²*
Name of RBD	*Adriatic River Basin District*
Which water body/bodies has/have been designated as HMWB in this case study?	*Water body 1 designated as HMWB; water bodies 2 and 3 as natural water bodies*
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	*Water body 1 moderate potential, water body 2 and 3 good status.*
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?	*Port of Split, O313-STLP*
Original (pre-modification) category of the selected HWMB	*Coastal water.*
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)?	☒ Presence of structures without quantified criteria ☒ Use of expert judgement on case-by-case basis without criteria
Which water use(s) was the selected HMWB mainly designated for?	☒ Navigation; ports ☒ Recreation; marinas; infrastructure ☒ Urbanisation including industry
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Dredged for navigation, flood conveyance / Maintenance dredging ☒ Breakwater, groynes, jetties, piers ☒ Quay walls, vertical piling, docks ☒ (Re-)nourished: sand, mud ☒ Intakes, outfalls

Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	*Hydromorphological changes in the Port of Split are the result of port activity, which includes the construction of the coast - piers and breakwaters, which affects the dynamics of water exchange, navigation, pollution and sediment uplift and siltation of the water column due to shipping.*
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 extent 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.	☒ Turbidity*: moderate* ☒ Nutrient conditions*, moderate* ☒ Oxygenation*: moderate* ☒ Thermal conditions*: minor*
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ Macroalgae (seaweeds)*: moderate* *Selected BQEs were phytoplankton and macroalgae* e.g. Changes in phytoplankton abundance following changes in nutrients and/or turbidity; Reduced abundance / loss of (migratory) fish species; Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of angiosperms (seagrass)
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ Yes, *Sewage wastewater has been partially removed from the port of Split.*
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Moderate: *The overall ecological status was "moderate" based on phytoplankton (good) and macrophytes (moderate).*
Are monitoring data available on hydromorphological conditions?	*There are monitoring data available on tides, bathymetry, substrate and habitats.*
Has monitoring data been used to assess the hydromorphological status?	☒ No: T*he first morphological status (in 2018) was assessed by the preliminary examination of coastal and transitional waters, based generally on the naturalness of the coast and usage of the water bodies. Further monitoring plan is to be defined based on the results of the first hydromorphological status results.*
Are monitoring data available on BQEs?	☒ Yes: *There are monitoring data available on BQEs phytoplankton and macrophytes.*
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ Yes: *Biological assessment methods for phytoplankton and macrophytes which*

	are sensitive to hymo alterations (for example port structure, turbidity/ transparency) were used.
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ No, not exactly applied in this way. *The most steps were applied. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type, were not applied. For BQE impacted by hydromorphological changes, the MEP corresponds to reference conditions in the* ***closest comparable*** *natural water body. For BQE for which no impact by hydromorphological changes was found, the MEP corresponds to reference conditions in natural water body.* *Mitigation measures have not yet been implemented.*

The area of the town of Split and Split harbour is made of marl and sandstone (Eocene flysch) with pockets of bio-calcarenite and bio-calcirudite (limestones). It is a rock complex exposed to marked mechanical and chemical wearing, with cliffs formed due to the wave action. Split harbour has experienced intensive human impact at least from the Roman times (1700 years), since the construction of Diocletian's Palace in a natural bay in which Split harbour developed over time. For the purpose of stabilizing the coast, quays had been built from dressed limestone blocks (grey stone from the island of Brač), and from concrete in the 20th and 21st centuries. As the result, all the coast in Split harbour has been modified by human activities. The construction of piers and particularly of external breakwaters has modified and slowed down the exchange of water in the harbor. However, due to the need for ships with increasing draughts to enter into the harbour, the areas immediately next to the coast have been deepened (Figure 1).

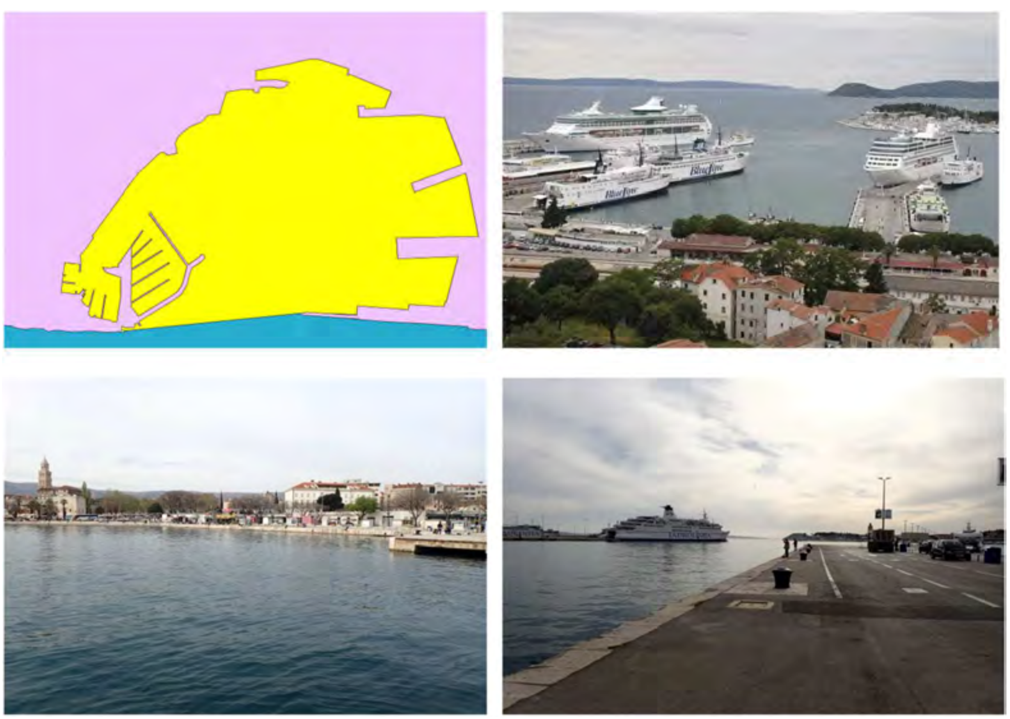


Figure 1. Scheme of Split harbour and images of coast modified by human activity

The hydromorphological modifications in Split harbour are the result of port activity which includes the development of the coast – piers and breakwaters, which affects the dynamics of water exchange, the process of navigation, pollution, and rising of the sediment and silting of the water column due to the movement of ships. It needs to be pointed out that in Split harbour there are also mineral springs present (in the northern part of the harbour (Matejuška)) containing hydrogen sulphur (H2S), which are now conveyed to the sewer system, giving it a characteristic odour, and can have a significant natural impact on the chemical characteristics of the seawater. Based on those changes in the hydromorphological characteristics, Split harbour is a candidate heavily modified water body (HMWB).

Figure 2. Water body O313-STLP, adjacent water bodies and similar parts of the water bodies

Such a reference water body which according to its hydromorphological characteristics, position, shape and exposure resembles Split harbour doesn't exist in the channel waters of the Middle Adriatic. For that reason, a hypothetic reference bay was defined. The status of communities, in particular of the species which are significant for a CARLIT analysis, was assumed based on the real current status and historical data for several similar areas nearby: 1) the Duilovo area in Split; 2) Voluja bay west of Vinišće; 3) the south-eastern side of Čiovo island.

Table 1. Ecological status of HMWB O313-STLP and adjacent water bodies – Physico-chemical quality elements

Water body	Water body code	Transparency						O2 saturation						Total inorganic nitrogen				
	Year	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
The northern part of Kaštela bay, Trogir bay, Marina bay	O313-KASP	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	GOOD	HIGH	HIGH	HIGH	HIGH
Kaštela bay	O313-KZ	GOOD		GOOD		GOOD		HIGH		HIGH		HIGH		HIGH		HIGH		HIGH
Brač and Split channels	O323-BSK	HIGH		GOOD		GOOD		HIGH		HIGH		HIGH		GOOD		HIGH		HIGH
Split harbour	O313-STLP*	GOOD		GOOD	GOOD	GOOD	GOOD	HIGH		HIGH		HIGH	HIGH	GOOD		HIGH	HIGH	HIGH
Water body	Water body code	Orthophosphates						Total phospohorus						Physico-chemical quality elements				
	Year	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
The northern part of Kaštela bay, Trogir bay, Marina bay	O313-KASP	HIGH	HIGH	GOOD	GOOD	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	GOOD	GOOD	GOOD	GOOD	GOOD
Kaštela bay	O313-KZ	HIGH		HIGH		HIGH		HIGH		HIGH		HIGH		GOOD		GOOD		GOOD
Brač and Split channels	O323-BSK	HIGH		HIGH		HIGH		HIGH		HIGH		HIGH		GOOD		GOOD		GOOD
Split harbour	O313-STLP*	HIGH		HIGH	GOOD	HIGH	HIGH	HIGH		HIGH	HIGH	HIGH	HIGH	GOOD		GOOD	GOOD	GOOD

Table 2 Ecological status of HMWB O313-STLP and adjacent water bodies – Biological quality elements

Water body	Water body code	Phytoplankton						Macrophytes (Posidonica oceanica)						Macrophytes (macroalgae)				
	Year	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
The northern part of Kaštela bay, Trogir bay, Marina bay	O313-KASP	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD			GOOD	GOOD				GOOD	GOOD	GOOD	GOOD
Kaštela bay	O313-KZ	GOOD		GOOD		HIGH								HIGH			GOOD	HIGH
Brač and Split channels	O323-BSK	GOOD		GOOD		HIGH		GOOD		GOOD				HIGH			GOOD	
Split harbour	O313-STLP*	GOOD		GOOD	HIGH	HIGH	HIGH							MOD.		MOD.	MOD.	BAD

Water body	Water body code	Macroinvertebrates						BIOLOGICAL QUALITY ELEMENTS						ECOLOGICAL STATUS				
	Year	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
The northern part of Kaštela bay, Trogir bay, Marina bay	O313-KASP	HIGH			GOOD			GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
Kaštela bay	O313-KZ							GOOD		GOOD	*GOOD*	HIGH	HIGH	GOOD		GOOD	GOOD	GOOD
Brač and Split channels	O323-BSK	HIGH						GOOD		GOOD	*GOOD*	HIGH		GOOD		GOOD	GOOD	GOOD
Split harbour	O313-STLP*	HIGH				GOOD		MOD.		MOD.	MOD.	BAD	BAD	MOD.		MOD.	MOD.	BAD

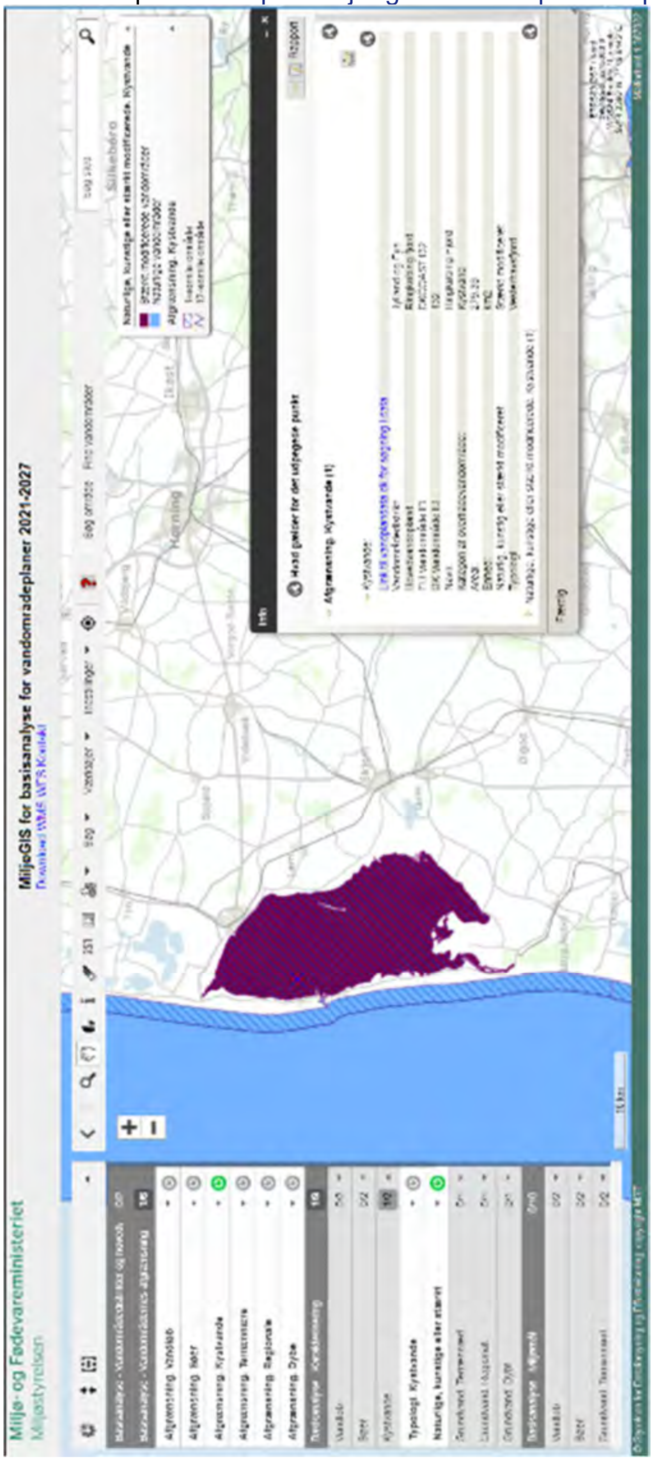
9.2 Denmark

Coastal water body Ringkøbing Fjord	
Size (area, length) of water bodies in example/case study (refer to sketch)	Area 280 km2
Name of RBD	Water district Jylland Fyn River basin Ringkøbing Fjord
Which water body/bodies has/have been designated as HMWB in this case study?	Ringkøbing Fjord
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	GEP=poor status
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?	Ringkøbing Fjord only
Original (pre-modification) category of the selected HWMB	Coastal water
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 expert judgement on case-by-case basis without criteria The expert judgement is supported by a semi-quantitative method consisting of a weighting of the significance of relevant physical pressures.
Which water use(s) was the selected HMWB mainly designated for?	☒ Flood protection Specifically, protection of land reclamation by diking and drainage for agricultural use.
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Dam, sluice, weir, barrier, barrage
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	The water exchange (between the North Sea and the Fjord) and the salinity of Ringkøbing Fjord is strongly influenced by the daily operation of the sluice, indicating that the ecosystem of the fjord is impacted as a

	result of the sluice and the operation of the sluice. The existing control of the sluice is assessed and found substantial. The effect of removal of the sluice has not been investigated further. It is assessed that GES cannot be reached unless the sluice is removed or kept open.
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 extent 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.	☒ Salinity*: **major**,* ☒ Nutrient conditions: ***major**,* decreased salinity and increased nutrient level.
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ Phytoplankton*: **major**,* ☒ Angiosperms (seagrass, saltmarsh) ***major**,* ☒ Benthic invertebrate fauna*: **moderate**,* ☒ Several/all BQE very likely affected, by expert judgement High phytoplankton biomass (chlorophyll-a) level, reduced Angiosperm distribution (depth limit), shift in bentich invertebrate community.
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ Yes –Operational control of the sluice aiming at a certain salinity level in the fjord has been practice prior to the WFD.
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Poor The overall ecological status (class) of the HMWB is actually assessed using methods for natural water bodies of the same type.
Are monitoring data available on hydromorphological conditions?	☒ Yes
Has monitoring data been used to assess the hydromorphological status?	☒ No The monitoring data and an advanced ecosystem model setup for the

	fjord allows simulations of different hydromorphological alterations. There are unfortunately no monitoring data or detailed information on the hydromorphological conditions from the situation before the establishment of the sluice in the 1930's. It is therefore difficult/unsecure to compare to a situation before the establishment of the sluice.
Are monitoring data available on BQEs?	☒ Yes –There are detailed monitoring data available on biological quality elements, providing detailed knowledge of the biological impacts.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ No, no methods are available
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ Yes

Sketch/map From https://miljoegis.mim.dk/spatialmap?profile=vandrammedirektiv3basis2019



9.3 Finland

Coastal water body WB1 Satama ja Ruissalon salmet	
Size (area, length) of water bodies in example/case study (refer to sketch)	Areas: WB1; 702 ha
Name of RBD	River Kokemäenjoki – Archipelago Sea – Bothnian Sea (RBD 3)
Which water body/bodies has/have been designated as HMWB in this case study?	WB 1 and WB 4 designated as HMWB; WB 2 and WB 3 as natural water bodies.
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	Water bodies 2 and 3 in poor status, waterbodies 1 and 4 poor potential.
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?	WB 1
Original (pre-modification) category of the selected HWMB	Coastal waters
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 irreversibly affected)
Which water use(s) was the selected HMWB mainly designated for?	☒ Navigation; ports
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Dredged for navigation, flood conveyance / Maintenance dredging ☒ Revetment, erosion protection, reinforcement ☒ Breakwater, groynes, jetties, piers
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	Loss and disturbance of natural habitats due to artificial structures in the port area (moderate/ major effect). Dredging in the port area and ship routes (major effect). Shipping affects the waterbody causing erosion (moderate/major effect), resuspension and transportation of sediments.
What physico-chemical supporting elements have been adversely affected directly by the main physical modification(s), or indirectly as a	☐ Salinity*: no effect*

result of changes to the hydromorphological character of the water body? Estimate the extent 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.	☒ Turbidity*: <u>major</u>,* ☒ Nutrient conditions*, <u>minor</u>,* ☐ Oxygenation*: <u>minor</u>* ☐ Thermal conditions*: <u>no effect</u>* ☒ Specific pollutants*: <u>minor</u>,* Increased turbidity due to shipping. Nutrients and oxygenation more affected by wastewaters from the WWTP. There are contaminants in sediments, but their concentrations don't exceed the national limits.
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ Several/all BQE very likely affected, by expert judgement Phytoplankton in poor status, but mainly affected by nutrient loading from the WWTP and from river Aurajoki. Macroalgae nor monitored but likely adversely affected. Benthic fauna in good status in the waterbody, but likely affected in the port area.
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ No
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Poor Biological status was "poor" based on phytoplankton (poor status).
Are monitoring data available on hydromorphological conditions?	☒ No –There are data available for example on bathymetry, substrate, freshwater inflow and morphometry.
Has monitoring data been used to assess the hydromorphological status?	☒ No –The hydromorphological status is checked on each assessment period.
Are monitoring data available on BQEs?	☒ Yes There are detailed monitoring data available on biological quality elements, providing knowledge of the biological impacts especially phytoplankton and on benthic invertebrates.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ No, no methods are available

	Only few studies exist on relationships between hydromorphology and biology.
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ Yes

The selected coastal HMWB ‘Sataman edusta ja Ruissalon salmet’

The HMWB 3_Ls_015 Sataman edusta ja Ruissalon salmet is situated on the southwest coast of Finland, off the city of Turku (Fig. 1). It belongs to inner archipelago coastal type. The area of the waterbody is 7 km2, and the mean depth is 3 m. On the eastern (inner) end the wb is confined to Turku city and harbor (Fig. 2). River Aura drains to the eastern part of the wb. Largest parts of the wb consists of sound ‘Pohjoissalmi’ between island Ruissalo and the mainland, and sound ‘Pukinsalmi’ between islands Ruissalo and Hirvensalo.

Proportion of transformed or constructed shoreline of the whole shoreline length of the wb is 30 %. Transformed and constructed shoreline is situated mainly in the inner part of the wb, on the harbour and city shores. Also the northern shore of Pohjoissalmi is mostly under harbour activities or otherwise modified.

Proportion of the altered area of the total wb area is 19 %. Due to the harbours (Turku city harbour and Pansio harbor, and military harbour in Pohjoissalmi), both Pukinsalmi and Pohjoissalmi and the harbour areas have been dredged. Maintenance dredgings are conducted at certain intervals.

Continuous shipping especially in Pukinsalmi causes shore erosion and resuspension from the bottom increasing turbidity.

The wb is HMWB only due to morphological alterations. Hydrological conditions and natural connection to sea are in good condition.

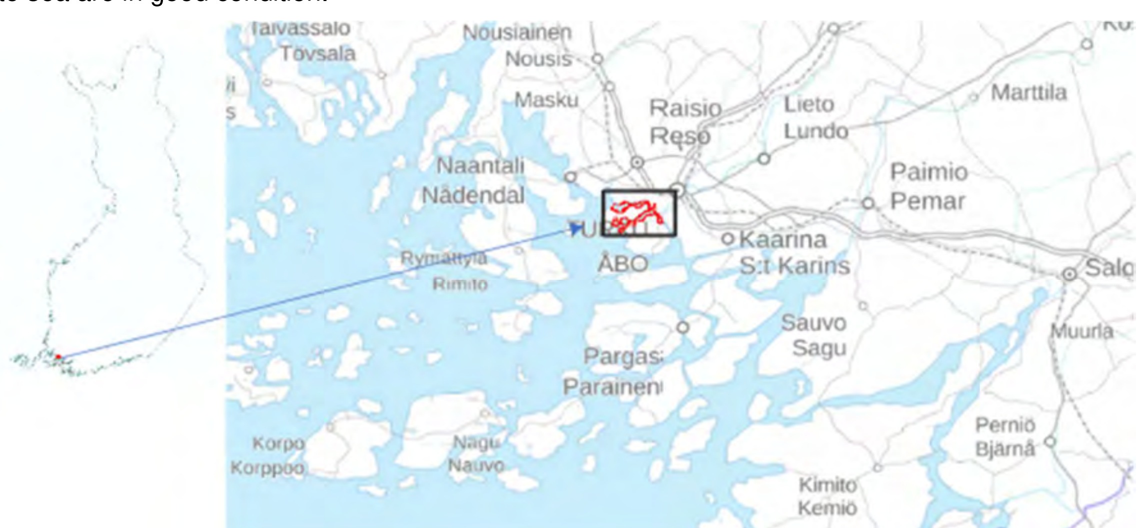


Figure 1. Location of the waterbody on the southwest coast of Finland, off the city of Turku (Åbo).

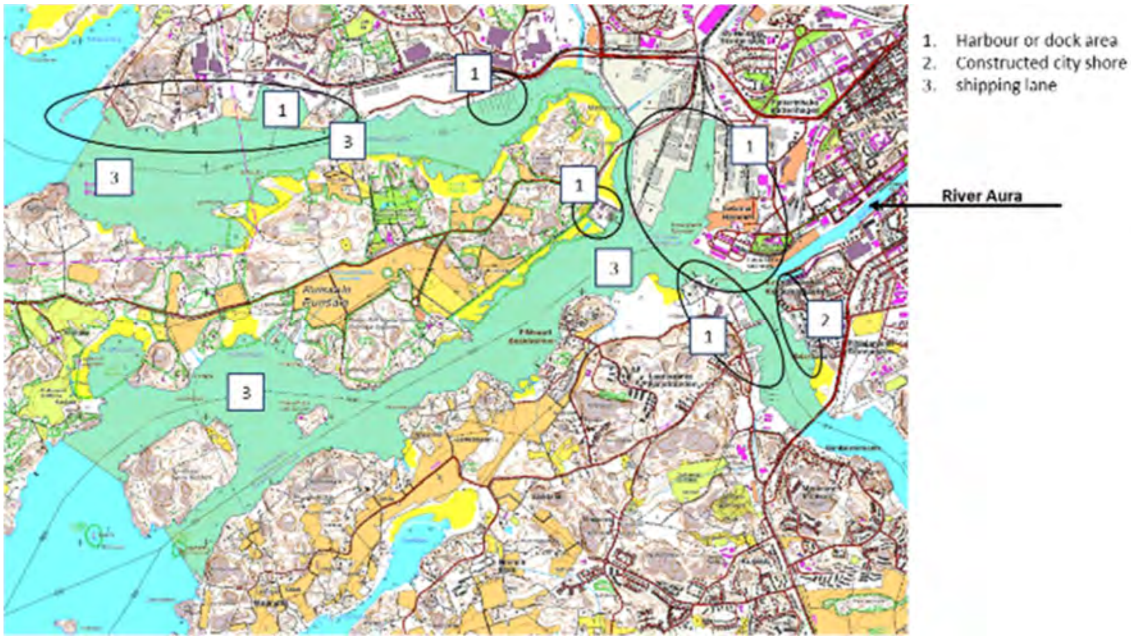


Figure 2. Harbour and dock areas, constructed city shores and shipping lanes in the highly modified water body Sataman edusta ja Ruissalon salmet (3_Ls_015).

9.4 Malta

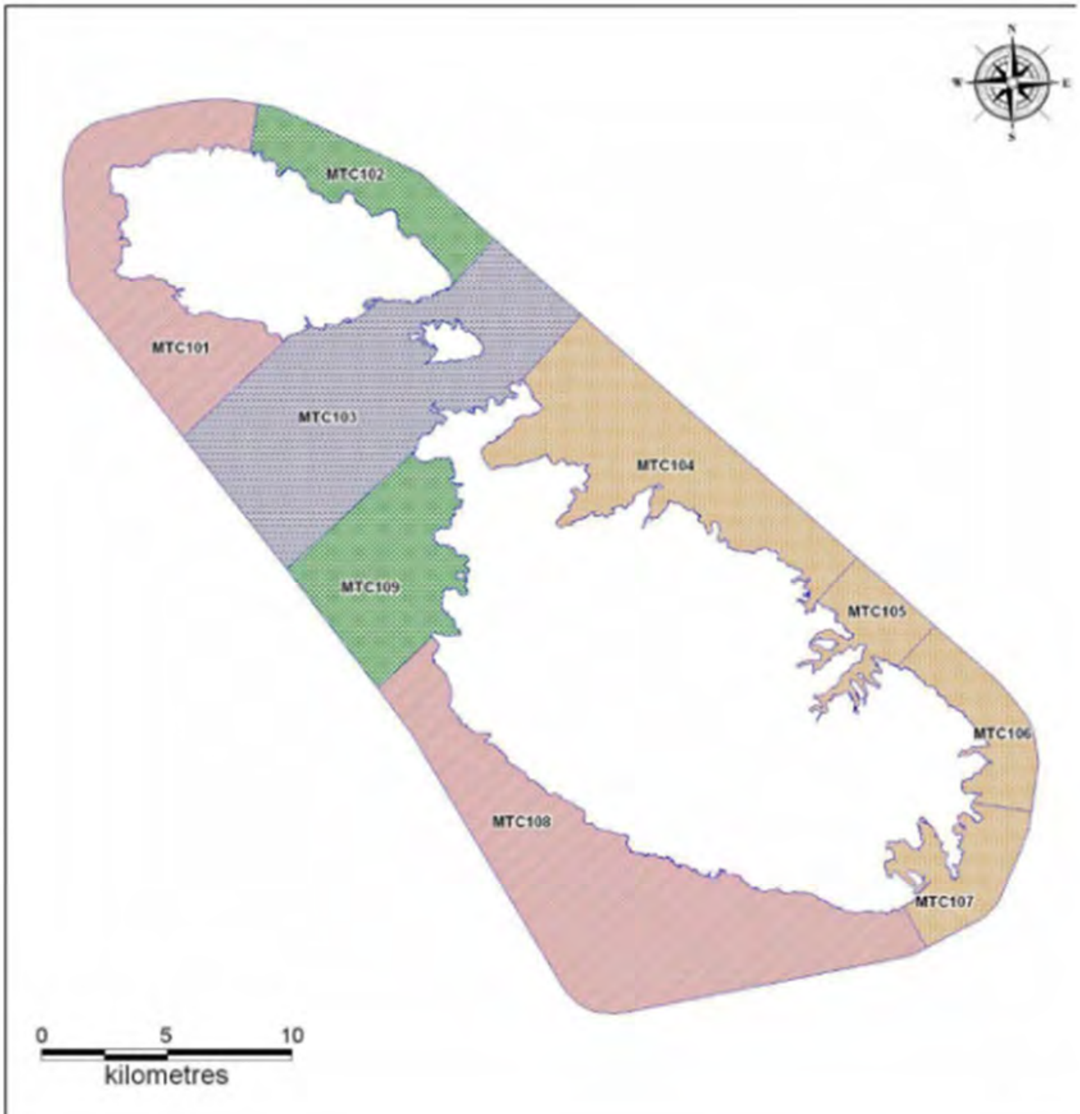
Coastal water body MTC 105 - il-Port il-Kbir and il-Port ta' Marsamxett	
Size (area, length) of water bodies in example/case study (refer to sketch)	Area: 13.34km^2 Length:
Name of RBD	All of Malta's waterbodies fall within a singular, national, RBD. The HMWB being presented as an example here, is 'MTC 105 - il-Port il-Kbir and il-Port ta' Marsamxett'.
Which water body/bodies has/have been designated as HMWB in this case study?	This case study considers the coastal water body of 'MTC 105 - il-Port il-Kbir and il-Port ta' Marsamxett', which has been designated as a HMWB. The other coastal HMWB, not being considered here, is 'MTC 107 - il-Port ta' Marsaxlokk'.
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	MTC 105 was listed as being moderate with regard to ecological potential, as of 2016 in the 2nd RBMP.
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?	The HMWB being presented as an example here, is 'MTC 105 - il-Port il-Kbir and il-Port ta' Marsamxett'.
Original (pre-modification) category of the selected HWMB	n/a
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)?	☒ Presence of structures without quantified criteria ☒ Use of expert judgement on case-by-case basis without criteria ☒ Other Malta's Grand Harbour has been used as a port for centuries. The changes to the character of this series of bays and submerged valley systems is readily apparent in the extreme, particularly in comparison to pristine stretches of Malta's coastline. Consequently, no quantitative method/thresholds were needed with regards to its designation as a HMWB.
Which water use(s) was the selected HMWB mainly designated for?	☒ Navigation; ports

	☒ Recreation; marinas; infrastructure ☒ Urbanisation including industry
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Constructed or raised dyke / levee / embankments ☒ Dredged for navigation, flood conveyance / Maintenance dredging ☒ Revetment, erosion protection, reinforcement ☒ (Re)claimed land, reclamation ☒ Breakwater, groynes, jetties, piers ☒ Quay walls, vertical piling, docks ☒ Pipelines, cables, etc. ☒ Intakes, outfalls
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	MTC 105 has been significantly altered from its natural state. The extent of the effect of the main physical modifications can likely be considered limited to the immediate harbour (/inlet) areas and possibly to the directly adjacent outer coastline. As harbours, numerous interventions are in place such as breakwaters, underwater tows and berms. All of these developments are by their very nature designed to alter hydromorphological conditions in the harbour areas. Specifically, they change the wave climate to improve conditions for the passage and mooring of vessels. They also likely lead to increased residence time and reduce water circulation and mixing. Most of the coastline within the harbours has also been artificialized through various modifications. These include developments such as quays, jetties, piers, slipways, drydocks and concrete platforms within the ports of Marsamxett and the Grand Harbour for various port related uses (transport, energy, defence, shipping, ship repair, marinas, etc.)
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?	☒ Nutrient conditions The supporting physico-chemical parameters related to nutrients, revealed that MTC 105 is particularly vulnerable to nutrient enrichment. However, longer-term data would need to be collated in order to be in a better position

Estimate the extent 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.	to confirm status (as per Malta's 2nd RBMP). It is posited that due to anthropogenic hydromorphological alterations, water residence times may be increased, and that circulation and mixing may be reduced, thus leading to an accumulation of nutrients within the sheltered and semi-enclosed harbour areas.
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	The data collected so far indicates that the BQEs have not been adversely affected. However, re-designation of HWMBs and realignment of future monitoring programs may yield results of greater spatial resolution.
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ No The measures relevant to hydromorphological changes in these port areas that were identified under the first RBMP (2010-2015) as those that would not have an adverse effect on the wider use of the port were as follows: 1. Strengthen the existing environmental and planning regulatory processes to cater for the objectives of the WFD 2. The development and implementation of planning and environmental guidance on major coastal engineering works 3. Develop and implement a protocol for the disposal or reuse of dredged material from harbours
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Good Malta is still in the process of re-evaluating the designation HMWB and associated monitoring processes. The 'good' status reported is in line with what has been reported by Malta in the second RBMP, noting however, that GEP was not established.
Are monitoring data available on hydromorphological conditions?	☒ No

	Knowledge improvement in hydromorphological conditions is being addressed through the development of hydrographical modelling as part of EU Funded Project LIFE 16 IPE MT 008 (Action C.16). This will enable further long-term monitoring of hydrographical conditions.
Has monitoring data been used to assess the hydromorphological status?	☒ No –Malta is working towards obtaining robust data and modelling on hydromorphology (as per reply to question above).
Are monitoring data available on BQEs?	☒ Yes Malta has monitored the BQEs for its coastal water bodies as per requirements under the WFD. The most recent comprehensive datasets were collected in 2017-2019 as part of EU Funded Project EMFF 8.3.1.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ No, no methods are available Data collected to date has indicated that Malta's BQEs are not linked to specific pressures and are thus not solely linked to hydromorphological changes.
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ No, not exactly applied in this way

The selected example HMWB is MTC 105, which includes Malta's Grand Harbour and the Marsamxett Harbour. Located and inset along the relatively shallower NE coastline of Malta, these extensive harbour areas are sheltered from Malta's characteristic and seasonal NE Grigal storms by the natural convolution of the coastline, and the presence of breakwaters and other such coastal defences.

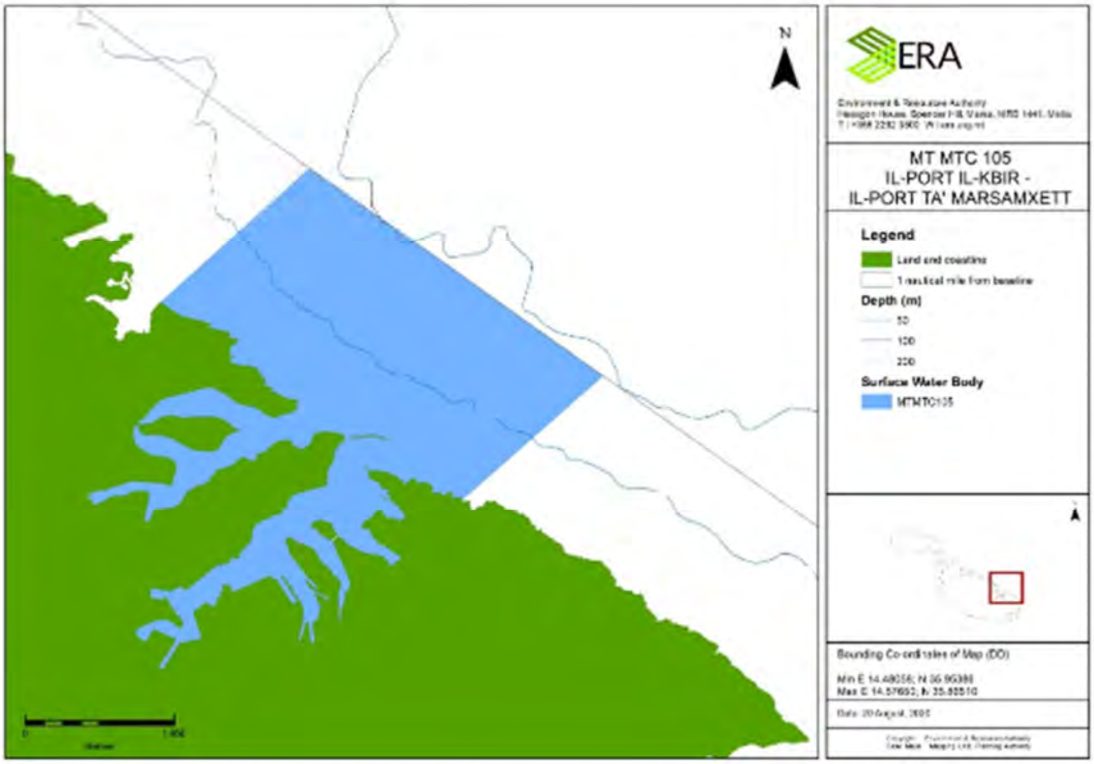


COASTAL WATER BODIES
(as in 2009)

Key

Typology

- Type I - Deep, very exposed
- Type II - Exposed, intermediate
- Type III - Exposed, intermediate to deep
- Type IV - Exposed, intermediate to deep waters with channel mix


N
ERA
Environment & Resources Authority
MT MTC 105
IL-PORT IL-KBIR -
IL-PORT TA' MARSAMXETT
Legend
Land and coastline
1 nautical mile from baseline
Depth (m)
50
100
200
Surface Water Body
MTMTC105
Bounding Co-ordinates of Map (DD)

9.5 Netherlands

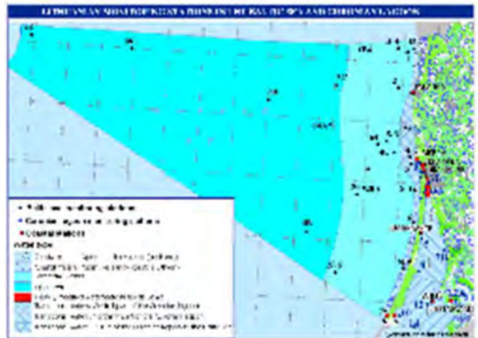
Transitional water Haringvliet West	
Size (area, length) of water bodies in example/case study (refer to sketch)	45.88 km²
Name of RBD	Rhine
Which water body/bodies has/have been designated as HMWB in this case study?	Haringvliet is used to be a transitional water but is dammed between sea and river. A part of the continuous body is separated and designated as HMWB of a most comparable type T category. The other part of Haringvliet is designated as HMWB but tidal River as most comparable type.
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	See above
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?	Only T part is described
Original (pre-modification) category of the selected HWMB	Dam with one –way opening to let out river water and to prevent floods from sea under stormy conditions
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)?	☒ Presence of structures without quantified criteria
Which water use(s) was the selected HMWB mainly designated for?	☒ Flood protection ☒ Other Fresh water for drinking water and irrigation
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Constructed or raised dyke / levee / embankments ☒ Revetment, erosion protection, reinforcement ☒ (Re)claimed land, reclamation ☒ Breakwater, groynes, jetties, piers ☒ Dam, sluice, weir, barrier, barrage

Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	The dam is the main thing, the other changes are relatively minor (although still having effect)
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 extent 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.	☒ Salinity*: major* ☒ Turbidity*: minor* e.g. Increased turbidity, increased/decreased salinity, …
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ Phytoplankton*:* major due to changes in salinity ☒ Phytobenthos*: see phytoplanktion* ☒ Angiosperms (seagrass, saltmarsh) *major* ☒ Benthic invertebrate fauna*:* major ☒ Fish fauna (only transitional water bodies)*: major* e.g. Changes in phytoplankton abundance following changes in nutrients and/or turbidity; Reduced abundance / loss of (migratory) fish species; Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of angiosperms (seagrass)
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ No or very limited
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Bad e.g. the overall ecological status was “bad” based on benthic invertebrates (bad status), fish (poor status)
Are monitoring data available on hydromorphological conditions?	☒ Yes –e.g. There are (detailed) monitoring data available on tides, bathymetry, substrate and habitats (including abundance/distribution of seagrass

	meadows, salt-marshes, inter-tidal flats, etc.), fresh-water inflow, …
Has monitoring data been used to assess the hydromorphological status?	☒ No –e.g. The monitoring data allows for a comparison of the situation prior to the hydro morphological alterations with the situation after.
Are monitoring data available on BQEs?	☒ Yes –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.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ Yes e.g. Biological assessment methods are used for fish and benthic invertebrates which are sensitive to hymo alterations.
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ Yes

Deelstroomgebied:	Maas	**Doeltype:**	O2
Waterbeheerder:	Ministerie van Infrastructuur en Milieu (Rijkswaterstaat)	**Status:**	Sterk Veranderd
Provincies:	Provincie Zuid-Holland	**Wateronttrekking t.b.v. menselijke consumptie:**	Ja
Gemeente(n):	Goeree-Overflakkee, Hellevoetsluis, Korendijk, Nissewaard	**Waterlichaamcode:**	NL94_11
Lengte (R-typen) of oppervlakte (M,K,O-typen):	45.88 km²		

9.6 Lithuania

HMWB – Klaipeda Strait (WB1), TW Northern part of the Curonian Lagoon (WB2, with the monitoring stations 5,7B and 8); TW Plume of the Curonian Lagoon water into the Baltic Sea zone (WB3, with the stations 3,4,5).	
Size (area, length) of water bodies in example/case study (refer to sketch)	WB1 – 6,59 km2 WB2 – 413 km2 (together with the central part of the Curonian Lagoon (with the stations 10, 12, 14) WB3 – 112,98 km2
Name of RBD	Nemunas RBD
Which water body/bodies has/have been designated as HMWB in this case study?	WB1 – HMWB, WB2, WB3 – natural WBs. All of them belong to the Transitional waters category
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	The ecological potential and ecological status vary between years from moderate to bad.
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?	
Original (pre-modification) category of the selected HWMB	The Klaipėda Strait with its modifications has served for the navigation and industrial purposes many decades.
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)?	☒ Presence of structures without quantified criteria ☒ Use of expert judgement on case-by-case basis without criteria
Which water use(s) was the selected HMWB mainly designated for?	☒ Navigation; ports ☒ Urbanisation including industr
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Constructed or raised dyke / levee / embankments

	☒ Dredged for navigation, flood conveyance / Maintenance dredging ☒ Quay walls, vertical piling, docks
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	The main modifications of the Klaipeda Strait: Dredging up to 12 m depth in 1990; reconstruction of piers in 2001-2002; dredging up to 15 m depth in the northern entrance channel and 12 m depth in the southern entrance channel in 2004; dredging up to 15.5 m depth throughout the navigation channel and the widening the turn circle; planning dredging up to 17 m depth in December 2020- 2021
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 extent 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.	☒ Salinity ☒ Turbidity ☒ Nutrient conditions ☒ Thermal conditions ☒ Specific pollutants Salinity, temperature and nutrients – due to the transitional character of the Klaipeda Strait and marine-freshwater water masses mixing; turbidity and specific pollutants – during the dredging, temporary alterations.
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ Macroalgae (seaweeds) ☒ Phytobenthos ☒ Angiosperms (seagrass, saltmarsh) ☒ Benthic invertebrate fauna ☐ Due to the dredging activities and unstable bottom environment biodiversity of zoobenthos is scarse (in the Klaipeda Strait mostly settle Oligochaeta, Polychaeta and Chironomidae). Criteria for zoobenthos and macrophytes QEs are not used for GEP assessment. The Klaipeda Strait is a fish migration route, however, dredging of port is forbidden during the fish migration period.

Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ Yes
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Moderate ☒ Poor ☒ Bad The overall ecological potential varies between years from moderate to bad
Are monitoring data available on hydromorphological conditions?	☒ Yes –Probably yes, in frame of the national monitoring, seaport monitoring
Has monitoring data been used to assess the hydromorphological status?	☒ No –The national monitoring, port's monitoring data and modeling allow for a comparison of the situation prior to any significant hydromorphological alteration with the situation after. However, we do not have any criteria for the hydromorphological supporting elements and therefore, do not assess GEP with respect to hydromorphology.
Are monitoring data available on BQEs?	☒ Yes –There are as much detailed monitoring data as possible on BQEs.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ No, no methods are available Only physico-chemical supporting elements for water layer and biological (chlorophyll "a") are used in GEP assessment
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ No, not exactly applied in this way – As it was described in the previous section – GEP was defined based on the physico-chemical and biological (chlorophyll "a") water quality elements and criteria applied for the closest natural transitional WBs.

9.7 Spain (Basque)

Oiartzun estuary

Size (area, length) of water bodies in example/case study (refer to sketch)	***Length: 5.5 km, size: 0.97 km^2, depth: 20 m, river flow: 4.8 m^3 s^{-1}***
Name of RBD	***Oiartzun estuary***
Which water body/bodies has/have been designated as HMWB in this case study?	It is a unique WB and is designed as HMWB because is a port
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	Moderate potential
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?	
Original (pre-modification) category of the selected HWMB	It is supposed to be in good status in the 19th Century (see the paper Borja et al., 2013, abovementioned)
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 irreversibly affected) ☒ Use of expert judgement on case-by-case basis without criteria
Which water use(s) was the selected HMWB mainly designated for?	☒ Navigation; ports ☒ Recreation; marinas; infrastructure
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	☒ Constructed or raised dyke / levee / embankments ☒ Dredged for navigation, flood conveyance / Maintenance dredging ☒ (Re)claimed land, reclamation ☒ Quay walls, vertical piling, docks
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	Near 100% of the surface has been modified
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?	☒ Salinity: major, ☒ Turbidity: moderate ☒ Nutrient conditions: moderate, ☒ Oxygenation: major,

Estimate the extent 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: minor ☒ Specific pollutants: major, Due to the increased residence time, and the artificial deepening of the estuary, salinity has increased (the total volume, related to the low river flow has increased), hence, oxygen has decreased, and turbidity increased. This, in addition to the waste discharges for years, affected the system. After the removal of discharges the situation has improved, but some changes (e.g. salinity) will be permanent.
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	☒ *Phytoplankton: major,* ☒ *Macroalgae (seaweeds): major,* ☒ *Benthic invertebrate fauna: major,* ☒ *Fish fauna (only transitional water bodies): major,* Due to the increasing residence time, phytoplankton abundance has increased, following changes in nutrients and/or turbidity after removal of the discharges; in general, resident fish have increased, since the estuary was previously intertidal and now has a large volume of water; for benthic invertebrates there was an increase of abundance of tolerant species, but this is changing after the removal of discharges and have recovered at some extent. There is also a change in the benthic community composition, from typical from intertidal habitats to subtidal
Have any mitigation measures been in place prior to designation of the water body as HMWB?	☒ Yes, but not for hydromorphology (it is not possible, being a port), but for waste discharges, which have been removed
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	☒ Poor Using the same boundaries as in natural WBs probably the general status should be a level lower, due to fishes and, partially, to macroinvertebrates
Are monitoring data available on hydromorphological conditions?	☒ Yes –We have plenty of data, as shown in the paper of Borja et al. (2013). There is very accurate data available on

	tides (a tidemeter installed in situ), updated bathymetry, data on substrate and habitats, fresh-water inflow, etc., under long-term monitoring (>25 yr)
Has monitoring data been used to assess the hydromorphological status?	☒ Yes - The monitoring data allows for a comparison of the situation prior to the hydro morphological alterations with the situation after, as shown in the mentioned paper of Borja et al. (2013).
Are monitoring data available on BQEs?	☒ Yes –There are detailed monitoring data available on phytoplankton and macroinvertebrates (since 1995), macroalgae (since 2002) and fishes (since 2002 and with previous data since mid-1990s) providing detailed knowledge of the biological impacts and the recovery after removing waste discharges
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	☒ Yes –In the case of the methods used to assess macroinvertebrates and fish, they have demonstrated the response to hydromorphological alterations
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	☒ Yes

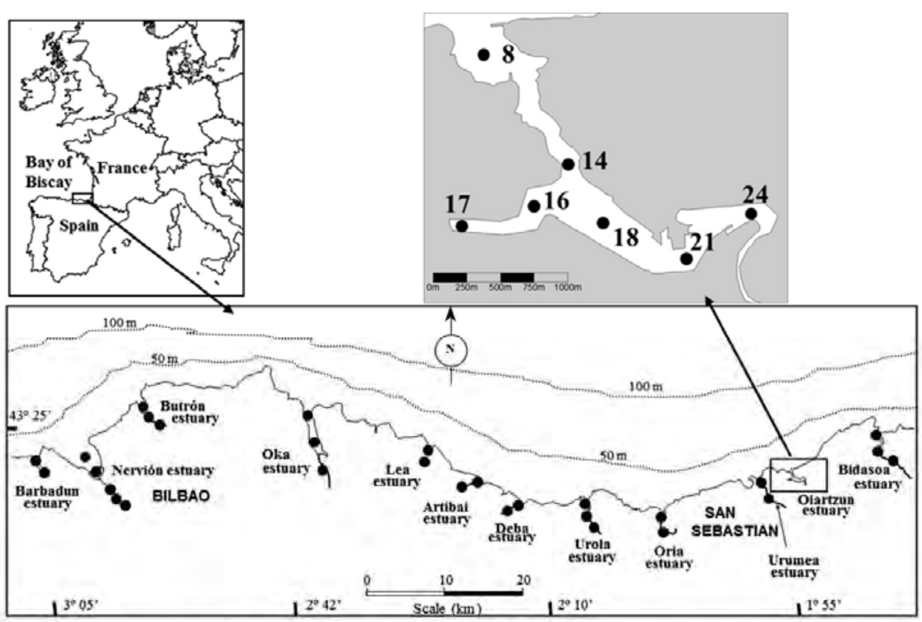


Fig. 1. The Oiartzun Estuary study area and sampling locations, within the Basque Country, showing also the position of the remaining estuaries included in the investigation of benthic metrics.

Borja, A. G. Chust, A. del Campo, M. González & C. Hernández. 2013. Setting the maximum ecological potential of benthic communities, to assess ecological status, in heavily morphologically-modified estuarine water bodies. *Marine Pollution Bulletin*, Vol. 71, p. 199-208

10 Annex 2: Original country responses per step

10.1 Step A. Identification of the closest comparable water category

Norway (NO) -

Croatia (HR) -

Denmark (DK) The designated HMWB coastal waters still have the character of coastal waters, but the typology has changed significantly as a result of the physical and hydromorphological changes. Thus, the closest water category to the HMWB is coastal water.

Finland (FI) This is done using expert judgement. For instance, imbounded coastal areas have been defined into the lake category.

Greece (EL) The closest comparable water category for every HMWB is defined in the 2nd RBMPs.

Ireland (IE) -

Italy (IT) -

Lithuania (LT) It should be noted, that the closest natural WBs are similar to the Klaipeda Strait in respect of water physico-chemical characteristics but not in respect of hydromorphology and benthical conditions (benthic flora and fauna). There are no similar natural water bodies to the Klaipeda Strait. The criteria for the physico-chemical and biological (chlorophyll „a“) QEs are used as those defined for the closest natural transitional water bodies, taking into acount the variability of salinity; three assessment methods exist for the marine (>4psu), freshwater (<2psu) or mixed (2-4 psu) water masses in the Klaipeda Strait. The criteria for marine and freshwater masses have been defined based on istorical data, modeling, relation with phytoplankton, the criteria for mixed masses have been set based on the expert judgement.

Netherlands (NL) -

Romania (RO): The identification of closest category is based on the recommendations of the Guidance no.37 which are compliant with the requirements of WFD Annex V 1.1.5, “the quality elements applicable to heavily modified surface water bodies shall be those applicable to whichever of the natural surface water categories most closely resembles the heavily modified water body concerned”.

Spain -Basque (ES) We compared our reference conditions with those from the closest natural WB in the same typology. We use similar natural WB in the same typology and reduce the boundary G/M by 15% in the HMWB.

Note: Status of the methods as of autumn 2020

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

Norway (NO) Relevant mitigation measures are being assessed.

Croatia (HR) Mitigation measures were taken into account when defining the MEP. Possible mitigation measures have been considered for hydromorphological alterations and their ecological effectiveness on the basis of expert judgment. Mitigation measures library was not used

Denmark (DK) The active regulation or control of sluices to maintain a certain level of salinity in the HMWB’s acts as the mitigation measure.

Finland (FI) Applicable measures are identified as well as the extent of applicability using expert co-operation, taking information from operators into account.

Greece (EL) In the method that was developed during the 2nd planning cycle, an indicative list of potential measures is given for each type of hydromorphological alteration. This list will be reviewed and updated.

Ireland (IE) Method in development

Italy (IT) -

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) Measures to mitigate the morphological alteration of the banks and measures to mitigate the alteration of aquatic habitats are considered

Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

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

Norway (NO) We do not implement mitigating measures that have significant adverse effect on use or wider environment.

Croatia (HR) The method includes this step and for six heavily modified water bodies covered by this method so far, mitigation measures with significant adverse effect on use were excluded (for example, navigation and port activities in the port of Split).

Denmark (DK) The relevant mitigation measure has already been implemented.

Finland (FI) There is no exact value or criteria for significant adverse effects. Instead, this is estimated for each case separately using expert judgement. For measures with significant adverse effects on use or wider environment, extent of measure with as high ecological effect as possible without significant adverse effects on use has to be estimated.

Greece (EL) There is no specific method in place. Assessment of adverse effects of any measures on use or wider environment is applied based on experts' judgement.

Ireland (IE) Method in development

Italy (IT) -

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) Mitigation measures which have significant adverse effect on use have been excluded from the very beginning /not taken into account at all.

Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

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

Norway (NO) Relevant measures may be to take into account water replacement, sediment transfer and biology

Croatia (HR) The MEP for hydromorphological conditions is derived from the hydromorphological conditions of the closest comparable natural water body, or the part of natural water body: existing or hypothetical using historical data.

Denmark (DK) The mitigation measure takes into account the continuum in relation to the passage of migratory fish species.

Finland (FI) Selection of beneficial measures include all measures that have no adverse effects on the use that have even a slight positive effect for ecology with the evaluated extent of implementation, and the measures with adverse effects that are optimised as follows. If several measures that have adverse effects on the use are selected, then the extent of each measure is optimised so that together they don't cause a significant adverse effect. If the number of measures that have adverse effects on the use is reduced, the ecological impact needs to be re-evaluated. For the final set of measures are selected the most effective measure(s) that have adverse effects in that extent that the level of significant adverse effect is very close, even if the effects of these measures are negligible for ecology. Next the combination of measures that in a best possible way improves the ecological status and without causing significant adverse effects on the important use are selected. Implementing these measures would result in that the water body would be in the best possible status for HyMo where it is crucial to implement all HyMo mitigation measures that don't cause significant adverse effects on the important use, that accomplish ecological continuum, takes into account sustainable/viable populations of biota that reproduce naturally.

Greece (EL) The existing proposed mitigation measures will be reviewed in relation to this Step.

Ireland (IE) At the moment this is based on expert judgement

Italy (IT) -

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) This step is not applicable in the case of CWs (to ensure the best approximation to ecological continuum)

Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

10.5 Step C. Derivation of hydromorphological conditions for MEP

Norway (NO) -

Croatia (HR) Hydromorphological conditions were assessed after the application of mitigation measures (for example removing of accumulated sediment with the aim of reducing the effects of turbidity).

Denmark (DK) MEP is defined in the same way as for REF based on the typologization.

Finland (FI) Hydrological conditions for MEP are derived using expert judgement (5-level scale). This is done in the database of SYKE for RBM. After description of the extent and number of all measures (written) into the RBM database, it is estimated how each individual measure impact

HyMo. This is done using 5-level scale: 0 = no change/impact, 1 = minor change, 2 = slight change, 3 = relatively large change, and 4 = large change.

Greece (EL) Hydromorphological conditions for MEP will be derived in the next planning cycle, based on predicted measure effects on the existing hydromorphological alterations and considering reference conditions of the original natural water body type.

Ireland (IE) Method in development

Italy (IT) Probably yes, in the framework of the simplified-reference-approach, for transitional waters only (except river mouths)

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) A method for evaluating the elements of hydromorphological quality was developed. The method took into account either NWB and HMWB (considering abiotic criteria, criteria that define the significance of hydromorphological pressures). For some hydromorphological indicators, the method considers BQE assessment to integrate the hydromorphological assessment with the biological one. Systems for assessing the values of hydromorphological quality elements are comparable for ecological potential and ecological status. The thresholds for the definition of MEP are assimilated with those that define / evaluate the hydromorphological indicator (for example for coastal waters the revised values that characterize the wave regime parameter are common for all typologies, and the revised values corresponding to the geomorphological elements are the same for the natural water body as for heavily modified water body (Cap Singol-Eforie Nord and Eforie Nord - Vama Veche)

Spain -Basque (ES) See the paper Borja et al. (2013) – Reference with the case study in Annex.

Note: Status of the methods as of autumn 2020

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

Norway (NO) -

Croatia (HR) For BQE impacted by hydromorphological changes, the MEP corresponds to reference conditions in the closest comparable natural water body.

For BQE for which no impact by hydromorphological changes was found, the MEP corresponds to reference conditions in natural water body.

Denmark (DK) MEP is defined in the same way as for REF based on the typologization.

Finland (FI) Physico-chemical conditions for MEP are derived using expert judgement (5-level scale). This is done in the database of SYKE for RBM. By implementing the identified group of mitigation measures the HMWB would be in MEP. After description of the extent and number of all measures (written) into the RBM database, it is estimated how each individual measure impact water quality. This is done using 5-level scale: 0 = no change/impact, 1 = minor change, 2 = slight change, 3 = relatively large change, and large change.

Greece (EL) The physico-chemical conditions for MEP are based, inter alia, on the hydromorphological conditions at MEP and the reference conditions associated with the closest comparable water type.

Ireland (IE) Method in development

Italy (IT) Probably yes, in the framework of the simplified-reference-approach, for transitional waters only (except river mouths)

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) For HMWBs, evaluation methods have been developed for the physico-chemical quality elements. For coastal waters, the general physico-chemical elements / parameters evaluated in terms of ecological potential are: transparency, pH, salinity, oxygen regime, nutrients (nitrates, nitrites, ammonium, orthophosphates) and silicates. The natural water type which most closely resembles the heavily modified is taken into account.

Spain -Basque (ES) We consider that the physico-chemical conditions in natural and HMWB must be the same

Note: Status of the methods as of autumn 2020

10.7 Step E. Derivation of BQE conditions for MEP

Norway (NO) -

Croatia (HR) For BQE impacted by hydromorphological changes, BQE conditions for GEP were derived by expert assessment of the MEP impact reduction factor. Impact reduction factor is implemented on class boundary.

Denmark (DK) MEP is defined in the same way as for REF based on the typologization.

Finland (FI) Finland uses the mitigation measures approach. In this context it is estimated what is the impact of each measure on the different quality elements (change in status): bottom fauna, macrophytes and water quality using a five-level scale. The impact of improvement in EQR is proportioned roughly using expert judgement. By implementing the identified group of mitigation measures the HMWB would be in MEP. There it is central to implement all HyMo mitigation measures that have not significant adverse impact on the use, to achieve ecological continuum, to only take into account sustainable/viable populations of biota that are adjusted/"naturalized" and reproduce naturally. After description of the extent and number of all measures (written) into the RBM database, it is estimated how each individual measure impact benthic invertebrates, macrophytes and fish. This is done using 5-level scale which is roughly proportioned into the change in ERQ: 0 = no change/impact (< 0.01 EQR), 1 = minor change (0.01-0.05 EQR), 2 = slight change (0.05-0.1 EQR), 3 = relatively large change (0.1-0.2 EQR), and large change (> 0.2 EQR). For coastal waters, this is largely done by expert judgement on the improvements of the number and quality of habitats, but also modelling, research results and areal estimates are utilised if available.

Greece (EL) BQE conditions for MEP are the reference conditions of the closest comparable type.

Ireland (IE) Method in development. Robust links between hydromorphological condition and BQE conditions have not been established. Following mitigation measures approach

Italy (IT) Probably yes, in the framework of the simplified-reference-approach, for transitional waters only (except river mouths)

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) For HMWBs, assessment methods for biological quality elements have been developed. The elements of biological quality specific to coastal waters, for which biological values have been obtained to define the maximum ecological potential are: phytoplankton, benthic invertebrates and other aquatic flora (macroalgae and angiosperms). Individual indices and multimetric indices are calculated for each of the biological elements, applying national methodologies specific for HMWBs. The evaluation systems for biological quality element values are comparable concerning ecological potential and ecological status. The natural water type which most closely resembles the heavily modified is taken into account.

Spain -Basque (ES) See the paper Borja et al. (2013) – Reference with the case study in Annex. We use a reduction of 15% in the H/G boundary for macroinvertebrates, macroalgae and fish.

Note: Status of the methods as of autumn 2020

10.8 Step F. Derivation of BQE conditions for GEP

Norway (NO) -

Croatia (HR) For physico-chemical elements for which the significant impact of hydromorphological changes has been assessed, derived conditions for GEP are slightly lower than those for GES.

Denmark (DK)

Finland (FI) The MEP assessment gives an estimate whether it results in a significant improvement. Next it is estimated whether the HMWB is already in GEP. If only a small impact/change (see step E explanation), then HMWB is already in GEP, if a relatively large change, then mitigation measures that have minor impact are left out. If ecological potential less than 'good' then selection of mitigation measures to PoM's. After that the impact of selected mitigation measures to BQE' is assessed using the five scale.

Greece (EL) If there are no biological monitoring data available, BQE conditions for GEP are derived based on hydromorphological data and mitigation measures

Ireland (IE) Method in development. Robust links between hydromorphological condition and BQE conditions have not been established. Following mitigation measures approach

Italy (IT) Probably yes, in the framework of the simplified-reference-approach, for transitional waters only (except river mouths)

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) See step E: The biological quality elements for which biological values have been defined, are derived from the their values at MEP, considering the slight change deviation (in order to define good ecological potential).

Spain -Basque (ES) See the paper Borja et al. (2013) – Reference with the case study in Annex. We use a reduction of 15% in the H/G boundary for macroinvertebrates, macroalgae and fish.

Note: Status of the methods as of autumn 2020

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

Norway (NO) -

Croatia (HR) The method includes this step, but for six heavily modified water bodies covered by this method so far, no measures were identified.

Denmark (DK) MEP is defined in the same way as for REF based on the typologization

Finland (FI) Estimation done using 5-level scale on the impacts of mitigation measures on GEP (estimation of change in status; done as for MEP).

Greece (EL) Physico-chemical conditions correspond to the values for good ecological status of the closest comparable type.

Ireland (IE) Method in development, will need to address this step

Italy (IT) Probably yes, in the framework of the simplified-reference-approach, for transitional waters only (except river mouths)

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) An assessment method for hydromorphological quality elements has been developed. The method considered NWB but also HMWB (having in view abiotic criteria, criteria which defines the significant character of hydromorphological pressures. The hydromorphological quality elements for which the hydromorphological values defines GEP is assessed in the same line with MEP by taken into account/referring to the indicator which defines the significant character of the pressure (considered in the designation of HMWB). The evaluation systems for hydromorphological quality element values are comparable for ecological potential and ecological status.

Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

10.10 Step H. Identification of mitigation measures for GEP

Norway (NO) According to the mitigation method approach. GEP equals all realistic mitigating measures that do not have an adverse effect on use or the larger environment.

Croatia (HR) Mitigation measures were identified for MEP, and GEP is defined as a slight deviation of BQE from the value for MEP

Denmark (DK) The mitigation measure is already known and implemented.

Finland (FI) If the status of water body is less than GEP, then measures to improve it are identified. Classification gives basis for the planning of measures and also advices whether the emphasis should be directed to measures improving water quality or HyMo status. If the impact of selected group of measures for HyMo status improvement is estimated to be minor, then for PoM's can be considered to be selected cost-efficient measures from the selected group of measures to improve ecological status, but this is not necessary. If the impact of selected group of measures for HyMo status improvement is estimated to be larger than minor, then measures need to be selected for PoM's. For PoM the most cost-efficient measures are selected whereas those measures that have only a minor impact on the ecological status can be left out from the identified group of measures. Measures that contribute to ecological continuum should always be included if their contribution is higher than minor to improve natural life cycle of biota. Finally, the impact of all identified measures together to BQE's, water quality and HyMo is estimated using a 5-scale approach. There is also a need to propose measures to improve water quality, if water quality of the HMWB is less than good.

Greece (EL) Priority will be given to measures that address the hydromorphological alteration such that the biological quality elements can recover naturally (alone or in combination with other measures).

Ireland (IE) Method in development. Mitigation measures approach

Italy (IT) -

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) The RO approach is in line with the recommendations of Guideline no. 37. 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.

Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

10.11 Monitoring to assess whether GEP is being achieved

Norway (NO)

Croatia (HR) Existing data from transitional and coastal waters monitoring were used in assessing GEP.

Denmark (DK) Monitoring and classification of status is the same as for natural coastal waters (GEP=GES).

Finland (FI) Monitoring is done at the mitigation measures level, not at BQE level. Monitoring and assessment of BQEs with hydromorphology-sensitive methods. There is not yet RBM level monitoring, but several studies are in process.

Greece (EL) his assessment will be available within the next planning cycles.

Ireland (IE) Currently developing a draft methodology to GEP definition. No GEP specific monitoring programme in place as the relevant POMs have not been finalised or implemented.

Italy (IT) -

Lithuania (LT) -

Netherlands (NL) -

Romania (RO) Monitoring and evaluation of biological, physico-chemical and hydromorphological elements. Monitoring data are provided by the national monitoring network. Coastal water monitoring is done in coastal monitoring sections / stations, as well as 5 m, 10 m and 20 m wide isobate sections

Spain -Basque (ES) We monitor regularly each BQE.

Note: Status of the methods as of autumn 2020

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

Norway (NO) Examples: modify existing jetties, bridges and other structures.

Croatia (HR) There are such measures like separation of ship traffic, addition of breakwaters, transplantation of sea grass, etc.

Denmark (DK) It has been assessed that the changes in the hydromorphological characteristics of the water bodies that are necessary to achieve good ecological status will have significant negative effects on the water regulation by the sluices, protection against flooding and drainage. Removal of the sluices or change in the control of the sluices will have an impact on drainage in the catchment area of the water bodies with an increased risk of floods. Furthermore, the useful purposes of the sluices cannot reasonably be achieved by other means due to disproportionate costs and which are a significantly better solution from an environmental point of view.

Finland (FI) Disproportionate costs are not analysed as part of the GEP assessment. However, the initial screening of measures to reach GEP, includes selection of measures that are technically and economically feasible. The assessment of disproportionate costs may be conducted in a later stage of defining programme of measures and setting environmental objectives for the water bodies and should include assessments of benefits/cost-effectiveness.

Greece (EL) The assessment of the dispropotionality and the infeasiblitiy of the measures will be part of the determination of the proposed reviewed list of measures for GEP.

Ireland (IE) Method in development. Relevant POMs have not been finalised. Italy (IT) - Lithuania (LT) - Netherlands (NL) - Romania (RO) Within the national methodology, the costs of disproportionality are assessed at this stage; the analysis of the costs of disproportion in the case of coastal waters was not relevant / inapplicable. No disproportionally expensive and infeasible measures have been identified. Spain -Basque (ES) -

Note: Status of the methods as of autumn 2020

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

Norway (NO) For larger measures: It is an objective to follow up measures with the help of biological and physical/chemical measures. Croatia (HR) Mitigation measures have not yet been implemented. Denmark (DK) Mitigation measures aimed at the physical modifications (sluices) i.e. a certain control of the sluices as well as measures of nutrient load reduction are expected to be included in the programmes of measures in the RBMP's. Finland (FI) All GEP measures are being implemented. Monitoring is done as part of operational monitoring, but suitable monitoring methods are largely missing. Greece (EL) Monitoring effects will be undertaken within the next planning cycles. Ireland (IE) - Italy (IT) - Lithuania (LT) - Netherlands (NL) - Romania (RO) Measures provided within the project "Coastal erosion reduction - Phase II 2014-2020", financing through the Cohesion Fund through POIM 2014-2020, Priority Axis 5 "Promoting adaptation to climate change, risk prevention and management" and state budget. The measures were included in the Program of Measures of the second RBMP and will be included in the next RBMPlan, the project ending in 2023. Spain -Basque (ES) Yes, we monitor regularly

Note: Status of the methods as of autumn 2020

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

Norway (NO) - Croatia (HR) - Denmark (DK) - Finland (FI) - Greece (EL) -

Ireland (IE) Method in development. Considering mitigation measures approach.

Italy (IT) - Lithuania (LT) GEP for the Klaipeda Strait has been defined by using different approach: physico-chemical and biological (chlorophyll "a") QEs are applied as those used for the closest natural WBs (which are similar in respect of water masses movement but not in respect of hydromorphology and benthic organisms). The criteria for GEP setting procedure have not taken into account any mitigation measures. All mitigation measures aiming to reduce an impact of the State port are taken into account by planning dredging, new constructions in frame of the Port monitoring programme and environmental impact assessments reports.

Netherlands (NL) -

Romania (RO) The method is in line with the recommendations of the Guideline no.37, following the step-by-step process; development of a comprehensive Catalogue of Mitigation Measures which addresses all water categories.

Spain -Basque (ES) –

Note: Status of the methods as of autumn 2020

10.15 Lessons learned, strengths and weaknesses

Key lessons learned from applying the methods of ecological potential definition for TraC HMWBs

DK: It is the characterization and the designation of HMWB that is difficult

FI: Biological indicators monitored do not support the mitigation measures approach.

IE: We do not have sufficient knowledge on some aspects of the process e.g. hydromorphology and ecology links.

IT: In TRAC bodies is difficult to separate the hydromorphological pressure from the other pressures.

MT: From Malta's 2nd RMBP, it is evident that it is possible to achieve GES in some parts of coastal water bodies in the previously designated HMWB. It was also evident that for the more heavily modified parts of the harbour areas, that GEP can be attained, provided successful implementation of practical mitigation measures. Results from the 2nd RBMP indicated that there was scope to improve the existing processes already put into place.

NL: for Coasts we have only one part HMWB and for the Transitional waters all bodies are HMWB. The effect of hymo on the biology in synergy with other pressures is difficult to unravel. On the other hand, the impact is so big that it is clear that effects will be there. In the case of T waters only expert judgement could be used to estimate the effects of mitigation measures. There are simply too few water bodies to use regression analysis or other statistical techniques. Also, the historical data are insufficient as major physical changes in the water system are made in our delta since the Middle Ages

NO: For our TraC HMWBs, it can be difficult to implement measures due to practical conditions, the scope of the measures and the costs. (It is easier to achieve measures if measures are taken into the planning phase. It is less realistic to implement changes after the structures have been built.)

RO: Water body monitoring (including those where mitigation measures have been implemented) is a key element in the classification and assessment of ecological potential; strengthening the link/knowledge between biology-hydromorphology is of high importance / relevance

Strengths of the methods for ecological potential definition on TraC HMWB

DK: The method of defining GEP in Danish coastal water bodies ensures that the definition of GEP methodically is the same as for GES in naturally coastal water bodies. GEP is determined for the type of natural coastal water that the HMWB most closely resembles at the present time. Thus, GEP is defined on the basis of the current physical and hydromorphological conditions and practically in the same way as GES.

FI: Can be done as expert judgement for all HMWB's. On the other hand, some may see this also as weakness. The method is rather "rough".

IE: Following CIS steps. Planning to use mitigating measures approach

IT: The methodology/process in development could be applied in different scenarios in a coherent way. For TW (with the exception of river mouths), the GEP will be defined using the same indicators developed for the natural WB (changing the ref cond and the boundaries). This will enhance the “transparency” of the classification and the assessment of the deviation from the GES.

MT: Malta used the Prague approach to define ecological potential for coastal HMWB. This ‘mitigation measures approach’ is a relevant option for defining ecological potential and had been agreed upon at the CIS workshop on Hydromorphology in 2005 (Kampa and Kranz, 2005). Through the Prague approach, GEP is established with reference to ecological targets and functionalities. The strength of this method is that it facilitates/drives identification of socio-economically viable mitigation measures for achieving GEP, thus setting out a clear path of actionable objectives to improve the status of a water body.

NL: Transparent on what is expected from the mitigation measures taken

NO: The method itself is meant to be a comprehensive review of relevant measures to achieve the best possible condition. However, this has not been implemented everywhere.

RO: The method is in line with the recommendations of the Guideline no.37, following the step-by-step process; development of a Catalogue of Mitigation Measures which addresses the effect of each mitigation measure in relation with individual quality elements

Note: Status of the methods as of autumn 2020

Weaknesses of the methods for ecological potential definition on TraC HMWB

DK: No significant weaknesses have been identified.

FI: The mitigation measures method is rather complicated and even experts may have difficulties to understand easily its logic. This is causing also challenges with stakeholder cooperation, as different interpretations of GEP may be possible.

IE: There is a lack of data on the links between ecology and hydromorphology in TraC waters

LT: Variability in the GEP assessment due to unstable environment.

MT: The Prague approach has been critiqued for following the requirements of the WFD less directly than the ‘reference approach’ (CIS Guidance Document no.37). By basing the definition of GEP on mitigation measures, instead of BQEs, the Prague approach can be considered to be limited by contemporary technical abilities, and their associated costs. Although, with renewal cycles of the RBMP, this is more of a potential delay mechanism rather than an indefinite limitation.

NL: It is purely based on expert judgement. Monitoring programs are set up to conclude on the effects of mitigation measures.

NO:	We do not have a well-developed system for classification of hydro morphological conditions. This would improve knowledge on the cause and effect of hydro morphological pressures on BQEs.
ES:	Lack of comparison with other methods out of the Basque Country

Note: Status of the methods as of autumn 2020

11 Annex 3: Blank intercomparison questionnaire for TraC HMWB

Country	
Contact person/Organisation	
Contact details	

1. General information on method used or to be used for the definition of ecological potential of Heavily Modified Water Bodies (HMWB) Transitional and Coastal Waters (TraC)

To be filled in by **<u>all</u>** countries

1	Which of the following statements best describes the situation with regard to definition of ecological potential for TraC HMWBs in your country?	*Tick-boxes (more than one reply possible):* ☐An official method was developed during previous river basin planning cycles and this will be used, unchanged, for the 3rd RBMPs ☐ An official method exists from previous river basin planning cycles and will be/has been updated for the 3rd RBMPs *(please explain below how and why it has been updated)* ☐ A new official method has been developed since the 2nd RBMPs and is being used in 3rd RBMPs ☐ A method is developed but is still being tested in pilot cases; it is intended that the method will be applied in 3rd RBMPs ☐ A method is in the early stages of development but is not likely to be ready to be applied in 3rd RBMPs ☐ No method exists and there are no current plans to develop one ☐ Other *(please explain below)* *Explanation (free text)*

2	When developing a TraC method, or planning to develop one, which of the following situations have you faced or are you facing?	*Tick-boxes (more than one reply possible):* ☐ Technical difficulties hindered the development of a TraC method ☐ Development of a TraC method was hindered / made difficult for reasons other than technical difficulties *(please explain below)* ☐ There are relatively few TraC HMWBs in my country ☐ TraC HMWBs in my country demonstrate a wide diversity of physical/biological characteristics ☐ TraC HMWBs in my country are relatively homogenous in their physical/biological characteristics ☐ Other *(please explain below)* *Explanation (free text)*
3	Where a method exists or is being developed, which of the following statements best describes how the method reflects or will reflect the contents of CIS Guidance no. 37	*Tick-boxes (more than one reply possible):* ☐ The existing method pre-dates the publication of CIS Guidance no. 37 ☐ The existing method has been or will be revised to reflect the contents CIS Guidance no. 37 ☐ The new method has been developed in accordance with CIS Guidance no. 37 ☐ It is intended to use CIS Guidance no. 37 when a new method is developed ☐ It is NOT intended to use CIS Guidance no. 37 when a new method is developed *(please explain below)* ☐ Other *(please explain below)* *Explanation (free text)*
4	Which of the following statements best describes the **approach** taken for ecological potential definition for TraC HMWBs in your country? *For more detailed description of the reference approach and mitigation measures approach, see Chapter 5.3.1 and 5.3.2 of*	*Tick-boxes (only one reply possible):* ☐ The reference approach is used (steps ABCDEFGH) ☐ The mitigation measures approach is used (steps AB[CDB]HG(F)) ☐ A combination of reference approach and mitigation measures approach is used *(please provide further explanation below)* ☐ A different approach is used *(please provide further explanation below)*

	CIS Guidance Document no. 37	*Explanation (free text)*
5	Which (if any) steps of the approach to ecological potential definition that is proposed in CIS Guidance no. 37, would you like to have more practical guidance and examples on for TraC HMWB's?	*Explanation (free text)*
6	Which of the following statements best describes the **background** to the existing or evolving method for ecological potential definition for TraC HMWBs in your country?	*Tick-boxes:* ☐ The method is the same as applied to rivers but adapted to TraC waters ☐ The method is or will be conceptually different from the method applied to rivers *(explain below how and why the method will differ)* ☐ No method exists ☐ Other *(please explain below)* *Explanation (free text)*
7	Which of the following statements best describes the intended **extent of application** of the existing or evolving method for ecological potential definition for TraC HMWBs in your country?	*Tick-boxes (only one reply possible):* ☐ The method will be applied in the whole country (national level) ☐ The method will be applied in part of the country (regional/basin level) *(please provide further information below)* ☐ No method exists ☐ Other *(please explain below)* *Explanation (free text)*
8	What are your key lessons learned from applying your method on ecological potential definition on TraC HMWB in your country?	*Explanation (free text)*
9	What are the main strengths of your method for ecological potential definition on TraC HMWB?	*Explanation (free text)*
10	What are the main weaknesses of your method for	*Explanation (free text)*

	ecological potential definition on TraC HMWB?	
11	Have the principles and steps of the CIS Guidance Document No.4 been used for the designation of TraC HMWBs in your country?	*Tick-boxes (one reply possible)* ☐ Yes ☐ Partly *(please provide further explanation below)* ☐ No *(please provide further explanation below)* *Explanation (free text)*
12	Has the designation of TraC HMWBs in your country 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)*	*Tick-boxes (one reply possible)* ☐ Yes – TraC HMWBs have already been reviewed ☐ Yes – HMWBs will be reviewed before the 3rd RBMPs ☐ No – it is planned to review the designation of TraC HMWB for the next planning cycle ☐ No *(please provide further explanation below)* *Explanation (free text)*
13	**Key references** Please provide links to the documents that describe your method for HMWB designation and ecological potential definition on TraC HMWB (also links to English translations if possible)	*Explanation (free text)*

2. Description of the method for the definition of ecological potential of Heavily Modified Water Bodies (HMWB) Transitional and Coastal Waters (TraC)

This section is to be filled in by countries that have an existing method, a new method or a reasonably mature method under development for ecological potential definition of TraC HMWBs.

The steps of the reference approach and mitigation measures approach in the CIS Guidance Document no.37 are used for the next questions. Chapters 5.3.1 and 5.3.2 of CIS Guidance Document no. 37 contain an overview of the steps and more detailed descriptions. In case the applied method has no equivalent steps to CIS no. 37, a description is asked in the final question of this section.

Step A. Identification of the closest comparable water category	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step *(please explain)* ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step B1. Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step B2. Exclude mitigation measures with significant adverse effect on use or wider environment	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step C. Derivation of hydromorphological conditions for MEP	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step

If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step E. Derivation of BQE conditions for MEP	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step F. Derivation of BQE conditions for GEP	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step G. Derivation of supporting quality element conditions for GEP	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Step H. Identification of mitigation measures for GEP	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Monitoring to assess whether GEP is being achieved	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step

If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Are there GEP measures that are disproportionally expensive or infeasible?	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation free text)*
Implement GEP measures and monitor effects on BQEs and supporting quality elements	*Tick-boxes (only one reply possible):* ☐ Yes, we use this step, or the method has or will have an equivalent step (*please explain*) ☐ No, our method has no equivalent step
If this step is used or the method will have an equivalent step please describe.	*Explanation (free text)*
Description of method in case of no equivalent steps to CIS no. 37. To be filled in, in case your method has no step equivalent to CIS Guidance no. 37	*Explanation (free text)*

3. Description of HMWB Case study selected for this questionnaire

To be filled in by all countries that have a case study available for the questionnaire based on a reasonably mature method.

Provide a simple sketch of the selected HMWB example and its neighbouring water bodies. Indicate and number the distinct water bodies relevant for the decision-making on ecological potential definition ("WB 1, WB 2, WB 3 ...")	Simple sketch with short description in words in separate file (Word, PPT or pdf)
Size (area, length) of water bodies in example/case study (refer to sketch)	*Explanation (free text)*
Name of RBD	*Explanation (free text)*
Which water body/bodies has/have been designated as HMWB in this case study?	*Explanation (free text)* For example: Water bodies 1 and 3 designated as HMWB; water body 2 as natural water body
What is the current ecological potential or ecological status of the water bodies identified in this example/case study?	*Explanation (free text)* For example: Water bodies 1 and 3 good potential, water body 2 good status
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?	*Explanation (free text)*
Original (pre-modification) category of the selected HWMB	*Explanation (free text)*
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)?	*Tick-boxes (more than one reply possible)* ☐Use of specific thresholds and criteria (e.g. percentage of water body irreversibly affected) ☐ Use of specific hydromorphological assessment methods ☐ Presence of structures without quantified criteria ☐ Use of expert judgement on case-by-case basis without criteria ☐ Change in character not assessed ☐ Other – *please explain* *Explanation (free text)*

Which water use(s) was the selected HMWB mainly designated for?	*Tick-boxes (more than one reply possible):* ☐ Navigation; ports ☐ Recreation; marinas; infrastructure ☐ Urbanisation including industry ☐ Flood protection ☐ Energy (renewables, oil and gas, associated infrastructure) ☐ Fishing activity; fish farms; aquaculture ☐ Other *Explanation (free text)*
What is (are) the physical modification(s) that led to the designation of the selected HMWB?	*Tick-boxes (more than one reply possible):* ☐ Constructed or raised dyke / levee / embankments ☐ Dredged for navigation, flood conveyance / Maintenance dredging ☐ Revetment, erosion protection, reinforcement ☐ (Re)claimed land, reclamation ☐ Breakwater, groynes, jetties, piers ☐ Disposal sites ☐ Dam, sluice, weir, barrier, barrage ☐ Aggregate extraction ☐ Quay walls, vertical piling, docks ☐ Channelised, straightened, realigned ☐ (Re-)nourished: sand, mud ☐ Pipelines, cables, etc. ☐ Intakes, outfalls ☐ Fished using beam trawl, scallop dredge, kelp trawling ☐ Cages, floating structures ☐ Other… *Explanation (free text)*
Estimate the extent of the effect of the main physical modification(s) and provide a qualitative description of the main hydromorphological alterations.	*Please provide a qualitative description of the main hydromorphological alterations (free text)*

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 extent 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.	*Please mark the main physico-chemical alterations and provide a qualitative description of the main physico-chemical alterations (free text below)* ☐ Salinity*: major, moderate, minor, no effect* ☐ Turbidity*: major, moderate, minor, no effect* ☐ Nutrient conditions: *major, moderate, minor, no effect* ☐ Oxygenation*: major, moderate, minor, no effect* ☐ Thermal conditions*: major, moderate, minor, no effect* ☐ Specific pollutants*: major, moderate, minor, no effect* *Explanation (free text)* e.g. Increased turbidity, increased/decreased salinity, …
Which biological quality elements have been adversely affected and how? (i.e. impacts on original ecology prior to any mitigation) Provide a qualitative description of the main ecological impacts.	*Please mark the biological quality elements and provide a qualitative description of the main ecological impacts (free text below)* ☐ Phytoplankton*: major, moderate, minor, no effect* ☐ Macroalgae (seaweeds)*: major, moderate, minor, no effect* ☐ Phytobenthos*: major, moderate, minor, no effect* ☐ Angiosperms (seagrass, saltmarsh) *major, moderate, minor, no effect* ☐ Benthic invertebrate fauna*: major, moderate, minor, no effect* ☐ Fish fauna (only transitional water bodies)*: major, moderate, minor, no effect* ☐ Several/all BQE very likely affected, by expert judgement *Explanation (free text)* e.g. Changes in phytoplankton abundance following changes in nutrients and/or turbidity; Reduced abundance / loss of (migratory) fish species; Increased abundance of tolerant species (e.g. benthic invertebrates); Reduced abundance / loss of angiosperms (seagrass)

Have any mitigation measures been in place prior to designation of the water body as HMWB?	*Tick-boxes (one reply possible)* ☐ Yes – *please explain* ☐ No *Explanation (free text)*
What would the overall ecological status (class) of the HMWB be when assessed using methods for natural water bodies of the same type?	*Tick-boxes (one reply possible)* ☐ High ☐ Good ☐ Moderate ☐ Poor ☐ Bad ☐ unknown *Explanation (free text)* e.g. the overall ecological status was "bad" based on benthic invertebrates (bad status), fish (poor status)
Are monitoring data available on hydromorphological conditions?	*Tick-boxes (one reply possible)* ☐ Yes – *Please explain* ☐ No – *Please explain* *Explanation (free text)* e.g. There are (detailed) monitoring data available on tides, bathymetry, substrate and habitats (including abundance/distribution of seagrass meadows, salt-marshes, inter-tidal flats, etc.), fresh-water inflow, …
Has monitoring data been used to assess the hydromorphological status?	*Tick-boxes (one reply possible)* ☐ Yes – *Please explain* ☐ No – *Please explain* *Explanation (free text)* e.g. The monitoring data allows for a comparison of the situation prior to the hydro morphological alterations with the situation after.
Are monitoring data available on BQEs?	*Tick-boxes (one reply possible)* ☐ Yes – *Please explain* ☐ No – *Please explain* *Explanation (free text)* 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.
Have biological assessment methods been used which are sensitive to hydromorphological alterations in TraC?	*Tick-boxes (one reply possible)* ☐ Yes – *Please explain* ☐ No but proxy" methods which are based on hydromorphological assessment methods have been used ☐ No, no methods are available *Explanation (free text)* e.g. Biological assessment methods are used for fish and benthic invertebrates which are sensitive to hymo alterations.
Was the method for the definition of ecological potential of TraC HMWB applied exactly as it is described in Section 2 of this questionnaire?	*Tick-boxes (one reply possible)* ☐ Yes – *Please describe any challenges* ☐ No, not exactly applied in this way – *Please describe what was different in the practical application of the method in the case study and any challenges encountered* *Explanation (free text)*