



Action Guidelines

Classification of Heavily Modified Water bodies and Derivation of the Ecological Potential in the German federal state of Bavaria

within the framework of the implementation
of the European Water Framework Directive (WFD)

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Published by:
Bavarian Environment Agency
Bürgermeister-Ulrich-Straße 160
86179 Augsburg
Tel.: +49(0)821 90 71 - 0
Fax: +49(0)821 90 71 - 55 56
E-Mail: poststelle@lfu.bayern.de
Internet: www.lfu.bayern.de

An agency of the Bavarian State Ministry of the Environment and Public Health

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1 Introduction and Basic Principles

These action guidelines describe the steps required for classifying heavily modified water bodies (HMWB) and for deriving their ecological potential (eP) in accordance with the EC Water Framework Directive (WFD).

The particularities relating to the derivation of the eP for artificial water bodies (AWB) are explained in a separate chapter.

The aim is to create specifications for a uniform approach conforming to WFD and CIS.

Among other things, the following two tasks need to be fulfilled for the River Basin Management Plan 2009 (RBMP) and the Programme of Measures (POM) assigned to it:

1. Transformation of the provisional classification into HMWBs and AWBs derived from the 2004 Inventory into a classification in accordance with the RBMP.
2. Derivation (assessment) of the eP for all water bodies classified as heavily modified or artificial in the RBMP.

1.1 Classification as heavily modified

The specifications used for stipulating when a surface water body (SWB) is to be designated as heavily modified are derived from Art. 4 (3) and Annex V WFD.

The 2004 Inventory according to WFD provisionally subdivided all SWBs in Bavaria into the following groups

- No HMWB (“natural SWB“)
- Candidate for HMWB
- HMWB
- AWB.

More detailed information on the methods applied may be obtained from Chapter 2.10 for running waters and from Chapter 3.9 for lakes of the methods compendium “Bestandsaufnahme WRRL in Bayern” – “WFD Inventory in Bavaria” -

(see link http://www.wasserrahmenrichtlinie.bayern.de/wrrl_live/navigation/show.php3?id=269&nodeid=269&p=).

Chapter 2 of these action guidelines describes seven steps leading to HMWB classification and the derivation of the eP. The schematic representation of the procedure is enclosed.

Starting from the provisional classification of the inventory (Step I), the ecological status of the SWB is determined in Step II. If the SWB has a reliable status, it is to be classified as “natural”. Otherwise two HMWB steps are to be carried out as specified in Art. 4 (3) WFD:

- Step III: Is it possible to achieve a good ecological status by means of hydromorphological restoration measures without significant adverse effects on the HMWB-relevant uses or the wider environment (if necessary with an extension of the deadline for reasons of technical feasibility or on account of disproportionate costs)?
- Step IV: Is it possible to achieve a good ecological status by other suitable means (without incurring disproportionate costs and provided that they are technically feasible) which are a significantly better environmental option?

If the answer to the two questions is “no”, the SWB is classified as a HMWB.

The classification applicable to the assessment of water bodies needs to be carried out for the Management Plan 2009, which then needs to be checked every 6 years.

1.2 Derivation of the ecological potential

The environmental objective applicable to both HMWBs and AWBs as stipulated by Art.2 (23) and Annex V WFD is not the good ecological status but the good eP (geP).

The derivation of the eP is described in Step V of these action guidelines. If a SWB has a poor eP, appropriate measures need to be selected and an effectiveness forecast needs to be made as to whether these measures (which then are to be included in the POM) are suitable for achieving the good eP by 2015 (Step VI). If the likelihood of achieving the geP is low, an additional procedural step is carried out (Step VII) in order to analyse the eP derivation procedure and the procedure for selecting the measures, with a view to any necessary adaptations. If it ultimately proves impossible to achieve the good eP by 2015, provision must be made for an extension of the deadline for the SWB. Reasonable measures for achieving as great an improvement as possible then need to be included in the POM.

Case group profiles have been developed to support the derivation of the eP (see Annex 1). There are 6 case groups in total for Bavaria's running waters resulting from a matrix made up of natural types of water bodies and their main use. Each of the case group profiles describes the natural character of the water body type, its uses and the restrictions resulting from these uses. In addition, there are recommendations for the derivation of the eP for all components that are relevant to the assessment. The purpose of these case group profiles is to make it possible to assess the eP under normal circumstances.

2 Heavily Modified Surface Water Bodies – Running Waters

2.1 Procedural steps

Step I: Inventory Basis

The results of the provisional classification in the updated version of the 2004 Inventory with an updated SWB-profile (status at end 2007) are to be taken as the basis and starting point of the HMBW classification for the Management Plan 2009.

The SWBs examined are those which have been provisionally classified as heavily modified or as a candidate for 'heavily modified' classification based on the methods specified by the inventory or through classification by experts for the updated running water SWBs.

Step II: Status assessment (Monitoring)

Status assessment is carried out in 3 sub-steps:

- a. Determination of the biocomponent(s) relevant for the assessment
- b. Determination of sampling site
- c. Examination and assessment

Re Sub-step a): Determination of biocomponent(s) relevant for the assessment

The structure-indicative biocomponents macrozoobenthos (module degradation) and fish (see first bullet point below) are the principal factors relevant to the question of classification as a HMWB.

- There may be cases where the achievement of the objective, based on the findings of the inventory, is rated “unclear” or “unlikely” with respect to the assessment category relating to “**Hydromorphological Changes**” – this will usually apply to HMWBs or candidates for HMWB classification. In such cases, the macrozoobenthos biocomponent (module: degradation) and/or fish need to be examined. It is especially recommended that the fish be examined if there is no free passage or connection to side channels. The sampling sites are to be characterised by means of a master data and physiography sheet.
- With HMWBs or candidates for HMWB classification where the achievement of the objective is rated “unclear” or “unlikely” with respect to the assessment category relating to “**Organic Loads**” (**saprobity**), the macrozoobenthos (module: saprobity) biocomponent needs to be examined and the chemical-standard measuring program (Messprogramm Chemie-Standard) needs to be carried out. These examinations are necessary because the different forms of use leading to classification as a HMWB can among other things also influence the oxygen content of the SWBs.
- With HMWBs or candidates for HMWB classification where the achievement of the objective is rated “unclear” or “unlikely” with respect to the assessment category “**Plant Nutrients**” (**trophy**) the macrophytes & phytobenthos biocomponent needs to be examined. In cases of plankton-dominated water bodies, the phytoplankton biocomponent also needs to be examined. Also the chemical-standard measuring program and the chemical trophy need to be carried out. These examinations are necessary because the different forms of use can lead to longer retention times and hence, also, to an increase in trophy, or because a development of plankton can only take place at all on account of the effects of the heavy modifications (e.g. damming).

Re Sub-step b): Determination of the sampling site

Sections of an SWB characterised by damming are usually unsuitable for sampling or assessment given the current status of the WFD assessment procedure for running waters. So, a free flowing section affected by hydromorphological change and therefore **as representative as possible** should be used for the examinations. Special attention is to be paid to the fact that the section examined is suitable for assessing the effects of the use.

Re Sub-step c): Examination and assessment

The analysis and assessment of running water SWBs is carried out in accordance with the specifications of the nationally co-ordinated assessment methods regarding ecological status.

If good ecological status is determined as being reliable, the SWB is designated as a “natural SWB”.

If the ecological status determined by monitoring is moderate, poor or bad, further examinations are required for the SWB in order to determine whether it is to be classified as a natural SWB or HMWB. In these cases, the HMWB step described under Step III is to be carried out.

Verification procedure if assessed status still proves unreliable

The following questions need to be clarified, if the good ecological status determined in the first assessment cannot be looked upon as sufficiently reliable from the point of view of the expert:

- (i) Is it possible to apply the result of the status assessment to the SWB as a whole?
- (ii) Are there any residual dynamics present relating to hydromorphological processes?

Re (i): The status assessment cannot be looked upon as applicable to the SWB as a whole, even though the ecological status has been determined as being good, if the sampling site does not even come close to being regarded as representative for the respective SWB, or if according to expert assessment, the effects of its use(s) are not sufficiently reflected at that particular site.

The applicability of the established good ecological status to the SWB as a whole may also be questioned if there is (still) no plausible result available for one of the biocomponents relevant to the assessment and if, according to expert opinion, it cannot be assumed that the good status will be achieved for this biocomponent.

Re (ii): The residual dynamics of hydromorphological processes are to be considered as not given if, despite the fact that good ecological status has been determined by the monitoring, it is impossible for hydromorphological processes to take place any longer, or to take place only to a minimum extent, although under normal circumstances, they would occur as a result of their own dynamic (for example, bedload discharge, bed shifts, bank erosions ,etc.), with the result that good ecological status is not guaranteed in the long term. The assessment can be based on the evaluation of the water-body bed dynamics resulting from the entries in the master data and physiography sheets.

If the considerations under (i) and (ii) confirm the assessment of “good ecological status”, the SWB is to be awarded the status of “Natural SWB”. The objective has been achieved, so no measures are required in the Management Plan 2009 as specified by the WFD.

If, according to examination (i), the assessment of the status is not representative of the whole SWB or (ii) there are no residual dynamics resulting from hydromorphological processes, the HMBW-step described under Step III. is to be carried out.

Step III: HMWB Step “Effects of restoration measures”

Step III derives from the specifications under Art. 4 (3) a) WFD. Step III implements Step 7 of the CIS Guidance Document [1].

As part of Step III, clarification is required as to whether it is possible to achieve a good ecological status by means of hydromorphological restoration measures without significant adverse effects on HMBW-relevant uses or the wider environment. There is also a need to examine whether it may be necessary to extend the deadline for reasons of technical feasibility or disproportionate costs.

HMWB-relevant uses are the exploitation activities that have led to modifications of the hydromorphological characteristics of the SWB thereby resulting in an ecological status that is currently not good or that it is not applicable to the whole SWB or cannot be sustainably maintained, owing to a lack of residual dynamics. Other uses (such as, for example, point sources) which lead to the good status not being achieved (e.g. with regard to organic or chemical loads) are irrelevant for purposes of classification as a HMWB.

For purposes of implementation, the following exploitation activities come under consideration when examining the HMWB classification (see also Art. 4 (3) a) WFD):

- Hydro-electric power
- Flood protection
- Torrent control

- Navigation (including port facilities)
- Water-body development (if not flood protection, torrent control, navigation)
- Agriculture and forestry, fish-farming
- Water withdrawal at certain points (without hydro-electric power, agriculture)
- Recreation
- Water storage for the purposes of drinking-water supply
- Water storage for the purposes of power generation
- Water storage for purposes of irrigation
- Other water storage
- The wider environment (e.g. conservation objectives in Natura 2000 protected areas or protection objectives: cultural assets / protection of cultural monuments / archaeology)
- Other important sustainable human development activities.

These exploitation activities are listed in the table in Annex 2 together with possible reasons for the load, main causative factors for the load and examples of uses.

According to the CIS Guidance Document [1] Step III (corresponds to CIS Step 7) is subdivided into 3 sub-steps:

- Sub-step III-1:
Assessment of restoration measures for the expected achievement of good ecological status
(corresponds to CIS Step 7.1)
- Sub-step III-2:
Would the restoration measures have significant adverse effects on the use(s)?
(corresponds to CIS Step 7.2)
- Sub-step III-3:
Would the restoration measures have significant adverse effects on the wider environment?
(corresponds to CIS Step 7.3)

The restoration measures for achieving good ecological status under Sub-step III-1 and those of these measures that would have significant adverse effects on the uses are to be documented in a data sheet for each SWB for reasons of comprehensibility.

If it proves possible, without significant adverse effects on use(s) and the environment, to modify the hydromorphological changes impeding the achievement of good ecological status in such a way that the possibility of achieving good ecological status can be expected, the SWB is to be classified as natural.

If, as the result of Step III, the SWB is not classified as a “Natural SWB”, Step IV is to be carried out.

Step IV: HMWB Step “Significantly better environmental option”

Step IV is derived from the specifications in Art. 4 (3) b) WFD. Step IV implements Step 8 of the CIS Guidance Document [1].

There is a need to examine

- whether the purpose of the HMWB-relevant uses can also be achieved by other suitable means that constitute a significantly better environmental option, and
- whether a good ecological status can be achieved by this.

Other possibilities are to be considered as unsuitable if they have to be excluded on grounds of technical infeasibility or disproportionately high costs.

In accordance with CIS Guidance Document [1] Step IV (is equivalent to CIS Step 8) is subdivided into 5 sub-steps:

- Sub-step IV-1:
Is it possible to achieve the purpose of the HMBW-relevant uses by other means as well?
(is equivalent to CIS Step 8.1)
- Sub-step IV -2:
Are these other means technically feasible?
(is equivalent to CIS Step 8.2)
- Sub-step IV -3:
Do these other means usually represent a better environmental option?
(is equivalent to CIS Step 8.3)
- Sub-step IV -4:
Are these other means disproportionately costly?
(is equivalent to CIS Step 8.4)
- Sub-step IV -5:
Is it to be expected that a good ecological status can be achieved by using these other means?
(is equivalent to CIS Step 8.5).

It can be assumed, in principle, that there is no better environmental option. There are often socio-political developments or statements relating to the uses that justify the current uses and specify suitable framework conditions.

Should there be a better environmental option in justified individual cases, appropriate measures are to be included in the management program.

Assuming the possibility of achieving good ecological status by using other means to attain the beneficial objectives that are the reason for the characteristics of the SWB being so heavily modified (“significantly better environmental option”), the SWB is to be classified as a “Natural SWB”. If this is not the case, it is classified as a HMBW for the RBMP 2009.

Step V: Derivation of the ecological potential

Step V describes the procedure for deriving the eP.

The derivation (assessment) of the eP is usually carried out in accordance with the specifications for the different case groups. A derivation is carried out for any SWB classified as heavily modified.

For running waters, the following case groups are distinguished for deriving the eP in Bavaria; they can be supplemented if necessary:

No.	Case Group	Type of Water Body	Predominant Use
1	Developed torrents	1.1, 1.2	Flood protection
2	Developed smaller water bodies in the Alpine Foothills	2, 3 (with sub-types)	Flood protection / water power, urban areas, agriculture
3	Developed large water bodies in the Alpine Foothills	4	Water power, flood protection, urban areas, agriculture
4	Developed smaller water bodies in the Central Uplands	5, 5.1, 6, 6K, 7, 9.1, 9.1K	Flood protection, water power, urban areas, agriculture, pisciculture
5	Developed large running waters in the Central Uplands (incl. Danube)	9.2, 10	Water power, navigation, flood protection, urban areas, agriculture
6	Artificial water bodies (canals)		Water power, navigation, transition

Particular cases may require an individual approach.

The following sub-steps need to be examined and, if necessary, carried out to adapt the environmental objectives for purposes of assessing the eP of HMWBs:

a. Category change:

In accordance with WFD Annex V (1.2.5) there is a need to examine whether the category of the HMWB under assessment will change on account of its use. Dammed running waters (e.g. a reservoir) can take on the character of a lake on account of such use. In these cases the SWB is to be assessed on the basis of the nationally coordinated procedures for lakes. However, such a change of category is only to be carried out if the retention times of the water amount to more than 30 days (orientation value).

b. Change of assessment type:

In accordance with WFD Annex V (1.2.5) there is a need to examine whether the water body type of the SWB has factually changed owing to its use.

For the biocomponent macrozoobenthos the examination can be carried out by calculating the German Fauna Index (Deutscher-Fauna-Index (DFI)). The DFI provides a measure of how characteristic the biocoenosis actually found is for the respective water-body type. If the calculated index value for the factually more similar type, taking the use into account (in what follows, called the “assessment type”), is higher than for the natural type, the type needs only to be adapted for the assessment purpose (is equivalent to assessment type). The natural water

body type is thus maintained.

The use of an assessment type makes it possible to apply nationally co-ordinated assessment procedures, which renders costly new developments unnecessary. It leads to assessment results that can be presented in a transparent manner. The maximum eP is equivalent to the high status, the good eP to the good status of the SWB for the applied assessment type, etc. (with regard to the quality components relevant to the assessment).

Potential reference coenoses are created analogously for the fish biocomponent for purposes of assessment by means of fiBS (fish-based assessment system for running waters) that take into account the changed requirements resulting from the use regarding the achievement of the objective by a HMBW. The potential reference coenoses need to be drawn up, in a technically well-founded manner, on the basis of clear, understandable criteria for the various types of use, water body types and fish habitats.

c. Shift of class limits (special cases):

A change in the assessment type will in some cases be impossible for technical reasons, because there are no comparable natural types with these characteristics (applies to water-body types 5.1, 9.1K, 9.2 and 10). These cases require an adaptation of the class limits. Moderate ecological status is still considered to be geP.

The derivation (assessment) of the eP can lead to two different results:

1. The geP has been achieved for all biocomponents relevant to the assessment: This means that the environmental objective has been achieved. No further measures based on the WFD are required in the water-body sections.
The derivation of measures based on potential assessments for dammed sections of the SWB are impossible because of the methods used (the result is not applicable to the whole SWB). Measures to enhance the status of these dammed sections need to be examined, described and implemented to a reasonable extent, for example, within the scope of the general maintenance of the water bodies.
2. The geP has not been achieved. In this case, Step VI needs to be carried out.

Step VI: Selection of measures and achievement of objectives

This step needs to examine whether the geP can probably be achieved by 2015 by implementing a suitable selection of measures from the catalogue of measures. Particular attention needs to be paid to the aspects of feasibility, ecological effectiveness and cost efficiency during the selection of suitable measures. The procedure of drawing up the POM is described in the action guidelines “Setting up the Programmes of Measures” (“Aufstellen der Maßnahmenprogramme”) (including the subsequent prioritisation of the measures, taking their financeability and the time horizon into account).

If it can be assumed that it is possible to achieve the geP by 2015 through implementing the selected measures, the measures are included in the POM.

If this is not the case, an additional examination is carried out as described under Step VII.

Step VII: Procedure-verification step

This step is applied if the achievement of the good ecological potential derived in Step V cannot be expected by 2015 by adopting the feasible measures.

What is required to start with in this case is a critical examination of the decisions taken so far for deriving the eP (Step V) and for selecting the measures (Step VI).

The following needs to be checked when it comes to deriving (assessing) the eP:

When the assessment was carried out were all necessary aspects into account? Can the selected procedure be applied to the SWB under examination? Is it possible to classify the result of the assessment as plausible?

The following needs to be checked when selecting the measures:

Were all feasible measures taken into consideration? Can the planned measures be conceivably extended or changed in order to achieve the geP?

If the verification of the procedure shows a need for modifications as regards the derivation of the eP or the selection of measures, the derivation of the eP needs to be corrected, or additional or modified measures need to be carried out.

An exception has to be made, if there is no need for modifications (the assessment is understandable and plausible, all feasible measures have been taken into consideration); in other words it is impossible to achieve the environmental objective. The only possibility for making an exception that can be considered in Bavaria for the RBMP 2009 (and hence the 1st RBMP) is an extension of the deadline.

In such cases, all reasonable measures that can lead to an improvement that is as far-reaching as possible need to be described and accounted for in the POM (corresponds to the “Prague Approach”).

2.2 Further course of action

All SWBs designated as HMWBs are to be re-examined in every future RBMP. In doing so, both the designation as such, as well as the derivation of the eP will have to be carried out on the basis of current knowledge at the time.

3 Artificial Surface Water Bodies / Running Waters

Here, running water SWBs are considered that have been classified provisionally as artificial with respect to the updated running-water SWBs on the basis of the methods of classification of the inventory or by classification through experts.

Artificial water bodies (e.g. canals) are technical constructions fashioned by human hand. They differ considerably from heavily modified running waters because no comparable water body existed before their construction. It is impossible to allocate artificial water bodies to similar natural types of water bodies.

Given the current status of the WFD assessment methods it is usually impossible to take samplings or make assessments. Job safety provisions mean that biological sampling can only be carried out to a very limited extent, if at all. If no biological sampling is possible, the assessment is to be carried out on the basis of chemico-physical parameters.

An assessment of the effect of structural changes in artificial water bodies is not practical because,

by definition, these water bodies cannot be allocated to any natural comparable type.

In this case, the assessment of the quality of the water body (assessment of the ecological status based on the WFD specifications) is replaced by an assessment of the water quality.

If possible, the results of biological analysis can be taken as a basis for the assessment of saprobity by means of the biocomponent macrozoobenthos and for the assessment of trophic status by means of the biocomponent macrophytes & phytobenthos (usually diatoms) and phytoplankton (if relevant).

If biological analyses prove impossible, a comparison of the measured values of the chemical-standard measuring program (Messprogramm Chemie-Standard) with the orientation values for physico-chemical auxiliary components.

In both cases, the assessment criteria that are applicable to the receiving water course are to be taken into consideration (what is decisive is the type allocation of the receiving water course!). This is supposed to ensure that the receiving water course and the connecting SWBs are not in danger of not achieving the objective owing to the artificial water-body.

Concrete information on the derivation of the eP can be obtained from Case Group Profile 6.

4 Abbreviations

AWB	artificial water body
RBMP	River Basin Management Plan
fiBS	Fish-based assessment system for running waters
RBD	River Basin District (e.g.: Rhine, Danube, Elbe)
HMWB	heavily modified water body
POM	Program of Measures
eP	ecological potential
SWB	Surface Water Body
WFD	Water Framework Directive

5 References

- [1] Leitfaden zur Identifizierung und Ausweisung von erheblich veränderten und künstlichen Wasserkörpern, CIS-Arbeitsgruppe 2.2, verabschiedet auf dem Treffen der Wasserdirektoren am 21./22. November 2002 in Kopenhagen
- [Guidance Document on the Identification and Designation of Artificial and Heavily Modified Water Bodies, CIS Working Group 2.2, agreed by the European Water Directors on 21/22 November in Copenhagen]

HMWB Classification Scheme and Derivation of ecological potential

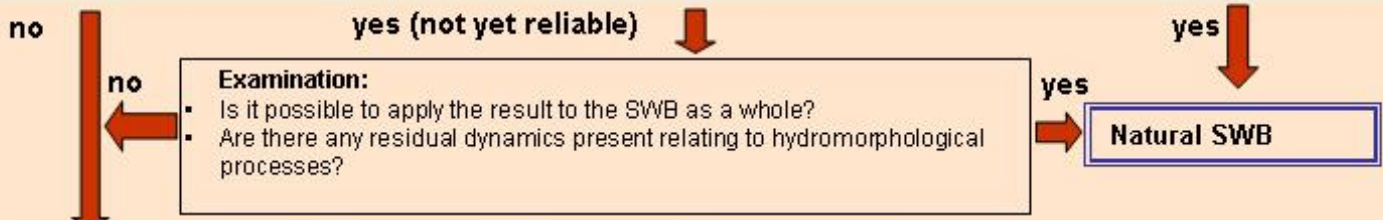
I Inventory Basis:

Provisional classification as heavily modified water body (HMWB/HMWB-candidate; Basis: SWB-update)

II Status Assessment (Monitoring)

- Determination of the biocomponent(s) relevant for the assessment
- Determination of sampling site
- Examination and assessment

Does the first assessment (monitoring) yield a good ecological status?



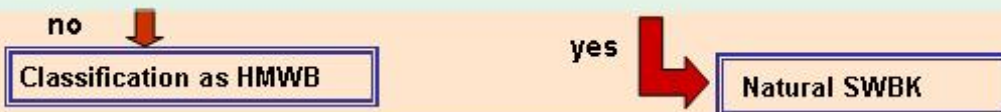
III HMWB Step "Effects of restoration measures" (see Art. 4 (3) (a) WFD)

Is it possible to achieve a good ecological status by means of hydromorphological restoration measures without significant adverse effects on the HMWB-relevant uses or the wider environment?



IV HMWB Step "Significantly better environmental option" (see Art. 4 (3) (b) WFD)

Is it possible to achieve a good ecological status using other suitable means to achieve the purpose of the HMWB-relevant uses (without disproportionate costs and provided that they are technically feasible) which are a significantly better environmental option?



V Derivation of the ecological potential

- Category change?
- Change of assessment type?
- Shift of class limits? (special cases)

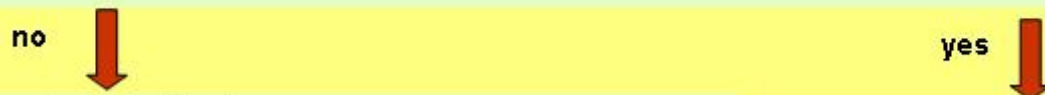
Is there a good ecological potential present?



VI Selection measures and achievement of environmental objective

- Application of Catalogue of Measures for Hydromorphology
- Examination of feasibility, ecological effectiveness, cost efficiency
- Prioritization / financeability / time horizon (iterative process)

Effectiveness forecast: Can the good ecological potential be achieved by 2015 by applying the proposed measures?



VII Procedure verification step

Verification of the derivation of the ecological potential and possible measures

Verification completed

Deadline extension and selection of reasonable measures for a restoration as far-reaching as possible

Inclusion of the selected measures in the POM

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