

Instruction manual: Development of a “Screening Tool” for climate proofing of water management measures

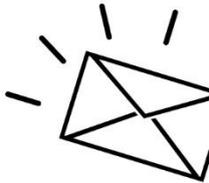
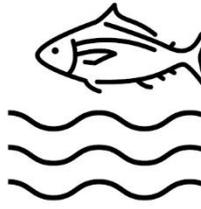
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1 Introduction and Background

Within the scope of the Common Implementation Strategy (CIS) of the Water Framework Directive (WFD), on 30 November, 2009, the water directors of the EU Member States endorsed the guidance document “River Basin Management in a changing Climate”¹. The guideline presented the first approach towards a methodology for carrying out a “climate check” (based on existing knowledge, data and “common sense”) of the programme of measures.

For an assessment of the “climate suitability” of measures – a so-called “climate proofing”- the guideline attempts to provide answers to the following questions:

- What measures strengthen or weaken the ability to adjust to climate change?
- What measures can be categorised as “no regret” or “win-win” solutions?
- What measures could be less robust in their effectiveness (to reach the WFD goals) to address the effects of climate change?

Even though the first steps to examine the “climate suitability” of the planned measures were taken during the development of the first programmes of measures for the management plans (from 2009 - 2015), a practical, understandable and easy to use method is missing in Germany, as well as in most other EU Member States. However, the European Commission expects that all management plans will have been “climate proofed” in the second management cycle.

The UBA funded research project “Development of a “Screening Tool” for climate proofing of water management measures” (FKZ 3713 21 222) aims to develop and ensure a methodologically sound approach to estimate the climate robustness and the effect of water management measures on climate change to enable a realistic evaluation at river basin level.

The “Action Plan Adaptation of the German Adaptation Strategy² to climate change” defines “climate robustness” as the ability of systems, organisations or (individual) actors to be able to exist under a wide range of climate conditions or to be able to tolerate climate changes without significant functional restrictions.

The LAWA catalogue of measures serves as the basis for the “climate check” assessment method. The LAWA executed an initial screening of the climate robustness and climate effectiveness for the measures listed in this catalogue in September 2013³. The majority of management plans reported to the European Commission in March 2016 are based on this approach.

¹ European Commission (2009): River Basin Management in a changing Climate- CIS Guidance N° 24, available under https://circabc.europa.eu/sd/d/a88369ef-df4d-43b1-8c8c-306ac7c2d6e1/Guidance%20document%20n%2024%20-%20River%20Basin%20Management%20in%20a%20Changing%20Climate_FINAL.pdf.

² See BMU (2012): Action plan adjustment of the German adjustment strategy under <https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/anpassung-auf-bundesebene/aktionsplan-anpassung#handlungsfeldubergreifende-aktivitaeten>.

³ See sample chapter “Climate Change” for the second management plans from the WRRRL and sample chapter “Climate Change” for the flood risk management plans agreed upon at the 146th LAWA-VV on September 26/27, 2013 in Tangermünde and the respective annexes.

2 What can the tool be used for?

The “Screening Tool for Water Management” is **not** designed to examine the general functionality of a generic (or specific) water management measure in regards to achieving its general goal, but rather it aims for a practical, user-oriented assessment of the functionality of the measure under the projected future climatic changes in Germany (or in a region).

In addition, the change in the indirect benefits (secondary benefits like the positive effects of a restored flood plain on tourism) of a measure can also **not** be included in the assessment due to the high complexity of this topic.

Due to the high practicality of the tool and its explicit use for “screening” purposes, it cannot replace other procedures for estimating the impact of measures (e.g. UVP/SUP, KNA, etc.). Due to this fact, the Screening Tool does not form a “hard” decision-making basis for the implementation/non-implementation of a measure, but rather enables an additional assessment of the suitability of a water management measure in light of climate change. The Screening Tool therefore does **not** represent an **exclusion criterion** during the selection of measures, but rather serves as an additional validation step to encourage a consideration of the impacts of climate change on the measure.

Thus, the potential added value of the Screening Tool is in its ability to deliver information about the climate robustness of water management measures that go beyond the LAWA climate check (sample chapter) in regards to their degree of detail and the justification behind them.

The Screening Tool should also help satisfy the requirements of the European Commission for a stronger consideration of climate change in the second and third management period of the WFD. The results of applying the Screening Tool can help to further define and develop the LAWA sample chapter on climate change through the following points:

- The regionalisation of statements on the climate robustness of “generic” measures (i.e. measures that are described in general and that within the scope of detailed planning must be adjusted to local settings): The Screening Tool makes it possible to consider the regional differences from the different climate projections and therein different climate impacts for different “eco-regions” (or “climate regions”) in Germany (for example, coast, Alps).
- Consideration of different climate impacts: On the basis of existing research, the Screening Tool provides differentiated statements on the climate robustness of measures in relation to different climate change effects (e.g. more/increased flood events and dry periods, heavy rain events, decrease in water quantity, change in groundwater recharge as well as an increase in temperatures in surface waters).
- Technical justification: The Screening Tool contains a “more scientific” and, therefore, a more refined technical derivation of statements on the climate robustness and climate effect of measures than intended in the climate change sample chapter from the LAWA. This also serves for the better justification of the decisions made for the public.
- Decision-making support for selecting measures: The Screening Tool offers support/a foundation in the discussions with the (expert) public in the administrative procedure (e.g. justification of the “management judgement”, § 12 WHG).

The Screening Tool is primarily geared towards implementing/planning authorities (local or federal state) at the level of a generic individual measure (in contrast to a programme of measure or something similar). An aggregation of results and/or measures in the determination of the climate robustness is questionable from a technical viewpoint. Specific and therefore concretely planned and spatially determined measures can also be assessed.

3 Application of the Screening Tool

The application of the Screening Tool will be described step by step, beginning with an overview of the general structure and followed by the individual steps.

Depending on the degree of detail of the assessment, the Screening Tool takes approximately 30 minutes to complete. When using the tool for the first time, additional time should be planned for processing and summarising studies and other documents in the Screening Tool.

As described above, the Screening Tool is a “superficial” (“screening”) assessment method with a focus on simple usability and practicality. This focus on “screening” is taken into account in the application of the Screening Tool through the following aspects:

- You as a user have the possibility after every question to explain your measure-specific assumptions and, if applicable, to justify the assessment made (can be filled out optionally).
- At the end of every assessment step, you also have the possibility to determine the degree of uncertainty of your answers/assessments. This will be made visible in the results document upon completion of the test.
- Furthermore, a general “disclaimer” is added to the results, which points out that the evaluation may be different for a concrete individual measure. This should account for the region or country specific circumstances.

3.1 Structure of the Screening Tool

The structure of the Screening Tool is based on the CIS guidelines from the European Commission and primarily includes two areas (“assessment areas”) that represent the procedure of the screening process:

Assessment area	Topic	Short explanation
Climate robustness	Topic 1: Relevance of the measure	This topic examines if the measure is at all relevant under changed climate conditions.
	Topic 2: Effectiveness of the measure	This topic examines how the effectiveness of the measure changes under changed climatic conditions (no CBA designated).
	Topic 3: Flexibility and reversibility of the measure	This topic examines how flexible the measure is and how it can be adjusted to changed climatic conditions.

	Topic 4: Side effects	This topic should be used to examine if the measure has positive or negative effects on other ecosystems or activities within water management relevant sectors in the future.
Effects on climate change	Topic 5: Intensification of climate change	This topic should examine if the measure intensifies climate change, i.e. it leads to a release of additional greenhouse gases ⁴ .

3.2 Application: Log-in and Preliminary step

On the website you will find a short version of the instruction manual.

First, create a profile or log in with an existing profile. When you create a profile, please consider that the password confirmation email may end up in your spam folder. If you are working on the tool with several colleagues, decide on a shared access profile together.

Before the actual assessment of a respective measure, an introductory “preliminary step” will appear in a pop up window directly after you have selected “Create new survey”. This preliminary step will make later assessments easier and - with sufficient data availability - customises them to the specific, regional climate projections.

The preliminary step consists of three parts. In the **first step**, you should determine if the assessment of the measure makes sense at all in regards to its climate robustness (e.g. this is not the case for measures that are geared towards education, “awareness raising” and “capacity building” because they are not affected by the impacts of climate change).

Other measures may only be of a short duration so that throughout their lifetime there will not be any climate change impacts that go beyond the current situation. An application of the Screening Tool is therefore not necessary for short-term measures; it should be noted that the longer the lifetime of a measure the more “helpful” or more significant the application of the tool becomes.

A suggestion for potentially relevant measures (from the LAWA catalogue of measures) can be found in Annex 1.

In the first step, the name, type (generic or specific measure, identification numbers, if available) and short description of the respective measure, as well as its planning progress, will be entered into the programme.

In the **second** part of the **preliminary step**, regional or the most current climate projects should be identified and set as a basis for further assessments. If there are different and/or contradictory projections for a region, then this must be clearly documented in the uncertainties section. The time

⁴ During the development of the Screening Tool methodology, it was also discussed how to determine if a measure intensifies climate change impacts. Due to the complexity of the causation between climate change - measure - effect and the difficulties in the assessment, this aspect was not included. In addition, taking into account the WFD principle of preventing any deterioration in status, no measures may be taken that worsen the condition of a body of water. This also applies to changing climatic conditions.

period of the projections must also be specified. There is also a possibility to differentiate between winter and summer.

The user will be given a series of sources for this (each with a short explanation of the content), which represent the current state of research during the duration⁵ of this project. The user should quickly research if there are more current and/or regional-specific climate projects available.

If recommendations for specific projections within a region exist (e.g. for Bavaria the provision of a uniform, inspected ensemble is planned starting in 2016/17 through the “Climate Future Bavaria” project), these should be applied for the assessment of measures in the Screening Tool.

The recommended sources are:

- Regional Climate Atlas Germany (<http://www.regionaler-klimaatlas.de/>).
- KLIWA (“Climate change and consequences for water management”): Federal states of Bavaria, Baden-Württemberg, Rhineland-Pfalz. (<http://www.kliwa.de/>).
- Competency centre for climate consequences and adjustment at the UBA (KomPass): Link to information for all states (<http://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung#strap-14675>).

Based on these projections, the user creates a list of the expected climatic changes. It is not considered useful to illustrate these changes in difficult to grasp units - like “+1 degree increase in air temperature”. Instead, the physical effects are “translated” in a series of climate impacts that are selected through a drop-down menu in the Screening Tool:

- More frequent droughts,
- Increased/stronger inland flood events,
- Increased heavy rainfall⁶,
- Increasing lower water levels⁷,
- Change in air temperature/water temperature,
- Increased storm surges,
- Changes in the groundwater level/recharge (including groundwater flooding),
- Changes to the average water flow,
- Seasonal shifts in precipitation throughout the year (in particular an increase in the winter, decrease in the summer),
- Sea level rise

The selected (or excluded) climate impacts will then be considered (or no longer considered) during the screening in order to configure the processing and the later representation of results in a simple and clear manner in the form of a bar chart.

⁵Project duration: 2013-2016

⁶ Including changes to the quality of water (through the increase of substances added to the waterways through the increase of strong rainfall).

⁷ And affiliated changes in the water quality (increase of the concentration of material burdens).

In the **third and final step**, the user is asked to note the assumptions and knowledge important for the application of the Screening Tool in a comment field (free text). In the best case, the points that should be noted include:

- Document how the user dealt with the climate projection and the time-scale of the measure in relation to its lifespan. Short-term measures may be completed at a time in which climate change does not yet result in any significant impacts going beyond what is known today. In such a case, the application of the Screening Tool may not be necessary or may occur on a theoretical level (e.g. assumption that the measure will be implemented in the near future). The free text field should be used to explain if this question played a role and how this was dealt with.
- Which climate projections (sources) were used (including project time-scale, web links, etc.).

3.3 Application: Answering the questions and Assessment

The assessment of the individual questions is carried out through a semi-quantitative assessment system with the extreme values +3 (“extremely relevant/high climate robustness/low climate impact”) or -3 (“irrelevant/low climate robustness/high climate impact”). In order to be able to better reflect on certain questions, this assessment scale was changed or adjusted in a few cases (e.g. from -3 to 0).

In addition to this, the relative uncertainty of the respective decisions is assessed after each topic. The goal is to investigate and transparently illustrate the robustness of the estimations made. A drop-down menu with predefined justifications or a free text for justification is available for this purpose (see image below). Furthermore, the relative uncertainty is represented in the results documents (“fact sheets”).

Assessment of the relative uncertainty of the responses:

Low uncertainty (e.g. detail study available, measure-related question, etc.)	Medium uncertainty (e.g. assessment by a team of experts, support of the answer through literature)	High uncertainty (e.g. very different climate projections, unclear impact of the climate on the measure, no/bad information through literature)
Description of the uncertainties (optional)		

Based on the CIS manual, a warning is displayed in cases where certain aspects for the climate robustness of a measure are evaluated (too) negatively.

Warning:

Please note: The possibility exists that the measure is problematic under the conditions of the climate change. Please check the assessment. If the result does not change despite this review, the application of the measure must be reconsidered under the basic conditions of climate change.

The results of the screening are illustrated for every assessed individual measure in a “fact sheet”, including visualisation through bar graphs. The consideration and evaluation of groups of measures (e.g. programmes of measures), thereby using the Screening Tool at a level higher than implementation (e.g. in a river basin), may make sense in order to increase the applicability.

3.4 Application: Assessment area 1 “Climate Robustness”

Due to the long-term changes in seasonal precipitation, as well as the change in frequency of extreme events caused by climate change, a climate check of new measures to be included in the WFD management plans and the flood risk management plans is an important task for public administrations.

The first assessment area determines the **climate robustness** of a water management measure under changing climate conditions based on different criteria. The results may amend and refine column 4 (“sensitivity”) of the LAWA assessment in the sample chapters for the WFD and the Floods Directive.

3.4.1 Topic 1: Relevance of the measure

Information for the assessment of the following question should be included in the chapter “Baseline Scenario - Future Developments” of the river basin management plans.

In your opinion, how does the relevance of the measure change in regards to the water management objective taking into account the (previously identified) climate consequences?

Description: The question about the relevance of a measure assumes that certain water management measures completely lose their relevance in the future - once the projected future climate changes occur - or could gain relevance in regards to the water management objectives. The assessment is qualitative, whereby it is assessed if the significance of the measure – i.e. if it is more or less necessary - changes under climate change impacts.

Example: There may be increased erosion and higher concentrations of nutrients in waterways caused by more frequent and intense rain events. Measures like riparian buffer strips are therefore even more relevant in the future. The same applies to measures to prevent flood protection/flood risk management if flood events are more frequent. The dimensions/designs of overflow basins for rainwater in regards to increased and/or heavier rain have to be reconsidered because their relevance would increase in such a case. In contrast to this, are, for example, measures like agricultural drainage ditches/facilities that lose their relevance with increasing dryness.

Assessment scheme: A separate assessment has to be carried out for each climate impact (drought, flood, heavy rain, low water levels, storm surges, changes in the groundwater level/recharge including groundwater flooding, as well as temperature increases (air/water))

Relevance strongly decreases			Relevance does not change			Relevance strongly increases
-3	-2	-1	0	+1	+2	+3

3.4.2 Topic 2: Effectiveness of the measure

This Topic is assessed based on multiple questions:

In your opinion, does climate change alter the effectiveness of the measure in regards to the water management objective?

Description: This question determines if the effectiveness of a measure changes with respect to the water management goal under the projected climate changes, i.e. if it increases or decreases in effectiveness.

Example: Due to higher air temperatures in the future, the cleaning performance of sewage treatment plants will increase (i.e. their effectiveness increases - higher loads will be treated).

Assessment scheme: A separate assessment is carried out for each climate change impact (see P.8).

Effectiveness strongly decreases			Effectiveness does not change			Effectiveness strongly increases
-3	-2	-1	0	+1	+2	+3

In your opinion, how do the maintenance costs of the measure change due to the projected climate change impacts?

Description: This question should be used to examine the changing operating costs, i.e. the costs of maintenance of the measure.

Example: Based on more frequent or stronger flood events, the costs for preservation and maintenance of flood protection measures or the costs to maintain water infrastructures that will transport less water due to a lower water level may increase. Increased drainage, however, may also lead to stronger sediment transport and increased shore erosion and therefore cause increased costs in river maintenance.

Assessment scheme:

Costs strongly increase			Costs do not change			Costs strongly decrease
-3	-2	-1	0	+1	+2	+3

3.4.3 Topic 3: Flexibility and reversibility of the measure

In your opinion, how far can the measures be adjusted/modified to changed parameters in the event of a more frequent occurrence of extreme events?

Description: This question examines if the measure can be adjusted to the impacts of climate change like the more frequent occurrence of drought and floods. This is geared towards the “technical” adjustment or modification of an existing measure at a later point in time.

Example: Low flexibility means that a measure may only be adjusted with very high expenses or costs (for example, “costs for the adjustment” correspond to the “costs for construction” of the measure). With medium flexibility, the measures may be adjusted under certain prerequisites, for example the increase in the height of dikes or the construction of additional retention areas for flood management. On the other side, high flexibility results where measures can be adjusted without considerable costs, like for certain measures in mobile flood protection or early warning systems.

Assessment scheme:

Only adjustable with very high expenses						High flexibility
-3	-2	-1	0	+1	+2	+3

Does the measure have installed/planned safety margins that guarantee the function of the measure in regards to its water management goal under the changing climate?

Description: The question examines if during the planning/design of the measure the expected climatic changes were considered by integrating safety margins and therefore the water management objective of the measure can be reached with higher probability.

Example: During the assessment of flood protection measures, a factor for climate change was considered in Bavaria. Flood design discharge have been increased beyond the statistically determined data (e.g. HQ100). In Bavaria, a flat-rate factor of 15% for flood events up to HQ100 was applied⁸. Such a factor is also applied to dikes in a few areas along the German coast.

Assessment scheme:

Safety margins not present	Safety margins not important for the measure	Safety margins present
-3	0	+3

In your opinion, does the measure also make sense if climate change does not develop as it is expected in the climate projections today (so-called “no-regret” or “low-regret” measures)?

Description: The question examines if the measure should be considered as reasonable despite climate projections that do not pan out, i.e. if the measure is reasonable independent of climate change (so-called “no-regret” or “low-regret” measures).

Example: Examples of low and no regret measures are the existing limitation of new construction in areas at risk of flooding (because these are in a risk zone independent of climate change) or the creation of protection areas/natural retention areas (because these also help to achieve biodiversity

⁸ stMUGV (2004): Consideration of possible climate changes - internal decree from the Bavarian Ministry for the Environment, Health and Consumer Protection, unpublished.

goals). Other examples for a low/no-regret measure include the reduction of leakage in the water infrastructure or all measures that lead to a decrease in the water demand (see attachment).

Assessment scheme:

No low/no-regret measure	Low-regret/no-regret measure
0	+3

3.4.4 Topic 4: Side effects

In your opinion, does the measure improve/worsen the resilience of ecosystems compared to the projected climate change impacts?

Description: This question examines if the measure improves or worsens the resilience of ecosystems against climate change compared to the projected climate change impacts.

Example: Climate change and its consequences may have effects on the functionality of ecosystems, for example through a change in water and temperature regimes. This may result in changes to the species composition. A water management measure may strengthen or weaken the resilience of affected ecosystems; thus, a measure that increases the temperature of waterways (e.g. wastewater flows into water courses with increasingly low water) would lead to a worsening of the resilience of the surrounding ecosystems. The opposite applies to a measure that increases the water quantity available (through savings, etc.). Measures that lower the flow of hazardous substances and nutrients into ecosystems (like riparian buffer strips or the expansion of treatment plants) increase their resilience, etc.

Assessment scheme:

Strongly reduces resilience			Resilience does not change			Strongly increases resilience
-3	-2	-1	0	+1	+2	+3

In your opinion, is this measure coherent with an existing climate adaptation strategy in place at a high governmental level?

Description: A central question for the assessment of measures is their coherence with a possibly existing climate adaptation strategy (e.g. on a national level). The selected measures should ideally be in agreement with such a strategy.

Example: The creation of natural retention areas for floods and nature protection on agriculture land represents, for example, a conflict of use. This measure is considered coherent with a climate adaptation strategy, for example at national level, if strategy calls for the expansion of natural retention spaces. A measure that would limit natural retention areas, however, would not be coherent.

Assessment scheme:

No coherence with adaptation strategies at high governmental level	No information / no high level adaptation plan	High coherence with adaptation strategies at high governmental level
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-3	0	+3
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3.5 Application: Assessment area 2 “Effects on climate change”

This second assessment area deals with whether or not the measure leads to the emission of greenhouse gases and therefore contributes to or intensifies climate change.

3.5.1 Topic 5: Intensification of climate change

Does the implementation of the measure lead to the direct emission of greenhouse gases?

Description: A lot of water management measures (for example under the management plans of the WFD and the Floods Directive) directly release greenhouse gases throughout their lifespan; however, other measures act as “sinks” for these gases. This question examines the relative contribution of the measure to the direct emission of greenhouse gases.

Example: Wastewater treatment plants without gas caps directly emit the hazardous greenhouse gas methane during operation. On the other side, the reforestation or restoration of wetlands (e.g. for flood protection) may permanently absorb and retain carbon dioxide (CO₂-reduction).

Assessment scheme:

High greenhouse gas emissions	Medium greenhouse gas emissions	No/low greenhouse gas emissions	Medium CO ₂ -reduction (e.g. wet meadows)	High CO ₂ -reduction (e.g. peatlands)
-3	-2	0	+2	+3

How high is the energy consumption of the measure during its running operation (indirect contribution to climate change)?

Description: This question examines the energy consumption of the measure during its running operation and corresponds to its indirect contribution to the emission of greenhouse gases.

Example: When answering the question, the entire lifespan of the measure should be considered. If the measure consumes significant quantities of energy (heat energy, electricity), this should be evaluated as a generally high greenhouse gas emission.

Assessment scheme:

High energy consumption during operation	Medium energy consumption during operation	No/low energy consumption during operation
-3	-2	0

3.6 Presentation of the results

The results of the Screening Tool are presented as follows (a complete evaluation sheet is found in Annex 2):

Kriterium 1: Relevanz der Maßnahme

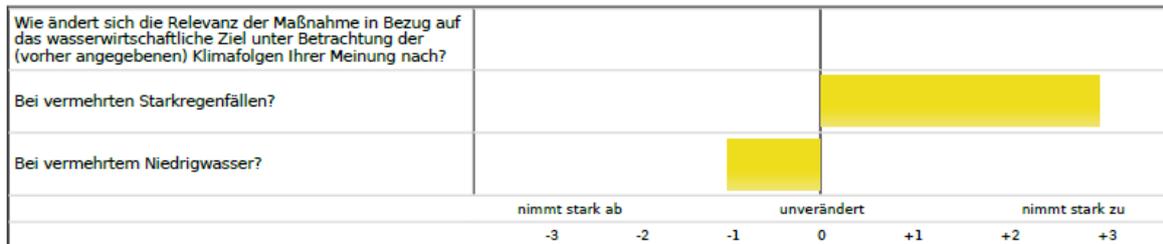


Figure 1: Graphic representation of the screening results.

The level of uncertainty selected by the user is presented (per question) in green (low), yellow (medium) or red (high). Omitted or unevaluated questions are not illustrated.

3.7 Use and interpretation of the results

The application of the Screening Tool “motivates” the measure-implementing authority to deal with climate change as one of the criteria that influences the selection of measures to possibly implement. The results from the tool include an overview of the assessment areas and their questions, the provided answers/assessments as well as uncertainties.

“Warning notes”

Based on the discussions on European level regarding the development of tools to assess measures, the Screening Tool offers “warning notes”. These are displayed if during the assessment of a measure certain questions that are particularly important for the overall question are evaluated as negative. The particularly negative assessment within a question is sufficient for triggering a warning note.

The following questions trigger a warning note:

Question	Value at which a warning note appears
In your opinion, how does the relevance of the measure change in regards to the water management objective taking into account under consideration of the (previously identified) climate consequences?	-2
In your opinion, does climate change alter the effectiveness of the measure in regards to the water management objective?	-2
In your opinion: How far can the measures be adjusted/modified to changed parameters in the event of a more frequent occurrence of extreme events?	-3
In your opinion, does the measure also make sense if climate change does not develop as it is expected in the	0

climate projections today (so-called “no-regret” or “low-regret” measures)?	
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Warning:

Please note: The possibility exists that the measure is problematic under the conditions of climate change. Please check the assessment.

If the result does not change despite this review, the application of the measure must be reconsidered under the basic conditions of climate change.