

## Annex 2.5.2 – Reference conditions setting

Category	REFCOND-Guidance
Introduction	<p data-bbox="443 354 772 570">High status or reference conditions is a state in the present or in the past corresponding to very low pressure, without the effects of major industrialisation, urbanisation and intensification of agriculture, and with only very minor modification of physico-chemistry, hydromorphology and biology.</p> <p data-bbox="800 354 1921 423">Totally unaffected sites do not exist anymore (at least due to the world wide atmospheric deposition). As "close-to-pristine" state is unlikely to be encountered, (except perhaps in some national parks), the concept of "pristine state" is not relevant in practice for the definition of reference conditions for the Central Baltic GIG.</p> <p data-bbox="800 443 1921 488">If an historic database has to be used, this should be from a time period without intensive industries, hydraulic engineering and agriculture.</p> <p data-bbox="800 505 1921 623">Selection criteria for reference sites are based on « anthropic pressures », that must be « null or very low » ; the problem is to define a very low pressure level that leads to insignificant or very low impact at the ecosystem level. « Insignificant impact » could be understood as « hardly distinguishable from natural (spatial and temporal) variability » at the level of the biological elements. A first validation of « very low impact » should be assessed at the level of abiotic parameters (physico-chemistry and hydro-morphology).</p> <p data-bbox="800 686 1520 708">In the first stage, biological elements are not considered as selection criteria.</p> <p data-bbox="800 721 1921 790">In the second stage, those sites whose aquatic communities exhibit statistically low biological values are carefully checked for pressures, and dubious sites are eliminated. The checking process must consider possible errors in evaluating the pressures, and in sampling methods for biological communities.</p> <p data-bbox="800 810 1921 855">If, after checking, no significant pressure or possible error is encountered, these sites are considered as representative of the type's natural variability.</p> <p data-bbox="800 870 1896 915">However, any samples falling outside the range of "good ecological status" should not be included in the calculation of the reference value for the biological quality element considered.</p> <p data-bbox="800 930 1921 976">Impacts on rivers or within the catchment should not affect the original characteristics, so that the aquatic community is only altered minimally. Type-specific communities and conditions should be represented.</p> <p data-bbox="800 1023 1902 1068">A river stretch that is considered for the selection of a reference site must be situated within one national type. It must have biological populations representative of the type.</p> <p data-bbox="800 1083 1892 1128">Pressures likely to affect the reference site must be evaluated at the three relevant spatial scales : the <b>catchment</b> of the site, the <b>reach</b> scale (i.e. the water body), and the <b>reference site</b> itself.</p> <p data-bbox="800 1143 1921 1188"><i>Proposed minimum length for the river reaches are: &gt; 1 km for small rivers (stream order 1- 3), &gt; 5 km for medium-size r. (stream order 4 - 5), &gt; 10 km for large rivers (stream order &gt; 6).</i></p> <p data-bbox="800 1235 1314 1256">For each pressure criteria, two thresholds are defined :</p> <ul data-bbox="856 1271 1818 1347" style="list-style-type: none"> <li>a « reference » threshold, below which a site is considered as « probably reference » ;</li> <li>a « rejection » threshold, corresponding to a high probability of significant impact, above which a site is eliminated.</li> </ul>

Sites that have all criteria below the reference threshold are considered as reference sites; sites having most criteria below the reference threshold and only some parameters between the reference and rejection threshold are « possible reference sites ». For these sites, only a few possible pressures (i.e less than 10% of the criteria) should exceed the reference threshold level. If a site exceeds the rejection threshold on any one criterion it should be eliminated. These sites should be retained only after carefully checking the cumulative effects of the pressures using local expertise.

Impacts on rivers or within the catchment area should have only local effects to be considered in Reference State.

It is proposed to use the CORINE Land Cover (CLC) classification for the evaluation of the land use in the catchment and riparian area. However, the land cover represents a "driving force" more than a "pressure", and thus must be understood as representing a probability of impact. The CORINE land cover classification should be regarded with some caution. The following definitions are proposed :

Artificial land use : the sum of all the categories of **CLC class 1**. (Urban areas continuous and discontinuous, industrial and commercial zones, communication infrastructures and networks, mines, etc..)

Intensive agriculture : the sum of the CLC categories corresponding to a high potential impact from agricultural activities: arable land (including irrigated land), permanent crops (with associated annual crops), vineyards, orchards, olive groves, complex cultivation patterns, - **CLC codes : 2.1, 2.2, 2.4.1, 2.4.2.**

Low intensity agricultural areas : the sum of the CLC categories corresponding to a lower potential impact from agricultural activities: pastures, land principally occupied by agriculture, with significant areas of natural vegetation, agro-forestry areas - **CLC codes : 2.3.1, 2.4.3, 2.4.4.**

Semi-natural areas: Forest and natural areas, wetlands, water bodies - codes CLC codes : **3.1.1, 3.1.2, 3.1.3, 3.2, 3.3, 4 and 5.**

Other effluents/discharges (Urban pollution)	No or very local discharges with only very minor ecological effects.	<p>Only minor impairments of the physical and chemical conditions, this means: Near-natural background values</p> <p>No or very local discharges with only very minor ecological effects.</p> <p>No known industrial cause of particular pollution (e.g. NaCl, thermal pollution, etc...)</p> <p><i>The following criteria can be used to validate very low levels of point source pollution :</i></p> <p>Very low level of urbanisation, evaluated by the percentage area of artificial areas in the catchment CLC class 1. The following thresholds can be used :</p> <p>"Reference" threshold : &lt; 0.4% of artificial land use in the catchment area. (Between 0.4% and 0.8%)</p> <p>"Rejection" threshold : 0.8 % of artificial area in the catchment.</p> <p>Above 0.8%, a validation with physico-chemical parameters at the site scale is necessary.</p>
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<b>Specific synthetic pollutants</b>	Pressures resulting in concentrations close to zero or at least below the limits of detection of the most advanced analytical techniques in general use (A Selection process for relevant pollutants in a river basin is presented as an example of best practice in section 6 of the guidance document from Working Group 2.1, IMPRESS).	<p>Substances mentioned in Annex X and/or in annex VIII of the WFD should have concentrations at least below the limits of detection of the most advanced analytical techniques in general use</p> <p>Measured values of other anthropogenic, synthetic substances should be below quality objectives or near natural background concentrations, except for those from atmospheric sources.</p> <p>The impact of atmospheric pollution on reference river stretches must not be detectable (e.g. depletion of the aquatic community due to acidification)</p>
<b>Spec. non-synthetic pollutants</b>	Natural background level/load (see reference above)	<p>Only minor impairments of the physical and chemical conditions, this means: Near-natural background values– if this can be estimated; if not, the limit of detection (quantitative) can be used tentatively.</p> <p>No known discharge of specific non-synthetic pollutants upstream in the river.</p> <p><i>If no chemical data are available, the following criteria can be used to validate the very low level of general toxic pressures :</i></p> <ul style="list-style-type: none"> <li>- For small streams : no known toxic pollution discharge.</li> <li>- For larger streams and rivers : no suspected toxic pollution discharge; if (actual or ancient) toxic pollution sources exist in the basin, ratio PEC / PNEC &lt; 1.</li> </ul> <p>In agricultural areas, sites with a known pollution risk by pesticides (according to existing risk maps) are avoided.</p>
<b>Land-use intensification: Agriculture, forestry</b>	Pre-intensive agriculture or impacts compatible with pressures pre-dating any recent land-use intensification. Pressures pre-dating any recent intensification in airborne inputs that could lead to water acidification.	<p>The share of anthropogenic land use in the catchment area (agriculture, afforestation) must be small and shows only local effects. In the case of type-specific floodplains, lateral and vertical connectivity has to be maintained. The reference sites must have a wide riparian buffer zone with type specific riparian vegetation.</p> <p>The land use upstream of the reference site must comply with the following criteria:</p> <p><u>Intensive agriculture</u> : &lt;20% of the catchment area as reference threshold. Rejection threshold : &gt; 50% of intensive agriculture in the catchment. However, in flat lowlands agricultural landscapes, sites with 20% to 50% of intensive agriculture can be considered only if :</p> <ol style="list-style-type: none"> <li>1) there is no significant risk of soil erosion</li> <li>2) the valley floors are mainly occupied by low intensity agricultural area (mainly pastures) and /or semi-natural areas, and riparian corridors are globally preserved at the reach and site scales. (<i>See Riparian vegetation criteria</i>)</li> </ol>

		<p>Between 20% and 50% of intensive agriculture, a validation with physico-chemical parameters at the site scale is strongly recommended.</p> <p><b>See rows at the bottom for chemical reference values.</b></p> <p><u>Cattle breeding</u>: only non-intensive (outdoor) cattle breeding; &lt; 1.25 animal (cattle) units per ha of the catchment area.</p> <p><u>Vineyards, orchards</u> : &lt; 1% of the catchment area, and not situated in the riparian zone.</p> <p><u>Irrigated fields</u> ≤ 10%</p> <p><u>Forestry</u> : &lt; 30% tree plantations (coniferous, Eucalyptus..).</p> <p>If tree plantations &gt; 30% in the catchment, even with no sign of acidification, the riparian corridor must be protected and composed of the type specific natural vegetation. <b>See Riparian vegetation criteria</b></p> <p><u>Acidification</u> : no sign of acidification due to coniferous plantation (on siliceous bedrock). pH &gt; 6. If pH &lt; 6 , it is necessary to determine if the site is naturally acid.</p> <p><u>Eutrophication</u> : no sign of plant proliferation (macrophytes, algae).</p> <p><u>Eutrophication</u> : if possible validate with chemical values</p> <p><b>See rows at the bottom for chemical reference values.</b></p>
<p><b>Riparian zone vegetation</b></p>	<p>Having adjacent natural vegetation appropriate to the type and geographical location of the river.</p>	<p><i>definition of the riparian zone: the minimum width of the riparian zone (or corridor) to be considered is 30m for small streams (order 1-3), 50m for medium size rivers (order 4 - 5) and 100 m for larger rivers (order ≥ 6)</i></p> <p><u>At the reach scale:</u></p> <p>In agricultural landscape (Intensive agriculture between 20% and 50%), intensive agriculture land cover &lt; 10% of the reach. Riparian corridor land use &gt; 90% semi natural or low intensity agricultural areas.</p> <p>In non agricultural landscape (Intensive agriculture &lt; 20%): valley floor and riparian corridor occupied by semi natural or low intensity agricultural areas.</p> <p>Artificial areas : &lt; 10% of the reach.</p> <p><u>At the site scale :</u></p> <p>The riparian zone of the site is entirely bordered by the type specific natural vegetation or semi-natural land cover, with the possible exception of access to the river site.</p> <p>Riparian vegetation zone continuity: uninterrupted or with few interruptions (access to the site).</p> <p>The lateral connectivity between river and riparian corridor is maintained along the site.</p> <p>No direct impact of cattle trampling.</p>

## River morphology

Level of direct morphological alteration, e.g. artificial instream and bank structures, river profiles, and lateral connectivity compatible with ecosystem adaptation and recovery to a level of biodiversity and ecological functioning equivalent to unmodified, natural water bodies

The type-specific hydromorphological conditions are maintained (including the elements mentioned in annex V of the WFD), leading to the conservation of all types of associated physical habitats.

The natural morphological dynamic is maintained, with no or very minor anthropogenic influence. Slightly altered morphological conditions have a high potential to return to natural flow conditions without human action in near future.

### At the basin scale:

Sediment transport : No dams which significantly modify the sediment regime (sediment retention) leading to morphological alterations, evidenced by signs of incision of the river bed (e.g. incision > 0.2m \* stream order, bare bed rock appearing...).

### 1) at the reach scale ( if no general mapping of morphological alterations exists, an expert evaluation is required for the selected reach):

Flow impedance: < 10% of the reach is affected by flow impedance, due to hydraulic effects of weirs, sluices, etc...  
*The % of the reach affected by flow impedance can be evaluated by the ratio of the sum of weirs' heights (in meters) to the total difference in height (slope \* length, in meters) between the upper and lower end of the reach.*

Channelisation: < 10% of the reach is affected by "hard works" (like modification of longitudinal and / or transverse profiles, narrow embankment, loss of lateral connectivity...), otherwise, bed and banks composed of natural materials

Stabilisation: < 20% of the reach is affected by "soft works" (like bank protection on one side, distant dikes, bank maintenance, not affecting the longitudinal and / or transverse profile, and lateral connectivity globally maintained...).

If both types of works are combined < 10% of the reach must be affected.

Siltation: reaches with anomalous siltation suspected, due to agricultural soil erosion, should be avoided (expert judgment).

Connection to groundwater: Total lateral and vertical connection to groundwater.

Substrate conditions: Correspond to related typology

River profile and variation in width and depth: Correspond to related typology

River continuity: At the reach scale, the continuity of the river is not disturbed by anthropogenic barriers and allows undisturbed migration of aquatic organisms (including resident fish populations).

		<p><u>2) at the site scale :</u></p> <p>The site is not situated in a zone directly or indirectly impacted by a nearby artificial structure upstream or downstream.</p> <p>Lacking any instream structural modifications (weirs or dams) that affect the longitudinal and lateral connectivity, and natural movement of river bed, sediment load, water and biota (except for natural waterfalls).</p> <p>Only very small artificial constructions with very minor local effects can be accepted</p>
<b>Water abstraction</b>	Levels of abstraction resulting in only very minor reductions in flow levels or lake level changes having no more than very minor effects on the quality elements.	<p><u>At the basin scale:</u></p> <p>No dams or water storage significantly altering the low flow regime</p> <p><u>At the reach scale:</u></p> <p>Only very minor reductions in flow level changes having no more than very minor effects on the quality elements.</p> <p>No significant water abstraction in the reach.</p>
<b>River flow regulation</b>	Levels of regulation resulting in only very minor reductions in flow levels or lake level changes having no more than very minor effects on the quality elements. Flow regulation that has the potential to recover to natural flow in near future.	<p><u>At the basin scale:</u></p> <p>No dams which significantly modify the natural hydrological flow regime (flow regulation) : e.g. suppression of frequent floods (&lt;5 years) with anomalous development of vegetation in the channel, or low flow alteration ( &lt; to + or - 20% modification of the natural monthly minimum flow discharge).</p> <p>The total storage capacity of the reservoirs in the catchment is &lt; 5% of the mean annual discharge at the site.</p> <p>No change of the natural (type specific) annual flow characteristics (seasonality of high and low flow)</p> <p><u>At the reach scale</u></p> <p>No by-passed section with residual flow (legal minimum discharge)</p> <p>No significant hydropower peaking effect (ratio Q hydropeaking / Q baseflow &lt; 2)</p> <p>Absence of flow regulation (dam) on the reach itself.</p> <p>No significant change of the natural temperature regime.</p>
<b>Introductions of alien species</b>	No impairment by invasive plant or animal species.	<p><i>NB: the issue is: to give a sound definition of 'alien species' and 'type-specific species' and to make clear if the one can shift into the other, and if so on what conditions. We consider this as an item that should be discussed and solved on a European level.</i></p> <p><u>Proposed definition of alien species</u> : non indigenous species recently introduced (i.e. during the XXth century) or in early stage of dissemination in the river reach, not known to present a risk of being invasive.</p>

	<p><i>Proposed definition of invasive species : alien species in stage of active colonisation, which are quantitatively predominant in their respective community, and whose development significantly alter the composition and abundance of the type specific communities. These species, by direct or indirect effects, can induce a risk of extinction of indigenous biota, and alter the global ecosystem functioning.</i></p> <p>At the site scale, no invasive species, but alien species which are not at the invasive stage are tolerated.</p>	
<b>Fisheries and aquaculture</b>	<p>Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.</p> <p>Stocking of non indigenous fish should not significantly affect the structure and functioning of the ecosystem.</p> <p>No impact from fish farming.</p>	<p>No intensive (commercial) fishery.</p> <p>Fisheries, fish management and / or aquaculture plants which have no significant impact on fish populations are tolerated, i. e. the type specific fish population is maintained.</p> <p>Fishing or stocking of fish is limited, and must have no impact on the ecosystem functioning.</p> <p>No or very limited direct pollution by aquaculture plants.</p>
<b>Biomanipulation</b>	No biomanipulation.	No biomanipulation.
<b>Recreation uses</b>	No intensive use of reference sites for recreation purposes (no intensive camping, swimming, boating, etc.)	No nearby intensive recreational use at the site scale: No regular bathing activities or motor boating. Occasional recreational uses (such as camping, swimming, boating, etc.) should lead to no or very minor impairment of the ecosystem.
<b>Chemistry</b>	Oxygen Saturation [%]	90 - 110
	BOD5 [mg/l]	<=2
	P-PO4 [µg/l]	<=20
	N-NO3 [mg/l]	<=2

**R-E1 validated reference sites**

country	number of reference sites	comment
CZ	3	-
HU	16	-
RO	20	-
SK	22	not validated yet