

Guideline for River Restoration Plans in Croatia



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PROPOSAL

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I. INTRODUCTION

1. Preface

1.1. G2G-project in short

This document, the Guideline for River Restoration Plans, has been developed as one of the results (deliverables) of the project MEANDER (MEASures for Naturation and Development of Rivers). The purpose of the project "MEANDER" was to develop procedures and capacity for hydromorphological monitoring and assessment at national level and to develop a methodology for the thematic and regional planning process of hydromorphological river restoration measures in accordance with the requirements of the Water Framework Directive (WFD) (Art. 8 & 11), Birds and Habitats Directives (commonly known as Natura 2000) (Art 6) and key elements of the Floods Directive (FD).

The MEANDER project has been developed under the G2G programme (G2G/V Environmental Facility) of the Dutch Ministry of Infrastructure and Environment and was implemented by the Agentschap NL.

The G2G programme aims to assist new EU member states, candidate EU member states and potential EU member states in meeting the criteria for EU membership through projects dealing with the (consequences of) implementation of European legislation.

1.2. Parties involved

Under this programme a General Project Plan (see literature) was developed and approved in November 2010 by the Dutch partners Agentschap NL (financing), Government service for Land and Water Management (DLG, projectlead) and Croatian partners Croatian Water (CW, Counterpart) and State Institute for Nature Protection (SINP, Beneficiary). The project started in January 2011 and was finished in March 2013.

During the first 2 months of 2011, the Inception phase, the project was discussed in detail with all partners and the Project Advisory Committee. As a result of this the project plan was slightly adjusted, where needed and agreed on. The result of this phase was documented in the Inception report, EVD, March 2011.

1.3. Components, activities and results

In general the project consists of 4 Components.

These Components represent a set of defined activities and results:

- **Inception phase (Component 1)**

Result: Inception report with mutual agreement over the project goals and details.

As a result of discussions during the inception phase, the purpose of the project "Capacity Building for Hydro-Morphological Monitoring and Measures in Croatia (MEANDER)" has been agreed to be:

"to develop procedures and capacity for hydro-morphological monitoring at national level and to develop a methodology for the definition of hydro-morphological measures based on a case study in the Mirna river basin in accordance with the requirements of the WFD (Art. 8 & 11), Birds and Habitat Directives (Art 6) and key elements of the Floods Directive."

- **Component 2: Hydro-morphological monitoring**

Result: An accepted methodology and trained staff for hydro-morphological monitoring and assessment in compliance with the WFD; This will provide trained staff, a draft strategy on hydro-morphological monitoring and hydro-morphological guidelines on a national level.

- **Component 3: Guidelines for HM Measures and River Restoration in support of WFD, Natura 2000 and FD Objectives**

Result originally agreed as: A developed approach on the definition of hydro-morphological river restoration measures, supporting the objectives of the Water Framework Directive, Natura 2000 and key elements of the Flood Risk Management Directive, through a Pilot in the Mirna river basin and comparison with cases in two other rivers in Croatia. This was

supposed to deliver a river restoration plan, a site restoration plan for two sites and a National River Restoration 'CookBook'.

During the project this result has been condensed into: Development of a River Restoration Guideline in Croatia, based on present knowledge and examples from the EU, and developed in cooperation with GOs and participation of representatives of some NGOs in Croatia.

- **Project management (Component 4)**

Result: handling of all project management. For this several progress reports will be made, there were three Project Advisory Committee (PAC) meetings and a final management report regarding the whole project.

All components and their results have been achieved through execution of a number of activities throughout the project lifetime of 2 years. A number of working sessions, internal and external workshops, and team sessions were needed to complete all planned work. For this a detailed planning was made and constantly monitored, discussed with all partners and the PAC.

1.4. Relation between Component 2 and Component 3

The project aims to develop two important instruments for the Croatian partners. An important part of the project was capacity-building amongst different staff of relevant Croatian implementing bodies.

Component 2 has focussed specifically on capacity building and methodology development on processes needed to gather and analyse hydro-morphological information in the field. This information is vital in the process of classification of water bodies according to WFD criteria. This classification will form the basis of the general set of measures that will be adopted in the RBMPs.

The River Restoration Guideline resulting from Component 3 gives specific instructions on using the hydromorphological data, collected and analysed within the framework of Component 2, as input for development of specific measures for mitigation of adverse effects of hydromorphological alterations.

The RBMP presents an umbrella document for RR Plans (RRPs) which, in turn, give detailed and specific measures for a certain area within the river basin. After the actual river restoration measures being taken in the field, the Component 2 instruments and knowledge must be used again to monitor the developments in hydro-morphology and/or ecological values of the water systems involved.

This River Restoration Guideline can be considered a flexible, "living" document that could benefit from newly acquired information and insights, therefore we invite the future users of this Guideline to actively put energy into updating this document in the future.

2. Content of this Guideline for River Restoration Plans

This Guideline consists of this Introduction, followed by 3 distinct Parts and ends with Annexes.

- The **Introduction** gives a preface of the guideline and a short overview of the bilateral MEANDER project, its components, activities, results and the parties involved with their roles in the project. The introduction also describes the purpose, use and status of the guideline.
- **Part A** is intended to be the part with all the relevant background information. It contains different information relevant to everyone who is interested or involved in River Restoration in Croatia. This part can be characterized as the theoretical backbone of this Guideline. It gives insight in all the relevant legal framework, definitions, organizational aspects, methods, source of information, etc.
- **Part B** is the actual Step-by-Step procedure that helps people develop a RRP. It is a plan development method that is meant to be flexible, non-prescriptive, with possibilities for adjustments where needed. The steps describe a number of activities that are considered to be logical in sequence and in time, with variable duration.
- **Part C** gives a basic overview of tools and methods and beside it relevant examples of technical and other sorts of measures that can be taken to enhance and restore natural

riverine ecosystems. Since this Guideline is mainly focusing on rivers (and its upstream tributaries) the focus in the examples will also mainly point in that direction. Therefore you will not find examples for lakes, ponds and canals, unless they can be identified as a direct part of a riverine waterbody. The examples are derived from many sources throughout European countries active in river restoration and are all assessed on their relevance for the Croatian situation. The examples are sometimes described just in words, or as pictures and photographs with short explanatory text, or can be just a link to an internet site where good descriptions are found.

- The **Annexes** state the sources of information, definitions and a list of acronyms and abbreviations used to create this Guideline.

3. Purpose of the Guideline

This Guideline is developed to be helpful in the process of developing and writing River Restoration Plans under the EU Directive 2000/60/EC, the Water Framework Directive, in Croatia. It should be considered as a practical help that has the appearance of a Handbook that guides people through the complex process of plan development. The guideline has no strict prescriptive character. Although quite detailed, it leaves openings and space for a different approach in plan development where needed. The guideline helps to understand the background of river restoration, gives structure to the actual river restoration plan and provides several examples of measures that have proven to be effective in river restoration.

Ecological river restoration refers to a large variety of measures aiming at restoring the natural state and functioning of the river and the riverine environment. By restoring natural conditions and processes, river restoration aims at providing the framework for the sustainable multifunctional use of rivers (ECRR). Technical structures (like hydropower plants, weirs and dams, enforced embankments to prevent erosion, canalisation in function of flood protection, pollution of the water bodies with sewage water or chemicals, dredging the rivers to improve shipping capacity etc.) are just a few examples of activities and their impacts on rivers by humans. In European countries hardly any river has escaped this kind of influence by men, thus resulting with a more or less degraded riverine system.

Apart from the visible degradation, there are many hidden effects of human impact (changes of water regime that cause changes of typical natural processes of riverine systems e.g. processes of erosion and deposition of sand and clay; changes of annual or periodical rhythm of flooding resulting in severe winter and spring flooding with high risk of damage; summer droughts; etc...). Often, these were not regarded as important or problematic in recent history, but nowadays are identified as important factors in the decrease of natural values of water bound habitats and ecosystems throughout the whole of Europe. Combined with water quality issues and potential effects of climate change many riverine systems in Europe nowadays seem to be far away from their so-called pre-disturbed situation.

As a consequence in many cases typical riverine habitats have decreased rapidly during the last decades, and some have even disappeared from certain riverine systems. This also applies for many plant and animal species of these habitats and ecosystems. There are many examples of typical freshwater species that can be found in international and/or national red lists of endangered species.

On the level of the EU and on the national level of the EU countries the past decades have brought some progress for threatened riverine systems, as is recently stated in the EU-Blueprint on water. During that time many countries have taken measures to not further decrease the water quality of streams and rivers. The improvement of water quality is an ongoing process, which started in the 1970s with legislation on water quality in general, and resulted with integrated approach to water quality in 2000 (enactment of Water Framework Directive). In number of cases the water quality situation has even improved strongly. Chemical pollution and sewage discharges have been strongly regulated and minimized. Chemical loads have decreased and oxygen levels in the water improved. Many fish and other animal species re-inhabited the rivers again.

This is already a good result, but the ongoing overall decrease in biodiversity shows there is more to be done. The EU countries have agreed on the implementation of the Water Framework Directive, to make sure the signs of improvement are continued over the coming decades. EU countries must implement River Basin Management Plans (RMBP) as instruments to take measures that will aim

for a continued improvement of the fresh water systems in Europe. The measures will not only focus on water quality, but also, more specifically, on improvements in the hydromorphological situation of the rivers, ponds, lakes and streams. The overall aim is to “restore” the system to the best we can, using the references for natural, pre-disturbed rivers that are left in Europe or in our scientific records. Member states have to take measures to mitigate the negative impacts of hydromorphological changes if it is proven to be environmentally and socio-economically effective. Hence the title “River Restoration Plan” (RRP), for plans that will be developed under the RBMPs, as the specific set of measures for a specific area or water body. These RRP will lead to the actual execution of measures in the field that will help to reach the WFD goals.

4. Who can use this Guideline?

This guideline is primarily composed for all people who are, or will become active in the implementation of the EU Water Framework Directive through river restoration.

It will especially be of use for the experts or project leaders working for governmental organizations in Croatia, responsible for developing and writing actual restoration plans. Hrvatske Vode (Croatian Waters) is the Competent Authority for managing waters in Croatia, residing under the Ministry of Agriculture. It has a Central Office in Zagreb and 6 regional offices throughout the whole country. Croatian Waters is main responsible body for implementation of the WFD in Croatia, including the development of the RBMPs for the whole of Croatia. It has the leading role in Croatia for the development of RRP as well. Many experts or project leaders will be working on the RRP development in the coming years. The Guideline will help them in their work, to structure and to develop uniform RRP throughout the country.

During the execution of a RR project, many other people will be involved:

- professionals from different relevant organizations could be active as members of project teams, sources of knowledge and information, in stakeholder meetings or just as people who are involved in the planning process;
- experts from universities, other Ministries and directorates (such as SINP), NGOs, regional and local governments, representatives of civil organizations and all kind of private persons could be interested in how the RRP are developed.

This Guideline, as a deliverable of MEANDER project, can be made available through internet or as a publication.

5. Status of the Guideline

The Guideline was the result of the MEANDER Project that was implemented from January 2011 until March 2013.

It will serve as a proposal for future official document for general approach on river restoration in Croatia. It will encompass all necessary steps to achieve a successful mitigation of negative impacts of hydromorphological alterations.

With ongoing and continuous fulfilling of the WFD requirements this document will be of utmost importance and use.

II. PART A – FRAMEWORK AND BACKGROUND

1. Legal framework

1.1. EU directives and regulation

This Guideline for River Restoration Plans in Croatia is developed as a practical method to support the implementation of the EU Water Framework Directive (WFD) in Croatia, in line with the Birds and Habitats Directive (Natura 2000) and the Flood Risk Management Directive (FD). Croatia, as a candidate EU-member, is taking great effort in preparing to implement EU directives and regulations and has taken action to harmonize national legislation with EU requirements.

Background of the WFD

Improvement of the water quality did not start with the publication of Directive 2000/60/EC (or the Water Framework Directive) in 2000. In 1988 the commission was asked to come with proposals to improve the ecological quality of surface waters. The declaration of the Ministerial Seminar on groundwater held at The Hague in 1991 recognized the need for action to avoid long-term deterioration of freshwater quality and quantity and called for a programme of actions to be implemented by the year 2000 aiming at sustainable management and protection of freshwater resources. In 1995 an action programme on the protection of groundwater against pollution and dangerous substances was requested by the Council.

The **EU WFD** aims to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater, which:

- (a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- (b) promotes sustainable water use based on a long-term protection of available water resources;
- (c) aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- (d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and
- (e) contributes to mitigating the effects of floods and droughts.

The Directive requires that surface waters (rivers, lakes and coastal waters) and ground waters are to be managed within the context of River Basin Management Plans (RBMPs). All waters are to be characterized according to their biological, chemical and hydro-morphological characteristics. These together are to be compared with an assessment of waters unmodified by human activity and classified into different categories of ecological status. All waters are required to meet 'good status' (for natural water bodies) or 'good potential' (for heavily modified water bodies), except where specific derogations are applied. The means to achieve this is through the use of the River Basin Management Plans, which integrate existing EU measures to protect the water environment and identify all remaining human pressures, which may result in a failure to achieve 'good status'. Member States are required to establish a programme of measures in each river basin appropriate to these pressures. The Directive is also a 'framework' measure in that it provides for additional measures to be adopted by the EC at a later date, including the establishment of environmental quality standards for specified priority substances.

The WFD includes articles that regulate how to deal with Protected Areas, like Natura2000 areas falling under the Habitats and Birds Directives.

1.2. Relation to other EU directives and regulations

In addition to the WFD that uses RBMPs as detailed accounts of how the objectives set for the river basin are to be reached within the required timescale, the Groundwater (GWD) and the Environmental Quality Standards (EQSD) Directives were adopted as daughter directives to the

WFD – completing the framework. They are directly linked and further clarify and complement the legislative framework of the WFD by providing operational guidance and additional criteria.

The **EU Habitats Directive** also known as Natura 2000 Directive 92/43/EEC aims to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member State. It is ultimately aiming to protect, maintain or restore a favorable conservation status for selected species and habitats of Community importance and to ensure a coherent network of special areas of conservation (Natura 2000 sites).

The **EU Birds Directive** also known as Natura 2000 Directive 2009/147/EC, codified version of 79/409/EEC, which covers the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member State. It covers the protection, management and control of these species and lays down rules for their exploitation.

The **EU Floods Directive** 2007/60/EC aims to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community.

For the exact and complete text of the above-mentioned EU Directives, see the links to the internet sites in the part 'Annexes' (under Sources of information).

All river restoration plans should at least be in line with these directives, but there are more directives of importance that must be taken into consideration. There are eleven Directives whose measures and provisions should be included into the programme of measures, which all Member States must produce for each of the River Basin Management Plans. These directives address different areas of legislation (see figure II.1 below). Some relate to the regulation of pressures on water, some relate to the quality of water while some relate to the protection of birds and biodiversity as such. Finally a number of directives are more procedural legislation, on the requirements for issuing permits or improving safety management in relation to dangerous substances.

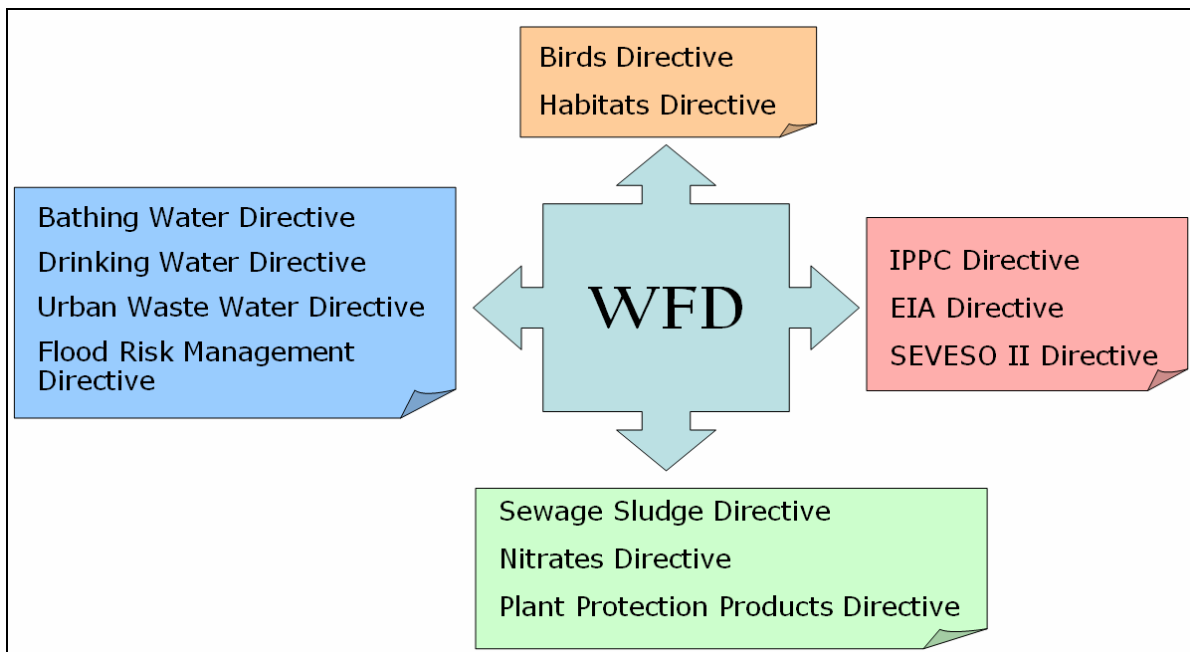


Figure II.1. Directives whose provisions are contained in RBMPs (**blue**-water related directives, **orange**-protection of biodiversity in relation to water related measures, **green**-pressures related directives, **red**-procedural directives).

Water management in Croatia is regulated with the national Water Act (OG 107/95, 150/05, 153/09, 63/11, 130/11), the Water Management Financing Act (OG 107/95, 19/96, 88/98, 150/05, 153/09) and accompanying by-laws as well as numerous international and bilateral treaties. Basic strategic document is the Water Management Strategy. The Water Act nominates Ministry of agriculture as the competent authority for complete implementation of the water management policy with cooperation of other bodies of state administration. According to the Water Act Croatian

Water is the legal subject competent for managing waters, including, amongst other things, making river management plans and their implementation (Figure II.2.).

The National Water Act of Croatia (OG 153/09) regulates the following issues:

- legal status of water, water estate and water structures,
- management of water quality and quantity,
- protection from flooding,
- detailed ameliorative drainage and irrigation,
- activities of public water and public sewerage,
- special activities for water management,
- institutional structure of these activities and
- other issues related to water.

The provisions of the Water Framework Directive are partially transposed into the national Water Act and will be fully transposed through subsidiary laws, proscribed under the Water Act, to ensure further detailed processing and implementation framework (for example: the Regulation on Quality Standards for Water entered into force in January 2011 and National monitoring plans are gradually being harmonized with the WFD requirements since 2009.).

The latest Water Act adjusted prior distribution of 4 water management districts to two river basin districts (Danube and Adriatic), with regard to their natural belonging to international basins (the Black Sea and the Adriatic Sea, respectively) establishing a basis for WFD implementation through the obligatory making and implementing of RBMP for these basins.

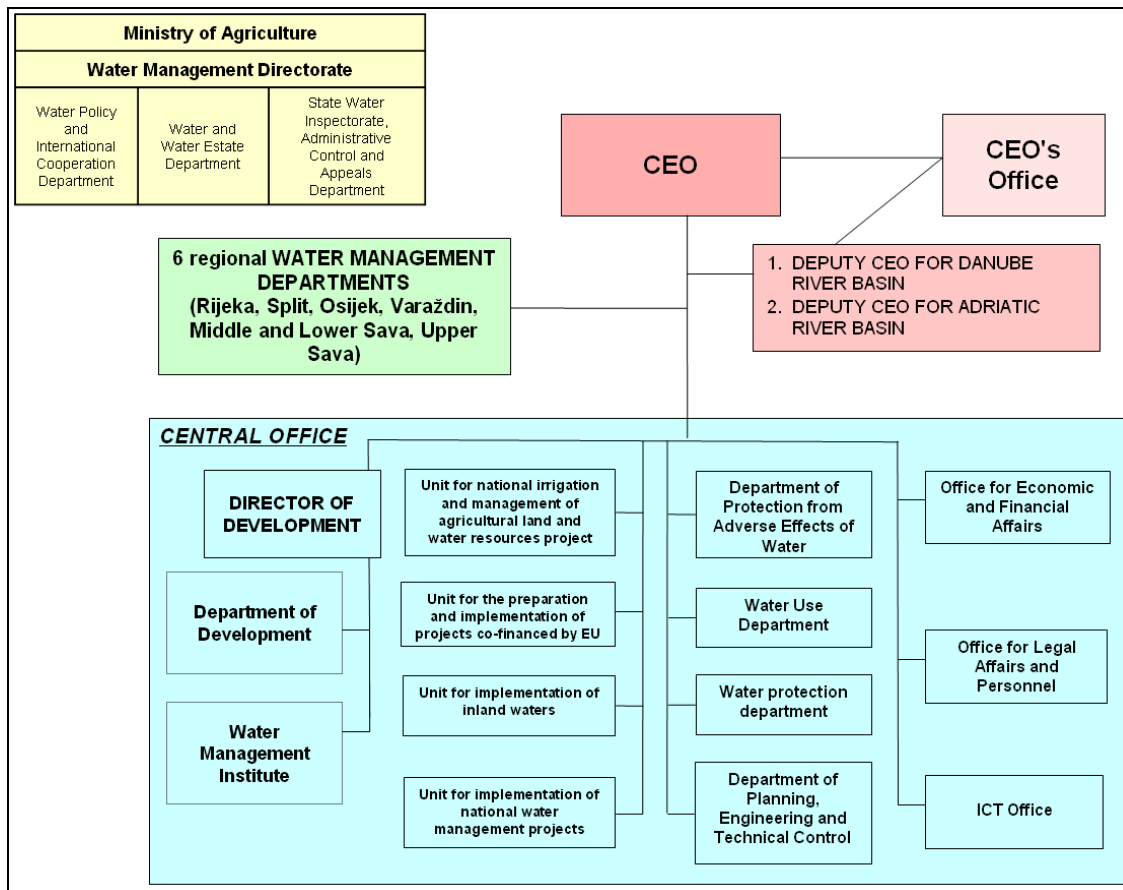


Figure II.2. Organigram of Ministry of Agriculture and Croatian Water

Laws on Nature protection

The basic regulation governing nature protection in Croatia is the Nature Protection Act (OG 70/2005, 139/08 57/11) making nature protection an obligation for all institutions and entities that use natural goods (agriculture, forestry and water management). The National Strategy and Action Plan for Biological and Landscape Diversity (NSAP) is a basic strategic document (OG 81/99 and 143/08) that determines long-term goals and directions for preservation of the biodiversity and protected natural areas as well as means of its implementation.

During the last two decades responsibility for nature protection often changed positions in governmental institutions in Croatia. From 2011 Directorate of Nature protection is part of the Ministry of Environmental and Nature Protection. State Institute for Nature Protection (SINP) was established in 2003 by Government Regulation as the central expert institution for nature protection. Public Institutions for nature protection on county level are responsible for management of Ecological network in their Counties.

The Nature Protection Act (NN 70/05, 139/08, 57/11) transposed many of the provisions of the Habitats and Birds Directives into national legislation. The main such mechanisms are National ecological network (Ordinance on establishment of national ecological network, NN 109/07) and Appropriate Assessment procedures (AA) (Ordinance on the assessment of acceptability of plans, programmes and interventions for the ecological network, OG 118/09). For interventions requiring an environmental impact assessment (EIA) or strategic environmental impact assessment (SEA), in line with EU practices, Croatian nature protection legislation unites the AA procedure with the EIA procedure (Regulation on the environmental impact assessment of interventions, OG 64/08) or the SEA procedure (Regulation on the strategic environmental impact of plans and programmes, OG 64/08).

Croatia has to adopt the Decree on internationally important ecological network sites (Natura 2000) until the day of accession. SINP has drafted the proposal for the Natura 2000 network in Croatia: this proposal consists of around 800 areas. The selection of these areas is based on standard scientific criteria that apply in the same way to all EU countries.

Natura2000 in Croatia, a further elaboration

Every EU Member State is responsible for setting up its national part of the Natura 2000 network. Every site in the network comprises exactly defined target features (species and/or habitats listed in the Nature Directives). Natura 2000 sites have their conservation objective already set up in the Habitats Directive: Member States are obliged to maintain the current status of target features, provided there is no higher, more ambiguous goal set up by the Governments.

A big number of NATURA 2000 sites are areas of different types of freshwater habitats, e.g. meandering rivers, lakes, temporary ponds, karstic rivers. Together with adjacent temporary flooded and connected swamps, all these areas are important for survival of different plants and animals. On each NATURA 2000 site activities must be executed in the way that ensures continuous, longlasting survival of species and habitats for which the site was desicological network.

This means that inside or outside of NATURA 2000 site should be:

- a) Avoided harmful activities that could significantly disturb the species or habitats for which the site is designated;*
- b) Taken the positive measures, where is needed, with aim to maintain and restore „favourable conservation status“ of these habitats and species in their natural environment.*

Natura 2000 neither replaces the national system of protected areas nor “competes” with them; it complements them at the EU level. Therefore, there is often an overlap with the national network of protected areas as well as national ecological network. However, it generally differs from national systems of protected areas due to one very specific obligation related to Natura 2000 sites, the strict test of Appropriate Assessment of plans and projects likely to affect them. Generally, this assessment should ensure that the conservation objective of Natura 2000 sites is maintained and that the entire network remains unaltered, meeting its main objective – to effectively contribute to biodiversity conservation within EU.

Appropriate Assessment

Assessment of the plans and projects in relation to NATURA 2000 sites is provision of the European Habitats Directive (92/43/EEC), in particular its article 6(3) and 6(4). The assessment has to be performed for all intended plans and projects which might have an impact on NATURA 2000 habitats and species. Only plans and projects connected to the management of NATURA 2000 sites do not have to be assessed.

The aim is to reveal negative impacts of plans and projects to coherence of NATURA 2000 network through appropriate assessment (AA) of their possible effects on integrity of the NATURA 2000 sites and in particular in regards to their effect on species and habitats that are sites target features. The assessment is concentrated only on impacts on the habitat types and species listed in the Annexes of Birds and Habitats Directive and not on all habitats and species which occur at the site. If impacts are detected such plans and projects have to be either avoided or amended, or if imperative reasons of overriding public interest are proved compensatory measures in favour of NATURA 2000 have to be taken to ensure overall coherence of the NATURA 2000 network.

The location of the projects is not decisive; even the projects that are outside of the site (i.e upstream on the river) or some distance away may still have to be assessed as they may have impact on NATURA 2000 sites.

Detailed information on Natura 2000 in Croatia and on Appropriate Assessment in Croatia you may find at <http://www.natura2000.hr>

2. Implementation of the WFD

2.1. Establishment of River Basin Management Plans (RBMPs)

The WFD is implemented through the cyclic process of river basin management planning. The final product of each planning cycle is a River Basin Management Plan for each designated river basin. Monitoring and reporting to EU will be on the level of these RBMPs.

The River Basin Management Plan describes the river basin and the pressures that the water environment faces. It shows what this means for the current state of the water environment in the river basin district, and what actions will be taken to address the pressures (Programme of measures). It sets out what improvements are possible by a set date and how the actions will make a difference to the local environment - the catchments, estuaries, the coast and groundwater. According to the provisions of the Water Act the competent authority responsible for the production of such a plan in Croatia is Croatian Water.

The "Summary of the Programme of Measures" is a key component of the RBMP giving an overview of basic and supplementary measures that are necessary to achieve the WFD goals in the river basin. The Programme has the character of a summary, a long list of measures for the whole basin with possible time and budget planning indicators, still on a rather high level of abstraction. Under each RBMP one or more RRP's can be developed, providing a much more specified and elaborated description and view on how the goals are to be reached.

Status of RBMP planning in Croatia

A draft RBMP was developed pursuant to provisions of the National Water Act, supporting legislation, adopted documents from the negotiation process with the European Union for Chapter 27 "Environment" and dynamics determined in the Action plan for preparation and adoption of the River Basins Management Plan. It was adopted On December 3, 2010 by the Government of the Republic of Croatia as a basis for preparation of the final River Basins Management Plan, after it has been harmonized with the comments and suggestions from the public consultation. During 2011 and 2012, the strategic environmental assessment procedure was carried out.

This draft RBMP has two clearly defined parts, the Adriatic and the Danube, and main components are as follows:

- Description of the characteristics of all bodies of surface water, groundwater, transitional and coastal waters;*
- Analysis of major pressures and impacts of human activities;*
- Water quality objectives and deadlines for achieving these goals;*
- A basic programme of measures;*
- Proposed program for monitoring water and its implementation;*
- Public participation.*

The process of planning is significantly more democratic and planning is not retained within the limits of state entities, but ensures the participation of a large number of subjects (water stakeholders and the public). Planning and managing respects the natural hydrographic division as well as difference in socio-economic districts, allowing the principles of solidarity, the right to equal conditions of development and water management to be applied.

River Basin Management plan is made for a period of 6 years, after which it is amended for the period of the next 6 years. Croatian Water can make detailed management plans for sub-basin, basin and small sector and plans relating to other issues of interest to management. Local and district (regional) governments are required to obtain a prior opinion of the Ministry of agriculture for conformity of their spatial plans with River Basin Management plans.

The execution of River Basin Management Plan shall be submitted to the Croatian Parliament every three years. This report is an integral part of the river basin management plan.

2.2. Establishment of River Restoration Plans (RRPs)

A River Restoration Plan can be described as a detailed plan that indicates which measures are to be taken where and when within the river basin area, including indications of costs and effects of these measures in the most possible details. It comes with a detailed map of the area involved, and the spots where measures are planned. River restoration in this context represents the actual

execution of a set of measures in one or more designated areas or spots, aimed to help “restore” the river as an ecosystem or set of ecosystems.

River Restoration in this Guideline is defined as:

“Returning the system to a close approximation of the pre-disturbance ecosystem that is persistent and self-sustaining, though dynamic in its composition and functioning” (Maurizi & Poillon 1992).

Often it is hard to determine the “pre-disturbance ecosystem”, its composition of species as well as chemical and physical conditions. In many cases field reference situations of more-or-less natural river ecosystems that have survived are used to describe the pre-disturbance status, and in some cases historical evidence and information may help to reconstruct the pre-disturbance “image”.

“Ecosystem” is a complex of chemical, physical, hydro-morphological and biological circumstances with certain ranges, determining what specific combination of plant and animal species occur on a well-defined spot in the riverine system. At the same time these animals and plants are influencing each other’s occurrence and have influence on the circumstances they live in providing a very specific equilibrium that makes an ecosystem. Ecosystems can be temporally and spatially dynamic, meaning that, throughout the bigger riverine system, ecosystems may periodically disappear on one place and re-appear on another, due to the dynamics in the system.

Ecology and river restoration are not exact sciences, and even though many aspects can be measured and recorded, the complexity of the situation always brings risk of mis-interpretation or mis-calculation. Also, time and budget can be limiting factors in the gathering of knowledge and information. In many cases river restoration plans will have to be based on a set of information that is not complete, has aged, or has other problems. As long as there is transparency regarding this, during the process of developing plans, it will be clear to everybody where the challenges lie and what should be done to overcome the challenges.

Discussions with stakeholders can be of great importance in this process. Since there is not one-and-only truth in ecology it must be made clear to everyone that there is more than one solution. Through discussion people may reach mutual agreement in difficult issues, which is necessary for progress.

3. Development of River Restoration Plans

3.1. Content of River Restoration Plans

The RRP’s can be of different character. The choice of character of the RRP’s may depend on several aspects, e.g. on the:

- total size of the river basin,
- possibility to divide the basin area in logical subareas,
- availability of basic information,
- administrative borders,
- planning of available budget,
- availability labor capacity of the implementing bodies,
- number and kind of stakeholders involved.

Roughly the RRP’s can be of the following categories:

- Integrated (or multi-thematic) RRP’s designed for sub-areas of the river basin. A specific area of the total river basin is delineated and an integrated plan is developed for this subarea. All aspects of river restoration and all regulations applicable in this sub-area are taken into account. The set of measures is diverse but very well integrated and attuned (some measures are technical, some managemental and some organizational and legislative). The whole scale of potential measures must be taken into consideration.
- Mono-thematic RRP’s are designed around one specific theme that rapidly helps to improve the basic conditions throughout the whole basin (for instance, one plan can be developed for the whole basin, with a special focus on one topic, e.g. improvement of sewage purification). It can be very cost effective to develop such mono-thematic plans, where

very specific expertise is needed, where there is no large claim of land involved, in the case of (almost) generic solutions for different spots.

- Special RRPs issues or projects under a RBMP that focus on detailed data-collection or other kind of preparatory activities that need substantial budget, time and planning, need to be completed before the actual RRPs can be developed. In the case the inventories during the RBMP development have proven that there is insufficient data in whatever field of knowledge in the basin or sub-basins, a special data collection project could be formulated even under the RBMP already.

A procedure for the development of RRPs will be explained in detail in part B: the Step-by-Step procedure.

3.2. Process of developing River Restoration Plan

3.2.1. Project and process design

The development of a RRP is a process that could best be done in a project structure, with a project leader and a project team. The project will have a clear starting point and a clear end. The project leader should start with writing a project plan that will in the end lead to an agreed and approved RRP as the main result.

In the project plan all the activities to be done to deliver a RRP are identified. Also all the experts needed in the project team, who will execute these activities are described. In some cases sub-contractors may be needed to do the job.

The project leader will also design the process that will lead to the wanted result. In an optimum situation this process design describes who will do what, how and when, and which stakeholders are needed and what information is crucial. Timelines will be of help to monitor the progress of the project. For a number of crucial steps a risk-assessment to do this step can help to optimize the process.

The process can be designed according to the Step-by-Step method as presented in Part B of this Guideline. All steps describe a number of activities to be carried out. Every step will deliver a number of results that are part of the RRP as a whole.

See part B for more specified information.

3.2.2. Program and Project organization

In most cases more than one RRP will be developed under a RBMP. The RBMP is the umbrella for the RRPs. The RRPs form the first step in the actual implementation of measures in the field.

The RRP will be the agreed plan on paper, followed by the actual execution of the measures in the field through a next step: the Implementation Plan. This implementation plan forms the technical description of the actual measures to be taken in the field, with calculations of units, quantities, prescribed dimensions, planning for execution, specifications for (sub)contractors, etc.

The program organization for RRP development is depicted in the schedule in figure II.3.

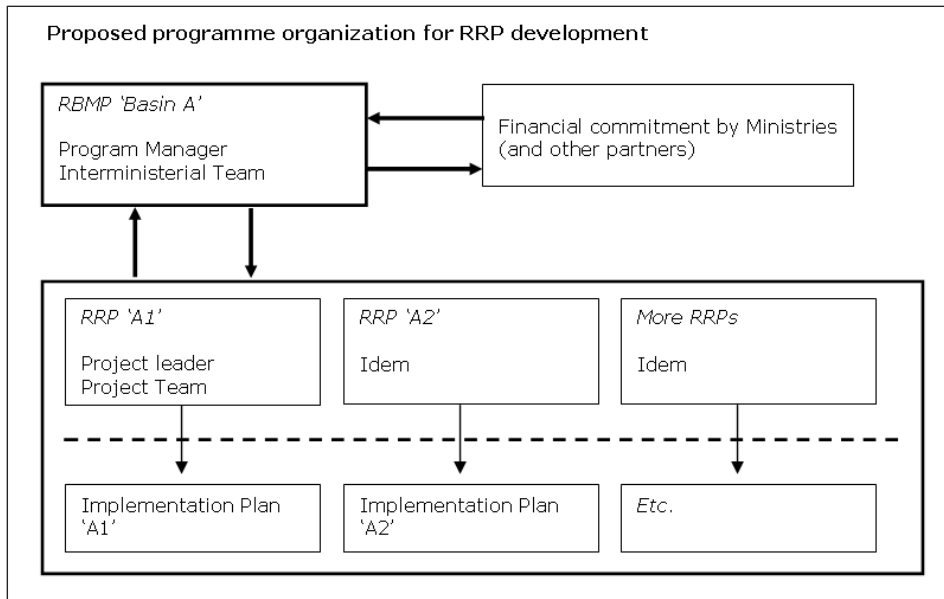


Figure II.3. Schedule for program organization for RRP development.

Each project team under the RBMP consists of a project leader from Croatian Water with support of a project team, consisting of a number of supporting staff and experts from Croatian Water and governmental organizations like Public Institutions for nature protection on county level, County offices, Public Institutions of Nature Parks and National Parks, the State Institute for Nature Protection and/or other relevant Ministries and bodies. The project team may also have some backing-up from specific short or long living working groups. These working groups can be established to deliver a very specific part of the work to be done on a special theme. For instance there can be a working group on the theme of identification of the most relevant measures to improve water quality, or a working group regarding the estimation of effects of the different (combinations of) measures. Working groups like these are likely to be composed of a number of experts/specialists on the specific subject involved and can be chaired by the project leader.

The project leader is responsible for in time delivery of the planned results. He or she will periodically report about the progress of the project to the responsible person from Croatian Water who decides on the project.

In most cases during the project preparation and development, there are moments in time that need extra attention in terms of contact between the project leader and the responsible person from Croatian Water who decides on the project. The following points in time need careful attention:

1. *The moment of finishing and agreeing on the scope of the project.*
This is the moment where the result of Step 1 of the Guideline Part B is coming to a conclusion. The draft "Scope document" must be agreed on by all parties involved on Ministerial levels. The program manager is the first to agree and check if the scope defines the project well, so that it fits into the river basin management program. In some cases the program manager will have to discuss issues on higher level and find commitment there. Sometimes this consultation may lead to a (partial) redefinition of the scope of the project. After this the scope should be discussed again and finally agreed on.
2. *The moment of development of (a set of) scenarios and choosing the preferred scenario.*
This is one of the most important moments where all stakeholders should be involved as much as possible. It is important that the project leader (and the project team) decides in an early stage how this process is done in the most effective and transparent way. The responsibility of the project leader is to find the best way to develop scenarios for a plan that finds solutions to problems, helps local stakeholders and fits into the mindset of directors of Ministries or even politicians. That is a challenge and requires good preparation. In the end all stakeholder should agree on a preferred scenario, and a set of measures for the plan.

3. *The moment of finishing the actual River Restoration Plan.*

This moment requires a lot of attention in terms of communication to all stakeholders on all levels involved. The project leader and his/her team will by delivering the plan finalize their job of plan development.

These are the major pass/fail moments in the plan development cycle in a situation with high level of delegation of responsibilities. Every project leader must be aware of these moments that can lead to agreement to enter the next step or phase, or that lead to reconsideration on the issues of that moment. In some other cases there may be more pass/fail situations on minor issues depending on the complexity and mandate of project leader and project manager.

In the case of development of a RRP for a very large area, where numerous stakeholders are involved, a small permanent project bureau may assist the project leader for the running time of the project, to support the ongoing progress of the development process.

3.2.3. Partnerships

In order to have a smooth operational process it may be needed to determine if there is a need for official partnerships. Partnerships can be of use in the case of insufficient capacity or financial means to run a project. Data-collection can be a very time consuming and expensive activity. It needs some creative ways to try and find partners who are prepared to take part in the financing of these necessary activities.

Partners are likely to be found in the sphere of stakeholders that benefit from a better, more viable and sustainable ecosystem. Producers of drinking water will see a profit in improvement of the quality of their sources of production. Some stakeholders may find it a good promotion for their company to contribute to a very specific measure, as a kind of public relations or advertising method. It is highly recommended to explore such possible partnerships, to find ways for mutual profit.

3.2.4. Financial settings and budget

The budget for the RRP development is decided in Croatian Water by the annual Water management Plan and the resulting annual Procurement plan, all regulated by the Water Management Financing Act. Annual budget reservations of Croatian Water are approved by the Croatian Water Administrative Council, on political level. Once these reservations have been made the responsible Croatian Water officer/manager will be held responsible for the just and due spending of the budgets, through agreed RRP.

3.2.5. Stakeholder involvement and Communication

See part C for a general overview on stakeholder involvement and communication.

3.2.6. Monitoring and reporting progress of the RRP

The implementation of measures by executing the RRP aims to change and improve abiotic conditions in water bodies and their close surroundings. These improved conditions should lead to sustainable pre-disturbance ecosystems.

The effects of measures are calculated, modeled and/or predicted in the RRP in the best possible way. These effects can be described in terms of hydro-morphological features, water flow characteristics, physical conditions, chemical conditions, flooding regimes, abundance of species of plants and animals, etc. These analyses are performed as an impact assessment in the iterative process of plan development of the RRP.

During the actual development and execution of a RRP the project leader in charge will monitor the costs and expenditures of the project. Project leaders will deliver RRP management information to the responsible higher level CW officer.

Once the measures have been executed in the field the effects of the measures should be monitored. The monitoring activities can be described in a monitoring plan for each RRP. All monitoring results for the different RRP's will add up to a total monitoring result for the RBMP. Monitoring frequencies must be in line with the EU regulations on reporting.

NB: the monitoring has a strong link with Component 2 of project Meander, which gives a draft strategy on hydro-morphological monitoring and hydro-morphological guidelines on a national level.

Elaboration of ecological monitoring:

For those rivers that are at risk to meet the ecological objectives monitoring is required. So a risk analysis whether existing pressures will have a significant negative impact on the realisation of the good status is necessary. For surface water the following aspects should be monitored:

- Chemical;
- Biological (fish, macro fauna, macro invertebrates and phytobenthos);
- Hydro-morphological (see also Component 2 of project Meander).

The WFD distinguishes various kinds of monitoring:

- Surveillance monitoring for the monitoring of the overall status. This is done for the larger sub-catchments;
- Operational monitoring (assess status and check improvement of water bodies identified to be at risk) focused on specified parameters to see whether measures have the predicted result;
- Investigative monitoring in cases where water bodies fail to meet the objectives but were it is not clear what caused it;
- Monitoring of protected areas to see whether measures have the predicted result.

Besides the requirements of the WFD, monitoring is important as well to:

- improve knowledge and understanding of the hydro-ecological system;
- improve knowledge on cause – effect relations;
- support ideas of adjusted designs;
- be able to check whether complaints about negative impacts are true or not.

4. Evaluation and future adaptation of this Guideline

The approach and the followed logic of steps as presented in this Guideline have been developed on the basis of the most recent expertise and scientific knowledge as applied throughout the EU.

Only by using the guideline in practice during the implementation of concrete projects, the steps can be tested and evaluated and lessons learned can be added to improve the guideline for future use. We therefore advise that the guideline will be updated and adapted by the responsible authorities based on gained experience by plan developer and writers.

III. Part B – STEP BY STEP PROCEDURE

Introduction

Part A of this guideline described the project organization of creating a River Restoration Plan (RRP).

This part B states step by step how to technically create the RRP, from the beginning to the end. The different steps are derived from the following general setup:

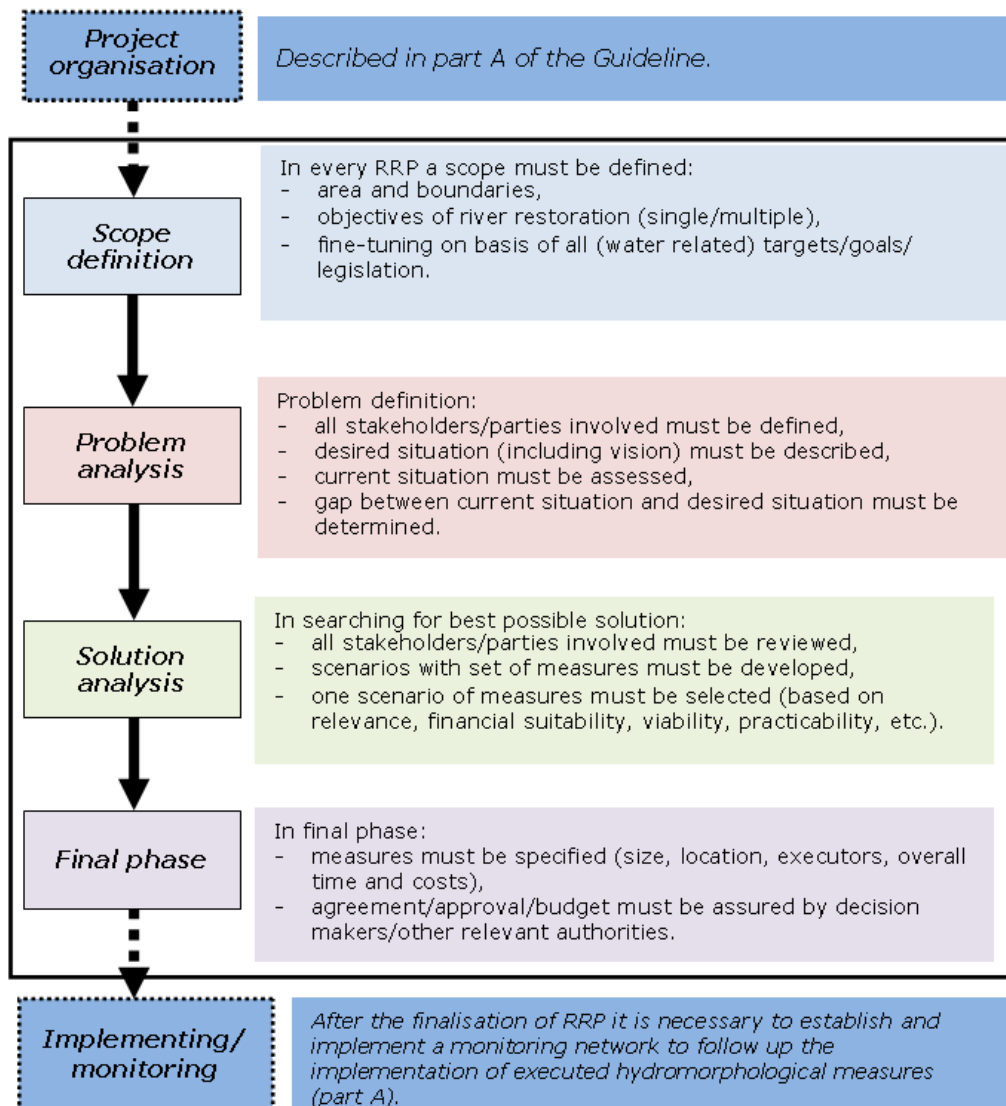


Figure III.1. General setup for creating a River Restoration Plan.

The steps that will be elaborated in this part B, are those marked in the box of Figure III.1. The previous step (building the team) is covered in part A, and the subsequent steps (further operationalising, preparing the execution of the RRP and monitoring and evaluation) are not part of the guideline, but are also briefly handled in part A.

This general setup stated within the inner box in figure III.1., leads to the following 7 steps in figure III.2., which are further elaborated after this introduction.

While each of the seven steps of the framework includes discrete tasks, the steps are interrelated and influence the steps before and after, as the process is followed. For example output of monitoring will be integrated in the future restoration team; the vision is a part of the problem

analyses and even the planning process, objectives and targets are linked to the future situation to ensure that the result of the project will reflect the view of the stakeholders; defining scenarios may prompt the redefinition of the desired situation and following this line, specifying the measures may induce the team to reconsider technical solutions or even scenarios. Project leader or project team are obliged to connect loops between the steps or adjust the process, when this is needed in the project.

Stakeholder participation is important throughout all steps of the process. It will ensure the involvement of (groups of) people affected by the RRP, such as landowners and (non-) governmental organisations. The project adheres, at the same time, to the policies of local, regional; and (inter) national agreements. (See Part C for more information on stakeholder involvement)

Finally it should be stressed that this framework provides a large amount of interdisciplinary work and spatial scales in which geographical, hydrological, geo-morphological and ecological processes occur, which require a strong integrated approach.

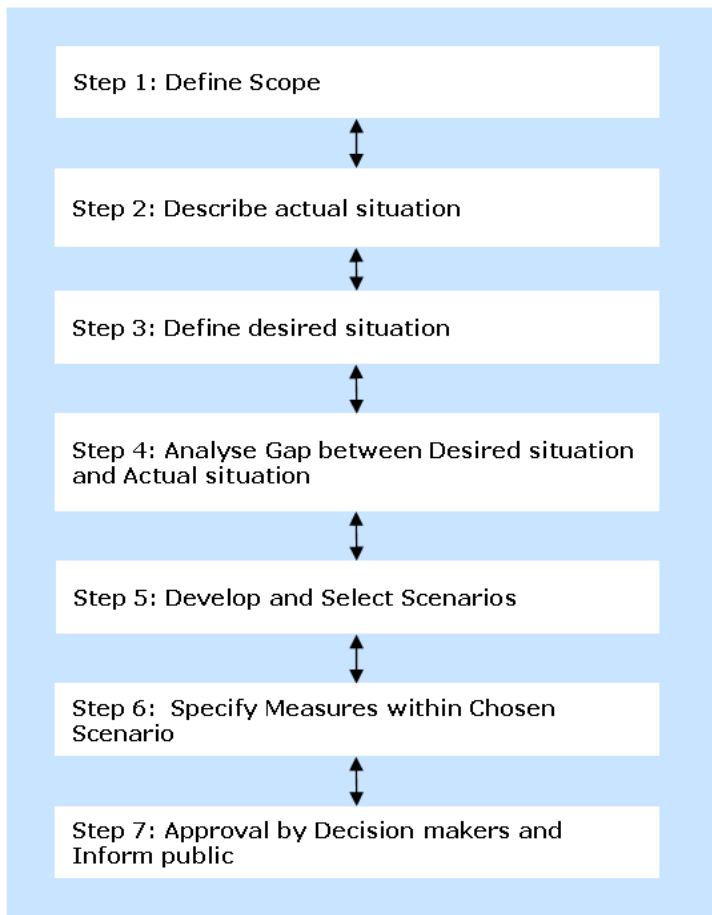


Figure III.2. Seven steps for creating a River Restoration Plan.

Each of the 7 steps consists of 5 elements which need to be taken into account, see figure III.3. (Examples can be found in Part C).

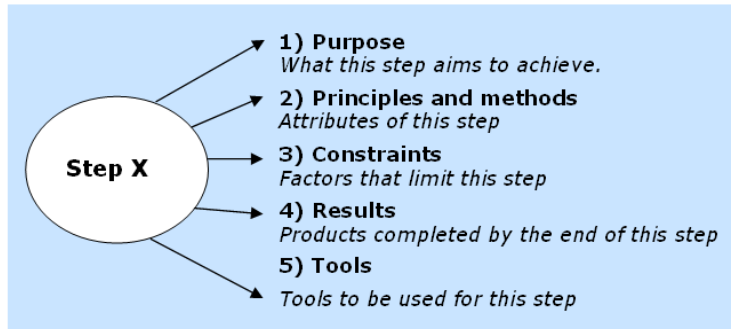
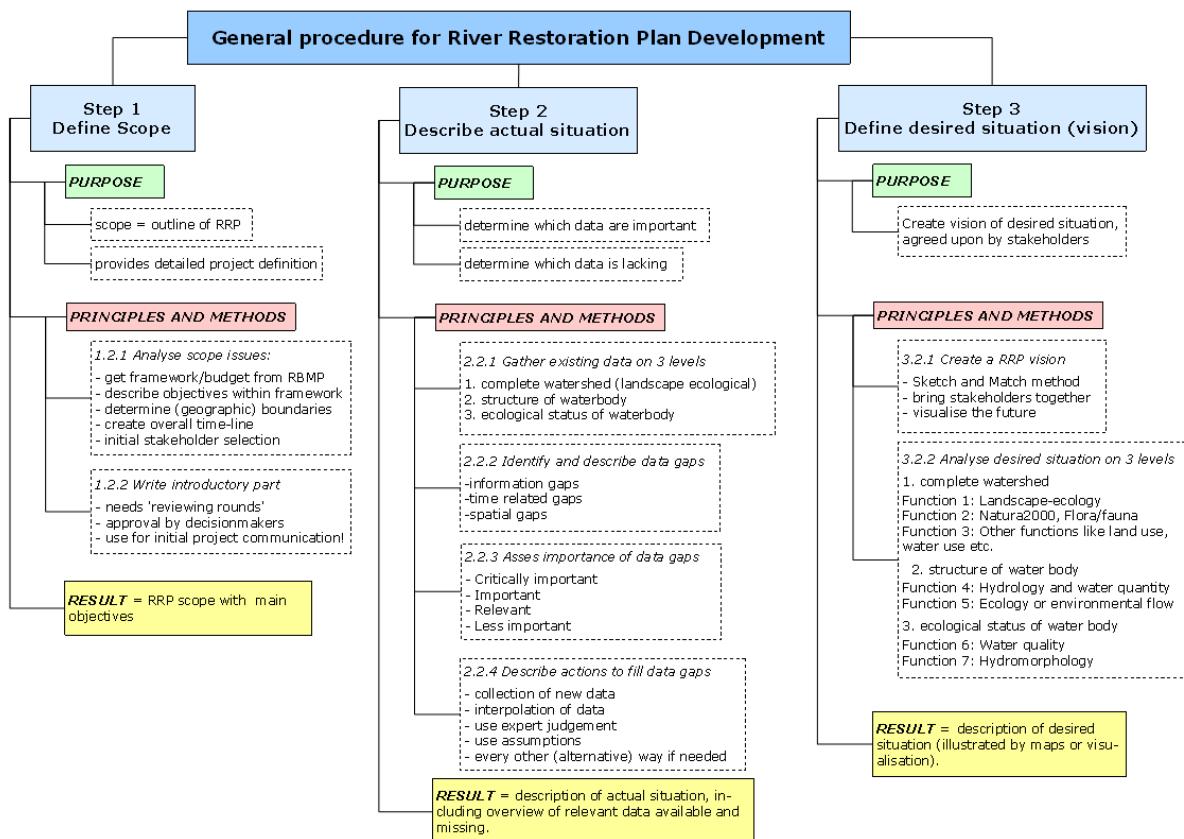
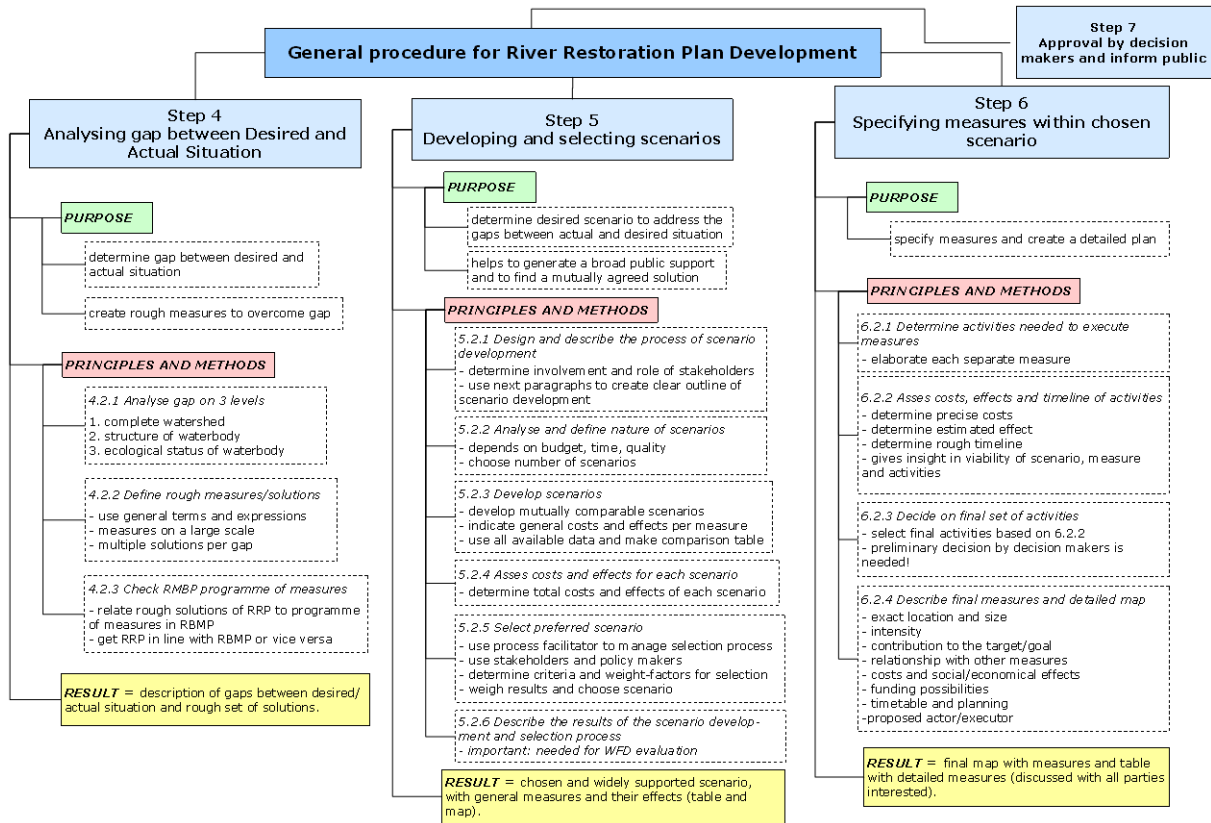


Figure III.3. Elements to be considered per individual step.

- 1) **“Purpose”** should clarify what this step should lead to, what objectives are to be reached.
- 2) **“Principles and methods”** needs to be a description of principles that are used that refer to scientific principles from ecology, hydrology or economics or they can be of a more social and political character. In part C a broader list of methods is given.
- 3) **“Constraints”** are considered as boundaries given by e.g. available data, time, skills, unclear definitions, conflicting interests and needs between stakeholders as well as any other limiting element.
- 4) **“Results”** of the project should be communicated as clearly and in concrete terms as possible.
- 5) **“Tools”** can be used during each step. It is important to select and describe carefully the available tools, especially those that have proven their usefulness earlier. In part C a list of tools is provided.

Below is the step-by-step procedure for creating a River Restoration Plan given in form of a concise flow chart.





1. Step 1: Defining the Scope of the project

1.1. Purpose

For a good understanding of this step the term “scope” needs to be well defined. In this guideline it is defined as: *‘area or playing field of a project, set by boundaries in terms of geography, issue, content, time or money.’*

A proper understanding of the scope by all stakeholders involved will save a lot of time during the implementation

phase and will help to avoid or manage conflicts during the river restoration process. “Scope” sets out the limits of a foreseen project and the outline of the RRP by providing a detailed project definition. The scope describes in short what the content of the RRP will be, how/when and by whom this RRP is developed.

A number of specific issues (see 1.2) need to be analysed and the results described in one clear document (Terms of reference of the project) that will help to communicate about the project in the early phase of development. This may be used to help clarify the project and as a point of reference for later.

1.2. Principles and method

The scoping of the project can be done by the proposed project leader (see Part A for composing the project team). It is a specified project definition following from the need to further implement the RBMP into one or more RRP.

For all issues described above, an analysis, based on available information from various sources, must be done. This may be wide range information, from high level and mere general political indications to very technical and specific data.

In most cases these analyses will be rather easy. Sometimes they may influence each other. For example: *Budgeting issues may heavily influence the size of the project area, or the number and/or intensity of the measures to be taken.*

In general the following issues will have to be analysed, described and decided upon by the proposed project leader of the RRP in cooperation with selected project team members:

- **Main framework and topic(s) of the project**
Describe the framework under which the project will be developed and executed. Also describe the responsible parties for implementation of the project.
- **Objectives to be covered by the result of the project**
All objectives derived from the RBMP and other relevant policy areas should be analysed and described here. In most cases these are general objectives. Analyse where objectives are complementary and where they are conflicting or overlapping. Prioritise objectives on the basis of these occurring conflicts. Ensure that the objectives selected are confirmed and agreed to by higher level policy makers. See part C for a detailed example of considering all objectives.
- **Geographic boundaries of the project**
The exact boundaries of the project should be determine and presented on (digital) maps. The boundaries are mostly influenced by administrative aspects, budget, capacity and planning. In some cases also physical and ecological aspects will influence the boundaries, and therefore the total size of the project area.

Step 1: Defining Scope

Step 2: Describing actual situation

Step 3: Describing desired situation

Step 4: Analysing gap between desired and actual situation

Step 5: Developing and selecting scenarios

Step 6: Specifying measures within chosen scenario

Step 7: Approval by decision makers and inform public

To achieve an optimal result you have to select your area carefully:

- *The selected area should not be too small*
The river restoration plan has to address all the major sources and causes of impairments and threats to the water body under review. Although there is no rigorous definition or delineation, the general intent is to avoid a focus on single water body segments or other narrowly defined areas that do not provide an opportunity for addressing watershed stressors in a rational, efficient, and economical manner. The river has to be restored over some significant length to have any impact.

- *The selected area should not be too big or too broad*
If activities are planned on too big a scale it can complicate implementation of measures and even lead to failure of the project as a whole. Be aware that the turnaround of a project will probably increase during the execution of such a project. When the area is too big, people won't have an overview of all the activities making it difficult to engage them in the project. Involvement of key stakeholders and successful implementation will be difficult.

- **Time-line planning**

The scope should give clear insight into the planning of the RRP, from preparation of the RRP, up until the execution of an approved set of measures in the project area.

- **Stakeholder involvement**

A first list of available methods and tools for stakeholder analysis and stakeholder involvement has to be prepared. An initial stakeholder list is needed to prepare or advise the preparation of the scoping document. (See part C for more information on stakeholder involvement)

Overall it can be helpful to use a prioritization for these issues according to the following principle:

- Identify and describe the more-or-less "fixed" issues. These are the issues that will influence the scope of the project the most.
- Identify and describe the more "flexible" issues.

1.3. Possible constraints

Lack of knowledge
Data and information missing or taking certain information for granted
Lack of understanding the context
Unfamiliar with process
Lack of skills or skills not adequate
Definitions unclear
Time frame
Scale of the project
Expected conflicts
Lack of political will
Unflexible scoping document
Etc.

A number of constraints mentioned above should be discussed and tackled by the project leader in cooperation with higher level officer from Croatian Water before a project team is being composed, because these constraints are directly related to the skills, experience and knowledge of the project team members. Therefore careful selection of the right persons for the team can avoid problems.

Other constraints are of a more technical nature. One of the main tasks of the project team is to find solutions for these constraints in the case they are actually considered to influence the project in a negative way. The right selection of people for the project team is crucial to overcome these constraints. Finally the political factor must not be ignored. Especially the project leader and responsible higher level officer from Croatian Water need to put energy to the communication process with politicians where and when needed.

1.4. Results

The result of this step will be an introductory part of the RRP which describes the scope of the foreseen RRP with its main objectives, or Terms of reference for the RR project. It defines the plan development towards the realisation of the result of the project: the RRP itself.

The development of the scope will include a number of reviewing "rounds" before it can be finalised, depending on the complexity of the project, and accordingly, depending on the number of parties that have to decide on the project progress. The finalised document will need to be well communicated with and approved by the responsible mandated person on the right level, probably being the program manager. The introductory part of the RRP is to be considered a go / no-go document for the rest of the plan development project.

Once approved, the introductory part of the RRP can be used to initially explain and clarify the project to all interested parties or stakeholder groups to be involved in the River Restoration Process. Be aware, however, that the original scope objectives possibly (very often) need adaptation after steps 2, 3 and 4 are completed!

1.5. Tools

This step needs an initial desk study performed by the selected project team members , followed by a number of presentations/workshops/information sessions/other forms of interactions with relevant stakeholders to more-and-more specify and agree on the project scope.

In case the team members come from different departments or even different organisations, it is important that people become to know each other, not only in terms of technical qualifications, but in terms of secondary skills, motivation and objectives as well. In this step it is important that the team becomes familiar with the subject. Reading existing information, discussions with people familiar with the area or a field visit will help.

Stakeholders in this stage are to be identified and asked to help develop and finalise the project scope. An initial list of stakeholders always includes:

- High level policy makers;
- Staff of different ministries;
- Staff of implementing governmental bodies or agencies;
- Relevant advisors from NGOs or Universities;
- Representatives of (land)owners, such as farmers;
- Other representatives of water or land users.

Additional stakeholders can be involved even though above mentioned parties have agreed on the project scope. The project scope has to be made available to all parties interested as first activity following the scoping phase. This will start the communication about the project or plan development for that area.

(See part C for a general overview on stakeholder involvement and communication).

Tools that are useful in this step are the following (further explained in Part C):

- Communication:
 - Workshops,
 - Round table discussions,
 - Conflict resolution.
- Biophysical/socio-political and economic data collection:
 - First step of data collection (oral, written, GIS),
 - Multiple criteria analysis,
 - SWOT analysis,
 - Etc...

2. Step 2: Describing actual situation

2.1. Purpose

Having set and agreed on the scope of the project in Step 1, the description of the actual situation is the first activity to develop the actual River Restoration Plan. This step helps to determine which data are important and which data are lacking.

The kind of data that is needed in a specific river restoration project depends on the objective(s) of the project. In this step the relevant data that describe the actual situation must be collected.

Step 1: Defining Scope

Step 2: Describing actual situation

Step 3: Describing desired situation

Step 4: Analysing gap between desired and actual situation

Step 5: Developing and selecting scenarios

Step 6: Specifying measures within chosen scenario

Step 7: Approval by decision makers and inform public

2.2. Principles and method

2.2.1. Gathering existing data

Which data should be collected before a river restoration project can start, depends on the nature of the project. In general, three levels of datasets are used to adequately describe the project area of the watershed. These levels range from large to small:

Level 1. The project area in its complete watershed (sources to river mouth, landscape-ecological context)

This is the highest level of information needed to understand the physical or other processes that are most important in the project area. Even when the project area is only a small part of a complete watershed it is highly recommended to describe the larger surroundings of the project, to be able to fully understand how the system works as a whole. This understanding will come of help in the phase of defining measures and analysing their effects.

Most important sets of data on this level are:

- *Watershed boundaries and sub-boundaries will provide information about which area will hydrological contribute to a specific river stretch;*
- *A digital terrain model (of the project area) will provide information about slope of the terrain;*
- *Geology and soil characteristics together with slope will provide information about the way and velocity of rainfall in the catchment that will flow towards the river, where erosion might occur;*
- *Data about groundwater flow will describe the relation of the river stretch with its surroundings;*
- *Geomorphological mapping will add to the understanding of the history and spatial relations;*
- *Habitat/vegetation and species data (available in charts, maps, documents etc.) can give information about the ability to support aquatic life and identify areas at risk of impairment, support identification of potential conservation, protection, or restoration areas;*
- *Historical maps will provide information in the change of land use and the former trace of the river (location of the river bed and sinuosity in the past);*
- *Land ownership in the project area is important to indicate stakeholders and especially when land should be purchased (as one of the possible measures);*
- *Actual land use will give information about pervious and impervious surfaces, possible sources of pollution (point sources in cities, diffuse sources in agricultural areas);*
- *Stakeholder data: Stakeholder analysis is an extremely important part of each and every planning process. Understanding well who are possible partners or enemies needs to become clear as early as possible in the process. Stakeholder analysis will help you to understand which parties are likely to be affected by the project, which parties or persons have which needs or interests, what are their points of view, what are their problems faced, what could they contribute, how to mobilize their knowledge, what is their influencing power, what relationships exist between them.*

(See part C for a general overview on stakeholder involvement and communication).

Level 2. Water bodies of the project area/watershed (specific dimensions, classification, technical infra-structure, eco-systems, habitats and species)

This second level is the level of the structures of water bodies, as part of your project area or complete watershed. In most cases it is information that can be observed by the eye in the field. It describes in a more or less technical manner what structures are present, how they function in hydrological terms and how they are maintained.

Most important sets of data on this level are:

- *Maps with technical measures to control the river flow (reservoirs, check structures, dikes, bank protection) are important when river restoration is considered;*
- *Water quantity data that describe discharge, levels, peaks, water balances, rainfall, seasonal characteristics and what is more available;*
- *Water quality standards are helpful in understanding for what uses the water bodies should be protected and to analyse with stream monitoring data or evaluate impairment;*
- *The discharge of pollutants from point sources, such as pipes, outfalls, and conveyance channels is generally regulated through a system of permits. This information is available at Croatian Water;*
- *Diffuse sources of pollution are landfills, (former) mines, leaking oil tanks, (former) industrial zones, agricultural related diffuse sources (stables, dung heaps) farmland as well as urban areas. Also any information on diffuse sources of pollution will be helpful in assessing the actual situation in the area.*

Level 3. Ecological status of water bodies

This third level describes the status of the water in the water bodies and the processes that directly influence these conditions. Most of this kind of data can only be gathered by extensive monitoring and measuring with specific equipment. Data sets like these, including chemical, physical, biological and hydromorphological data, are critical to characterize your water bodies. Without such data, it is difficult to evaluate the status of the water bodies in your watershed. These data might represent specialized data collected to answer a specific question about water body conditions, or the data might be collected regularly as part of a fixed network of long-term monitoring to assess trends in water quality.

Most important sets of data on this level are:

- *Data on water quality, both physical and chemical will give information about the current state of a water body. It might give information about problems and possible sources of pollution;*
- *Biological data can provide additional information about the general health of the water body. The ecological quality is a reflection of the physical and chemical quality;*
- *Morphological data can help analysing the movement of sediment downstream from upland sources and waterbanks and other issues like the prior or "undisturbed" morphology of the waterbody.*
(See also Component 2 of project Meander for more information)

2.2.2. Identifying and describing data gaps

For every category or set of data the following kinds of data gaps may occur:

Information gaps

- Determine whether the available data include all the types of information needed: data on flow and water quality might be available, but if further ecological data are missing, your planning process needs further data gathering.
- Information gaps can exist when there are no data present for validation of the indicators identified by stakeholders to assess current watershed conditions. Such as: the use of the amount of rubbish observed in a stream as an indicator of stream health.
- A common data gap is the lack of flow data that specifically correspond to the times and locations of water quality monitoring.

Time related gaps

- Temporal data gaps occur when there are existing data for the area(s) of interest but the data were not collected within, or specific to, the time frame required for the analysis.
- Available data might have been collected long ago, when the watershed conditions were very different, reducing the data's relevance to your current situation.

- The data might not have been collected in the season or under the hydrologic conditions of interest, such as during spring snowmelt or immediately after crop harvest.

Spatial gaps

- Spatial data gaps occur when the existing data were not collected at the location or spatial distribution required to conduct your analyses. These types of data gaps can occur at various geographic scales.
- At the individual stream level, spatial data gaps can affect many types of analyses. Samples collected where a tributary joins the main stem of a river might point to that tributary sub watershed as a source of a pollutant load, but not specifically enough to establish a source. Measuring the effectiveness of restoration efforts can be difficult if data are not available from locations that enable upstream and downstream comparisons of the restoration activities.
- Data collected at the watershed scale are often used to describe interactions among landscape characteristics, stream physical conditions (e.g., habitat quality, water chemistry), and biological assemblages.
- The reliability of these analyses can be affected by several types of spatial data gaps. Poor spatial coverage across a study region can hinder descriptions of simple relationships between environmental variables, and it can eliminate the potential for describing multivariate relationships among abiotic and biotic parameters. In addition, underrepresentation of specific areas within a study region can affect the reliability and robustness of analyses.

2.2.3. Assessing importance of data gaps

The data gaps that are identified should be assessed to decide about how to deal with these gaps. Some gaps may be rather unimportant or easy to overcome. Others will be critical for the next steps in plan development. Proper actions will have to be defined to overcome all the gaps, critical and non-critical.

Data gaps can be classified as:

- Critically important.
- Important.
- Relevant.
- Less important.
- Unimportant.

The classification can be done on the basis of a set of criteria and weighing factors, like:

- *Classification: Can you classify your water bodies for WFD on the basis of the available data?*
- *Data quality, quantity and recency: Is it really necessary to have more, better, more recent, etc. information to be able to specify the place, size and nature of the measures needed to improve the situation?*
- *Data predictive quality: Can you describe the effects of measures on the basis of the available data?*
- *Data gathering budget: What is your available budget for data collection?*
- *Etc.*

For each gap-class specific actions should be described how to deal with the gap. Critical gaps may be the reason to start additional data-gathering and even field work. This can lead to substantial extra costs and to delay in the project planning.

The lesser important gaps may lead to alternative ways to deal with the gap. These may include interpolation methods, specific assumptions, best-professional judgement and other methods.

The most unimportant gaps may even stay like gaps.

2.2.4. Describing actions to fill data gaps

For any gap determined, actions to be taken must be described, so that your analysis is transparent and ready to be communicated to relevant stakeholders.

In general it is clear that there is not only one single way to deal with information-gaps. For every specific gap a specific action will be needed. Below there are a number of possible actions to choose from:

Ways to deal with information gaps

- *Collection of new data*

Collection of new data in most cases will take considerable amounts of time and money. For critical data-gaps this often may be the only way to deal with the gap. Always take into consideration if there are alternative ways to deal with the gap.

One alternative may be to fill the gap temporarily with less precise information (like assumptions, best-professional judgement, etc), work on with this information in the plan development process and meanwhile start fieldwork to gather better, up-to-date information. In this way no time is lost in the plan development process and once the newly gathered information becomes available your plan can be updated.

In the case you actually decide to gather new, additional data you will need a kind of sampling plan. Sampling plans may include a mixture of different types of data, including biological (e.g., benthic, fish, algae), physical (e.g., visual habitat assessment, geomorphic assessment), chemical (e.g., conductivity, nitrate, and dissolved oxygen) and hydrologic measurements, or just one specific data type.

Numerous methods are available for collecting these data, but the achieved data quantity and quality differ. Therefore, data collection techniques should be carefully selected to ensure that the data produced can be used to meet project goals completely (United States Environmental Protection Agency (2008), Handbook for Developing Watershed Plans to Restore and Protect Our Waters).

- *Interpolation of data sets*

In the case of availability of datasets on a certain high-scale level, and there is a need for smaller scale information, interpolation methods may be helpful to derive lower-scale data. This may be done by hand, and expert input for small data-sets or by computers of larger sets.

Interpolation will not lead to better data in terms of statistics and errors. The basic data set and its errors is in fact not changing. But interpolation will help to create better images on paper or in the mind about what is actually going on in the field.

- *Use of best-professional or expert judgement*

Expert knowledge can be used to deal with information gaps.

Expert working groups can be used to find the best-professional judgement on certain issues. These may be challenging processes that need good preparation and fine steering by a capable project manager to avoid discussions on details. It needs a "solution driven" mindset of all the people that are involved and the ability to overcome differences in opinions. Ultimately, the result of this input of (a group of) experts can be a specific "approach" on how to deal with some of the gaps. This could be in the form of a description or interpretation by the experts of the specific topic that reflects their view on this topic in the project area, based on their scientific knowledge and sources. (Inter)national databases and knowledge sources should be consulted in the best possible ways. Additionally field work to gather new data may be started simultaneously.

- *The use of assumptions*

Assumption can be useful as a method to try and understand the actual situation by trial-and error. In most cases these assumptions can only be proposed by people or experts who have good inside knowledge of the area involved.

Every assumption may be supported by a "likeliness" indication, to give "weight" to the assumption. Assumption may be used during description of the actual situation, and also during analysis of effects of measures.

An example on using assumptions:

An assumption whether or not a specific bird-species is likely to actually nest and breed in a specific area, can only be made by somebody who knows the actual situation. This person could also be a local farmer, fisherman or hunter. They may have seen the species, they know if the habitat for breeding is actually suitable, etc.

Ways to deal with other data gaps

In every project the project team has the possibility to find alternative ways of dealing with problems. In fact every other method to handle this issue may be appropriate and effective, provided that it is done in a transparent way and is well documented.

2.3. Possible Constraints

Lack of adequate skills
Lack of knowledge
Lack of data and information or taking certain information for granted
Limitation by time frame
Restrictions by missing resources
Lack of budget for data gathering

The constraints are to be considered partly at the start, partly during this step and at the final end. Each time one has to consider how important the missing data, information or skills are for the sake of the project. Data concerning ecological, physical or hydrological aspects are crucial and without them analysing problems and developing solutions is impossible. Some of the essential gaps can be solved during the project and with not to much effort, e.g. via supplementary fieldwork or doing some modelling.

2.4. Results

The result of this step will be a description of the relevant data available and a description of the actual situation as well as which essential data are missing. Also a decision whether or not this is a problem is given.

The results can be written according to the following framework:

1. General description of the project area
2. Historical development
3. Present physical conditions
 - Geology, geomorphology etc,
 - Hydrology, groundwater system, surface water system, etc.
 - Water bodies in detail, map, conditions, water quality, water quantity, etc.
 - Inventory of problems, etc.
4. Present ecological situation
 - Nature reserves, Natura2000 areas, other areas with protection status,
 - Nature values in terms of vegetation types, habitat types, endangered species, invasive species,
 - Inventory of problems.
5. Present situation on relevant laws and regulations, competent authorities
6. Present situation on other relevant functions of the area, by e.g.:
 - Agriculture,
 - Fishery,
 - Tourism,
 - Cities, villages, housing development,
 - Infrastructure,
 - Water use.
7. Information gaps and dealing with them
8. Miscellaneous issues

2.5. Tools

In this step the team describes the actual situation as relevant for the purpose of the river restoration plan. Part of the information might be available within the organisation of Croatian Water, other data sets might be available within other partner organisations. Analyse in which way these partner organisations should be involved in the project.

When they only have data to spare, probably there will be no need to further engage them in the process. When they have to financially contribute to the measures or otherwise play a decisive role in the process, it will be wise to involve them in the project, for example, as a member of an advisory council or a steering committee.

Tools that are useful in this step are the following (further explained in Part C):

- Communication
 - Stakeholder analysis
- Biophysical/socio-political and economic data collection and analysis
 - Detailed data collection (Geophysical/ ecological/biological data and reports, historical data, hydrological and hydro morphological data, habitat surveys, land use etc).
 - Describe present situation in the project area, e.g with help of the so-called LESA method (Landscape Ecological Systems Analysis). See for more information part C.
 - Map production.

3. Step 3: Describing desired situation

3.1. Purpose

The description of the desired situation means the development of an agreed vision with all stakeholders and the requirements of this desired situation must be gathered, in order to be able to determine the 'gap' between actual and desired situation, for which the measures must be formulated in step 4.

Step 1: Defining Scope
Step 2: Describing actual situation
Step 3: Describing desired situation
Step 4: Analysing gap between desired and actual situation
Step 5: Developing and selecting scenarios
Step 6: Specifying measures within chosen scenario
Step 7: Approval by decision makers and inform public

This step should contain the following important parts:

1. Participatory vision development: The vision is the description of the ideal situation and is based on a series of workshops or brainstorm session per stakeholder group (e.g. project team, landowners, municipality staff, academicians etc. and additionally with all stakeholders together to come to an agreed vision).
2. A detailed elaboration of objectives for different water based functionalities in the area, followed by a prioritisation, like (e.g.): 1. Nature, 2. Safety, 3. Drinking water supply, 4. Agriculture (food production) 5. Tourism, 6. etc.
3. Describe desired situation on different levels, like: 1. Landscape-ecological level (functionality, completeness), 2. Hydro-Technical (desired system of water bodies, water works, functionality of these, water levels) 3. Hydro-morphological and water quality (desired), 4. Flora and fauna (desired effects on ecological values).

3.2. Principles and method

3.2.1. Creating a RRP vision

There are several methods and techniques to create a shared vision. The Sketch and Match is a technique elaborated in this chapter.

The Sketch and Match brings experts, policy makers and regional stakeholders together to tighten the goal of the project and to integrate and visualise the different wishes/disciplines of all stakeholders.

3.2.1. Creating a RRP vision
3.2.2. Analysing the desired situation
3.2.3. Analysing and refine the RRP objectives
3.2.4. Analysing the most desired situation

Directions of development are sketched and plotted along the way, so that directors and stakeholders in the area can make clear choices for the further elaboration of the project. See part C for a visualisation of this method.

A river restoration project is probably not the only one project that will take place in a certain area. There will possibly be other projects on different aspects in the future. To give all these projects a certain kind of cohesion, it will help to draw a picture how people see the future of the project area. It is possible that this picture will never materialize, because there are too many obstacles for the realization. See Part C for examples of visions.

There can be a vision from a mere technical point of view, but also about social-economic aspects (e.g. what is the ideal place for future water storage, which cultural aspects of a region can be emphasized, what should be the agricultural development in a certain area). This can be visualised on paper. These pictures can help to create a shared vision on the desired situation and first idea about general measures to reach that situation.

A vision will provide a constant reference point. Most rehabilitation projects last for many years, therefore it is important to describe the underlying motivation that sustains the effort.

The goal, the aim, the overall objective (these are terms that are used interchangeably nowadays) may not even be achieved as situations constantly change and interventions need to be adapted, but the vision helps your way forward.

A common vision is something that is shared, even developed, with counterparts and stakeholders. A vision is supportive for project progress and development, even necessary, when the project team has to convince people who oppose the river restoration plans. An agreed vision helps to manage conflicts.

Visioning is a specific method encouraging stakeholder involvement. More information on visioning and some examples of visualisations are provided in Part C of this Guideline.

3.2.2. Analysing the desired situation

The desired situation should be analysed and written down in the plan to give insight to the readers of the plan in how certain aspects of the plan area should look like, or how they should function AFTER the measures of the plan have been executed. This can be done in terms of a general description and/or maps with "images" of how things could look like after a certain period of time (even 5 or 10 years) after the execution of the measures.

Example

If a measure consists of removing a barrier in order to reconnect a part of a river delta to its original marine habitat, the removal may result instantly in restoration of physical conditions like salinity of the water and tidal influences. The physical system is restored quite directly. But the ecological recovery may take much more time. In these descriptions these temporary aspect are to be take into account.

The desired situations can be described on the same three levels as used in step 2. The levels are subdivided here with underlying functions. In some situations, depending on the scope to the

project, not all functions have to be elaborated. For example, when your project scope is limited to improvement of water quality by stopping wastewater influx from a specific source, it is probably only needed to describe the desired situation on Level 3. The other levels are probably not relevant in that case. The project team should decide on this.

- Level 1. The project area in its complete watershed (source to mouth, landscape-ecological context)
 - Function 1: Landscape-ecology
 - Function 2: Natura2000, Flora and fauna
 - Function 3: Other functions like land use, water use etc.
- Level 2. Water bodies of the project area/watershed (specific dimensions, classification, technical infra-structure, eco-systems, habitats and species)
 - Function 4: Hydrology and water quantity
 - Function 5: Ecology or environmental flow
- Level 3. Ecological status of water bodies
 - Function 6: Water quality
 - Function 7: Hydro-morphology

For every aspect specific demands can be described. These demands will help to make the aspect understandable and to quantify the aspect. Quantification is needed define an objective way of describing and monitoring in the field. In this paragraph the demands are described more specific for the aspects mentioned above.

Attaining these demands means that the conditions are optimal to reach an objective. In reality it will not always be possible to fulfil these requirements, because the negative consequences on other uses will be too great. So the demands describe the desired situation.

Function 1: Demands regarding Landscape-ecology

On the scale of landscape-ecology a good set of demands can help to understand and describe the important relationships between spatial patterns and ecological processes (*see also chapter 2.2, where the LESA method is introduced*).

Key demands in landscape ecology consider ecological flows in landscape mosaics, land use and land cover change, scaling, relating landscape pattern analysis with ecological processes and landscape conservation and sustainability.

The scale is in many cases defined by the size of the water catchment, and the system can be described in different terms that can be given a value to quantify the demand. For these demands it may be needed to apply some "best-professional judgement" whereas not everything can be measured easily.

Function 2: Demands with regard to Natura 2000 and/or other protected areas (national or international)

Water dependant Bird and Habitat Directive (BHD) target species have their preferences as well. This can be found in scientific literature. See a Dutch example in Part C.

The Bird and Habitats Directive in Croatia:

Both the Bird and Habitat directives are based on the idea of protection of species (biodiversity aimed policy) through and by the protection of ecosystems and habitats in which these species live. The Bird directive directly sets goals for the protection of bird species and indirectly for the protection of the habitats they live in. The habitat directive's first aim is to protect and improve the quantity and quality of specific habitats, but indirectly protects specific vegetation(type)s and therewith specific (combinations of) plant species. Additionally the HD includes lists of species that require special protection regimes.

For both Directives the EU-member states have to designate protection areas. For the HD these are called Special Areas of Conservations (SAC) and for the BD these are called Special Protection Areas (SPA).

The species and habitats that need protection may differ from country to country within the EU. Depending on the bio-geographical region in which the country lies, specific lists of habitats types and species will be developed for each country.

Croatia has to adopt Decree on internationally important ecological network sites (Natura 2000) until the day of accession. The State Institute for Nature Protection (SINP) has drafted the proposal for Natura 2000 network in Croatia. Natura 2000 network proposal consists of 578 pSCI polygonal areas, 177 point pSCI areas (caves) and 38 SPA polygons. The areas of Natura 2000 are selected for:

- 72 habitat types under the HD Annex I,
- 135 species under HD Annex II,
- 77 bird species under the BD Annex I and 29 regularly occurring migratory birds.

Republic of Croatia has requested for amendments of Annexes I and II of the Habitats Directive for certain species and habitat types which are specific for Croatia and neighbouring countries that are not yet members of the EU. Sites selected for these species and habitat types are also included in the proposal of Natura 2000 in Croatia although request for amendments is not yet accepted by the European Commission (EC) (provisional approval has been received).

For details about the Natura 2000 in Croatia see web site www.natura2000.hr

Demands for these habitats, vegetation types and species can be expressed on different levels of detail, depending on the information and knowledge that is available.

For some species there may be very specific knowledge available about the optimum circumstances for a viable population. This can be derived from scientific research done in the past. For other species there may be only very little known about specific growing or living conditions.

In the light of the WFD implementation some specific factors (physical or chemical) that are related to water are given below.

Regarding habitats, vegetations and plant and animal species of open water the following physical factors are usually the most relevant:

- | | |
|--|--|
| <ul style="list-style-type: none"> → current speed, → water depth, → visibility → water temperatures, → shading, → hydro-morphological conditions, → other... | <ul style="list-style-type: none"> → Oxygen → Phosphate → Total N → pH → salinity → water-pollutants → other... |
|--|--|

Regarding habitats, vegetations and species of groundwater related ecosystems the following physical factors are usually the most relevant:

- | | |
|---|--|
| <ul style="list-style-type: none"> → groundwater levels and yield, → groundwater level variations, → flooding conditions, → sedimentation of clay and sand during floods, → soil type, → other... | <ul style="list-style-type: none"> → ph → Nutrients → ion content → pollutants → salinity → other... |
|---|--|

The basic situation regarding demands may be when for all species involved a rough or specific outline can be made of the optimum conditions that are required for the species. In the best situation there may also be knowledge about the minimal and maximal values for the factors that are relevant for the species.

For all factors there is the possibility of more or less detail. For example at some point in time for a certain species it may only be known that it needs medium to strong water currency for survival. The exact values of currency throughout the year, and the exact oxygen content of the water may be unknown. At such point the plan developers can decide to do extra research or not.

Function 3: Demands for other functions like land use, water use etc...

There exist many other water demands for different functions (hydro-power, housing, infrastructure, navigation/shipping, fishing, extraction of drinking water, cooling water, sewage system etc...) and all relevant must be reviewed and taken into consideration.

For example *in the Netherlands, there are rules for the frequency of inundation (in a natural situation more frequent inundations may occur) that must be respected when planning a river restoration project or other works.*

<i>Land use</i>	<i>Frequency</i>
<i>Pasture</i>	<i>1*10 year</i>
<i>Arable land</i>	<i>1*25 year</i>
<i>Capital intensive arable land</i>	<i>1*50 year</i>
<i>Constructions/roads</i>	<i>1*100 year</i>

Function 4: Demands regarding hydrology and water quantity

These demands or requirements can be deducted from descriptions of reference situations for certain types of water bodies in Croatia (Testing biological methods for determining ecological status (WFD) in the representative river basins of Panonic and Dinaric ecoregions, 2011, Croatian Waters).

Function 5: Demands regarding ecological or environmental flow

Environmental flow is a flow regime that sustains the functionality and structure of the fluvial ecosystems, and at the same time enables the necessary utilization of the water resources (urban, industrial and agricultural uses).

The flow regime of a river is the main factor determining the composition, structure, functions and dynamics of the fluvial ecosystems. Aquatic species have developed life history strategies in direct response to natural flow regimes. Maintenance of natural patterns of longitudinal and lateral connectivity is essential to the viability of populations of many riverine species.

The effects of the inexistence of an adequate flow regime are very broad, from substantial change of the structure of populations of invertebrates, fish and plants, reduction of diversity and abundance of riparian birds, massive loss of humid zones to reduction of ecological, cultural and landscape diversity, loss of socio-cultural values of the river, and decrease of tourism potential.

There are various methodologies to establish an ecological flow. Characteristics of a good methodology for estimating environmental flow requirements are:

- It should include multi-disciplinary approaches;
- It should be applicable in regulated and not-regulated rivers;
- It should be applicable in different scales, depending on the information flux and the required accuracy;
- It should include the opinions of the different stakeholders;
- It should consider all different aspects concerning the fluvial environment.

In literature there are several methods available, based on different approaches, e.g. hydrological, hydraulic, hydrobiological, holistic methods. See part C for an overview of relevant links and literature.

There is no European standard for ecological flow of a river. Table III.2 gives an overview of the general criteria for some European countries.

Country	Most general criteria
Spain	10 – 20% of the yearly discharge
Italy	10 – 20% of the yearly discharge in some regions, specific discharge of 2 – 4 l/s.km ² in others
France	10% of the yearly discharge
Austria	Discharge that will be exceeded 300 days per year
Germany	30- 60% of the yearly discharge
Ireland	1 – 10% of the yearly discharge
England and Scotland	Discharge that will be exceeded 347 days per year

Table III.1 Examples of ecological flow in some European countries

Discharges of zero should be avoided in any case, although some systems in Southern Europe, in very steep areas or Karstic areas show discharges of zero as part of their natural behaviour during a certain period of time. In these cases the ecosystem will most probably be well adapted to such dry periods, and there should be no need to change the flow in such cases.

Function 6: Demands regarding water quality

Demands for water quality are well defined by the Regulation on water quality standards (OG 89/10).

Function 7: Demands regarding hydro-morphology

Demands for hydromorphology are well defined by the Guideline for hydromorphological monitoring and assessment of rivers in Croatia (Component 2 of project Meander).

3.3. Constraints

Lack of adequate data
Lack of adequate skills
Commercial reserves by stakeholders
Participants unfamiliar with process
No consensus to reach
Lack of understanding
Occurrence of multiple agenda's
Pre-existing value judgements
Lack of political will

Adequate data are needed to fulfil certain demands and perform desired situation analysis. Most of the constraints when developing a vision, are dealing with ideas, opinions, beliefs, value judgements etc. Those may have to do with cultural or social or even psychological backgrounds of people or groups of people and cannot be ignored but are not always so easy to handle, even more difficult, to be changed. High level facilitation, communication and conflict management skills of the project team are desired to overcome or to handle constraints at this stage. It needs to be stressed that ignoring such constraints is risky and never a sensible strategy; one may regret that in a later phase of the project stakeholders (as individual or group) could cause serious delay.

3.4. Results

The result of this Step is to have a good insight in the desired situation in and for the project area. This is described in words and in a summary table and can be illustrated by maps and visualisations.

The results can be summarized in a way indicated below, which follows the structure of the issues stated in 3.2.3. (data just for example purpose). See part C for more information on visioning and some examples of visualisations.

Category	No.	Issue/demand	Desired situation	In line with RBMP?
Level 1				
Function1	1	Level of disturbance	Undisturbed situation in spring-areas	yes
	2	Completeness	Reconnection of low-land flooding areas needed	yes
Function2	3	Discharges	Natural regime	yes
	4	Flooding frequency	Etc...	
	5	Etc...	Etc...	
Level 2				
Function3	6	Discharge (max)	20 m3/s	no
	7	Discharges(min)	12 m3/s	yes
	8	Etc...		
Function4	9	SO4-cont during max	4 mg/l	...
	10	SO4-cont during min	28mg/l	...
	11	Etc...
Function5	12	Etc...

Table III.2. Example of analysis table

3.5. Tools

In this step the project team creates a shared vision and analyses the optimal situation for relevant parameters in the project area.

Tools that are useful in this step are the following (further explained in Part C):

- Communication
 - Sketch and match session to create a vision (stakeholder involvement!)
- Biophysical knowledge
 - Scientific reports on ecological or hydrological demands (ground water depths);
 - River type specific demands on flow velocity, water depth, water quality;
 - Legal requirements related to flood risk;
 - Map production.

4. Step 4: Analysing gap between desired and actual situation

4.1. Purpose

The purpose of this step is to determine the gap between the present situation (Step 2) and the desired situation (Step 3).

This is done in 3 sub-steps:

- Analyse the gap by comparison.
- Define rough sets of solutions.
- Check RBMP programme of measures.

Step 1: Defining Scope
 Step 2: Describing actual situation
 Step 3: Describing desired situation
Step 4: Analysing gap between desired and actual situation
 Step 5: Developing and selecting scenarios
 Step 6: Specifying measures within chosen scenario
 Step 7: Approval by decision makers and inform

4.2. Principles and method

The difference between the actual situation and the desired situation is defined as the gap. Gaps for different aspects give direction to the measures. A few examples are given in the box below.

When the flow velocity is too high and there is little variation in the profile, species will be washed away. A solution will be a different profile that will give a lower flow velocity.

When the flow velocity is too low, the amount of oxygen that will enter the system will be very small. Flow loving species will be affected negatively, especially in cases where there is a biological oxygen demand. A solution will be a different profile that will give a higher flow velocity.

In case of a too big water depth, the growth of water plants is affected negatively. Water can be stored temporarily in a reservoir, but this will create another problem. A solution will be a different profile that diminishes the water depth.

In case the ground water level for habitats is too low, a combination can be sought by creating another profile that solves the hydrological and hydro morphological problems and solves the problem of the ground water level and eventually the problem of flooding as well. A similar solution is valid for agriculture.

4.2.1. Analysing the gap

To analyse the gap between the desired and the present or actual situation a comparison should be done. This strongly implicates that both should be described on the same level(s) and in the same terms.

In the best situation the desired situation is again described on three different levels, regarding different functions mentioned in Step 3.

The proposed three levels are:

1. Complete watershed (from sources to mouth, in its landscape-ecological context),
2. Water bodies of the watershed (with specific dimensions, classification, technical infrastructure, eco-systems, habitats and species),
3. Ecological status of the water bodies (water quality, hydro-morphology).

Step 3 should deliver clear descriptions on these three levels about the desired situation to be reached within a specific period. It may include differentiation in time for the different levels. Some goals may be reached faster than others.

Also the description of the actual situation, as produced in Step 2, should be ready.

The table III.2. may be used to analyse the gaps between desired and actual situation. Add two extra columns titled "actual situation" and "gap".

It is most practical to have the description or values in the field "desired" and "actual" are of the same order, so that the gap can easily be established.

4.2.2. Defining rough (sets of) measures/solutions

In order to overcome the gaps first ideas on how to solve the problems may be formulated. This can be done in more-or-less general words and expressions. In many cases for every gap a number of potential solutions can be identified, although in this stage the effects of all solutions will still be uncertain. But it is advisable to keep a broad view on all potential solutions in this stage.

All these potential solutions may be input to different sets of measures that can be added up to different scenarios in Step 5. In step 5 all scenarios will need evaluation/appropriate assessment to determine the effects of the measures.

4.2.3. Checking RBMP programme of measures

The RBMP includes a programme of measures, which gives a general idea of the possible solutions for all the WFD objectives and thus for the objectives of each RRP. Check if the rough sets of solutions from the previous paragraph 4.2.2 fit into this RBMP list.

In the case there are differences, like new measures defined that were not mentioned in the RBMP, find a way to fit in the new measures in the RBMP list, or get the RBMP in line with newest ideas. See also Part A, chapter 3.2.2 for more information on the role of the project leader in this case.

In Step 6 the (rough) measures of the chosen scenario(s) will be elaborated in further detail.

Example

When the desired situation is describing a spring peak discharge for a small river of 5m³/s, and the actual is 9m³/s the gap is +4m³/s. For this surplus a number of solutions may be possible. In this case it may involve technical measures aiming to lower the peak discharge, like:

- Create/Restore the use of a flooding area;
- Use an extra parallel waterway;
- Change the profile of the water body;
- Use a temporary catch;
- Other measures.

4.3. Constraints

Problems with matching scales
Lack of adequate skills
Lack of knowledge
Lack of data and information or taking certain information for granted
Participants unfamiliar with process
No consensus to reach
Lack of understanding
Lack of tools
Pre-existing value judgements
Lack of political will

Most of the constraints above are dealing with information and experience; e.g. skills, data, value judgements, scaling, etc. On the other hand the social and political context may influence the project- process and results. They should not be easily ignored, because the effects on the result, the process, the timeline and the outcome of the project could be heavy and influence the implementation afterwards. Adequate facilitation is needed to prevent those risks.

4.4. Results

A description of the gap is given between the desired and actual situation and rough ideas about how to overcome the gap.

The description can also include visualization on maps, just like scope which is also geographically pinpointed on a map.

4.5. Tools

In this step the gap between the actual and desired situation for the relevant parameters of the project was set.

Tools that are useful in this step are the following (further explained in Part C):

- Communication
 - Cause – effect analysis and mapping
 - Interrelationship diagrams
- Biophysical/socio-political and economic data analysis
 - Map production

5. Step 5: Developing and selecting Scenarios with stakeholders

5.1. Purpose

In RRP and other studies a scenario is a combination of a set of measures or policies. Costs and benefits for a scenario can be calculated as well as the pros and cons of one scenario against another.

The scenario development can help to generate a broad public support for the RRP. Stakeholders are invited to contribute to the scenario development.

In case of conflicting interests, scenarios and their consequences on costs and benefits can help to find a mutually agreed solution. See Part C for more background on the purpose of scenarios.

Step 1: Defining Scope

Step 2: Describing actual situation

Step 3: Describing desired situation

Step 4: Analysing gap between desired and actual situation

Step 5: Developing and selecting scenarios

Step 6: Specifying measures within chosen scenario

Step 7: Approval by decision makers and inform public

This step is guidance through the process of scenario development and selection.

The next sub-steps are:

- Design and description of the process.
- Analysis and definition of the nature of the scenarios.
- Development of scenarios.
- Assessment and evaluation of scenarios (costs and effects).
- Selection of scenarios.
- Description of the results of the process (Chapter and annexes in RRP).

5.2. Principles and method

5.2.1. Design and description of the scenario development process

The scenarios that will be developed, and especially the chosen scenario, are in fact the blue-print of the RRP in terms of what measures will be put into place to solve problems. A scenario is a set of measures with its predicted or foreseen effects. Choosing the measures therefore also implicates choosing its effects. Stakeholders will be especially interested in the effects of the measures and more so if these affect their needs, interest in the area with regard to land use, use of water, their vision, etc. etc.

In order to manage the involvement of stakeholders and stakeholder groups, it may be very helpful to start with designing the process of how to come from the general sets of measures in Step 4, to a selected scenario by the end of Step 5.

The project leader or project team is (legally) responsible for designing a procedure that is transparent, logical, and well documented. The process may even be designed with the help of stakeholders from outside the project team.

A detailed overview/scheme/description explaining a summary of the process (e.g. in the form of a PowerPoint presentation) is essential for communication purposes. It should reflect how, in what way, you are going to do your work. It should also stress the complexity, possible constraints and the need for a cooperative form of plan development. Showing and communicating a clear view on project approach will prevent a lot of mis-communication and stress in the end.

The scenario-development is not only a technical procedure. In an optimal situation different stakeholders will be invited to actively take part in the scenario-development. For all stakeholders it is a way to communicate their interests and needs in detail, to hear the story of other stakeholders, to expose their possible and best creative solutions to discuss problems identified, to start thinking of accepting compromises etc.

Scenario development is also a process that involves a lot of human psychology. Skilled process facilitation and management is needed to guarantee success and to be able to move towards the implementation phase.

The important issues for the process are elaborated in the sub-paragraphs below. The process design helps you to put these sub-steps and its activities on a time-line and helps to find out what project-time is needed. At the same time it enables outlining responsibilities, stakeholders, their roles, ways of communication, and the possible results of different sub-stepsetc.

5.2.2. Analysis and definition of the nature of scenarios

For good understanding a definition of a scenario in this context is as follows:

"A scenario is a composition (in words, drawing, or both) of a set of measures and their effects, proposed to address a number of identified problems regarding specific issues, in a well-defined project area".

Scenarios will always be dependant on available budget, available time and minimum quality to be delivered. In most situations development of a small number (not less than 3) of scenarios will be sufficient to have all problems and measures for a certain area covered. Usually 3 scenarios are developed, but the project team always has mandate to choose to develop more.

In order to be able to choose from these scenarios, it is important to develop scenarios that are mutually comparable. Scenarios should be of "the same nature or character", to be able to choose easily.

Example

- *Scenarios that have different sets of measures and consequently different effects for the same problems, but which can all be realised within time and money limits.*
- *Scenarios that have the same sets of measures and maximum effects but differences in time of realisation. Best quality, but short, mid or long term realisation. Sometimes long term realisation is necessary, or advisable for reaching e.g. N2000 objectives with a higher impact, sometimes, if conflicts are to be expected, to simply have more time for implementation.*
- *Scenarios that address a different quantity of problems identified and thus give expression to a lower or higher level of realisation of goals.*

The "nature" of the scenarios is also depending on the scope of the project, as defined in Step 1 and on the stakeholders that are involved in the process.

5.2.3. Development of scenarios

Development of scenarios may be done by a small group like the project team, as a desk activity, or can be done with more people or stakeholders. This has to be decided in an early stage and will be described in process-design, as mentioned in sub-step 5.2.1. Below are a few practical tips to guide through the scenario-development process. These can be applied in all situations, in small or large groups. The only difference will be the preparation time.

It is important for a good understanding and communication that scenarios of the same "nature" have clearly distinctive issues in them, which have proper names reflect the differences.

Example

Two scenarios that differ in the number of hectares that will be flooded in future, with Scenario A at 100ha and Scenario B at 110ha, are possibly one and the same scenario. The difference is too small. This is of course arbitrary, but should be reconsidered. Only in the situation when these hectares are (partly) in different places, there is a real difference and reason for 2 distinct scenarios. As mentioned, the naming of scenarios is also important: These should not be referred to as 2 scenarios "Flooding 100ha" scenario and "Flooding 110ha" scenario, but be more specific names should be used "Flooding area 1" and "Flooding area 2". A third scenario could be "Two area flooding" as a maximum-solution.

The development of scenarios should be done on the basis of the rough set of measures that is identified in Step 4. A way of dealing with this is to produce a comparison table with the list of gaps to be addressed, and the long-list or potential measures. At this point all the measures (located in

specific place and time) should be assessed individually to identify their costs (rough estimation) and effects (for WFD, Natura 2000, Economy, etc).

This long-list of gaps and measures can be extended with columns for 3 or more scenarios. For every scenario an analysis can be done to make combinations of measures that fit to form the scenarios. All effects should be taken into consideration during this combination session. Special attention should go out to measures that will sort adverse effects, or cannot be combined for specific reasons.

Table III.3. gives the structure of a possible comparison table.

Every measure is geographically pinpointed and time-framed on a map. The list and the map can be elaborated simultaneously during a working session. People see the place and the measure, and can give other ideas, opinions etc. For each scenario a separate map is drawn with legend that covers all the measures mentioned. The map and legend should be "readable" on its own, without further explanation.

A very helpful method for this is the sketch-and-match method, see also Part C.

Gap	Measure (loc/time)	Scenario 1 (Most natural)	Scenario 2 (Agricultural)	Scenario 3 (Minimum goals)	Indication of direct Cost	Effect WFD	Effect N2000	Effect economy
G1	M1	X	X	X	X	X	X	X
	M2	Y	Y	Y	Y	Y	Y	Y
G2	M3	X	X	X	X	X	X	X
	M4	Y	Y	Y	Y	Y	Y	Y
Etc...								

Table III.3. Comparison table, with the list of gaps, potential measures, scenario's and effects. Per scenario is stated which measures apply for this scenario.

Remember that in this stage "a measure" in most cases is still defined in a rather general way. It describes the general idea and size to overcome the gap that is identified. The exact technical details and necessary activities will be defined later in Step 6.

Some examples of measures on general level are the following:

- Creating a flooding area;
- Reconnection of an old river arm;
- Re-meandering a stream;
- Making a river passable for migrating fish;
- Improving overall water quality;
- Re-profiling the waterbody;
- Softening the embankment of a stream;
- Etc.

5.2.4. Assessment of costs and effects for each scenario

In 5.2.3 the costs and effects of each measure separately has been determined in more or less general terms. They are indications of what a single measure could do for a certain gap.

Now that the scenarios have been developed, as specific combinations of measures, a re-assessment should be done to determine the costs and effects again. This is necessary because measures can influence each other's effect.

Example

- Re-meandering, as a measure on its own, may have positive influence on hydro-morphology and physical conditions of the waterbody: turbulence may improve, oxygen-levels may rise, differences in flow may occur. As an effect it can be expected that conditions for biota may improve, although the chemical water quality may stay the same.
- Improving the water quality like lowering the phosphate-load, as a measure on its own in the same waterbody, may also have a positive effect for biota, although the other physical conditions will stay the same.
- Individual effects can enhance each other.

The costs of combinations of measures may also differ from the costs of all separate measures individually.

Examples

- *Transportation costs for large amounts of soil can sum up to a large amount of money.*
- *If one measure needs soil and another has a surplus, it is more cost-effective to have these measures in one project, close to each other.*

As a result an overall total cost for each scenario will be calculated, still on a rough scale. It is an estimation that will be specified later in Step 6.

5.2.5. Selection of the preferred scenario

One of the developed scenarios needs to be selected from the total set. This is best done with the whole group of stakeholders that has developed the scenarios. In the case of a larger group this will need good process facilitators to manage the selection process.

To execute a balanced selection a strong set of criteria is needed, and a clear method to apply the criteria so that it will lead to a good selection. Weighing-factors will be helpful to differentiate between the scenarios. Sometimes one large selection workshop for all stakeholders together, if possible with policy makers present, can be held. In the end the level of policy makers (from high level national to lower level local) will usually have influence on the final decisions regarding larger projects that need large budgets.

In cases where policy makers claim the most important role in scenario selection (they are stakeholders with different interests), approach below can also be applied.

Possible selection criteria are:

- *To what extent the WFD goals are reached,*
- *To what extent Natura 2000 habitats and species profit,*
- *To what extent flooding risks have diminished,*
- *What the economic profits are,*
- *The overall cost of the scenario,*
- *The speed of execution of all the measures of the scenario,*
- *The willingness of stakeholders to support a scenario.*

In the selection process the stakeholders can be asked to:

- establish a set of criteria that they all approve on (at least 5 criteria),
- give weight to every chosen criteria (anonymously),
- assess all criteria on a scale of 0-100% in the group (with the help of experts on the issue and in the end approved by all).

After this the process leader collects the individual weight-factors, sums them up and applies this to the criteria. This will lead to a calculation that multiplies "percentage" and "weight", leading to an outcome for the most preferable scenario.

Above is a rather technical way of choosing, but if documented well, it will give clear insight to everybody in later stages how the selection was done.

5.2.6. Description of the results of the scenario development and selection process

The RRP should at least contain a description of the selected and preferred scenario. A chapter of the RRP can be used to present summaries of all the developed scenarios and a detailed description of the selected one. This reflects the final result of the process. For the implementation of RRP in frame of the WFD, such reflections are legally binding, as Member States have to indicate in their RBMPs how plans have adapted and feedback of stakeholders has been included (this does not mean that all wishes of stakeholders are granted).

A report of the working process towards the selected scenario can be part of the RRP as an annex. The way of working, the criteria, the overview of all scenarios, etc. can be given here, as background information.

5.3. Constraints

Trouble with unclear definitions
Problems with matching scales
Lack of adequate skills
Lack of knowledge
Lack of data and information or taking certain information for granted
Participants unfamiliar with process
No consensus to reach
Lack of understanding
Lack of tools
Occurrence of multiple agenda's
Pre-existing value judgements
Lack of political will

It is important to be well aware of the effects of ignoring the above constraints. Negative effects could deal about the content but also about the tempo of the process. It should be stressed the importance to clarify concepts amongst team members and relevant stakeholders, but also management of expectations by good and open communication.

5.4. Results

The result of this step will be a chosen and widely supported scenario that represents a set of measures in general terms, with indications and estimations of the positive and negative effects for different aspects in the area involved.

The scenario will be a map on 1:50.000 scale or smaller, with all measures indicated, pinpointed, quantified and assessed. The map and legend should be "readable" on its own. A full description in words supports the map.

5.5. Tools

Once the gaps have been set, it is important to select measures and develop scenarios to overcome the gaps. To make a final cost – benefit analysis it is necessary to have models (ground water, surface water, ecological, economic) that predict the effect of a measure as secure as possible. A measure will certainly have a positive effect on e.g. a river or a habitat but might cause a negative effect on other economic functions in the area (agriculture, constructions). A cost – benefit analysis can help to prepare a final scenario with eventually measures that mitigate (some) of the negative consequences.

Tools that are useful in this step are the following (further explained in Part C):

- Communication
 - Sketch and match sessions to develop scenarios and discuss the outcomes,
 - Involving responsible officer from Croatian Water to discuss the outcome of the various scenarios and discuss the final scenario.
- Biophysical/socio-political and economic data analysis
 - Construction of models (ground water, surface water, ecological, economic),
 - Calculation of different scenarios,
 - Calculation of effects (ground water, surface water, ecological, economic),
 - Environmental Impact Assessment,
 - Proposal of measures to mitigate negative results,
 - Cost – benefit analysis.

6. Step 6: Specify and assess measures within Chosen Scenario

6.1. Purpose

Once the final scenario has been selected by the parties involved, the measures have to be specified in detail and a detailed plan prepared.

This gives the results of the RRP: a final map (or several sub-maps) with detailed measures, including charts, tables, matrices of analyses, objectives, outputs, activities (including budget and parties responsible for executing the measures) etc..

Step 1: Defining Scope
Step 2: Describing actual situation
Step 3: Describing desired situation
Step 4: Analysing gap between desired and actual situation
Step 5: Developing and selecting scenarios
Step 6: Specifying measures within chosen scenario
Step 7: Approval by decision makers and inform public

The next sub-steps will be needed:

- Determining activities (at the level of actual fieldworks) that are needed to execute the measure,
- Assessing the costs and effects of these activities,
- Decision on the activities,
- Drawing a final set of maps that indicate all activities, place and time.

6.2. Principles and method

6.2.1. Determining activities needed to execute the measures

Starting with the lists of general measures as identified and described in the chosen scenario from Step 5, it is possible to determine the next level of detail. Most measures need to be detailed to see what specific fieldwork activities are needed.

To illustrate this, the list of general measures presented in 5.2.3 is given again:

- Creating a flooding area;
- Reconnection of an old river arm;
- Re-meandering a stream;
- Making a river passable for migrating fish;
- Improving overall water quality;
- Re-profiling the waterbody;
- Softening the embankment of a stream;
- Etc.

Every measure mentioned here could be part of the selected preferred scenario, and must be elaborated up to needed activities.

A few examples out of above list:

For the creation of a flooding area on a certain spot the next activities may be needed:

- *regulatory constructions or waterworks (weirs, new side-canals, walls and dams to protect specific structures, etc.),*
- *a compensation fund for damage to agricultural areas or houses,*
- *spatial laws and regulation may need adaptations,*
- *some land may have to be bought, or landowners asked to move out of the area,*
- *etc...*

To make a (stretch of) river passable for migrating fish the next may be needed:

- *Removing all weirs and*
- *Re-meandering the river,*
- *Or making fish ladders "around" all weirs,*
- *Etc.*

6.2.2. Assessment of costs, effects and timeline of activities

For this assessment the same approach as in Step 5 can be used, although now all estimations of costs and effect should be far more precise. The use of unit prices may be helpful here, where available.

The assessment should give show if this scenario is really viable, in terms of effectiveness and budget. Also indications of time-lap needed and sequence of activities will be needed to draw-up a full plan.

This assessment is likely to be done as a desk study by a small group of experts like the project team. It is too complicated to do this with larger stakeholder groups. The outcome of the assessment can be checked by other people or stakeholders. In the end the outcome must be communicated with every stakeholder that has been active in scenario development.

6.2.3. Decision on final set of activities

The assessment in the previous sub-step will give insight over the final set of activities to be executed. As a result additional activities may be needed, or some may be skipped from the list.

Determined set of activities need a preliminary decision by the responsible person.

6.2.4. Description of final measures and detailed map

After a positive decision on the scenario chosen, with its measures and activities, a final set of maps can be drawn, and final descriptions made. All measures will be detailed to activities, quantified and specified, and located on new detail maps. Maps could be now on scale 1:10.000 to give more precise locations and descriptions.

Details can be:
 -exact location and size,
 -intensity,
 -contribution to the target/goal,
 -relationship with other measures,
 -costs and social/economical effects,
 -funding possibilities,
 -timetable and planning,
 -proposed actor/executor.

This final set can be considered as a planning part of RRP. It must be put through several procedures of communication, and, most important, a final decision on the start of the execution of the RRP. This final "go" is needed to change from the stage of "plan making" to the stage of "realisation" in the field. For more details see part A and Step 7.

The realisation of the RRP should be executed by making an Implementation Plan (see also Part A, 3.2.2), which forms the technical description of the actual measures to be taken in the field, with calculations of units, quantities, prescribed dimensions, planning for execution, specifications for (sub)contractors, etc.

This is not further elaborated in this Guideline for River Restoration Plans and can be performed by the parties responsible for executing the different measures. This will be done according to local policies, methods and formats for implementation and execution.

6.3. Constraints

Lack of adequate skills
Lack of knowledge
Lack of data and information or taking certain information for granted
Limitation by time frame
Restrictions by missing resources
Lack of tools
Problems with logistics

Passing over the mentioned constraints could have negative effects in the sense of delay, half work, rising of costs or insufficient support by stakeholders. The importance of these constraints should be realised on beforehand and well managed during the project. One can prevent these risks or

solve the expected problems by delaying the start, prolonging the duration of the project, raising the funds, training of team members etc.

6.4. Results

The result of this step will be a final map (or several sub-maps) with detailed measures, including charts, tables, matrices of analyses, objectives, outputs, activities (including budget and parties responsible for executing the measures) etc., that have been discussed with all parties interested.

6.5. Tools

This step needs a desk study for specification and commenting by stakeholders. The measures have to be specified in detail and prepared into a detailed plan.

Tools that are useful in this step are the following (further explained in Part C):

- Implementation/Execution
 - Microsoft project.
 - Probabilistic planning methods.

7. Step 7: Approval by Decision makers and Inform public

Assessment of the ecological status of water bodies, which is carried out through the River Basin Management Plans, singles out river parts (water bodies) that are influenced by hydromorphological alterations. River Basin Management Plan prescribes the responsibilities that need to establish procedures for:

- HMWB (heavily modified water bodies), which means lower environmental and water protection objectives,
- temporary need for lowering environmental and water protection objectives, with a delay of implementation of measures for the subsequent planning cycle, or
- implementation of measures for achieving the good ecological status of those water bodies for which permission has not been obtained to lower environmental and water protection objectives.

For river parts (water bodies) for which permission has not been obtained to lower environmental and water protection objectives, it is necessary to define projects aimed at restoration of the river or river part, in order to be achieve good hydromorphological and ecological status.

Restoration project is implemented in cooperation with following stakeholders:

- Institutional bodies whose activities led to significant hydromorphological changes;
- The authorities responsible for water management, which declares water status and monitors the effects of the implementation of measures and
- The authorities responsible for nature protection.

In the process of preparing and implementing a river restoration project it is recommended to include the NGOs and especially the local stakeholders.

IV. PART C: TOOLS, LINKS AND EXAMPLES

This part consists of the following 3 chapters:

1. Tools – This chapter gives a brief overview of tools that can be used during the various stages of a project, partially based on the tools described in Koehn et al. (2001).
2. Links – This chapter contains a list of relevant links to manuals, case studies, projects, examples and other information on River Restoration.
3. Examples and elaboration – This chapter contains additional examples and detailed information on the steps in Part B and tools in this part C. Some general issues and step-specific issues are covered.

All chapters (and information in it) may and should be further elaborated due to progressive insights due to implementing the WFD and using this Guideline for River Restoration Plans.

1. Tools

1.1. Process

Activity	Purpose
<ul style="list-style-type: none"> • Brainstorming Thinking by a group of people of as many ideas as they can about the topic in question. 	To quickly gather many ideas without getting unduly caught up in discussion Restoration Team, Vision Setting.
<ul style="list-style-type: none"> • Communication Informing participants and community, getting feedback (hearings, workshops, focus groups, articles in newspapers, websites, information panels, surveys/interviews). 	To raise awareness of the importance of rivers and river restoration Restoration Team.
<ul style="list-style-type: none"> • Sketch and Match The Sketch and Match brings experts, policy makers and regional stakeholders together. It is an interactive session within a short period of time and makes much use of images/visualisations. <u>See visualisation in chapter 3 in this part C.</u> 	To tighten the goal of the project and to integrate and visualise the different wishes/disciplines of all stakeholders. Directions of development are sketched and plotted along the way, so that directors and stakeholders in the area can make clear choices for the further elaboration of the project.

1.2. Planning and Design

Activity	Purpose
<ul style="list-style-type: none"> • Geophysical/ecological/biological data and reports Climate, soils, environmental problems, land capability maps, presence/absence data, species richness data, threatened/endangered species list, farm and catchment plans, reports commissioned by water and land management authorities 	To obtain baseline data and scoping; System Assessment.
<ul style="list-style-type: none"> • Hydrological data Discharge, rainfall, catchments, ground water levels, morphological data, flood information. 	To obtain baseline data and scoping; System Assessment.
<ul style="list-style-type: none"> • Habitat surveys Aerial photos, snag counts, aquatic vegetation, riparian vegetation. 	To assess the habitat as it relates to the health of the system; System Assessment.
<ul style="list-style-type: none"> • Historical records/reconstruction approach Maps, photographs, explorers diaries, surveyors 	To define river restoration trajectory by outlining pre disturbance state using

notes, archival records, local interviews, historical societies	crosschecked data Creates sound basis for restoration activities and thus increases cost effectiveness Scoping; System Assessment.
<ul style="list-style-type: none"> Cause and effect mapping Fish bone diagram with effect at the end of the spine and main causes as ribs. Contributors to the main cause can be sub-branches of the ribs. 	To explore the contributing causes or reasons for a particular problem or issue and to help identify root causes rather than symptoms Scoping; Problem Definition.
<ul style="list-style-type: none"> Hydraulic models Surface water models: Duflow, Sobek, DHI Mike11, HEC-RAS, etc... Ground water models*: Modflow, Simgro 	To understand flow/flood depth, velocity, relation surface water – groundwater etc. To predict effects of measures. Important for risk assessment, System Assessment. *excluding karst groundwater
<ul style="list-style-type: none"> Hydrologic Models/Analysis Rainfall–run-off models River gauging data Flow duration analysis Annual flood frequency curves 	To aid in assessment and understanding flow regimes in stream systems during assessment and design. The listed tools move from the rapid, 'black box' type of approach (e.g. rational method) through to the complicated distributed parameter, process type models; System Assessment.
<ul style="list-style-type: none"> Environmental Impact Assessment NSW Determination of ecological, social and economic impacts of a development and proposed measures to protect the environment. 	To ensure that any development of a visually or ecologically sensitive site is subject to the most rigorous assessment of environmental impact.
<ul style="list-style-type: none"> GIS Mapping and Modelling Geographic information system Satellite imaging of vegetation land use types, precipitation, geographical features, ArcView. 	To present information such as hydrological, catchment boundaries, streams, development, on a spatial basis. Output can be in a format suitable for assisting managers and communities to plan Scoping, Monitoring and maintenance.
<ul style="list-style-type: none"> Touch table A digital table which processes spatial data and information in an interactive way. 	To assist parties to explore problems, chances, scenario's and solutions for different kind of interests by designing and touching on the table; useful for all kind of people e.g. decision makers, spatial planners and landscape architects
<ul style="list-style-type: none"> SWOT – Strengths, Weaknesses, Opportunities and Threats analysis Can be done as a brainstorming exercise or as a synthesis of other information. <u>See elaboration in chapter 3 in this part C.</u> 	To identify strengths, weaknesses, relation to a project in Assessment, Scoping, Evaluation; Problem Definition; Objective Setting and Prioritisation; Select Options and Activities.
<ul style="list-style-type: none"> Benefit/Cost Analysis (BCA) Potential costs and benefits of an activity, or objective are listed and may be quantified for use in prioritising. 	To understand positive and negative aspects and resources needed for an activity or objective Scoping, Evaluation.
<ul style="list-style-type: none"> Stakeholder analysis Method to explore persons or institutions that might be involved in or impacted by a project. <u>See elaboration in chapter 3 in this part C.</u> 	To identify people of institutions and their interests as to the project and to analyse the level and phase of participation.

1.3. Implementation/Execution

Activity	Purpose
<ul style="list-style-type: none"> Microsoft Project Software package 	To aid project management – budget, planning, schedules personnel etc. Restoration Team.
<ul style="list-style-type: none"> Probabilistic planning methods Software packages for risk analysis on costs and planning. 	To aid project management – budget, planning, risk analysis. Restoration Team.

2. Links

2.1. Useful manuals

- Cottingham, P., N. Bond, P.S. Lake & D. Outhet (2005), Recent lessons on river rehabilitation in eastern Australia.
- Doll et al., (no date), Stream restoration, A natural channel design handbook North Carolina State University, North Carolina A&T State University.
- Food and Agriculture Organization of the United Nations, Deutscher Verband für Wasserwirtschaft und Kulturbau e.V.(2002), Fish passes – Design, dimensions and monitoring.
- Janes, Martin, Karen Fisher, Jenny Mant and Laura de Smith (2005), River Rehabilitation Guidance for Eastern England Rivers. Environment Agency.
- Koehn, J.D., G.J. Brierley, B.L. Cant and A.M. Lucas (2001), River restoration framework.
- Rutherford, Ian D., Kathryn Jerie and Nicholas Marsh (2000), A Rehabilitation Manual for Australian Streams.
- United States Environmental Protection Agency (2008), Handbook for Developing Watershed Plans to Restore and Protect Our Waters.
- WWF, (2001), Elements of Good Practice in Integrated River Basin Management A Practical Resource for implementing the EU Water Framework Directive.
- Zöckler, Christophe (2000), Wise use of floodplains. A review of 12 WWF River restoration projects across Europe.
- Zeeman, Wim (2011), Water Management and multiple land use: Competing and complementary functions in water management: Irrigation and drainage.

2.2. Website links

2.2.1. www.ecrr.org

ECRR is a European network based on a framework of national networks ([national centres for river restoration](#)) whose mission is to enhance and promote river restoration and sustainable river management throughout Europe, to disseminate information on river restoration experiences and approaches and to foster the establishment of national river restoration networks in as many European countries as possible. It shares the same goals of many River Restoration national centres, but it acts at the international level, as a "network of networks".

2.2.2. <http://www.restorerivers.eu/>

RESTORE is a partnership for sharing knowledge and promoting best practice on river restoration in Europe. It is supported by LIFE+ funding from the European Commission and works closely together with the European Centre for River Restoration (ECRR). RESTORE encourages the restoration of European rivers towards a more natural state. This delivers increased ecological quality, flood risk reduction, and social and economic benefits. RESTORE supports river restoration practices across Europe by:

- Sharing river restoration knowledge to policymakers, river basin organisation and practitioners.
- Strengthening river restoration networks.
- Developing knowledge transfer tools and organising knowledge exchange events.

A list of some of the projects available from the http://riverwiki.restorerivers.eu/wiki/index.php?title=Main_Page is given in a bellow table.

Nr.	Project name	Country	Project status	Restoration themes	Project description links
1.	Biomura LIFE06NAT/SI/000066	Slovenia	Completed	Conservation of existing natural resources (habitat types) and biodiversity Restoring the ecological character of the Mura river corridor to meet the needs of the wetland ecology	→ http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3153&dDocType=pdf
2.	Ecoremediation system (ERM) for treatment of polluted	Slovenia	Completed	Riparian development, Pollution incident mitigation, Improving quantity & dynamics of flow, and substrate conditions	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AECOREMEDIATION_SYSTEM_%28E

Nr.	Project name	Country	Project status	Restoration themes	Project description links
	tributary of Glinščica			Macrophytes & phytobenthos: Average abundance, Macrophytes & phytobenthos: Taxonomic composition, Nutrient concentrations, pH, Salinity, Oxygen balance, Temperature, Specific synthetic pollutants, Specific non-synthetic pollutants	RM%29 FOR TREATMENT OF P OLLUTED TRIBUTARY OF GLIN %C5%A0%C4%8CICA → http://www.digitalna-knjiznica.bf.uni-lj.si/dn/blumauer_sabina.pdf
3.	Gatzaue riverbed widening	Italy	Completed	Flood risk management Habitat and biodiversity Hydromorphology Social benefits Spatial planning	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AGatzaue_riverbed_widening
4.	HPP Blanca	Slovenia	Completed	Creation of river passage	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AHPP_Blanca
5.	Habitat and water flow restoration on River Rábca	Hungary	Completed	Habitat and biodiversity Hydromorphology Flood risk management	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AHabitat_and_water_flow_restoration_on_River_R%C3%A1bca
6.	Improving the structure of the Lahn-patak in Hungary	Hungary	Completed	Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AImproving_the_structure_of_the_Lahn-patak_in_Hungary → http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE_04_NAT_AT_000001_LAYMAN.pdf
7.	Klebach-Side channel	Austria	Complete	Habitat and biodiversity Monitoring Hydromorphology Water quality	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AKlebach-Side_channel → http://wiki.reformrivers.eu/index.php/Klebach_-_Side_channel
8.	LIFE 06 NAT/SLO/000069 Intermittent Lake Cerknica	Slovenia	Complete	Hydromorphology (Quantity & dynamics of flow, Channel pattern/planform, Structure & condition of riparian zones)	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ALIFE_06_NAT/SLO/000069_Intermittent_Lake_Cerknica → http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE_06_NAT_SI_000069_LAYMAN.pdf
9.	Lower Aurin river: Molini di Turess riverbed widening	Italy	Complete	Flood risk management Habitat and biodiversity Hydromorphology Monitoring Spatial planning	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ALower_Aurin_river%3AMolini_di_Turess_riverbed_widening
10.	Lower Aurin river: San Giorgio di Brunico riverbed widening	Italy	Complete	Flood risk management Habitat and biodiversity Hydromorphology	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ALower_Aurin_river%3ASan_Giorgio_di_Brunico_riverbed_widening
11.	Remediation and revitalization of Séd-Nádor stream	Hungary	Complete	Water quality Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARemediation_and_revitalization_of_S%C3%A9d-N%C3%A1dor_stream
12.	Revitalisation of Nagy-Pándzsa watersystem	Hungary	Complete	Flood risk management Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARevitalisation_of_Nagy-P%C3%A1ndzsa_watersystem
13.	Revitalisation of branch 'Felsőszentmártoni' at River Dráva	Hungary	Complete	Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARevitalisation_of_branch_%E2%80%99F%C5%91szentm%C3%A1rtoni%E2%80%99_at_River_Dr%C3%A1va
14.	Revitalisation of branches 'Boros Dráva and	Hungary	Complete	Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARevitalisation_of_branches_%E2%80%99

Nr.	Project name	Country	Project status	Restoration themes	Project description links
	Drávakeresztúri'				9Boros Dr%C3%A1va and Dr%C3%A1vakereszt%C3%BAr%E2%80%99
15.	River Tesina restoration	Italy	Complete	Habitat and biodiversity Hydromorphology Social benefits	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARiver_Tesina_restoration
16.	Water and Life for Drava and Vuka	Hungary/Croatia	Complete	Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AWater_and_Life_for_Drava_and_Vuka
17.	Water is Environmental Pearl (WEP) - SLO-HU ETE 2007-2013	Hungary/Slovenia	Complete	Habitat and biodiversity Flood risk management	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AWater_is_Environmental_Pearl_%28WEP%29_-_SLO-HU_ETE_2007-2013
18.	Vén-Duna (Old-Danube) sidearm's revitalization	Hungary	Complete	Habitat and biodiversity Water quality Monitoring	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AV%C3%A9n-Duna_%28Old-Danube%29_sidearm%E2%80%99s_revitalization
19.	Progetto wetland - Voltorno	Italy	Complete	Riparian development, Flood defence Pollution incident Hydromorphology (Connection to groundwaters) Physico-chemical (Nutrient concentrations, Specific synthetic pollutants) Recreation	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3APROGETTO_WETLAND_-_Voltorno → http://www.cirf.org/download/convegno_sarzana/sessd_lafratta.pdf
20.	Environment-friendly Reduction of Flood Risk in the Multi-thread Reach of the Czarny Dunajec River	Poland	Complete	Flood risk management Hydromorphology	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AEnvironment-friendly_Reduction_of_Flood_Risk_in_the_Multi-thread_Reach_of_the_Czarny_Dunajec_River
21.	Isar-Plan	Germany	Complete	Flood risk management Habitat and biodiversity Hydropower Hydromorphology Land use management – forestry Monitoring Social benefits Spatial planning Water quality	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AIsar-Plan → http://www.wwa-m.bayern.de/fluesse_seen/massnahmen/isarplan/index.htm#fina → http://www.wwa-m.bayern.de/fluesse_seen/massnahmen/isarplan/doc/the_isar_experience.pdf
22.	Morava restoration project	Austria	Complete	Economic aspects Habitat and biodiversity Social benefits Water quality	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AMorava_restoration_project → http://www.etc-more.eu/ms/etc_more/more_en/
23.	Regelsbrunner Aue	Austria	Complete	Land use management – agriculture Economic aspects Flood risk management	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARegelsbrunner_Aue → http://www.aquamedia.at/Regelsbrunner-Au-Restoration-Project.2497.0.html
24.	Rehabilitation of Benta stream	Hungary	Complete	Flood risk management Habitat and biodiversity	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3ARehabilitation_of_Benta_stream
25.	Valtellina 2005 – New green system	Italy	Complete	Riparian development Flood defence Hydromorphology (Structure & condition of riparian zones) Recreation Community demand Landscape enhancement	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AValtellina_2005_%E2%80%93_New_green_system
26.	Water is Environmental Pearl	Hungary Slovenia	Complete	Habitat and biodiversity Flood risk management	→ http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AWater_is_Environmental_Pearl

Nr.	Project name	Country	Project status	Restoration themes	Project description links
	(WEP) - SLO-HU ETE 2007-2013				er is Environmental Pearl %28WEP%29 - SLO-HU ETE 2007-2013 → http://www.nyuduvizig.hu/upload/3_WEP_Branka_Bensa.pdf

Table IV.1 List of some relevant restoration projects

2.2.3. <http://www.reformrivers.eu/>

The overall aim of REFORM is to provide a framework for improving the success of hydromorphological restoration measures to reach, in a cost-effective manner, target ecological status or potential of rivers.

To achieve this the REFORM consortium will develop protocols and procedures to monitor the biological response to hydromorphological change with greater precision, to support the design of programmes of restoration and mitigation measures for the WFD, in particular for the upcoming 2nd round of RBMPs, and to integrate restoration better with socio-economic activities.

2.2.4. <http://www.restorerivers.eu/LinkClick.aspx?fileticket=IBgquy8Es9g%3d&tabid=2624>

Website links to 'WFD AND HYDROMORPHOLOGICAL PRESSURES TECHNICAL REPORT - CASE STUDIES - November 2006'. Especially relevant in this report are the following case studies:

- F3/01 - Restoration of the Jeseniscica River,
- F3/04 - Symbiosis as the basis for a natural system of flood risk management in the Dijle valley, Belgium,
- H2/01 - Minimum flow requirements and new small weirs in a 5 km long river section in River Numedalslaagen,
- H2/03 - Dam removal on the Mirna River,
- H2/04 - Restoration of migration path on the Sava River, Tacen,
- H2/20 - Restoring the Loire: The "Plan Loire Grandeur Nature",
- N2/01 - Bed load management in the river Elbe,
- N3/02 - Controlling water levels in river-training projects to preserve floodplain habitats. The example of the Öberauer Schleife (cut-off meander),
- N3/04 - Reconnection of oxbow lakes/ wetlands.

2.2.5. <http://www.ecrr.org/publication/ecrrbrochure.pdf>

Website links to 'ECRR Addressing practitioners, June 2008. Especially relevant are the following practical examples: Hungary – Gemenc (Ven Duna), Switzerland: Thur river.

2.2.6. <http://www.opw.ie/en/FloodRiskManagement/Publicationstest/#d.en.9100>

Example of environmentally friendly maintenance of streams, channels and rivers.

2.2.7. <http://www.opw.ie/en/media/OPW%20Environmental%20Management%20Protocols%20&%20SOPs%20April%202011.pdf>

Website links to 'The Office of Public Works, Arterial Drainage Maintenance Service, Environmental Management Protocols & Standard Operating Procedures, The Office of Public Works, April 2011'.

2.2.8. http://ec.europa.eu/environment/water/flood_risk/better_options.htm

Website links to information about 'TOWARDS BETTER ENVIRONMENTAL OPTIONS FOR FLOOD RISK MANAGEMENT'. Relevant elements are:

- A [Note on Towards better environmental options in flood risk management](#) discusses a series of aspects on this topic such as legal requirements, the need to identify better environmental options for new physical modification to water bodies, the role of measures which work with nature such as green infrastructure, stakeholder involvement, the multiple benefits of win-win measures, and possibilities to fund such measures with EU funds.

- An [Annex to Note on Towards better environmental options in flood risk management](#) provides further information on best practice examples, which have been implemented for natural flood risk management in Europe, and gives relevant background on methodologies which have been used to put the principles of ecosystem-based approaches and Green Infrastructure for flood risk management into practice.
- A [Power Point Presentation](#) to assist in summarizing the information and facilitate stakeholders presenting the approach.

2.2.9. Other useful links

NGOs and Associations

- ERN - European River Network → www.rivernet.org/ern.htm
- River Basin Initiative Portal → www.riverbasin.org
- Euronatur → www.euronatur.org
- WWF → <http://wwf.panda.org/bs/slatkovodni/>
- LIFE → <http://ec.europa.eu/environment/life/themes/water/thematic.htm>

Public bodies/boards/agencies

- Flood Risk Management Research Consortium FRMRC - www.floodrisk.org.uk
- Water Information System for Europe (WISE) - <http://water.europa.eu>

Science, Universities and Research Bodies

- Catchment Science Centre → www.shef.ac.uk/csc
- Amt für Landwirtschaft und Natur des Kantons Bern – Fischereiinspektorat
→ www.be.ch/fischerei (German) , www.be.ch/peche (French)
- Deltares → www.deltares.nl/nl
- Finnish Game and Fisheries Research Institute → www.rkti.fi/english
- Finnish Society for Stream Conservation → www.virtavesi.com
- Wageningen University – Department of Land Degradation and Development
→ www.idd.wur.nl/UK
- Biogeomorphology Platform → www.biogeomorphology.org
- Delft University of Technology (useful information on river morphology) which contains links to research projects and as well as links to useful downloads
→ www.citg.tudelft.nl/index.php?id=17857&L=1,
→ www.citg.tudelft.nl/index.php?id=17858&L=1
→ www.citg.tudelft.nl/index.php?id=17859&L=1
- list of Croatian faculties and Institutes that can be useful for river restoration
→ <http://www.gradri.uniri.hr/>
→ <http://www.grad.unizg.hr/>
→ www.gradst.hr/
→ www.gfos.hr
→ www.pmf.unizg.hr/biol

Projects

- Communityrivers → www.deltares.eu
- River landscape-types in Austria → www.flusslandschaften.at/en
- Doñana 2005 → www.mma.es/en
- Corredor Verde del Guadiamar → www.juntadeandalucia.es/index.htm
- Tagliamento River → www.fiumetagliamento.it
- Twinbasins → www.twinbasins.org
- Biotas and rehabilitation of four Drava river side-branches in Hungary → http://www.ddnp.hu/user/browser/File/downloads/Drava_mellekegak_konyv.pdf

3. Examples and elaboration

3.1. Identifying and Analysing Stakeholders

References

- *European Communities, 2003. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No 8. Public Participation in Relation to the Water Framework Directive. Produced by Working Group 2.9 – Public Participation. Office for Official Publications of the European Communities, Luxembourg.*
- <http://www.wageningenportals.nl/msp/>

3.1.1. Purpose and introduction

Each planning process, whether it is a management planning process at basin level, or a river restoration planning process at e.g. village level, is by definition a multi-stakeholder process in order to be successful. The division of management responsibilities between different administrative authorities often results in fragmented and competitive approaches in, first of all, the use of rivers or water in general, but additionally in their restoration. River restoration requires, however, a multidisciplinary approach that integrates the technical, economic, environmental, social and legal aspects of river basin management and river restoration. Next to the data, for the area to be restored, on water quality, water quantity, hydro-morphology, data on flora and fauna, river restoration activities, data are needed on land use, population growth, social welfare, legal frameworks etc. etc. Since data are simply not stored neatly in *one* overarching database, cross sectoral cooperation is necessary, as your data are 'stored' with different stakeholders or stakeholder groups (and sometimes not yet available at all...). Moreover, some data aiming at understanding people's livelihoods in the area, understanding the unwritten rules and regulations of society, i.e. the institutional setting of the area, are not stored in any database! But without a proper understanding of the bigger picture and embedding your restoration activities in - and building your restoration activities on the actual institutional setting, river restoration interventions are likely to fail.

The purpose of this annex is to understand the role of stakeholder involvement in, or with regard to, the area of the restoration plan, as well as their interests, the problems they face, their position regarding decision making processes, the relations between them etc. etc. Not just because it is simply more efficient in the longer run to address river restoration planning as a multi-stakeholder process, but also because Directive 2000/60/EC (the EU Water Framework Directive) simply legally binds Member States to do so.

3.1.2. Stakeholder involvement and the EU Water Framework Directive

The WFD mentions the following about participation and stakeholder involvement in its preamble 46: *'To ensure the participation of the general public including users of water in the establishment and updating of river basin management plans, it is necessary to provide proper information of planned measures and to report on progress with their implementation with a view to the involvement of the general public **before** final decisions on the necessary measures are adopted'.*

A bit strange in the WFD is that in the preamble there is a focus only on the general public. In the later article 14 the WFD mentions about interested parties (or stakeholders) and the public. These two are not necessarily the same.

In its article 14, the WFD states the following:

1. Member States **shall encourage** the **active involvement** of all **interested parties** in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans. Member States **shall ensure** that, for each river basin district, they publish and make available for comments to the public, including users:
 - (a) a timetable and work programme for the production of the plan, including a statement of the consultation measures to be taken, at least three years before the beginning of the period to which the plan refers;

- (b) an interim overview of the significant water management issues identified in the river basin, at least two years before the beginning of the period to which the plan refers;
 - (c) draft copies of the river basin management plan, at least one year before the beginning of the period to which the plan refers. On request, access shall be given to background documents and information used for the development of the draft river basin management plan.
2. Member States shall allow at least six months to comment in writing on those documents in order to allow **active involvement and consultation**.
 3. Paragraphs 1 and 2 shall apply equally to updated river basin management plans.

The stakeholder analysis results need to inform about the composition of the river restoration planning team and need to outline the necessary level of participation of stakeholders.

The following figure (figure 1) is based on the official text of Directive 2000/60/EC (the EU Water Framework Directive) as described above and the *CIS (Common Implementation Strategy) Guidance Document No. 8 on Public Participation in relation to the EU Water Framework Directive*.



Figure IV.1. Legal obligation on public participation in the EU Water Framework Directive

Figure IV.1. shows visually what is legally binding for EU Member States in terms of stakeholder involvement. Information supply and consultation are to be ensured, and what actually is to be expected of Member States is clearly stated in article 14. Restoration Plans are part of the broader River Basin Management plans and therefore interested parties and the general public need to be informed and it has to be described how consultation measures have been taken into account. Article 14 states (also see above): 'Member States shall allow at least six months to comment in writing on those documents in order to allow **active involvement and consultation**'.

In order to have an efficient planning process, the identification and analysis of institutions and stakeholders starts, therefore, as early as possible in the project planning cycle.

The primary condition for achieving success is, as many examples from different Member States have shown, even taught, us, the *willingness* of stakeholders to work together. Hence, the planning and implementation of restoration activities require an open process through which stakeholders can clearly understand the actual situation (and therefore each other!) as well as the need for restoration intervention, even if it is not in their personal interest or benefit. At the same time, be aware of the need for understanding where the planning processes will go, thus the need for developing a common vision.

In many River Restoration activities stakeholders (whether they are civil servants at national or local level, farmers or restaurant owners) are often just informed about the need for river restoration interventions, without engaging them in the earlier planning and analysis process. To achieve the necessary cooperation and the smooth implementation of River Restoration activities, stakeholders need, however, as mentioned earlier, to be able to understand the actual situation and each other clearly. In addition they need to have a common vision regarding the future situation, in which they see themselves, and that provides sustainable opportunities for their own situation as well.

What is a stakeholder?

Anyone who can (positively or negatively) affect or is (positively or negatively) affected by the River Restoration intervention, for example who has data already, who has influence or decision making power on the actual outcome or who has an interest in its successful (or unsuccessful!) outcome is a stakeholder. It is essential to make a thorough analysis of all stakeholders and describe how they are affected or can affect your River Restoration Plan.

The WFD does not prescribe how to 'encourage' active involvement, but all Member States do have examples where processes unnecessarily lengthened because of not involving stakeholders. But involvement or participation exists in many different levels.

What is participation?

Based on your stakeholder analysis results (if it is done properly), who (which stakeholder) participates when, how and how much, follows straight from your analysis results. Participation is a very wide concept, which includes different levels of stakeholder involvement: from just informing, to consulting, to ensuring active engagement in planning, implementation or decision making (or a combination of these). Make sure that stakeholders together agree at what level and to what extent they participate and what this means in practice, e.g.:

- Are stakeholders expected to develop any work products?
- What amount of time is expected from stakeholders?
- Is time compensated in one way or another?

Beware, figure IV.2. also shows a level of participation, although in most cases it has not proven to be very effective with regard to the implementation of plans.



Figure IV.2. Participatory dialogue

3.1.3. River restoration is a multi-stakeholder process!

Starting a river restoration planning process means, without exception, starting a stakeholder process, mostly a multi-stakeholder process. An open door perhaps, but this is a process requiring effective communication, *patience* and *mutual trust*. Good partnerships are simply and definitely the most important ingredient for an effective and efficient planning process. Effective in the sense that it leads to an agreed result: a process that leads to impact and ensures that locally-held knowledge finds its way to the right decision platform. Efficient in the sense that there is a minimum waste of resources, expenditure and without unnecessary effort.

An important element of engaging stakeholders (and encouraging active participation, as prescribed by the WFD) in the planning process is that it helps to identify and prepare for possible upcoming conflicts. Conflicts are not necessarily bad. It often stimulates creative thinking and looking at problems from different angles. The result of the River Restoration Planning process might in the end not be agreed to by all stakeholders, but important is that all stakeholders understand why decisions are taken and when. Expectations have to be seriously considered and communicated. In a successful multi-stakeholder process, all stakeholders understand their role in the process and understand how they could contribute to the process. An important keyword for multi-stakeholder processes is learning: All stakeholders learn together throughout the process.

This step 2 does not advocate for the active participation of all *people*, but it does advocate for ensuring the involvement of all *relevant* players of a River Restoration planning process at the right level of participation as it will save time and thus money in the long run.

Starting up the River Restoration process... Starting up the multi-stakeholder process

Starting up the river restoration process means starting up the multi-stakeholder process. The steps below provide the logical flow from starting up, to implementing and finally to evaluating your river restoration process. Implementation, is not just

Step	What?
1.	The first logical step is a desk study to draft an initial list of stakeholders, to describe their role regarding river restoration, to describe their interests and their position with regard to decision making. Realise this initial list needs to be checked, adapted and updated on the basis of further meetings and consultation with stakeholders. Just start with simple matrix, like the one below and simply fill what you know.

Stakeholder	Characteristics	Role	Interest	Position (decision making power)
Ministry of Agriculture – Water Management Directorate	Public sector	Responsible for the implementation of the EU WFD... etc		Competent authority for EU WFD
Ministry of Economy	Public sector			
Ministry of Environmental and Nature Protection	Public Sector			Competent authority for implementation of Natura 2000 and implementation of national law ... etc.
Farmers – Animal husbandry	Private sector – very small number of farmers ... etc		Financial or land compensation for farm land needed for flood protection	
Farmers – crop production	Private sector – relatively a big group, well organised in an association			
WWF Croatia	Civil society		Biodiversity protection	
...				
Media	Private sector			
...				

Also think of relationships between the different stakeholders. What are relationships you can build on, what stakeholders need extra care because of conflicting issues in the past. Use simple tools to show current strong relationships and conflicting relationships.

The following tool will help you to prepare an initial overview of which stakeholders could work closely together with you on the development and implementation of the River Restoration Planning Process.

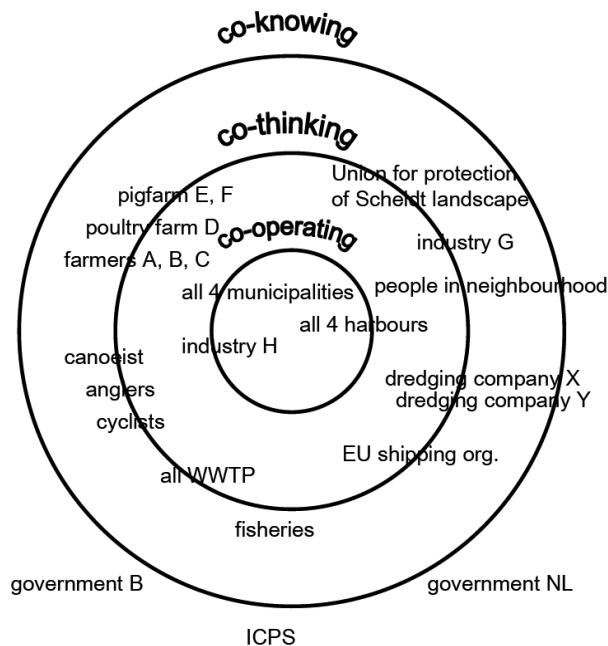


Figure IV.3. Example of a stakeholder target scheme in terms of levels of participation (River Basin Management Plan of the Scheldt Basin)

You could even make a different 'participation scheme' for the different phases from exploring and analysis, to prioritising and decision making, to implementation and evaluation.

Remember this initial step of desk study is just an initial step. As your stakeholder analysis results need to be verified during meetings with stakeholders (either bilateral or multi-lateral).

2. Bilateral meetings or focus group meetings per stakeholder group

After initial stakeholder analysis (desk study work), bilateral meetings with stakeholders are extremely beneficial. Not only with those that might become your allies but also visit those that might be negatively affected by the intervention:

- Consider to start by contacting the people and organisations that have an interest in improving the water conditions in a river and might become partners assisting with the river restoration planning process. (Also consider who would be the most appropriate person to contact the potential partner!).
- Those who might be negatively affected by the river restoration intervention should be encouraged to share their concerns and offer suggestions for possible solutions.

For all different stakeholders it is recommendable to arrange bilateral meetings before bringing all parties together to enable better understanding of each others interests. It shows care for the situation and can provide a better atmosphere for mutual trust.

Discuss interests, roles, visions, plans to understand stakeholders' views as these views and mindsets will make themselves heard! Better therefore to plan appropriately.

3 Multi-lateral meetings

After meeting bilaterally, it is essential to bring your relevant stakeholders together in a plenary session and finish together the stakeholder analysis! Additional plenary and bilateral meeting will be necessary to implement step 4 and the following steps of the River Restoration Planning process.

Multilateral meetings: discuss interests, roles, visions, plans to understand stakeholders' views

Regarding visioning

At many international fora, e.g. the Ramsar Convention, the Convention on Biological Diversity, World Water Forum, and at many EU River Basin Management Planning meetings the following is continuously stressed for successful planning processes: the need for a common vision shared by all stakeholders, the exchange of experience and lessons learned between stakeholders and the participation of all relevant stakeholders whether governmental organisations, NGOs, private sector or academic organisations.

- ## **4.**
- Beware... stakeholder analysis does not stop after the 'analysis phase', it continues throughout the implementation phase, and evaluation phase of the River Restoration process

3.2. LESA – a Landscape Ecological System Analysis

The 'Landscape Ecological System Analysis' is a comprehensive description how the landscape in the study-area evolved, how it functions and which processes determine presence and distribution of flora, vegetation and fauna. This understanding is the basis for long-term management and planning for an area.

Central to drafting a management or development plan is performing a LESA. The words 'landscape ecological' indicates a description of the relationship between species and/or habitat-types with their environment. This is necessary in order to determine –first of all- the effects of the current use of the area, on the existing and potential natural values; and –second-which measures are necessary to keep or bring them in a favourable conservation status or to realise other conservation goals, both in space and time.

Practically speaking, the analysis for habitat-types focuses primarily on site conditions and relates them to the processes that determine the environmental conditions on a landscape scale. It also includes the effects of human influence on these processes and conditions. For species, the analysis focuses mainly on the size, quality of their habitats and their range and the processes that determine these.

The definition of landscape also implies that we should not limit ourselves to what we consider to be 'nature', but that we also need to include the use made of the landscape by man.

Central to landscape ecology are the connections between the various landscape components such as climate and geo(morpho)logy, water, soils, flora, fauna and mankind. Each of these components provides a framework for the next. So in this sense every next –and smaller- layer is dependent on the previous –larger- one, but also influences and changes the previous one. This order provides the basis for the stepwise landscape ecological approach. It also helps to reconstruct how the landscape functioned before human interference, which helps to assess the magnitude of this later influence.

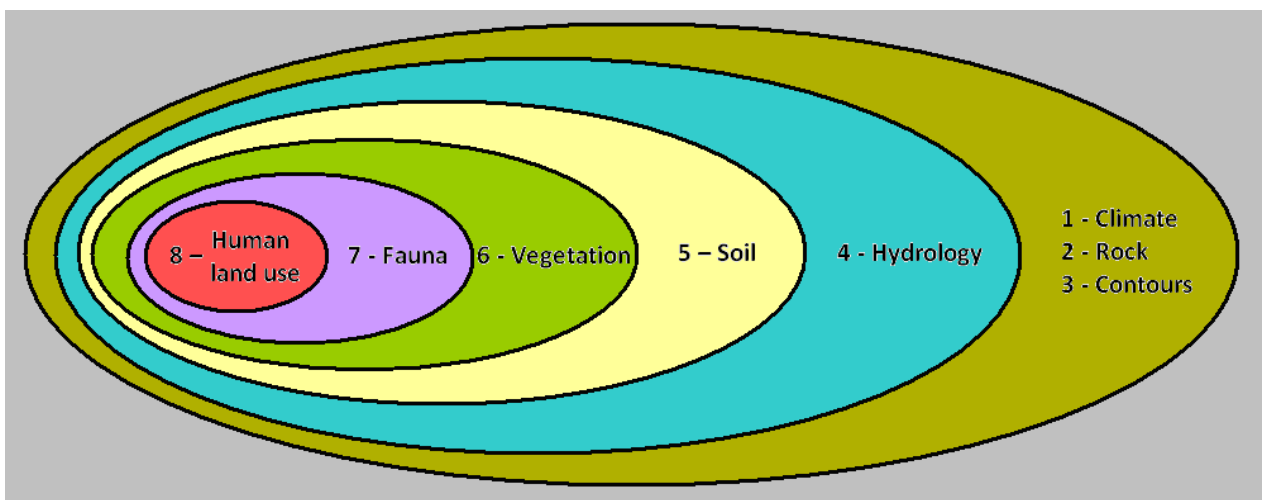


Figure IV.4. The various components and their mutual relationships.

The collected information needs to come together to be synthesized into an overview of the nature and functioning of the landscape ecological system. It needs to demonstrate how the landscape was functioning originally, what has happened to it, how it is functioning now and it should provide explanations for the distribution patterns of flora, vegetation and fauna.

For conservation and restoration purposes, it is important to find the determinative processes. These determine the presence and trends in the dynamics of habitat-types and species. They are in fact the 'handles' to 'tune' the area, the area the means through which we can regulate those conditions for habitat-types or species that are under our influence. The determining factors for the occurrence and quality of natural values can be very different, such as: chemical processes in the soil, groundwater dynamics, trophic interactions, connectivity, and influence of human activities such as agriculture, infrastructure, water use or recreation.

In the analysis all the factors for all eight hierarchical levels: climate, geo(morpho)logy, water, soil, flora, fauna and mankind are included. They are included from large to small, from outside the area to inside the area and from old to recent and in this way patterns, processes and trend are revealed that have shaped the landscape as it presents itself to us.

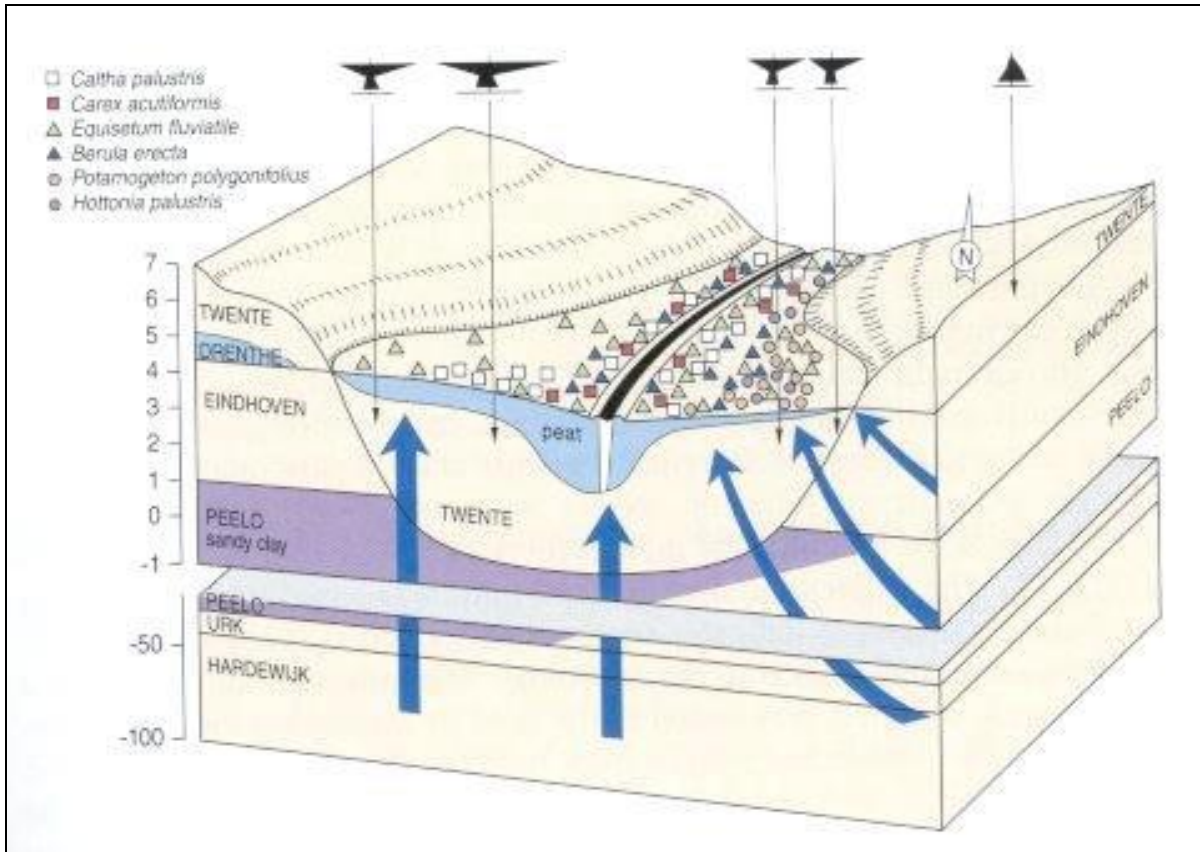


Figure IV.5. Block diagram of the valley of the Rolderdiep near Anderen (Drenthe, NL) used for the analysis of the distribution of species in response to specify groundwater flows.

In order to test a landscape ecological description, concrete hypotheses are postulated concerning the functioning of the various landscape elements. Based on these hypotheses, detailed predictions are made concerning phenomena for specific locations that have not been studied yet, such as the presence of certain indicator species or the occurrence of seepage or particular sediment types or their particle size (see figure IV.5.).

These hypotheses are then tested and verified through measurements and field visits and if these process hypotheses have to be rejected, it simply means that our understanding of the landscape is still falling short and that our model has gaps or flaws that need to be solved. So an iterative process takes place where the acceptance or rejection of postulated hypotheses leads to further hypotheses that needs to be tested (see figure IV.6.).

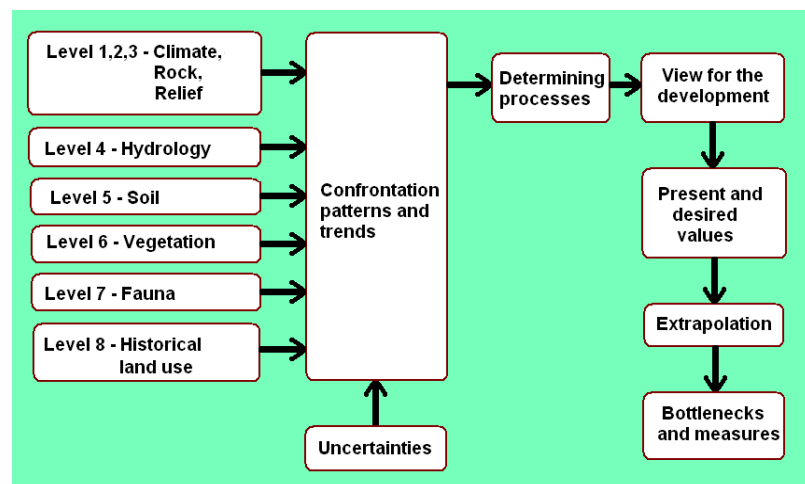


Figure IV.6. Summary schedule for a LESA

3.3. Sketch and Match visualisation

The Sketch and Match brings experts, policy makers and regional stakeholders together to tighten the goal of the project and to integrate and visualise the different wishes/disciplines of all stakeholders.

Directions of development are sketched and plotted along the way, so that directors and stakeholders in the area can make clear choices for the further elaboration of the project.

During one or two days all participants work together at the same place and discuss the various alternatives. The result is a visual impression (Figure IV.7.). These alternatives are the base for the calculations of the impacts of the measures.

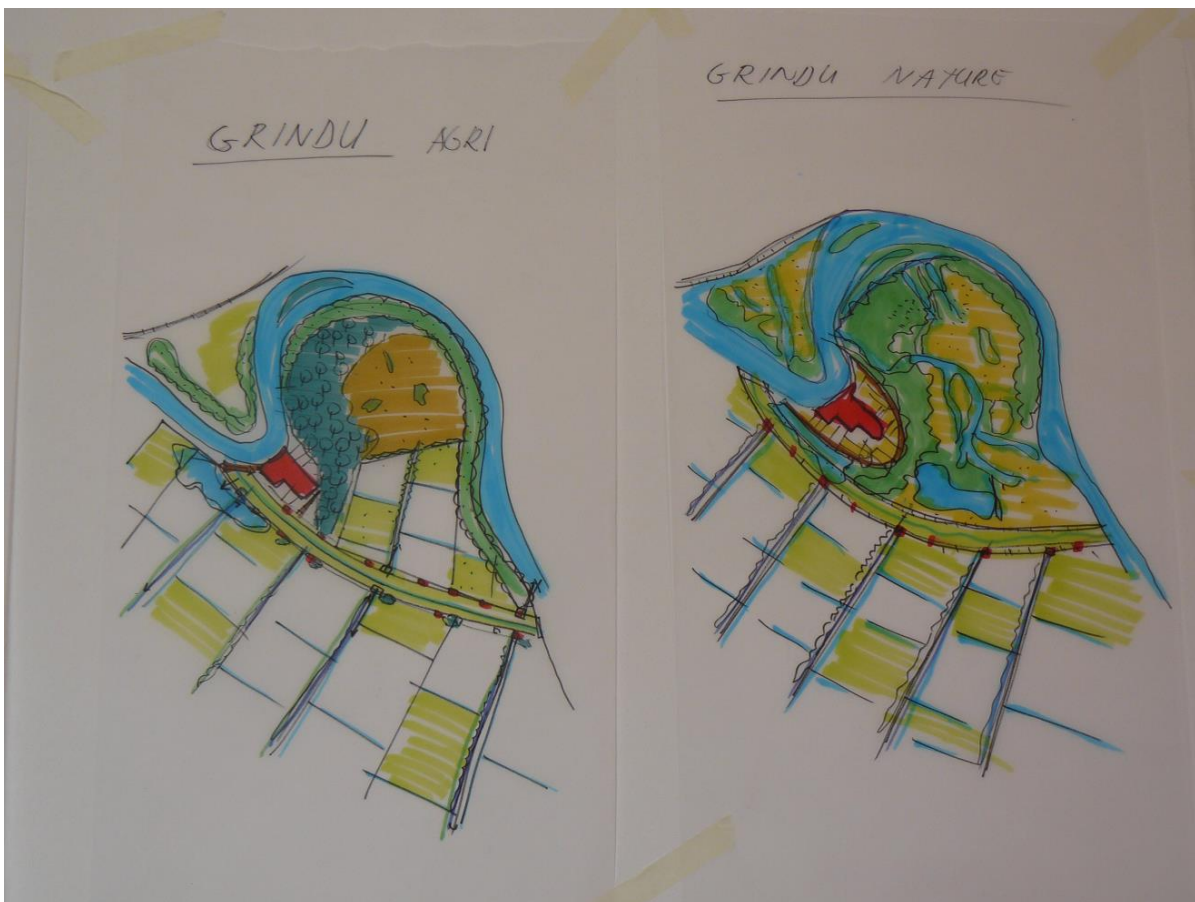


Figure IV.7. Example from a Sketch and Match workshop

3.4. SWOT analysis

A SWOT analysis can be a helpful tool to get a better picture of the project area, which information is already in people’s minds (strength and opportunities) and on which aspects the efforts should focus (weaknesses and threats) See example below:

<p>Strengths</p> <ul style="list-style-type: none"> Upstream is a spawning area with meanders, Upstream is a floodplain that can be used for water storage. 	<p>Weaknesses</p> <ul style="list-style-type: none"> Little opportunities to buy land.
<p>Opportunities</p> <ul style="list-style-type: none"> Water related nature, Possibility to create a solid ecological connection, Budget is available, Downstream part is already reconstructed, Higher groundwater level in Nature 2000 site. 	<p>Threats</p> <ul style="list-style-type: none"> Less agricultural production and depreciation of house in case of higher (ground)water tables.

3.5. Examples and elaboration per Step

3.5.1. Paragraph 1.2 – Objectives to be covered by the result of the project:

Unless the objective of the project is the improvement of effectiveness and/or efficiency of sewage systems, in most of the river restoration projects other water related objectives have to be considered as well. When a River Restoration Plan takes all relevant aspects into account, an integrated assessment and solution is possible. The solution is much cheaper and much faster to realize when all water related issues are considered integral rather than separated.

In the definition phase of the project all these possible objectives have to be considered:

- Objectives of the Water Framework Directive*

An obligation of the Water Framework Directive (WFD) is to include a register of protected areas in the RBMP. In this register the following protected areas have to be included (also integrated in the national Water Act):

 - areas designated for the abstraction of water intended for human consumption under Article 7;
 - areas designated for the protection of economically significant aquatic species;
 - bodies of water designated as recreational waters, including areas designated as bathing waters under Directive 76/160/EEC;
 - nutrient-sensitive areas, including areas designated as vulnerable zones under Directive 91/676/EEC and areas designated as sensitive areas under Directive 91/271/EEC; and
 - areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites designated under Directive 92/43/EEC (1) and Directive 79/409/EEC (2).
- Objectives of other directives*

There is a strong linking between the WFD and the Drinking Water Directive (Council directive 98/83/EC) and the bathing water directive (directive 2006/7/EC). Both directives set respectively quality standards for drinking water and bathing water (also integrated in the national Water Act and a Regulation on Quality Standards for Water along with Shellfish Waters Directive and Freshwater Fish Directive).
- Objectives of Natura 2000*

Natura 2000 has conservation/protection objectives for habitats and species. Some habitats are dependent on high groundwater levels or even flooding and some species are also water dependent.
- National objectives for flora and fauna or specific regions*

Besides the flora and fauna species that are protected under Natura 2000, there are other species that have to be protected. Some species are legally protected by the Nature Protection

Act, but this might not be enough to guarantee the surveillance of these species. In this case specific plans to protect these species might be necessary. Protection plans for species of rivers and river valleys should be combined in RRP.

- *Flood protection objectives*

As mentioned before, the objective of a RBMP is to achieve good ecological and chemical status, and will contribute to mitigating the effects of floods. However, reducing the risk of floods is not one of the principal objectives of the WFD. The Flood Directive requires each member state to make an assessment of floods that have occurred in the past and an assessment of the potential adverse consequences of future floods for human health, the environment, cultural heritage and economic activity (taking into account impacts of climate change on the occurrence of floods).

The results are flood hazard maps and flood risk maps. On the basis of these maps member states shall establish flood risk management plans. In these plans member states establish objectives how to reduce the flood risks. A link with the RRP is then inevitable. The re-meandering of a river creates a higher resistance in the river bed, reducing the speed of water and thus, the travel time. Restoration of the floodplain or creation of secondary channels will improve the ecological quality of water bodies, but can at the same time reduce the flood risk of downstream cities.

3.5.2. Paragraph 3.2.1. – Creating a RRP vision

Figure IV.8. gives two examples of target images for a middle reach and a marsh land reach. These can help with creating a vision for a RRP.

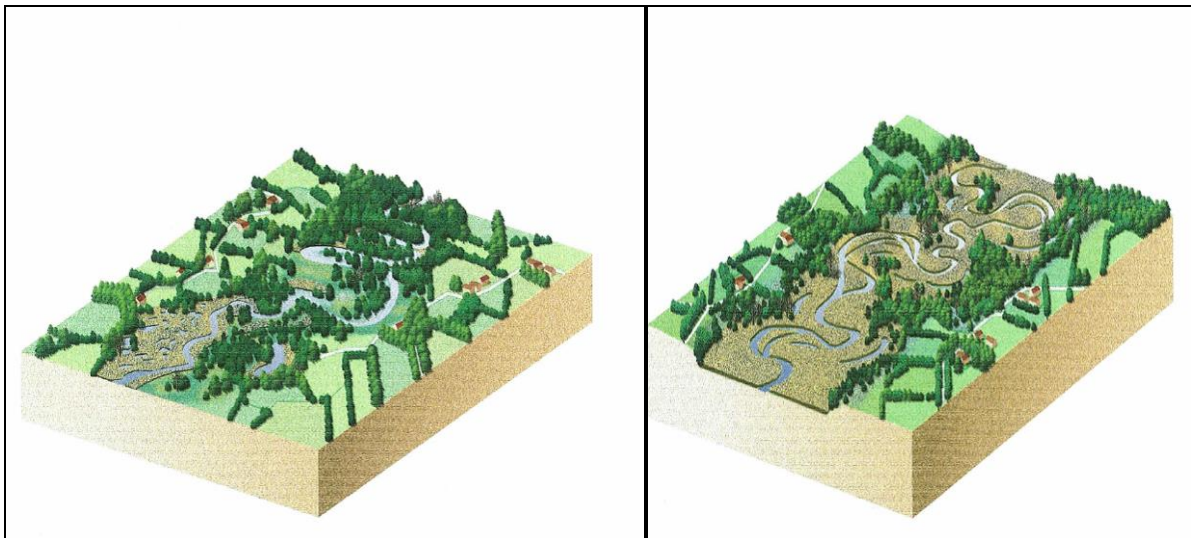


Figure IV.8. Reference situation of a middle reach and a marsh land reach

Figure IV.9. gives the result of vision making for a project where a dike around a village had to be restored. The dike served as a protection against high waters of the river Maas, but had a function in the war with Spain as well. The provincial plans have foreseen the construction of factories in an area with important water related vegetation that has a water storage function as well. The picture gives an image how both functions could be realized.



Figure IV.9. Spatial vision of project 'Eemland'

3.5.3. Paragraph 3.2.2, Analyse desired situation:

Demands regarding hydrology and hydro-morphology

Table IV.2. contains important characteristics on hydro morphology, flow regime and water quality for a Dutch river type R6:

WFD description	unit	range
<i>slope</i>	<i>m/km</i>	<i>< 1</i>
<i>velocity</i>	<i>cm/s</i>	<i>< 50</i>
<i>geology > 50%</i>		<i>gravel</i>
<i>width</i>	<i>m</i>	<i>8-25</i>
<i>catchment size</i>	<i>km²</i>	<i>100-200</i>
<i>permanency</i>	<i>-</i>	<i>not relevant</i>
<i>tidal influence</i>	<i>-</i>	<i>not relevant</i>

Table IV.2. Characteristics for a Dutch river type R6

For reference situations of R6 the range of values for the different hydromorphological quality elements have been set, based on literature, as indicated in table 2.

parameter	unit	low	high
<i>width</i>	<i>m</i>	<i>8</i>	<i>25</i>
<i>depth</i>	<i>m</i>	<i>0,25</i>	<i>0,6</i>

wet surface	m ²	2	14,8
velocity	m s ⁻¹	0,2	0,5
discharge	m ³ s ⁻¹	0,4	7,4
seepage	0\1	0	0
river continuity	0\1	1	1
variation in width	m	6	winter bed
variation in depth	m	0,25	2
cross section irregular	0\1	1	1
cross section intermediary	0\1	0	0
cross section regular	0\1	0	0
length profile meandering	0\1	1	1
length profile intermediary	0\1	0	0
length profile straight	0\1	0	0
mineral silt	%	0	5
mineral sand	%	60	100
mineral gravel	%	0	25
mineral boulders	%	0	5
organic stem/branches	%	0	15
organic leaves	%	10	30
organic detritus/mud	%	5	10
organic plant	%	0	30
shrub/tree	0\1	-	1
shade	%	60	80

Table IV.3. Hydromorphological parameters of a Dutch river type R6

The table provides important information for River Restoration. If a new bed for a river type R6 has to be designed it should have a width between 8 and 25 meters and a depth between 0,25 and 0,6 meters. A variation in width and depth is desirable. It should have an irregular cross section and in the flow direction it should meander. The substrate consists mainly of sand with some gravel and boulders. There should be shading over more than half of the length. This will give some inflow of branches and leaves, which is desirable.

The values in table IV.3. are mean values. It is important that there is variety in river depth, flow velocity and substrate. Each river type has its own specific community of fish, macro fauna and macro-invertebrates and phytobenthos. Each of these species has its own preferences and will colonise part of the river (both broad wise and length wise).

Figure IV.10. is an **example how it should not be done**. It is a river restoration project in the Netherlands where a straight ditch was changed into a winding ditch with the same straight profile along the whole length. Despite of the curves, it will take years to improve the ecological quality.



Figure IV.10. Negative example of river restoration

The variation in bed width, water depth, flow velocity and substrate is very important. In a natural river bed there is a diversification in flow velocity. This diversification in flow velocity gives a distribution in sediments (FAO and Deutscher Verband für Wasserwirtschaft und Kulturbau (2002), Fish passes, design, dimensions and monitoring). See figure IV.11.

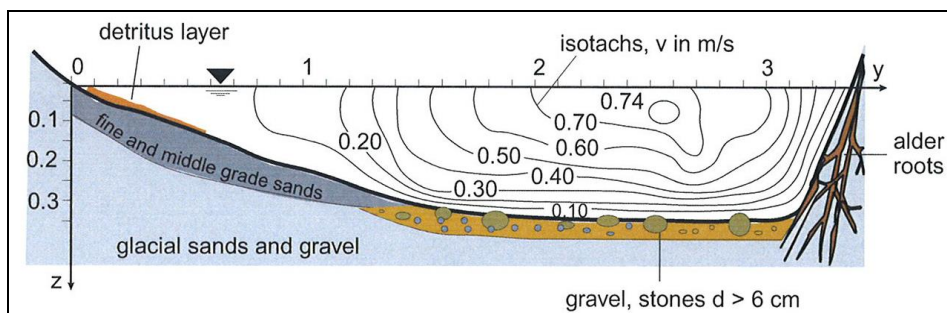


Figure IV.11. Distribution of sediment within a river profile

Demands are different for upper, middle and lower reaches.

The distribution of fish species varies according to different physical properties of the watercourse. Different fish species are bound to particular river stretches and the taxa of these species have been used to classify typical reaches of the streams. Based on physical parameters such as the slope, width and water temperature, stream sections are divided into different zones:

- Trout zone;
- Grayling zone;
- Barbel zone;
- Bream zone;
- Ruffe-flounder zone (Huet, 1949)¹.

Illies (1961) suggested a classification that fits all aquatic fauna and can also be applied to running waters outside Europe. This is based on the physical structures of the river bed and the water temperature that prevails during the year. The running waters are divided into brooks (rhithron) and rivers (potamon) and can be further divided into upper, middle and lower reaches. For central European waters, indicator fish zones are synonymous with the classification of Huet (1949) (FAO

¹ This classification is suitable for streams in northwest Europe and the Carpathian area of Central Europe. In the rivers and streams of the British Isles this zonation is not as fully developed because the watercourses are in general shorter from sea to source.

and Deutscher Verband für Wasserwirtschaft und Kulturbau (2002), Fish passes, design, dimensions and monitoring). See figure IV.12.

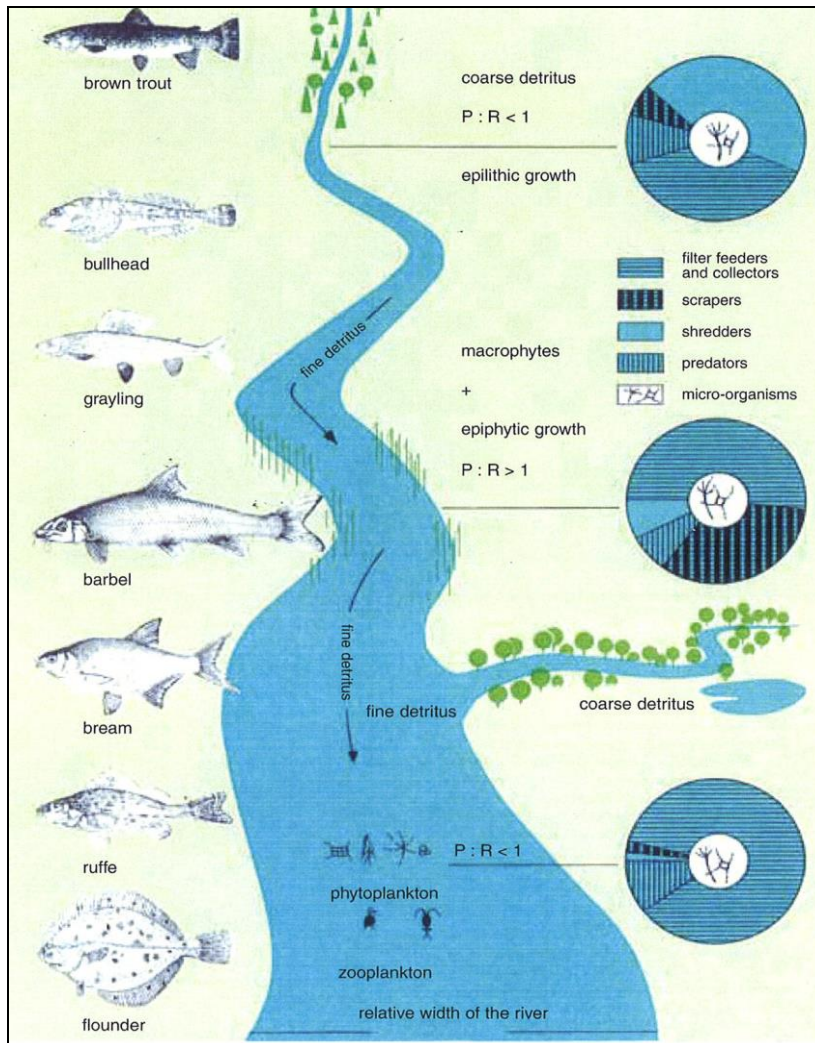


Figure IV.12. Distribution of species along a river.

An example in step height

Due to constructions like weirs and dams it is often not longer possible for fish to reach their spawning areas. There are various ways, however, to construct fish passages. Sometimes there are specific constructions for specific species like e.g. the eel. The handbook of the FAO gives a maximum size of the steps of 20 cm in upper heads, while in downstream parts the maximum drop is 10 - 15 cm (FAO and DVWK, 2002).

The Portuguese experiences are slightly different (Pinheira, António and Ferreira, Teresa (no date), Portuguese fish ladders operating conditions: an overview). For Salmon and Sea trout the maximum step is 30 - 40 cm. For Trout this is \pm 30 cm, which is again in line with values from e.g. Australia (Rutherford, Ian D., Jerie, Kathryn and Marsh, Nicholas (2000), A rehabilitation manual of Australian streams, volume 1). For Allis shad and salmonids the step is 15 - 30 cm.

The water boards in the Netherlands used to work with a maximum height of 15 cm. This has been lowered to 7,5 cm.

3.5.4. Paragraph 4.2.1 - Analysing the gap

Figures IV.13. and IV.14. give an example of the gap between actual and optimal ground water level in spring in Land consolidation project De Hilver in the Netherlands.

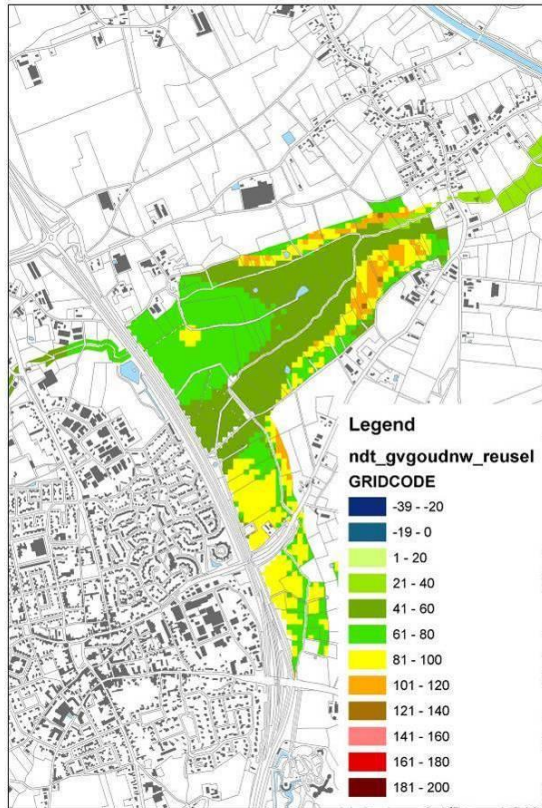


Figure IV.13 Actual ground water level in spring

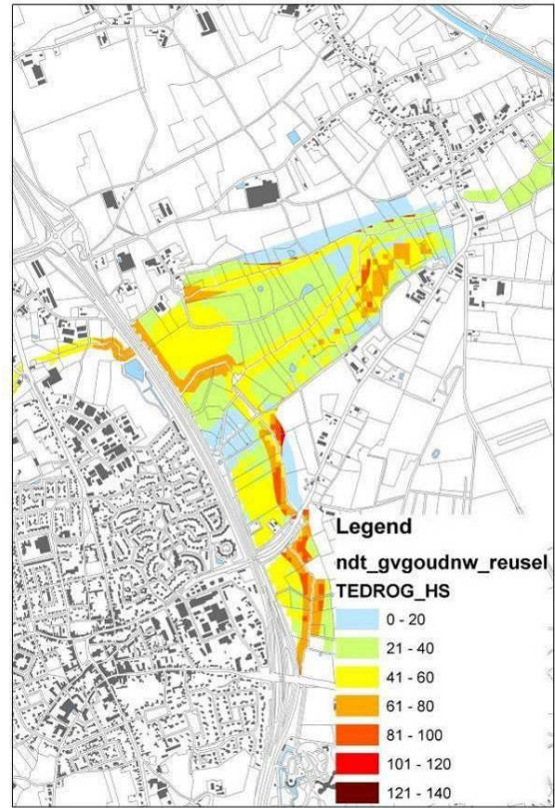


Figure IV.14. Gap between actual and optimal ground water level in spring

3.5.5. Paragraph 5.1 - Purpose of scenarios

Using scenarios help people to change their usual ways of thinking or their mental models of how things work. During times of change, existing ways of thinking are often based on assumptions and rationales that are no longer or just partly valid. Our 'regular' patterns of thinking and the assumptions we make, often limit us to really observe what is happening. They might prevent us from seeing relationships and opportunities. Einstein said: 'It is impossible to solve today's problems by thinking the way we thought when we created these problems'.

A nice publication on scenario development (Wollenberg, 2000) formulated our thinking 'trends' as follows:

"We tend to undervalue things that are hard to remember or imagine, to remember better and give more weight to recent events, to underestimate uncertainties, to deny evidence that does not support our views, to overestimate our ability to influence events beyond our control, to be overconfident about our own judgments and to overestimate the probability of desirable events. Scenarios introduce hypothetical possibilities that spur our imagination to overcome these tendencies and enable us to think freshly about things."

Scenarios can be developed based on stakeholders' visions (desired situations), but also be based on expectations (expected situations). At the same time scenarios can result from brainstorming sessions about expected actions, threats and opportunities that will shape the way from current to the future situation: what positive (e.g. resources available) and negative forces (constraints) or drivers exist affecting achieving goals. Macro- level and environmental forces can be given special attention in scenario construction as sources of risk and drivers of change. In river restoration these forces could be a new government and/or changes in the existing policies. It could be

increased pressure from civil society organisations, which sometimes support the implementation of specific actions and sometimes make implementation more difficult.

In summary, scenarios are used to develop an overview of more than just one future, whether they are based on desired situation, expectations or drivers of change. The development of scenarios open up the possibilities for yet more creative thought and critical understanding through comparison of alternatives and can encourage interaction among different groups.

The choice of the 'right' scenario is not always based on objective criteria (as explained in paragraph 5.2.5). Sometimes it is simply based on what will avoid most conflicts.

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V. ANNEXES

1. Preface Acronyms and abbreviations

WFD	Water Framework Directive
CW	Croatian Waters
FRMD	Flood Risk management Directive
RBMP	River Basin Management Plan
RRP	River Restoration Plan
PL	Project Leader
PM	Project Manager
PT	Project Team
DLG	Dutch Government Service for Land and Water management
SINP	State Institute for Nature Protection
MoEaNP	Ministry of Environmental and Nature Protection
MS	Member State

2. Definitions

abundance	degree of which some species are found per unit (riversystem or area)
assessment	decision as to a matter, question or problem, cause, solution etc.
catchment	area from which a river, stream or other water body receives its water
channel	part of a stream or river confined between banks, or deeper passage through a lake or harbour
classification	regular arrangement of matters such as species, habitats, water bodies
connectivity	the capability to connect two parts or points of a river or stream
constraint	factor that limits a matter
RBMP	see part A
reach	homogeneous section of stream channel, characterised by uniform, discharge, gradient, channel morphology, channel confinement and stream bed and bank materials
rehabilitation	restoration of valued or appreciated systems or species
restoration	restoration of systems in neutral terms
river basin	area drained by a river and its tributaries
river branch	part in which a river is splitted
river stretch	big almost straight part of a river of stream or branch
RRP	see part A
scenario	combination of a set of measures or policies
scope	area or playing field of a project set by boundaries in terms of geography, issue, content, time or money
stakeholder	(group of) people who have interest in or are effected by the project
vision	a clear defined image of a future matter in terms e.g. of appearance or insight
water body	any "homogeneous" water volume limited in terms of space and habitat characteristics
watershed	a boundary between areas drained by different river systems

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- Text of the EU Directive 92/43/EEC, Habitats Directive <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1992L0043:20070101:EN:HTML>
- Text of the EU Directive 2009/147/EC, codified version of Directive 79/409/EEC, Birds Directive <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>
- Ecological assessment tools and methods, Alterra <http://www.alterra.wur.nl/UK/research/International+research/Projects+in+Europe/Ecological+assessment+methodologies+and+tools+for+catchment+management/>
- River restoration centers in Europe <http://www.ecrr.org/partners-ecrr.html>

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