Global Water Partnership
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Integrated Drought Management

Programme in Central and Eastern Europe

Guidelines for preparation of the Drought Management Plans

(activity 2.1)

Draft version

Guidelines for Drought Management Plans

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Name of the output	**Guidelines for Drought Management Plans**
Purpose of the output:	*Development of the Guidelines for Drought Management Plans (DMP) with the aim to provide practical guide for the production of DMP on the national level within the River Basin Management Plans in context of the Water Framework Directive.*

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ACRONYMS

CEE	Central and Eastern Europe
CIS	Common Implementation Strategy for the Water Framework Directive
EC	European Commission
EU	European Union
GWP	Global Water Partnership
GWP CEE	Global Water Partnership for Central and Eastern Europe
DMP	Drought Management Plan
DWG	Drought Working Group
IDMP	Integrated Drought Management Programme
NAP	National Action Programme
WS&D	Water scarcity and drought
WFD	Water Framework Directive
BG	Bulgaria
CZ	Czech Republic
HU	Hungary
LT	Lithuania
MO	Moldova
PO	Poland
RO	Romania
SLO	Slovenia
UA	Ukraine
WMO	World Meteorological Organization

Content

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1. INTRODUCTION

1.1. Background

Over the past decade the concerns about drought events and water scarcity have grown within the EU. Water scarcity and drought issues were widely recognized as relevant issues across the EU. In response to the situation Commission issued in 2007 Communication in which Drought Management Plan (DMP) was identified as one of the main policy instrument to combat the water scarcity and drought problems. Commission Report on the Review of the European Water Scarcity and Drought policy (2012) revealed that the development, implementation and integration with River Basin Management Plans (RBMPs) remains limited.

The situation in the countries of CEE region is presented in the ***"Inception report for the GWP CEE part of the WMO/GWP Integrated Drought Management Programme"*** (J. Kindler, D. Thalmeinerova, 2012). The obtained results confirmed that the droughts and water scarcity issues were widely recognized as a relevant phenomenon also in the CEE region.

The outcome of the Activity 1.2 executed as a part of IDMP ***"Report on review of the current status of implementation of the drought management plans and measures"*** (E. Fatulova, 2014) showed that the actual situation in DMP development within the region is not satisfactory. Majority of the countries have not produced DMP in accordance with EU general guidelines provided in the Technical report ***Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change Aspects*** (Report 2007) in the context of Water Framework Directive (WFD). The main shortcomings have been found in implementation of all key elements of the DMP - indicators and thresholds establishing different drought stages, measures to be taken in each drought phase and organizational framework of drought management.

The Guidelines for Drought Management plan tailor-made on the regional conditions can contribute to the development of the national DMPs in the individual countries what will allow achieving substantial progress.

1.2. General objectives and scope

The Guidelines for Drought Management Plans have been developed under Activity 2.1 and Activity 2.2 (National consultation dialogues) of IDMP CEE. The general objective was to develop Guidelines intended to the **national level** as a practical guide providing support for timely production of DMPs within RBMPs. The Guidelines are primarily addressed to the public bodies and competent authorities responsible for drought planning. The emphasis was given to simplicity in order to be easy understandable by brought public.
The general objective has been supplemented by specific objectives:

- to provide broader commitments to the integrated water management system in context of the Water Framework Directive (WFD) for better understanding how to integrate drought into planning process for development of the RBMPs,
- to use step-wise approach to develop DMP in accordance with existing general guidelines,
- to provide information on associated issues covered by WFD (quantitative status, "prolonged drought", climatic change).

In line with the specified objectives Guidelines were structured into three core chapters:

- Chapter 2 General framework
- Chapter 3 Drought planning process
- Chapter 4 Related issues.

The Guidelines are supplemented by description of practical experiences of the involved countries, which are summarised in the Annexes I. - VI.

1.3. Elaboration process

The elaboration of the Guidelines was based on participative process with involvement of the representatives of the CEE region. The development of the Guidelines was divided into two phases.

First phase

During the first phase the Slovak case study was performed with the aim to provide practical example how to develop the key components of DMP. The overall intention was to integrate drought planning process into the integrated water management system within development of RBMPs. The key elements of DMP (indicators, thresholds, program of measures, organizational structures) were elaborated using available data from monitoring network. The study is based on evaluation of historical series of meteorological data. One drought event was selected and used for detailed drought assessment (2011/2012) providing a variety of evaluation methods. Indicator system, thresholds and early warning system has been established as a result of the data evaluation. The experiences gained during the execution of Slovak case study are summarised in the final Slovak Study Report which is available on IDMP CEE internal web page.

The main output of the first phase **is a draft of the Guidelines for Drought Management Plans (this document)**, which was developed on the base of Slovak national experiences and key recommendations from other countries summarised in the guidelines developed for different regions.

Second phase

During the second phase a final version of the Guidelines will be developed later based on the national experiences of the involved CEE countries. In order to gather practical examples relating to planning process the second National Consultation Dialogues (NCD) will be launched with the aim:

- to gather the national practical experiences and another relevant information relating to drought planning by elaboration of the short summary for the chosen key elements of DMP (according the list of annexes),
- to elaborate comments, corrections, suggestions, amendments to the draft of the Guidelines according to countries' specific conditions and experiences with drought planning,
- to contribute to the development of the final version of the Guidelines tailor-made on conditions of CEE region.

2. GENERAL FRAMEWORK

2.1. Policy framework

The EU countries adopted a joint water policy, which is based on the principles of integrated water management. Legal framework for implementation of such integrated policy is constituted in the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (hereinafter Water Framework Directive – WFD). The purpose of this Directive inter alia is to contribute to mitigating the effects of droughts.

The success of the WFD primarily depends on close cooperation and coherent actions on the Community level. For that purpose a Common Strategy for Implementation of WFD (CIS) was established in 2001. The process is coordinated by the Strategic Coordination Group (SCG) under the supervision of the Commission. A variety of technical guidance documents has been developed under the CIS process and approved by Water Directors (official representatives of the Member States). Even though those documents are not legally binding, by achieving consensus of competent authorities from all EU countries, they become "quasi" binding documents.

Many actions on EU level resulted in the development of EU drought policy that is documented in the several policy and technical documents. For development of the Guidelines the following outputs of CIS process have been used:

- "Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change" (Report 2007) – general guidance for production of the Drought Management Plan in accordance to the RBMPs,
- Communication from the Commission to the European Parliament and the Council "Addressing the challenge of water scarcity and droughts in the European Union (COM (July 2007)" – drought strategy providing policy options and set of key actions to tackle the drought and water scarcity problems,
- A Blueprint to Safeguard Europe's Water Resources (November 2012) – policy document aims to tackle obstacles hampering action to safeguard water resources. A part of document is dedicated to vulnerability problems and solutions including drought issues.

Currently new drought related components are being developed within CIS (e.g. definitions, indicators, water accounts, ecological flows and other). Drought Management Plans are still in progress and all components need to be considered dynamic. As new technologies and methods evolve Drought Management Plans have to be revised.

2.2. Drought management concept

When developing Guidelines for Drought Management Plans is necessary to start with clear and agreed concept of drought policy and drought definitions.

The most common approaches are based on two basic concepts:

A **reactive approach based on crisis management -** includes measures and actions after a drought event has started and is perceived. This approach is taken in emergency situations and often results in inefficient technical and economic solutions since actions are taken with little time to evaluate optimal actions and stakeholder participation is very limited.

A **proactive approach based on drought risk management -** includes all the measures designed in advance, with appropriate planning tools and stakeholder participation. The proactive approach is based both on short term and long term measures and includes monitoring systems for a timely warning of drought conditions. A proactive approach consists of planning the necessary measures to prevent or minimize drought impacts in advance.

Most EU countries are in process of moving from crisis management to risk based management. Guidelines for development of Drought Management Plan could contribute to this movement.

Several guidelines based on the principles of drought risk management have been developed. They are usually adapted to specific local or regional conditions (legislation, administration, nature conditions) respecting the basic principles.

The following guidelines have been used as a basis for defining the key components of DMP and steps needed for development of the preparedness plan (DMP).

- World Meteorological Organization (WMO) and Global Water Partnership (GWP) (2014) National Drought Management Policy Guidelines: A Template for Action (D.A. Wilhite). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden. (hereinafter WMO/GWP guidelines),
- Drought Management Plan Report Including Agricultural, Drought Indicators and Climate Change Aspects (Water Scarcity and Droughts Expert Network), European Commission, Technical report 2008-023, November 2007 (hereinafter Report 2007 or EU Guidelines),
- Drought management Guidelines (European Commission - EuropeAid Co-operation Office Euro-Mediterranean Regional Programme for Local Water Management (MEDA Water) Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN) (hereinafter Medroplan guidelines).

Based on compilation of recommendations provided in these documents own regional tailored-made approach has been created in the Guidelines.
WMO/GWP guidelines are generic, providing outline of the process for drought policy and preparedness planning grouped into 10 steps:

Step 1: Appoint a national drought management policy commission
Step 2: State or define the goals and objectives of a risk-based national drought management policy
Step 3: Seek stakeholder participation; define and resolve conflicts between key water use sectors
Step 4: Inventory data and financial resources available and identify groups at risk
Step 5: Prepare/write the key tenets a national drought management policy and preparedness plans which would include the following elements:
  - Monitoring, early warning and prediction
  - Risk and impact assessment
  - Mitigation and response

Step 6: Identify research needs and fill institutional gaps
Step 7: Integrate science and policy aspects of drought management
Step 8: Publicize the national drought management policy and preparedness plans and build public awareness
Step 9: Develop educational programs for all age and stakeholder groups
Step 10: Evaluate and revise national drought management policy and supporting preparedness plans.

WMO/GWP guidelines defining key components of risk management has been used as a basis for design step – wise approach. All suggested steps were followed and are included in the merged 7 steps of the planning process (Chapter 3).
The EU guidelines have been used for adapting of the generic steps taking into account specific conditions of EU based on joint water policy including drought policy. Some principal elements were taken from this document (e.g. objectives, DMP content and key elements drought stages).

Medroplan guidelines provide useful recommendations for planning process. Some methodological components were taken from this document (e.g. some definitions, impact assessment).

2.3. Legislative framework

The legal framework of EU water policy constitutes the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (hereinafter Water Framework Directive – WFD).

WFD contains several provisions dealing with quantitative aspects, which are connected to the water scarcity problems. However legally binding requirements specifically focused on solution of drought issues are not included in the WFD. Despite of this fact, the WFD is rather flexible instrument, enabling integration of drought issues into the context of integrated water management. The preventive and mitigating measures needed for reduction of drought effects can be/or should be included into the RBMP and become a part of programme of measures for achievement of environmental objectives in accordance with Article 4 of WFD. Legal basis for such procedure provides provision of Article 13 (5) of WFD worded as follows: „***River basin management plans may be supplemented by the production of more detailed programmes and management plans for sub-basin, sector, issue, or water type, to deal with particular aspects for water management".***

According to this article, if a member state considers drought as a relevant issue, an additional management plan to deal with drought aspects (Drought Management Plan) should be produced. The decision whether drought is relevant issue or not is left on the particular countries. DMP, which while not an obligation to Member States, can be a powerful tool to alleviate drought impacts. If production of DMP is inevitable (with regards to drought relevance) it is recommended to become a part of RBMP (COM (2007)414 final and COM (2012) 673 final). The suggested measures included in DMP should be interconnected and complementary with programme of measures to comply with environmental objectives. It means that the production of the both planning documents (RBMP and DMP) should be coordinated in 6 year planning cycles with the deadlines in 2009, 2015, 2021.

Even if WFD does not cover specifically drought issues, many quantitative elements being connected with the drought are incorporated in the Directive. Besides mentioned Article 13 (5) there are following articles associated with drought issues:

Article 4 (1b) (ii) RSV – requires to ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater status by 2015. In case when bad quantitative status is assessed the necessary measures (e.g. regulation of water abstraction) have to be adopted in the programme of measures and subsequently implemented. The data on current abstractions from groundwater (register of abstractions) and available groundwater resources are needed for groundwater status assessment. This database shall be used as a basis for drought and water scarcity assessment and development of DMP.

Article 4 (6) WFD – set up an exemption from environmental objective "to prevent deterioration of the status of all bodies of surface water". The exemption can be applied if exceptional circumstances resulted in prolonged droughts. Such temporary deterioration of water status is not considered to be in breach of the WFD requirements. The common effect of prolonged drought is for example increasing rate of fish mortality. Application of this exemption clause is connected with the necessary measures to be adopted:

- all practicable steps are taken to prevent further deterioration in water body status,
- to adopt appropriate indicators (in RBMP) determining conditions under which exceptional circumstances are foreseen,
- to adopt measures (programme of measures in RBMP) to be taken under such exceptional circumstances,
- to review annually the effects of exceptional circumstances and take all practicable measures with the aim of restoring the water body to its status prior to drought event.

Article 5 WFD – requires ensuring inter alia:

- impact assessment of water abstraction on water status;
- economic analysis of water use.

According to technical specifications set out in Annex II and III WFD, member states are obliged inter alia to ensure the following data:

- estimation and identification of significant water abstraction from surface water for urban, agriculture, industry and other uses including seasonal variation and total annul demand and of loss of water in distribution systems (Annex II, point 1.4 WFD);
- the data on abstractions from groundwater (Annex II, point 2.1 WFD);
- sufficient data to calculate the long term annul average rate of overall recharge (Annex II, point 2.2 WFD).

Economic analysis inter alia requires:

- to assess trends in water supply, water demand and investments;
- to carry out an economic analysis of water uses in each River Basin District.

Economic analysis is a basic document needed for implementation of incentive pricing policies according to Article 9 of WFD.

Article 9 of WFD – requires establishment of pricing policy stimulating effective water use. It is strong economic instrument enabling reverse of trends of water scarcity and decrease of vulnerability to droughts.

In the presented review only basic articles associated with water scarcity and drought issues have been explained. It is necessary to emphasize that mentioned requirements of WFD are legally binding (in contrary to DMP). Fulfilment of these obligations can promote better integration of water scarcity and drought issues into water management system.

WFD introduces the concept of joint framework for the implementation of measures needed by both WFD and nature protection and conservation directives (Birds and Habitats directives). The main objectives of the WFD are to reach good ecological status of all surface waters. This refers to all water bodies including those that form part of a Special Protection Area under the Birds Directive and a Site of Community Importance under the Habitats Directive (Natura 2000 sites). WFD stipulates obligation to achieve compliance with standards and objectives established for individual protected areas specified in Community legislation. As for groundwater the main objectives are to achieve good quantitative status in all groundwater bodies. The definition of good quantitative status includes also protection of directly dependent surface water and terrestrial ecosystems (e. g wetlands). RBMP must therefore include into the programme of measures any measures needed to reach environmental objectives and measures necessary to achieve compliance with objectives for Natura 2000 sites.

It is concluded that WFD provide a legal basis for addressing droughts considering also ecosystems needs.

Above mentioned provisions are parts of EU water legislation which must be transposed into the national legal system.

Additional regulations related specifically to drought could/should be supplemented. They should constitute the duties and responsibilities in the field of drought management. Also some restriction measures to be taken by decision-making authorities during drought episode, should be incorporated into the national laws.

2.4. Guiding principles

Principle 1:
Drought policy is based on proactive approach with emphasis on drought risk management associated with the preparedness plan developed in advance with the aim to prevent or minimize drought impacts.

Principle 2:
Drought Management Plan is an administrative tool for enforcement of preventive and mitigation measures in order to achieve reduction of drought impacts on social life, environment and economy.

Principle 3:
Water Framework Directive provides legislative framework for development of Drought Management Plan focused on reduction of the drought impacts in the affected areas and enhancement of resilience against droughts.

Principle 4:
Drought Management Plan is an additional planning document supplemented River Basin Management Plan developed as a part of planning cycles in accordance with Article 13.5 of WFD.

Principle 5:
Development of drought policy and production of the Drought Management Plan is consistent with the policy documents issued by Commission and other technical and methodological documents developed and adopted within the process of Common Implementation Strategy for implementation of WFD.

Principle 6:
Professional experiences and scientific knowledge from other regions are to be utilised.

Principle 7:
Three main elements are crucial for effective drought management – drought indicators and thresholds for drought classification and drought early warning system; mitigation measures to achieve specific objectives in each drought phase; organizational framework to deal with drought.

Principle 8:
Key factor for establishing effective and integrated drought management is ensuring of involvement of key sectors, decision makers, professionals, stakeholders/impacted sectors and public participation in the process of development of Drought Management Plan and its implementation.

2.5. Definitions

Drought
Drought is a natural phenomenon. It is a temporary, negative and severe deviation along a significant time period and over a large region from average precipitation values (a rainfall deficit), which might lead to meteorological, agricultural, hydrological and socioeconomic drought, depending on its severity and duration.

Water scarcity
Water scarcity is a man-made phenomenon. It is a recurrent imbalance that arises from an overuse of water resources, caused by consumption being significantly higher than the natural renewable availability. Water scarcity can be aggravated by water pollution (reducing the suitability for different water uses), and during drought episodes.

Crisis management
Crisis management is the unplanned reactive approach that implies tactical measures to be implemented in order to meet problems after a disaster has started.

Proactive management
Proactive management are the strategic measures, actions planned in advance, which involve modification of infrastructures, and / or existing laws and institutional agreements.

Quantitative status
Quantitative status is an expression of the degree to which a body of groundwater is affected by direct and indirect abstractions.

Available groundwater resource
Available groundwater resource means the long-term annual average rate of overall recharge of the body of groundwater less the long-term annual rate of flow required to achieve the ecological quality objectives for associated surface waters

specified under Article 4, to avoid any significant diminution in the ecological status of such waters and to avoid any significant damage to associated terrestrial ecosystems.

Competent authority
Competent authority means an authority or authorities identified under Article 3(2) or 3(3) of WFD.

Water consumption
Water consumption is the portion of the withdrawals (water supplied) that is not returned to the environment after use, it is either consumed by activities or discharged into the sea or evaporated.

Water demand
Water demand is the actual need for water under current water use practices (i.e. irrigation techniques, efficiency of the system, water pricing policies, present cultural practices, standard of living, etc.). It is determined by the needs of users' activities.

Water supply
Water supply refers to the quantity of water generally available and not only to water supply for a specific use (e.g. urban water supply).

Prevention
Prevention is the reduction of risk and the effects of uncertainty. Prevention therefore refers to the activities that provide outright avoidance of the adverse impacts of hazards.

Mitigation
Mitigation is the set of structural and non-structural measures undertaken to limit the adverse impact of hazards.

Drought indicator
Indicator of a meteorological, hydrological, agricultural, or socio-economic variable that provides an indication of potential drought related stress or deficiency.

Threshold
Specific value of an indicator used for classification of drought categories according to severity level.

Forecast
Forecast is the statistical estimate or the definite statement of the occurrence of a future event.

Early warning
Early warning is the provision of timely and effective information, through identified institutions, that allows individuals at risk of a disaster, to take action to avoid or reduce their risk and prepare for effective response.

Risk
Risk means a combination of the likelihood of occurrence (hazard) and the magnitude of the unwanted consequences (vulnerability)

Hazard
Hazard means probability of occurrence of a drought event with certain intensity.

Vulnerability
Vulnerability means potential impact of a drought event on people, environment and economic activities.

Drought Impact

Drought impact is a specific effect of drought on the economy, on the social life or on the environment, which is a symptom of vulnerability.

Drought Impact Assessment

This is the process of assessing the magnitude and distribution of the effects due to drought.

Stakeholders

Stakeholders are those actors who are directly or indirectly affected by an issue and who could affect the outcome of a decision-making process regarding that issue or are affected by it.

3. DROUGHT PLANNING PROCESS

The following chapter constitutes the core part of the document outlining the guidance for the development and implementation of drought management policy based on the concept of reducing risks associated with drought occurrence. The process for designing of drought risk-based management strategy must be linked with the production and implementation of preparedness and mitigation plan – Drought management plan (DMP). DMP will be served as an administrative instrument through which a national drought policy is executed.

Drought policy development and production of DMP are recommended by following up step-wise-step approach developed in "WMO/GWP guidelines" (described in chapter 2.2). Suggested 10 steps are merged into 7 steps listed below (according to WFD):

Step 1: Develop a drought policy and establish a Drought management Committee

Step 2: Define the objectives of a drought risk-based management policy

Step 3: Inventory of data needed for DMP development

Step 4: Produce/update the DMP

Step 5: Publicize the DMP to the public for comments and active involvement

Step 6: Develop a research and science programme

Step 7: Develop an educational programme.

It is important to remember that drought management and production of DMP is dynamic and iterative process that needs to be regularly revised and updated. Periodic post-drought evaluation process and updating of DMP based on review of steps 2 – 7 should be linked with the 6 years cycle of RBMPs planning process. Post-drought evaluations establish a baseline for revision of drought policy and updating of DMP and should include analysis of climatic, social and environmental aspects and evaluation of effectiveness and weaknesses of the drought policy and implemented mitigating measures.

3.1. Development of drought policy and establishment of the Drought Committee

The process for creating a national drought management policy should begin with policy actions aiming at establishment of the national drought committee responsible for development and implementation of drought policy. The main objective of this step is to ensure, that the process is coordinated from the governmental level and all key national authorities, drought experts and stakeholder groups dealing with or impacted by drought are included in the committee. The first step requires policy actions focused on:

- identification/confirmation of the competent authority for drought risk management;
- official announcement of competent authority that drought is a relevant issue in the country (e.g. in RBMPs or another legally binding planning document);
- development of a risk-based national drought management policy;
- government Resolution or another policy act (e.g. adoption of the legal regulation) guaranteeing adoption of binding rules for relevant ministries, municipalities, governmental agencies and their duties in the drought management system;
- establishment of the National Drought Committee with governmental mandate.

Competent authority

According to Article 3 of the WFD Member states had to identify an appropriate competent authority responsible for application of the rules of this Directive. As drought is one of the significant water management problems it should be solved in the context of WFD. The administrative unit once identified in line with Article 3 of WFD, is a national competent authority for drought risk management as well.

Drought – relevant issue of water management

Official announcement recognizing drought as a relevant issue based on evaluation of drought situation could/should be a part of ongoing planning process in accordance with the WFD. According to EU water legislation development of drought policy and production of DMP is not legally binding requirement. It depends on voluntariness of Member states to deal with the drought issue. According to an agreement of the representatives from the individual Member States, RBMPs should contain a chapter describing situation on water scarcity and drought within national parts of river basins. If drought risk is evaluated as "not relevant water management issue" there is no duty to produce additional planning document (DMP). If it be to the contrary, the production of the DMP becomes an obligation of the Member State.

Development of a risk-based national drought management policy

If drought is considered by competent authority as a relevant issue a risk-based national drought management policy shall to be developed. The competent authority shall develop policy/strategy document intended to be a generic road map for drought mitigation planning. The national drought policy shall be based on the main principles of the risk-based approach and include all necessary steps needed for implementation of drought policy taking into account all aspects – administrative, organizational, institutional, financial and other. The document is designed for the Government approval.

Government Resolution

Government Resolution is needed in those countries which do not have appropriate legislation introducing legal and institutional framework for drought planning process.

Drought Committee establishment

Drought Committee should be established as a permanent committee **with a strong mandate from the Government.** Establishment of the Drought Committee and coordination of its actions are the roles of the national competent authority. The main tasks of the Committee are:

- supervise and coordinate the national drought policy development process (during initial phase);
- be responsible for implementation of the drought policy at all levels (governmental, regional, local), including:
    - DMP production and its updating;
    - design and making operational drought monitoring program;
    - design and making operational drought early warning system;
    - ensure mechanism for timely and accurate assessment of the drought impacts,
    - providing accurate and timely information to the public;
    - activation of mitigation actions (measures) during drought occurrence according to severity of drought stages – pre-alert, alert, emergency, taking into account priority needs;
    - on-going and post-drought assessment;
    - implementation of drought mitigation programme during normal drought stage;
- be responsible for cooperation on drought issues on the transnational (river basin) level;
- development of the research, science and educational programmes.

The mandate of the Drought Committee issued by the competent authority after Government approval should contain:

- composition of the Drought Committee and its organizational structure;
- establishment of the specific working groups under coordination of the Drought Committee;
- determination of the responsibilities and competences of the Drought Committee;
- definition of duties and responsibilities of individual members of the Committee;
- communication strategy between Drought Committee and competent authority (minister, state administration on all levels);
- coordination and communication measures providing clear relations among partners from different groups (decision makers, sectors, experts, affected stakeholders) and different governmental levels (central and local level);
- assignment of the Committee tasks specified for all drought stages – normal, pre-alert, alert, emergency;

- definition of Committee´s duties connected with transnational obligations.

The Drought Committee should have the right to design and establish expert working groups entrusted with specific tasks focused on elaboration of background documents for development of DMP (e.g. evaluation of historical droughts, impact assessment and other).

Composition of the Drought Committee

Composition of the Drought Committee should reflect interdepartmental and multidisciplinary nature of the drought and should include all key representatives from:

- state administration on central level from key sectors facing drought impacts having power to take policy decisions – ministries responsible for environment, water, agriculture, energy, tourism, industry and other identified state bodies;
- decision-making authorities on local level having power to take operational decisions;
- key professional institutions dealing with drought – environmental agencies, hydrometeorology service, agricultural research institutions, drought experts from universities and other institutions providing expert services (monitoring, drought and impact assessment);
- stakeholders representing affected groups – municipalities, farmers, water companies, NGOs, providing actual information on impacts during drought event.

Proposals for organizational structure of drought management of the involved countries established in line with WFD, Report 2007 and WMO/GWP Guidelines will be summarised in Annex IV.

Policy actions are crucial prerequisites for the development and implementation of drought risk-based strategy reflecting political will to tackle the problem.
Organizational arrangement of the Drought Committee is a key factor for establishing effective and integrated drought management system. The success of drought policy depends on close cooperation of responsible sectors on all levels as well as involvement of affected groups of stakeholders into drought management system.

3.2. Objectives of a risk-based management policy

Following the formation of the Drought Committee, its first official action should be a statement of drought strategy to move from crisis management to a drought risk reduction approach and establishment of specific and achievable goals for this policy. Appropriate objectives of the national drought policy based on principles of risk reduction should be specified and adopted at an early stage. A set of general objectives constitute basis for principal activities, developing mitigation actions and measures during the development and implementation of DMP. **General objectives should be confirmed by the competent authority as a starting point for development of the DMP**.

The main objective of DMP is to minimize adverse impacts on the economy, social life and environment when drought appears. It also aims at extending WFD criteria and objectives to realize drought management.
This general objective can be achieved through a series of specific objectives that should include (as stated in Report 2007):

- guarantee water availability in sufficient quantities to meet essential human needs to ensure population's health and life during all drought stages;
- avoid or minimize negative drought impacts on the status of water bodies, especially on ecological flows and quantitative status of groundwater and, in particular, in case of prolonged drought, as stated in Article 4.6 of the WFD;
- minimize negative effects on economic activities, according to the priority given to water uses in the River Basin Management Plans in connection with another plans and strategies (e.g. land use planning).

It is recommended to constitute also basic objectives for the development of DMP:

- to define mechanisms and methodology for detecting and predicting droughts;
- to establish thresholds for different stages of drought as it intensifies and recedes;

- to define measures to achieve specific objectives in each drought phase;
- to ensure transparency and public participation in the development of the drought plans.

A list of concrete management objectives for each drought stages should be established by the Drought Committee during the drought planning process on the base of generic objectives and the results of comprehensive drought risk and impact assessments. The management objectives should be specified for each drought stages and included in DMP as a basis for development of programme of measures.

The objectives and application of DMP must comply with WFD environmental objectives.

3.3. Data inventory for DMP development

Drought management depends on the data enabling characterisation of drought conditions and quantification of drought intensity. Therefore, data inventory needed for DMP development is the first step of the Drought Committee in the preparation phase. This step should include:

- determination of the data needs for DMP development;
- analysing of existing data collection system usable for drought risk and impact assessment and data availability;
- identification of data gaps and modification of current data and information delivery systems.

Data, drought parameters/indicators are essential elements for identification and evaluation of different types of drought – meteorological, hydrological, agricultural, and socio-economic.
The data needed for DMP development can be grouped into following categories:

- meteorological data (temperature, precipitation, snow reserve) – allow quantitative assessment of the climatic anomalies with respect to normal values in terms of intensity, spatial extent and frequency (meteorological drought);
- hydrological data (stream flow, reservoir volume, reservoir outflows, spring yield, groundwater level) – allow to quantify impacts of identified meteorological drought on water reserves in groundwater and surface water bodies and water quality (e.g. ecological status);
- agricultural data (soil moisture deficit) – allow to assess a direct consequence of meteorological drought on soil water storage;
- data on environmental impacts – mortality of fish species, impacts on wetlands (Natura 2000 sites, loss of biodiversity, forest fires risk and other possible impacts;
- socio-economic data - reflect impacts of drought on households, industry, energy production, transportation, recreation, tourism and other water use sector;
- drinking water supply data – water demand, water availability, existing water infrastructure, water shortages.

Usually key elements of drought information system are monitored within many networks which are operated by different sectors and operators (state hydrometeorology services, agricultural institutions, nature protection services, stakeholders operated on local level). Often the data are scattered in many existing databases which are not interconnected and commonly are not readily available for decision makers, users and public. **It is necessary to identify weaknesses and obstacles in data accessibility at the very beginning of the process. Establishment of open information channels to ensure information flow between all sectors, decision makers at all levels, professionals and stakeholders is essential step for further actions.**

As an integral part of data inventory process should be also data analysis focused on identification of constrains for data exchange within European territory that may impede the development of the European Drought Observatory (Commission initiative) and Drought information exchange Platform (Activity 1.3 of IDMP). It is necessary to open data flow channels in order to allow the development of transnational drought early-warning system.

Data inventory needed for DMP development has to be connected with establishment of the national system of drought indicators for each type of drought to describe and evaluate meteorological, hydrological, agricultural and socio-economic drought. Also data analysis for exchange of data needed for development of international drought early-warning system should be performed.

3.4. Production/updating of Drought Management Plan

In order to achieve the specific DMP objectives, 3 basic elements should support a DMP:

- drought indicators and thresholds for drought classification and drought early warning system;
- measures to achieve specific objectives in each drought phase;
- organizational framework to deal with drought.

These elements represent more or less „obligatory" parts of the DMP creating fundamental conditions for its effectiveness.

Moreover it is necessary to ensure transparency and public participation.

3.4.1. Content of Drought Management Plan

A possible content for DMP should/could include (taken over from Report 2007):

- general river basin characterisation (national part) - basic elements relevant to drought occurrence taken over from RBMPs, e.g. climate conditions, quantitative and qualitative status of water bodies, water demand, water availability (current figure and trend scenarios), water infrastructure characterization, irrigation system, protected areas (e.g. wetlands) land use and other;
- drought characterization based on historical drought events (summary of expert studies);
- indicators and thresholds for classification of drought stages;
- drought early warning system implementation;
- program of measures for preventing and mitigating droughts linked to indicators systems;
- organizational structure of the DMP (identification of competent entity, committee or working group to identify drought impacts and propose management measures);
- update and follow-up of the DMP;
- water supply specific plans (basic information on existing water supply infrastructures and available groundwater resources usable for mitigating of drought impacts);prolonged drought identification and management in line with Article 4.6 of WFD.

3.4.2. Characterisation of historical drought events

The general objective of characterisation of historical drought events is to analyse and evaluate the drought risk based on long term series of meteorological, hydrological data and other historical records associated with consequences of drought in different sectors (agricultural, water supply, environment, industry, forest and other).
Drought risk is understood as combination of probability of drought event (hazard) and of the potential adverse consequences for the people, environment, and economic activities associated with a drought event (vulnerability).

Risk = Hazard & vulnerability

In this concept:
Hazard is considered as the probability of occurrence of a given intensity of drought phenomena in a given area. Hazard is dependent on nature conditions (precipitation, temperature, morphology, geology and other) and their mutual interactions. This probability can be described in terms of:

- frequency – number of times that can occur in a data series;
- duration – number of weeks/months/years that the event last;
- severity – intensity of the event according the drought stages.

Vulnerability is the potential impact of a drought event on people (water supply), environment and economic activities (agricultural, industry, power production, forestry, tourism and other). The intensity of these effects will be more depending on characteristic of the territory affected by drought (e.g. population density, type of economic activities, type of natural ecosystems) than on intensity of drought.
Characterisation and evaluation of historical drought events must be complex and should focused on both hazard and vulnerability and include all types of drought (meteorological, hydrological, agricultural, socio - economical). From

practical aspects is recommended to accomplish the characterisation of historical drought events within the two interconnected actions aiming at elaboration the studies on:

- assessment of historical meteorological and hydrological monitoring data;
- drought impact assessment.

Assessment of historical meteorological and hydrological monitoring data

The output of the first study is characterisation of meteorological and hydrological drought periods in the historical record based on available data series. For characterisation of historical drought events should be preferably used meteorological data (precipitation, air temperature) and hydrological data (water outflow, stream flow, reservoir volume, reservoir outflows, spring yield, groundwater level) and other appropriate indicators chosen for this purpose. It is important to remember, that CEE countries have a seasonal climate, which requires an analysis on the seasonal or monthly scale. Annual data can hide shorter extremely dry periods. This fact should be taken into account in the assessment of historical meteorological and hydrological monitoring data.

The examples of the national approaches and methodologies used for assessment of series of meteorological data will be included in Annex I.

Three steps are recommended:

The first step – focused on evaluation of the data series according to annual characteristics or indicators (e.g. annual runoff, annual precipitation and other) which allow characterising each year in terms of drought conditions. The results of the first step should be:

- identification of the “dry years”;
- characterization of intensity of “dry years” (using terms as low, medium, extreme);
- trend assessment of drought occurrence;
- selection of significant “dry years” for detailed evaluation of the past drought events.

The second step – focused on more detailed evaluation of the chosen significant “dry years”. The characterisation of each drought event should include evaluation of:

- temporal and spatial drought distribution within river basin (national part);
- duration and evolution of drought during drought event (e.g. based on monthly assessment of drought indicators);
- severity of drought in relation to drought stages defined on the base of thresholds;
- identification of drought-prone areas characterising probability of occurrence of meteorological and hydrological drought within a national part of river basins or sub-basins.

The third step – focused on evaluation of climate change and its consequences on drought occurrence and severity of drought impacts. The objectives of the climate change assessment are as follows:

- to identify the current and future trends in development of the natural factors (precipitation, temperature);
- to detect the possibly effects on frequency of drought and severity of drought impacts;
- to design an adaptation measures connected with influence of climate change on droughts.

The recommendations for the climate change evaluation are summarised in the Section 4.3 of the Guidelines.

Drought is a national phenomenon that can be characterised by its severity, duration and geographic extent. Drought characterization should be complex and wide range of meteorological and hydrological indicators can be used. It requires an accurate selection of drought identification methods and drought indicators suitable for clear description of drought conditions and its evolution in space and time. The appropriate set of indicators and methodology should be selected according to the type of drought (meteorological, hydrological) and purpose of the analysis (evaluation of long-term data series, detailed characterization of historical drought events). Taking into account diversity of nature conditions within the region harmonisation of the indicator system and methodology for drought risk assessment currently seems to be hardly achievable. **To support development of joint approach on the regional level (or river basin level) is a future vision.** For this purpose examples of national indicator systems and methodologies of the individual CEE countries will be included in Annex II providing options for selection of the most appropriate indicators and evaluation methodologies. A comprehensive overview of methodology used for assessment of one drought event provides the Slovak Study Report.

Drought impact assessment

Impact assessment examines the consequences of a given drought event. Drought is usually associated with a number of impacts that result from the reduction of water availability during drought episode. Drought can affect a wide range of water dependent users in different sectors. It is necessary to evaluate a potential impact for each user (or group of users) and subsequently make a comprehensive impact assessment for the whole area. It is appropriate to classify the types of impacts, which can be classified into three categories as economic, environmental and social. A detailed checklist of impacts is provided in Table 1 (source: Drought Management Guidelines, European Commission, MEDA Water, MEDROPLAN).

Table 1: The overview of the main drought impacts

Category of drought impact	Drought impact
ECONOMIC	Decreased production in agriculture, forestry, fisheries, hydroelectric energy, tourism, industry and financial activities that depend on these sectors
	Unemployment caused by production decrease
	Economic damage to reduced navigability of streams, rivers and canals
	Damage to the tourism sector due to the reduced water availability in water supply and/or water bodies
	Pressure on financial institutions (more risks in lending, capitals decrease etc.)
	Income reduction for water firms due to reduced water delivery
	Costs in emergency measures to improve resources and decrease demands (additional costs for water transport and removal, costs of advertising to reduce water use, etc.)
ENVIRONMENTAL	Decrease water supply and quality of surface water and groundwater
	Damage to ecosystems and wetlands, biodiversity and diseases (soil erosion, dust, reduced vegetation coverage etc.)
	Increased fires
	Lack of feed and drinking water
	Increase of salt concentration (in streams, underground layers, irrigated areas)
	Loss in natural and artificial lakes (fish, landscapes, etc.)
	Damages to river and wetlands life (flora, fauna)
	Damage to air quality (for example polluting dust)
SOCIAL	Damage to public health and safety, by affecting air and water quality or increased fire
	Increase in social inequality, by affecting different socio-economic groups
	Tensions between public administrations and affected groups
	Changes in political perspectives
	Inconveniences due to water rationing
	Impacts on way of life (unemployment, reduced saving capability, difficulty in personal care, reuse of water at home, street and car washing prohibition, doubt on future, decrease of celebrations and amusements, loss of property)
	Inequity in drought impacts and mitigation measures distribution
	Abandoning of activities and emigration (in extreme cases)

For each of the identified users (groups, sectors) a potential drought impact should be quantified, using a set of appropriate indicators. The indicators should be type-specific established for each significant drought impact. Usually for economic sectors (e.g. industry, agriculture, power production) an economic criteria are used. For instance impact on agriculture could be quantified in terms of production losses. In the urban water supply is appropriate to calculate a shortage of water to meet common water demands (e.g. drinking water, irrigation, etc.). In the area of environmental impacts number of fires and mortality of fishes are used as a common impact indicators.

It is necessary to emphasise that identification and quantification of impact indicators is hard and substantial efforts are required to find relationships between impact indicators and physical indicators (climatic, hydrological).

Drought impact relates many sectors. Some of them do not have any responsibility and duty to monitor and record the drought impact data. In contrast to the meteorological records which are usually stored in one state institution, databases of archived drought impact data, if exist, are scattered in many institutions with limited access for other users.

It should be the task of Drought Committee to overcome this problem and facilitate the development of Drought impact assessment using historical drought impact data.
Drought Impact assessment is a basis for characterization of agricultural drought and socio-economic drought.
The output of impact assessment should include:

- identification of affected users (groups, sectors);
- identification of types of direct drought impacts;
- assessment of expected damages caused by drought;
- identification of areas with potential risk of drought impacts.

Results of evaluation of historical drought events are needed for decision makers to set specific targets for development of programme of mitigation measures.

3.4.3. Indicators and thresholds for drought stages classification

The process includes two interconnected steps:

- Establishment of the national drought indicators system;
- Establishment of thresholds for different drought stages.

Drought indicators system

Drought indicator system is one of the key elements of DMP. Establishment of appropriate set of drought indicators is inevitable step in drought management allowing identification and evaluation of drought conditions and quantification of drought impacts. Due to complexity of drought variability according to climatic and geographic conditions, is appropriate to work on different parameters to be included in the national indicators system.

The national indicator system should be complex comprising of appropriate parameters and indicators needed for characterization and evaluation of each type of drought and indicators needed for evaluation of different drought stages (e.g. historical drought event, ongoing drought episode).

Based on these aspects the complete drought indicator system should/could comprise of different sets of indicators which can be grouped into following sub-systems:

- First sub-system including selection of appropriate indicators specific for evaluation of different drought types:
  - meteorological drought (based on climatic parameters – precipitation, temperature, evapotranspiration);
  - hydrological drought (based on hydrological parameters – river flow, groundwater level);
  - agricultural drought (based on parameters characterising water deficit in soil – soil moisture indexes);
  - socio-economic drought (based on impact assessment).
- Second sub-system including established sets of indicators appropriate for:
  - evaluation of historical or past drought events;
  - drought early warning system.
- Additional set of indicators is needed for identification of a “prolonged drought” and evaluation of impacts associated with temporary deterioration of surface water quality parameters not reaching the good ecological status of water bodies as required by EU WFD.

Intentions and activities on EC level are intended to solve the drought issues on the river basin level in context with WFD implementation. For this purpose a set of common EU drought indicators has been established within CIS. So far seven drought indicators have been developed:

Table 2: EU drought indicators

Drought indicator	Drought type characteristic
FAPAR (fraction of absorbed photosynthetically active radiation)	Meteorological drought
H (groundwater level)	Hydrological drought
SSPI (standardized snowpack index)	Meteorological drought
Soil moisture	Agricultural drought
SPI (standardized precipitation index)	Meteorological drought
SRI (standardized runoff index)	Hydrological drought
WEI + (water exploitation index plus)	Water scarcity indicator

The detailed information describing each EU indicator (e.g. definition, relevance of indicator to drought, technical information including methodology for calculation) is included in the expert document "Water scarcity & drought indicators' Fact sheets" developed within CIS process (TYPSA, December 2013) and endorsed by Water Directors (official representatives nominated by EU countries). It is supposed that these indicators will create joint European indicator system as a basis for development of European Drought Observatory acting as an early warning system. Member states will be "forced" to carry out evaluation of drought according to the indicators approved on the Commission level. Joint European indicator system should be a prerequisite for transnational/river basin issues.

Therefore it is strongly recommended to include EU drought indicators into own national drought indicator system as a basis for harmonised approach on river basin level. EU indicators should create without any comments a basis of the national indicator system, which could/should be supplemented by country specific indicators taking into account variability of climatic and geographic conditions. It is important to remember that development of European indicator system has not been finished yet. It is on-going process bringing new incentives and changes.

Table 3 presents a review of some of the national drought indicators applied for drought characterisation in the CEE countries.

Table 3: Other national drought indicators used in CEE Countries (will be completed by countries)

Country	Drought indicator	Drought type characteristic
SK	Palmer Drought Severity Index	Meteorological drought
SK	Tomlain climatic indicator of irrigation	Meteorological drought
SK	Konček index of irrigation	Meteorological drought
HU	Pálfai drought index	Meteorological drought

It seems that the main weakness in process of establishment of drought indicator system is associated with rare examples of socio-economic indicators enabling evaluation of drought on social life and economic activities. More attention should be paid to evaluation of this type of drought in dependence on their local relevance.

Thresholds for different drought stages

Drought should be characterised according to different levels of drought intensity and severity of its impacts. It is recommended to follow drought classification provided in Report 2007 suggesting definitions for 4 drought levels (stages).

- **Normal status** – no significant deviation in relation to average values is observed.
- **Pre-alert status** – is declared when monitoring shows the initial stage of drought development.
- **Alert status** – is declared when monitoring shows that drought is occurring and will probably have impacts in the future if measures are not taken immediately.
- **Emergency status** – is declared when drought indicators show that impacts occurred and water supply is not guaranteed.

More detailed characterization of drought stages as stated in the Report 2007 is in the box below.

Normal status: this phase should be seen as the hydrological planning one, in which strategic and long term measures are applied. These measures concern water demand management (water efficiency measures) and might include hydraulic infrastructures for improving the storage and regulation capacity of the river basin, infrastructures that promote the use of non-conventional resources (e.g. treatment and reuse facilities) and any other measures that might need extended time frames to be implemented.

Pre-alert status: the objective is to prevent the deterioration of water bodies while ensuring the activation of specific drought management measures, and continuing to meet water demands. These are mainly informative and control measures, as well as voluntary water saving measures.

Alert status: it is an intensification of the pre-alert status, since drought progresses as well as measures to apply. It is a priority to continue preventing the deterioration of water body's status. These types of measures should be focused on saving water. Demand restrictions might be applied, depending on the socio-economic impacts, and by consensus of the affected stakeholders. Areas with high ecological value should be monitored more intensively to prevent their deterioration,

Emergency status: when all previous prevention measures have been applied, but the drought situation prevails to a critical status, when no water resources are sufficient for the essential demands (even affecting and restricting public supply), additional measures might be used to minimize impacts on water bodies and ecological impacts.

The classification system must be based on threshold values determined for chosen drought indicators. Usually thresholds are designed for meteorological and hydrological indicators. The examples of determination of threshold values provided by some CEE countries will be included in Annex III.

The threshold values characterising drought stages have to be frequently revaluated and updated (at least after each drought event) based on calibration of limit values among related drought indicators (climatic, hydrological, impact). Thresholds need revision after a while, because impacted sectors could get a higher or lower priority based on the proved impacts during drought occurrence.

3.4.4. Drought early warning system

One of the main objectives of the DMP is establishing a reliable early warning system based on appropriate indicators and thresholds classifying drought stages according to drought intensity and severity of its impacts.

The main objective of early warning system is to provide:

- timely information (warnings) about actual drought status in real time for decision makers (grouped in Drought Committee) for activation of an adequate operational measures;
- timely warnings on drought severity for stakeholders (e.g. farmers) that could be potentially effected by drought in real time or near future enabling to take appropriate measures (e.g. activation of irrigation systems).

Early warnings should provide information in different time span defined on the basis of stakeholders needs as a:

- short-term warnings (1-7 d),
- medium-term warnings (10-15d),
- seasonal forecasting (3 - 6 months).

To obtain timely information and sufficient amount of spatial data on actual drought situation is necessary to analyze of existing monitoring network for chosen drought indicators included into early warning system.
The analysis should be focused on examination of the density of monitoring stations and frequency of measurements. An effective warning system should provide actual information updated at least in weekly intervals. Usually upgrading of current monitoring system is needed requiring of increase of metering frequency of the chosen indicators. Also a rational selection of representative monitoring stations is needed so that the whole territory would be covered by early warning points.

In order to deliver early warnings to broad public it is recommended to use existing technical means applied for another type of warnings (e. g. floods). Usually is possible to mediate information to public through web and/or electronic communications or by means of media (radio or TV broadcast).

The basic information on early warning system which should be included into DMP should contain information on:

- indicators and thresholds creating an early warning system;
- time span for short-term, medium-term warnings and seasonal forecasting;
- evaluation of sufficiency of monitoring system and identification of gaps in monitoring;
- monitoring system upgrading in terms of density and frequency of measurements;
- technical services used for distributing information.

3.4.5. Programme of measures

A program o measures is a crucial element of DMP. The main objective is to minimize the risk of drought impacts on the economy, social life and environment. Programme of measures should be designated for each drought stage (normal, pre-alert, alert, emergency). The measures can be classified according to their purpose and grouped as follows (as stated in Report 2007):

- preventive or strategic measures;
- operational measures;
- organizational measures;
- follow-up measures;
- restoration measures.

Preventative or strategic measures are developed and used under the **normal status**. The aim is to increase resistance on drought and mitigate potential drought risk and impacts on the society, economy and environment. Program of preventive measures should be interconnected with the program of measures included in RBMPs developed in line with WFD requirements. Direct links between drought issues covered by DMP and integrated water management covered by RBMPs relates to groundwater quantitative status assessment and ecological status assessment of surface water bodies (more details in chapter 4 of these Guidelines).

> The preventive or strategic measures included in the DMP are only complimentary to those adopted in the RBMPs in relation to quantitative groundwater status and ecological surface water status aimed at achieving of good water bodies status. As a side effect they can also contribute to mitigation of drought risk. Clear links between both programmes of measures included in RBMP and DMP must be ensured.

In order to improve the resilience of the aquatic ecosystem, it is necessary to look into water efficiency options and suggestions provided in the Communication from Commission “A Blueprint to Safeguard Europe´s Water Resources” from 2012. Among the measures that can greatly contribute to limiting the negative effects of droughts is **green infrastructure**, particularly **natural water retention measures.** These include restoring floodplains and wetlands, which can hold water in periods of excessive precipitation. The Guidelines on Natural Small Water Retention Measures is output of Activity 5.3 of IDMP CEE. The Guidelines will be supplemented by several examples of good practices applied in conditions of CEE countries. Similar guideline on Natural Water Retention Measures, but probably more general and usable for all EU countries, is to be developed within CIS process (Commission, Member States, stakeholders) in 2014.

Another measure that can diminish drought risks is reducing soil sealing and **increasing water holding capacity in soil.** The methodology accompanied by demonstration of concrete practices is described in the final Activity output 5.1 of IDMP CEE.

Another alternative supply option is **water re-use for irrigation or industrial purposes**. Due to the lack of common EU standards (health, environmental) for re-used water this instrument is currently used to a limited extent. It is expected that the regulation establishing common standards is to be proposed by Commission by 2015.

Program of drought preventive measures should be developed as a part of a cross-sectorial and multi-hazard risk management plans which include also flood risk and take into account climate change and adaptation needs.

Operational measures are those that are typically applied when droughts occur (during pre-alert alert and emergency status). Operational measures should be based on the management objectives specified for each drought stage.

Pre-alert

The management objective in the pre-alert status is preparing on the possibility of drought impacts occurrence. The goal is to prepare users for future actions. The main actions should be focused on activation of Drought Committee, intensification of monitoring, running of drought early warning system with the aim to increase public awareness and evaluation of future scenarios. The measures in the pre-alert situation are generally of indirect nature, implemented voluntarily by stakeholders (e.g. irrigation).

Alert

The management objective in the alert situation is to overcome the drought with the aim to avoid the emergency situation. The priority is to mitigate occurred drought impacts on specific water use groups and prevent deterioration of water body's status. These types of measures should be preferably focused on saving water. Demand management measures including partial restrictions for water uses might be applied, depending on the socio-economic impacts, and by consensus of the affected stakeholders. Areas with high ecological value should be monitored more intensively to prevent their deterioration.

Emergency

The management objective is to mitigate impacts and minimize damages. The priority is satisfying the minimum requirements for drinking water. Other uses of water are a second priority. Measures adopted under drought emergency conditions could be non-structural, such as water restrictions for all users (including urban demand), subsidies and low interest loans, or structural, like new infrastructure, permission for new groundwater abstraction points and water transfers.

Application of operational measures could be linked with the specific advisory services. For example advisory service for irrigation has been established in some countries providing information for farmers about the recommended irrigation dose at a given drought stage.

Organizational measures establish appropriate organization to ensure production and implementation of the DMP and enforcement of program of measures; create coordination protocols among administrations and public and private entities directly linked to the problem, in particular to those entities in charge of public supply. Organizational measures should be specified for all drought stages.

Follow-up measures serve in the process of watching out for the compliance and application of the DMP and its effects.

Restoration or exit drought measures include deactivation of adopted measures and activation of restoration ones over the water resources effects and the aquatic ecosystem.

3.4.6. Organizational framework for production, implementation and updating of Drought Management Plan

It is important to remember that drought management based on risk reduction has three phases:

- design of DMP;
- implementation of the DMP;
- review/update of DMP.

Drought Committee should ensure and guarantee execution of all phases. Specific tasks needed for each phase should be included in the DMP.
This chapter should contain the basic information on establishment of drought management organizational structure needed for production, implementation and update of DMP. Organizational structure is a key element of effective drought management. The creation of organizational structure is not regulated by EU legislation. Therefore a variety of different organizational arrangements and steering-system diagrams can exist. But the main principles based on integrated water management (integration of drought management into water management according to WFD) and participatory approach (involvement of all affected actors) must be ensured in any case.

The following elements should be included in the DMP:

- information on the results of policy actions - identification of competent authority, establishment of Drought Committee and working groups;
- list of involved sectors, institutions and stakeholders;
- organizational arrangements and allocation of the roles and responsibilities of individual committee members;
- coordination among competent authorities, entities and stakeholders;
- description of the planning process for production of DMP. There are two possibilities. The first option is to develop DMP as a part of production of RBMPs respecting the same planning cycles for update (6 years) and the deadlines set for production of planning documents in the WFD including public participation process. The second option is develop the DMP outside the scope of the WFD planning process;
- details on the implementation of DMP (how the program of measures will be enforced, monitoring of the introduced measures, evaluation of the effectiveness of the executed measures);
- details on activation of early warning system;
- operational measures needed during the drought occurrence for mitigating impacts (e.g. regulation measures);
- after ending of drought event to evaluate drought impacts and adopt the follow-up and restoration measures;
- evaluation and revision of drought management policy;
- details on update of DMP;
- contact points and procedures for obtaining the background documentation and information of the actual monitoring data gathered during the ongoing drought episode;
- summary of the public information and consultation measures taken with the aim to encourage public participation;
- duties on the transnational/river basin level.

The examples of program of measures designed by individual countries will be included in Annex V.

3.4.7. Gaps and uncertainness

The first DMP is usually developed from the available monitoring data that do not need to be necessarily complex and sufficient. It is supposed that the DMP can be to a certain extend influenced by quality and/or of lack of data. Evaluation of the data quality used for DMP development is appropriate step within the drought planning process. It is recommended to make a data quality assessment aimed at identification of the main weaknesses of information system (lack of data, not very precise data) requiring more attention in the next phases.
It is expected that data characterising the social-economic drought (e.g. impacts on society and economic activities and other) can be missing in the first DMP.
Identification of gaps and uncertainness should be supplemented by design of specific measures for improvement of data collection and evaluation.

3.5. Publication of Drought Management Plan

The aim of the publication of DMP is to encourage public participation and active involvement of the interested parties in the production, implementation and updating of DMP. Public participation is an essential element of drought management system representing an opportunity for achieving consensus considering social, economic and environmental aspects. The process of public participation relates to:

- publishing of DMP (including provisional planning documents);
- making DMP available for comments;
- consultation aimed at active involvement of the interested parties.

Publication for comments

If DMP is developed in context of WFD as an additional planning document (Article 13.5) its publication is ensured altogether with RBMPs in accordance with rules of WFD. The procedure for public information and participation is constituted in Article 14 of the WFD. The Member States are required to ensure publishing of RBMPs (including DMP) and making available to the public for comments the following provisional planning documents:

- interim overview of the significant water management issue identified in the river basin, at least two years before the beginning of the period to which the plan refers;
- draft copies of the RBMP, at least one year before the beginning of the period to which the plan refers.

Both documents should contain at least basic information on the relevance of the water scarcity and drought issues supported by relevant proofs. The public has the right to comment those documents during the six months period.
Public must have ensured an access to all background documents used for development of the RBMPs and DMPs.
If DMP is developed outside the scope of RBMP development (in the middle of planning cycles) similar procedures for publication of the DMP making the draft publicly available for comments should be applied. In this case the Drought Committee should ensure publishing of the DMP.

Consultation

After receiving the comments a consultation processes should be launched. The Drought Committee should develop a consultation strategy and communicative plan in advance. Basically, there are two different forms of consultations:

- written consultation in the form of written communication;
- oral or active consultation that can be organized in different ways (e.g. bilateral meetings, workshops, conferences).

In order to involve interested parties identified during the consultations into the decision-making process it is recommended to prepare summary from the consultation process containing the public opinions and information on the changes made based on the results of public consultation.

3.6. Scientific and research programme

The Drought Committee should identified the needs for the national scientific and research programme, that can contribute to the better understanding of drought, its impacts and mitigation alternatives. The development of the programme should be connected with identification of gaps and uncertainties during the production of DMP, taking into account relevant related issues (e.g. existing knowledge on climatic change and its impacts on water resources, new effective monitoring methods based on remote sensing and other).

Many examples of the national scientific and research programmes identified during the National consultation dialogue (Act. 2.2 of IDMP CEE) will be included in Annex VI.
Based on the list of drought oriented scientific and research projects a joint regional programme can be initiated for future activities (e.g. Danube strategy action plan).

3.7. Educational programmes

Broad educational programmes should be developed by the Drought Committee. The goal of this activity is to raise awareness of the new strategy by providing information on DMP and programme of measures associated with the needs of specific groups affected by drought. Educational programmes should be preferably oriented on the interested groups on local level (e.g. decision makers, farmers, municipalities and other).
Development of education programmes includes:

- establishment of the task group in charge of ensuring of training activities;
- identification of vulnerable groups potentially affected by drought and groups having potential to influence an outcome (e.g. decision-makers);
- development of education programmes – scope, time frame, form (e. g. workshops, education trainings);
- development of training materials.

4. RELATED ISSUES

This chapter summarises the basic information on issues directly related to drought that fall under the WFD. Contrary of the drought issues (described in the previous chapter) based on non - legally binding recommendations, quantitative status and prolonged drought assessment and partially climate change aspects are subject to binding regulations of WFD. These elements must be an integral part of development of RBMs.

4.1. Groundwater quantitative aspects

Groundwater quantitative aspects covered by WFD are associated with environmental objectives set for groundwater. A general objective is requirement of achievement of good quantitative status by 2015. Quantitative status expresses the degree of affection of water body caused by direct and indirect abstractions. The main condition is to ensure that the available groundwater resources are not exceeded by the long-term annual average rate of abstraction and groundwater level is not subject to anthropogenic alterations resulting in damages of associated surface waters and terrestrial ecosystems (e.g. wetlands). The data needed for quantitative status assessment must be obtained from comprehensive monitoring network for groundwater level measurements. Monitoring programme must ensure enough data for reliable quantitative status assessment including assessment of the available groundwater resources.

The output of groundwater quantitative status assessment is identification of groundwater bodies not reaching good quantitative status and potential effects on surface water and associated ecosystems and human development (e.g. water supply). It means the areas influenced by water scarcity are identified. Necessary measures for achievement of good quantitative status of groundwater bodies must be developed and included into the programme of measures of RBMPs including measures relating to water scarcity issues.

Where there is an increase of water scarcity problem, appropriate water efficiency measures should be taken in RBMPs. The Blueprint provides several options for improvement of quantitative water management and water efficiency. They include:

- **Implementation of pricing policies** in accordance with Article 9 of WFD stimulating more efficient use of water in the main water-using sectors. It is necessary to stress that this measure is obligatory and must be included in RBMPs as a legally binding requirement. Pre-condition for incentive pricing policy is improvement of water metering.
- **Development of water accounts** – improvement of water balance calculation at river basin and sub-catchment level. Water accounts are closely linked to the identification of ecological flow ensuring that the needs of nature are respected and that water balances stay within sustainable limits. The guidelines on water accounts and ecological flow are under development within the CIS process (with deadline in 2014),
- **Acceleration of good practices to stop leakages from water distribution networks** – strategic vision for the future focused on improvement of technical conditions of water infrastructure,
- **CAP reform to improve irrigation efficiency and water holding capacity** – based on philosophy of water use reduction as a pre-condition for irrigation projects under Rural Development,
- **Efficient water appliances in buildings –** based on voluntary EU Ecolabel and Green Public Procurement criteria for key water related products,
- **Improvement of water governance** – overall improvement of implementation of WFD.

The quantitative data collected during the WFD planning process should/could be used as a basis for the development of DMP. The data and information relevant to both planning documents (RBMPs and DMP can be grouped into the following categories:

- database of water abstractions according to users;
- database of available groundwater resources calculated for all groundwater bodies;
- water demand data (current + future trend scenarios);

- water supply data (water supply infrastructures, operators, capacity of water supply system, leakages from water distribution networks, trend in water consumptions);
- list of areas (groundwater bodies, surface water bodies, terrestrial ecosystems) effected by water scarcity supplemented by mapping illustration;
- evaluation of water scarcity using WEI+ indicator;
- identified shortcomings of quantitative management (e.g. estimation of amount of "black abstractions" (without authorisation).

Development of programme of measures for reaching good groundwater quantitative status within production of RBMPs and development of complimentary mitigation measures summarised in DMP are subject to separate practices. For introduction of effective drought risk-based management direct links between both processes are essential. Distinguishing the water scarcity issues and drought issues is a basic requirement.

4.2. Prolonged droughts

The term "prolonged drought" is introduced in the WFD in connection with exemptions from environmental objectives indicated in Article 4.6 which allows a temporary deterioration of water status. Legal definition of this term is not included in WFD. "Prolonged drought" can be understood as a specific type of drought resulting in temporary deterioration of water body status. For better understanding of the term "prolonged drought" the following conditions set in Article 4.6 for application of the exemptions can be used:

- it is a result of natural caused of force (majeure which are exceptional or which could not reasonably be foreseen) and which are reviewed periodically (e.g. through a follow up of the Programme of Measures of RBMPs and/or Drought Management Plan);
- all practicable steps are taken to avoid further deterioration;
- measures taken during the prolonged drought do not compromise the recovery of the water body after the prolonged drought and are included in the Programme of Measures;
- measures to restore the water body are taken as soon as reasonably practicable and are included in the next update of the RBMPs,
- a summary of effects of the prolonged droughts is included within the RBMP.

In order to identify the occurrence of a "prolonged drought" and avoid drought effects three types of indicators can be identified in relation to droughts:

- natural indicators based on precipitation as the main parameter (where relevant including evapotranspiration, and with statistical series) indicate that it is a 'natural cause or force majeure', and that the circumstances are exceptional or could have not reasonably been foreseen;
- indicators to prove that the prolonged drought has resulted in a temporary deterioration of one (or several) water bodies as an integral part of the monitoring programmes established under Article 8 and Annex V WFD (these are indicators related to environmental impacts);
- indicators to illustrate the socio-economic impacts of the prolonged droughts (drinking water supply, agriculture, industry and other).

The first and second types of indicators should be used to prove the occurrence of a "prolonged drought" and the associated temporary deterioration of water bodies. The second and the third types of indicators should be used:

- to take the appropriate measures in order to mitigate the impacts of the prolonged droughts and recover the quality of the water bodies, according to 4.6 (c) and (d);
- to draft the annual review of the effects of the prolonged droughts (4.6(d));
- to draft the summary of the effects (4.6(e)).

In the case of a prolonged drought occurs it is necessary to take exceptional measures. These measures need to be included in the programmes of measures and/or the Drought Management Plan. The more detailed recommendations are summarised in the Guidance Document No. 20 (Guidance on Exemptions to the Environmental objectives).

„Prolonged drought“ is considered to be a specific drought type used when river basin authority declares a “temporary derogation” to good water status. Identification and characterization of “prolonged drought” and development of appropriate measures should/must be ensured according binding rules set in WFD and non – biding guidelines for development of DMP. The outcomes should be included in both documents – RBMPs and DMP.

4.3. Climate change aspects

Water scarcity and drought have been broadly documented as phenomena which are likely to be impacted by climate change. Climate change is expected to aggravate both water scarcity and drought problems producing further reduction in water availability. Therefore special consideration should be given to climate change aspects with the aim to integrate them into water management planning. The first step should be focused on detection of current and future consequences of climate change followed by development of adaptation strategies including programme of adaptation measures.

Within the climate change adaptation process is essential to develop and use statistical methods, special indicators and modelling technics allowing reliable distinction of climate change consequences from changes induced by human anthropogenic activities.
It is also necessary to differentiate between the “drought” and “water scarcity” in order to clearly distinguish the causes of the both phenomena.

WFD offers potential to address drought consequences and water scarcity issues. There are many links between climate change adaptation measures related to water scarcity and droughts and the WFD environmental objectives, such as good groundwater quantitative status ensuring balance between abstractions and groundwater recharge. Also requirement of achieving good ecological status for surface waters associated with establishment of minimum flow needs with respect to aquatic life. Measures to achieve these objectives have to be reported in the RBMPs. **River Basin Management Plans present the basic tool for addressing water scarcity and drought.**

The details how to integrate climate change aspects into planning process according to WFD are described in the **guidance document No. 24 “River basin Management in a Changing Climate”.** The guidance has been developed within the CIS and approved by Water Directors. The guiding principles relating to water scarcity and drought issues taken from this document are included in the box below.

Overall guiding principle

Use the Water Framework Directive as the basic methodological framework to achieve climate change adaptation in water-scarce areas and to reduce the impacts of droughts.

Guiding principles

- Make full use of the Water Framework Directive environmental objectives, e.g. by the requirement to achieve good groundwater quantitative status to ensure a robust water system, which is more resilient to climate change impacts.
- Determine, on the basis of robust scientific evidence and on a case-by-case basis, whether a prolonged drought allows for the application of WFD Article 4.6, and take into account climate change predictions in this case-by-case approach.
- Pay special attention to the requirements of WFD Article 4.7 when developing measures to tackle water scarcity under a changing climate and which may cause deterioration of water status.

To detect climate change effects it will be probably necessary to adapt existing monitoring systems. The recommendations for performance of this step are expressed in guiding principles and suggested actions in the Guidelines No. 24. They are provided in the box below.

Guiding principles

- Diagnose the causes that led to water scarcity in the past and/or may lead to it in the future.
- Monitor water demand closely and forecast it, based on improved knowledge about demands and trends.

- Collect as much high quality information as possible to anticipate changes to water supply reliability, which may be imposed by climate change, in order to detect water scarcity early.
- Distinguish climate change signals from natural variability and other human impacts with sufficiently long monitoring time series.

Suggested actions

- Adapt the hydrometric networks to track the impact of climate change on water resources, providing enough redundancy to obtain accurate estimations of naturalised stream flow series from observation, closing the water balance in each sub-basin.
- Establish already now a monitoring system of water uses as well as demand monitoring.
- Develop a comprehensive set of indicators at appropriate temporal and spatial scale which can link phenomena in order to predict drought and water scarcity impacts.
- Diagnose water scarcity based on past water demands and improve knowledge about past and current water demands and on future trends, incorporating climate change projections.
- Analyse how predicted changes in mean annual runoff will change supply reliability and how those changes will affect the socioeconomic system behind the water resources system.

Another source for evaluation of climate change provides the 5th IPCC Assessment Report of 2014 referring explicitly to the CEE region. Here is a link to the 5th IPCCC Report: http://www.ipcc.ch/report/ar5/.

5. ANNEXES

Annex I: Examples of the national methodologies for assessment of historical drought
Annex II: Examples of drought national drought indicator systems and evaluation methodologies
Annex III: Examples of the national drought classification, thresholds and early warning systems
Annex IV: Examples of national organizational structures to deal with drought
Annex V: Examples of national program of measures for preventing and mitigating drought
Annex VI: Examples of the national research programme supporting drought management

6. REFFERENCES

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