Groundwater Guidance

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LIST OF USED ABBREVIATIONS

DRB – Danube River Basin

DRBMP – Danube River Basin Management Plan

EC – European Commission

GIS EG – GIS Expert Group (of the ICPDR)

GW – Groundwater

GW-body – Groundwater Body or group of bodies of groundwater

GWD – Groundwater Directive (2006/118/EC)

GW TG – Groundwater Task Group (of the ICPDR)

MS – Member State

QA, QC – Quality assurance, Quality control

RBD – River Basin District

RBMP – River Basin Management Plan

RBM EG – River Basin Management Expert Group (of the ICPDR)

TNMN – Transnational Monitoring Network

WFD – Water Framework Directive (2000/60/EC)

WG C –Working Group Groundwater (of the EC)

1. Task Group Groundwater and Scope of the Guidance

The contracting parties of the Danube River Protection Convention, EU Member States and non-Member States, committed to make all efforts to draw up a co-ordinated international River Basin Management Plan (RBMP) for the Danube River Basin and that the ICPDR should serve as a common platform for the implementation of the WFD on a basin wide scale. It is the coordinating platform for compiling the WFD 'Roof Reports', the Danube RBMP by 2009 and for compiling a joint programme of measures.

1.1. ICPDR Task Group Groundwater

During the data and information collection for the Roof Reports for the Danube River Basin many technical questions arose especially concerning the identification of transboundary GW-bodies of basin-wide importance, bilateral agreements and harmonisation of the activities. Member countries of the ICPDR stated their need for a Drafting Group Groundwater to deal with groundwater related issues of basin wide concern. The Task Group Groundwater[1] was established in 2004. Up to now, its main objective was the definition of criteria for the identification of transboundary GW-bodies of basin wide importance, the development of guidelines for the harmonised characterisation, the collection of that information, the drafting of the Roof Report on the risk assessment (Article 5 WFD), the collection of information on the groundwater chemical and quantity monitoring networks and the drafting of the Roof Report on monitoring (Article 8 WFD).

Currently there are two meetings a year on expert level, dealing with actual groundwater issues according to the workplan of the ICPDR. The Task Group Groundwater decided that a guidance document, summarising the particular groundwater related procedures according to the needs within the ICPDR framework should be prepared to further support cooperation within the Danube river basin.

1.2. Danube River Basin Management Plans (DRBMP)

River basin management plans and programmes of measures according to the WFD are developed at three levels in the DRB, which are:

1. Part A – International level, 'Roof Reports';
2. Part B – National level and/or Sub-basin level (for selected sub-basins e.g. Tisza, Sava, Prut, Danube Delta);
3. Part C – National level data which are to be provided by Member States on request to the European Commission (EC).

As outlined in the strategic document on the *Development of the River Basin Management Plan in the DRB* (ICPDR document 101) the information increases in detail from Part A to Part B and to Part C. The content of the RBM Plan on the A-level is highlighting all relevant issues of basin-wide importance and is strongly based on findings and actions on the national/sub-basin level. The interrelation between the different levels is manifold and should be exploited in the best possible way to achieve the objectives on all levels in the most efficient way. Adverse overlaps and duplication of work should be prevented.

[1] Groundwater Task Group at the ICPDR (restricted area)

The approach on the A-(basin wide) level must be complementary and inspirational to the national planning and implementation, and vice versa. To enable this approach in practice, visions and specific operational objectives (= management objectives) on the international scale are defined to guide the Danube countries towards a commonly agreed aim.

1.3. Scope of the Guidance

As already mentioned above, the guidance document should summarise the particular groundwater related procedures according to the needs within the ICPDR framework. It should provide brief technical information on the characterisation and grouping of GW bodies and necessary explanation on monitoring parameters, aggregation procedures, data reporting including reporting frequencies and the presentation of status in order to contribute to a harmonisation of approaches within the DRB. Furthermore, the guidance should document the ways of data exchange towards the ICPDR TNMN Groundwater, either when fulfilling the WFD reporting requirements or when contributing to the Annual Yearbook.

A lot of harmonisation is needed in the coming years, which should be covered and assisted by the guidance. Due to the ongoing process of the WFD and GWD implementation and due to the increase of knowledge in time, this guidance is intended as a living document being updated and completed according to the further development and agreements within the ICPDR Task Group Groundwater.

The guidance intends to contribute to the following issues of harmonisation:

- Bilateral coordination and bilateral agreements on approaches and principles in the transboundary GW-bodies. First steps have been initiated but there is a need for further refinements.
- The need of further harmonization concerning the delineation of GW-bodies and the development of common conceptual models for each transboundary GW-body (as a whole).
- Need of further harmonisation within the revision of the risk assessment.
- Harmonisation of monitoring activities.
  Differences in the implementation progress of the Water Framework Directive (WFD) in the Danube countries concerning groundwater quality and quantity monitoring were identified; Since the monitoring networks are already established according to national requirements a wide spectrum of approaches for the network design was applied. The monitoring frequency and the list of parameters might be more easily adaptable than the selection of monitoring points. Monitoring with regard to dependent terrestrial ecosystems and respective assessment criteria still needs further discussion.
- Need of coordination of status and trend assessment for transboundary GW-bodies. Harmonization and coordination in the establishment of groundwater threshold values.
- Establishment of a data flow of groundwater data to the ICPDR and data exchange between the member countries sharing a transnational GW-body of basin-wide importance. At all stages emphasis should be put on QA and QC aspects.

The information in this document is based on already existing information: the outcome of working group meetings, results of the work of the Drafting/Task Group Groundwater, ICPDR documents and reports, CIS documents, the WFD and the GWD. Moreover, other documents dealing with transboundary groundwater issues were considered e.g. UN/ECE-Report on Guidelines on Monitoring and Assessment of Transboundary Groundwaters. Since the process within ICPDR is among others driven by the implementation of the WFD across Europe, some issues may also be discussed at the European Commission (EC) level in the Directorate General (DG) Environment Working Group Groundwater (WG C) in parallel. Hence, respective results and other helpful information should be taken into account in this guidance.

The guidance document shall support the achievement of the underlying ICPDR visions for groundwater quality and quantity which are as follows[2]:

- The ICPDR's basin wide vision is that the emissions of polluting substances do not cause any deterioration of groundwater quality in the Danube River Basin. Where groundwater is already polluted, restoration to good quality will be the ambition.
- The ICPDR's basin wide vision is that the water use is appropriately balanced and does not exceed the available quantity of groundwater resource in the Danube River Basin, considering future impacts of climate change.

[2] Significant Water Management Issues in the Danube River Basin District. Final document & Annex 1

2. Groundwater bodies at ICPDR level

2.1. The Transboundary Groundwater Bodies of Basin-wide Importance

Already in 2002[3] and 2003[4] workshops were dealing with questions concerning GW-bodies of basin-wide importance to be dealt with at ICPDR level. An important recommendation of these workshops was the proposed set up of a Drafting Group "Strategy for the implementation of the WFD regarding transboundary groundwater issues". Finally in 2004 on February 13 the 1st meeting of the Drafting Group 'Groundwater' of the RBM EG of the ICPDR took place in Vienna[5].

The following criteria for the selection of GW-bodies at ICPDR level have been agreed:

- GW-bodies at ICPDR level are important transboundary GW-bodies in the Danube River Basin. They are defined as follows:
    - important due to the size of the GW-body which means an area > 4,000 km²;
      or
    - important due to various criteria e.g. socio-economic importance, uses, impacts, pressures, interaction with aquatic eco-system.
- The criteria need to be agreed bilaterally. This means although there are other GW-bodies with an area larger than 4,000 km² and fully situated within one country of the DRB, they are dealt with at the national level as they are not transboundary and not of basin-wide importance.
- The link between the GW-bodies of the Roof Report and the GW-bodies of the national reports is given by the national codes of the GW-bodies.
- The importance of groundwater sources for associated ecosystems is dealt with in the national reports.

The bilateral and partly multilateral discussions concerning the identification of GW-bodies of basin-wide importance lead to the following 11 nominated GW-bodies or groups of GW-bodies as listed in Table 1.The data presented in this table reflect the situation during the risk assessment process.
As the Groundwater Guidance is a living document this table will be updated regularly, in line with the publishing of DRBMPs.

Definitions

- **Group of GW-bodies:** Groundwater bodies can be grouped according to Annex II of the WFD (e.g. for the purpose of characterisation, monitoring and status assessment).
- **Aggregated GW-bodies:** Represents the sum of individual national GW-bodies which form a whole national part of an ICPDR GW-body (e.g.: HU_sp.2.5.2 + HU_p.2.5.2 together form the whole aggregated Hungarian part of GWB-9).

[3] 1st Workshop on Identification, Characterisation and Monitoring of GW-Bodies for the Danube Countries, February 4-5, 2002 in Budapest.

[4] 2nd Groundwater Workshop on the Implementation of WFD in the Danube River Basin. May 12 and 13, 2003 in Budapest.

[5] Summary Report of the 1st Drafting Group Meeting

Table 1: Nominated important transboundary GW-bodies or groups of GW-bodies in the DRBD

Code	Size [km²]	Aquifer characterisation		Main use	Overlying strata [m]	Criteria for importance
		Aquifer Type	Confined			
1-DE-AT	5,900	K	Yes	SPA, CAL	100-1000	Intensive use
2-BG-RO	26,903	F, K	Yes	DRW, AGR, IND	0-600	> 4,000 km²
3-RO-MD	21,626	P	Yes	DRW, AGR, IND	0-150	> 4,000 km²
4-RO-BG	6,356	K, F-P	Yes	DRW, AGR, IND	0-10	> 4,000 km²
5-RO-HU	na	P	Y/N	DRW, IRR, IND	2-30	GW resource, DRW protection
6-RO-HU	na	P	Y/N	DRW, AGR, IRR	5-30	GW resource, DRW protection
7-RO-CS-HU	28,608	P	Y/Y/N	DRW, AGR, IND, IRR	0-125	> 4,000 km², GW use, GW resource, DRW protection
8-SK-HU	3,353	P	No	DRW, IRR, AGR, IND	2-5	GW resource, DRW protection
9-SK-HU	2,666	P	Yes	DRW,IRR	2-10	GW resource
10-SK-HU	1,069	K,F	Y/N	DRW, OTH	0-500	DRW protection, dependent ecosystem
11-SK-HU	3,601	F,K	Y/N	DRW, SPA, CAL	0-2500	Thermal water resource

[Source/Status: WFD Roof Report 2004]

Description

Size	Whole area of transboundary GW-body covering all countries concerned in km²
Aquifer characterisation	Aquifer Type: Predominantly **P** = porous/ **K** = karst/ **F** = fissured. Multiple selections possible: Predominantly porous, karst, fissured and combinations are possible. Main type should be listed first. Confined: [**Yes / No**]
Main use	**DRW** = Drinking water / **AGR** = Agriculture / **IRR** = Irrigation / **IND** = Industry / **SPA** = Balneology / **CAL** = Caloric energy / **OTH** = Other. Multiple selections possible.
Overlying strata	Indicates a range of thickness (minimum and maximum in metres)
Criteria for importance	If size < 4,000 km² criteria for importance of the GW body have to be mentioned. They have to be bilaterally agreed upon!

For the next plan period it should be considered to allow for a new category of confined: ‘partly’.

2.2. Procedures for data provision and data exchange

For GIS purposes templates for data collection were elaborated by the GIS Expert Group. The templates relevant for groundwater issues are as follows and are attached in the Annex:

- GWBody
- GWBodyAggr and
- GWStn

The detailed content of the templates is explained in the related code lists.

The templates need to be submitted to DANUBIS by the national GIS experts in close cooperation with the groundwater experts (GW TG members) who are mainly responsible for the groundwater related content.

3. Characterisation, Review of Impacts and Status Assessment

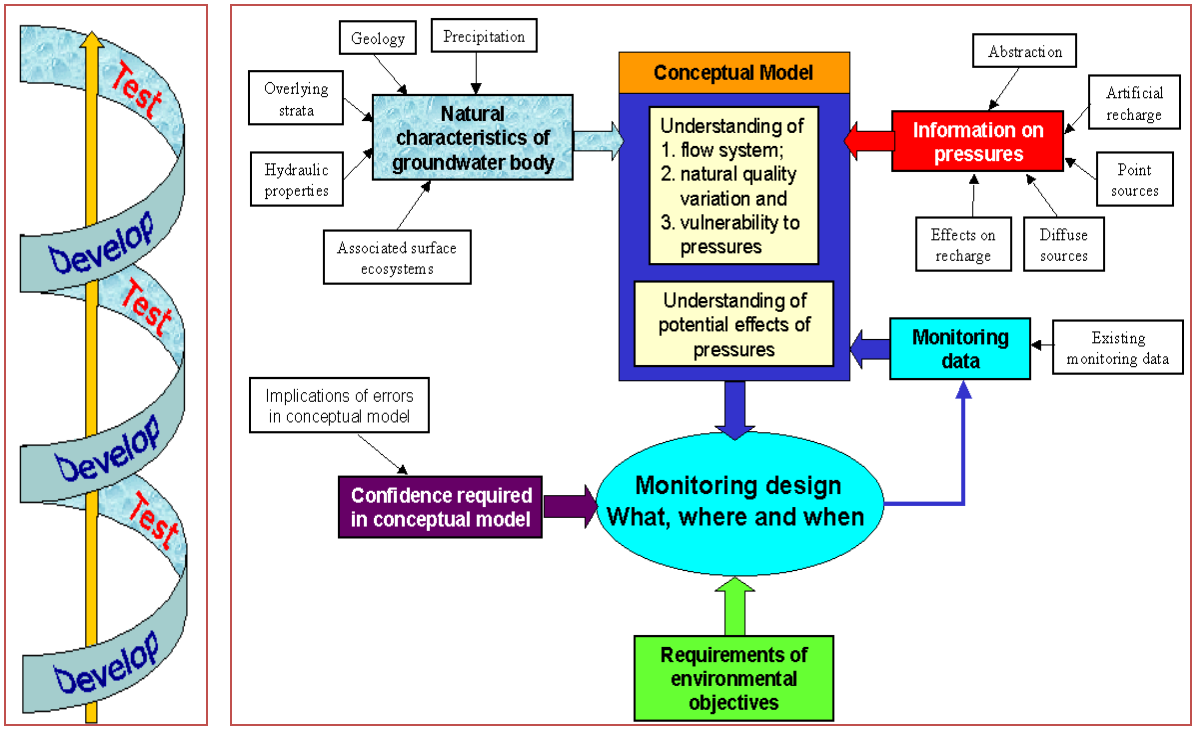
Article 5 of the WFD requires the characterisation of each RBD and a review of the environmental impacts of human activities, as well as an economic analysis of water use, has to be undertaken. Detailed specifications are laid down in Annex II of the WFD where specific provisions concern those bodies of groundwater which cross the boundary between two or more Member States, focusing mainly on quantitative aspects such as the location of groundwater abstraction points serving more than 10 m³ a day or more than 50 persons, the abstraction rates, direct discharges to groundwater etc.

3.1. Risk of failure to reach the environmental objectives (overview)

The groundwater risk assessment is part of the characterisation and the review of the environmental impacts of human activity on the status of groundwater. For each GW-body the degree to which it is at risk of failing to meet the objectives under Article 4 WFD has to be assessed. If the GW-body fails to meet the environmental objectives, or is at risk of failing to meet the objectives by 2015, then the cause of this failure (i.e. the pressure or combinations of pressures) must be investigated.

The Driver, Pressure, State, Impact and Response (DPSIR) analytical framework is widely-used. Possible approaches for groundwater risk assessment combine pressure data, vulnerability information and monitoring data. The assessment of whether a pressure on a GW-body is significant must be based on the knowledge of the characteristics of the GW-body and the pressures within the catchment area: a kind of conceptual understanding/model. There must be some knowledge that a pressure may cause an impact because of the way the catchment system functions. Such a conceptual model (see Figure 1) is the basis of the monitoring network design and it is subject of regular revision, validation and improvement depending on the increase of knowledge (e.g. by the obtained monitoring data) and depending on the need of further improvement to properly understand the system.

Figure 1: Conceptual model / understanding



[Source: Guidance Document No. 7: Monitoring under the WFD (2003)]

3.1.1. Approach for the Risk Assessment on Groundwater

The risk assessment is performed on national criteria both for quality and quantity. Hence the approaches are different. As a consequence the result of the risk assessment may differ for the national shares of an important transboundary GW-body. At EU level a technical report[6] (workshop report) has been elaborated summarizing the elements of the general approach for the analysis of pressures and impacts and tools to assist and contributing to a harmonization of approaches and procedures.

The main components of the methodologies for assessing the risk of failure to achieve good **chemical status** are the available monitoring data on water quality, data on existing pressures and possible impacts, data on the overlying strata of the GW-bodies and the corresponding vulnerability of the aquifer. Derived from the available data the evaluation can be carried out e.g. in a stepwise approach by using threshold values for each of the criteria and expert knowledge. However, the risk assessment methods are rather country specific and range from using combinations of the above mentioned data sets to focusing on interpreting water quality data.

The assessment of the risk of failure to achieve good **quantitative status** concentrates on the evaluation of changes in groundwater levels and estimating the available water resources taken into account information on groundwater abstraction. Being “at risk” is mainly defined by a threshold ratio of annual withdrawal rate and exploitable groundwater amounts. Hydrogeological and mathematical models are also used for assessing the risk by some countries.

[6] Groundwater Risk Assessment. Technical report on groundwater risk assessment issues discussed at the workshop of 28th January 2004.

3.2. Procedures for data provision and data exchange

3.2.1. Characterisation and Review of Impacts

According to the stratified approach of 3 level reports which supplement each other, the content of the "WFD Roof Report 2004" (Part A (basin-wide) level under Article 5 WFD) is intended to give relevant summary information on the characteristics and the review of impacts for the selected transboundary GW-bodies of basin wide importance (see Table 1). Detailed information is to be found in the Part B (national level) reports.

In order to fulfill the requirements and receive harmonized data on characterisation, templates for reporting on GW-bodies were prepared and discussed at the 1st meeting of the Drafting Group 'Groundwater' of the RBM EG of the ICPDR[7].

The information for the initial characterisation of the transboundary GW-bodies was collected and presented via Table 2 and information on further characterization was collected and presented via Table 3.

[7] 1st Meeting of the Drafting Group Groundwater of the River Basin Management Expert Group of the ICPDR on February, 13 2004 in Vienna

Table 2: Initial characterisation of the transboundary groundwater bodies

NAME	MS_CD	Size: km²	National size: km²	Aquifer characterisation		Main use: DRW = drinking water AGR = agriculture IRR = irrigation IND = industry SPA = balneology CAL = caloric energy OTH = other	overlying strata: Range in m	criteria for importance bilaterally agreed	Risk: Yes = at risk No = not at risk Insuf = insufficient data/knowledge		bilaterally agreed with	responsibility for data delivery
				Predom. P = porous K = karst F = fissured	Confined: Yes/No				Quality	Quantity		

NAME	Name of the important transboundary GW-body. Max. 100 digits, no restrictions concerning language, central European encoding (CEE), different national names divided by slash
MS_CD	Member State Code which is a unique identifier. ISO-Code 2-digits & max. 22 digits. National codes from all countries sharing the GW body have to be named to identify the bodies in the respective part B (National Reports).
Size: km²	Whole area of the transboundary GW-body covering all countries concerned
National size: km²	Each country indicates the size on the national territory
Aquifer characterisation	Multiple selection possible Predominantly porous, karst, fissured and combinations are possible. Main type should be listed first.
Main use	Multiple selection possible
Overlying strata	Indicates a range of thickness min, max in metres.
Criteria for importance	If size < 4,000 km² criteria for importance of the GW body have to be named, they have to be bilaterally agreed upon.
Risk	Indicates whether a GW-body is at risk of failing good status
Bilaterally agreed with	Country which has been bilaterally agreed with has to be indicated, two digit country code after ISO 3166
Responsibility for data delivery	Indicate two digit country code after ISO 3166 and institution which is responsible for the data delivery

Note: *EU_CD is the unique European code for a water body at EU level. This code has to be defined on a central level for the transboundary GW-bodies. The yellow marked columns contain information which is also needed for GIS purposes.*

[Source/Status: WFD Roof Report 2004]

Ad Table 2

GIS-DATA
IMPORTANT NOTICE: Please attach GIS maps (ArcView shapes) **or paper maps** (to be sent in digital formats such as .JPG or .TIFF)**.** **GIS data should be sent in the reference system of WGS84/ETRS89,** **or at least information about: *1. Name of Reference System*, *2. Projection*, *3. Ellipsoid* must be added.**

Table 3: Further characterisation of the transboundary groundwater bodies

Descriptive text on the transboundary groundwater body ½ to 1 page for one body	
Member State Code MS_CD	Member State Code which is a unique identifier. ISO-Code 2-digits & max. 22 digits. National codes from all countries sharing the GW body have to be named to identify the bodies in the respective part B (National Reports).
Descriptive text on the important transboundary GW-body	*Criteria for delineation, geological overview, GW use, impacts, pressures, interaction with aquatic ecosystems, criteria for selection as 'important'*
Description of methodology for estimating the risk of failure to achieve the good status	*approach and criteria for both quality and quantity*
GW-body identified as being at risk of failing to meet the objectives under Art. 4	
Lower objectives identified according to Art. 4 and Annex II 2.4 and 2.5	
Gaps and uncertainties in the underlying data	

[Source/Status: WFD Roof Report 2004]

3.2.2. Status presentation

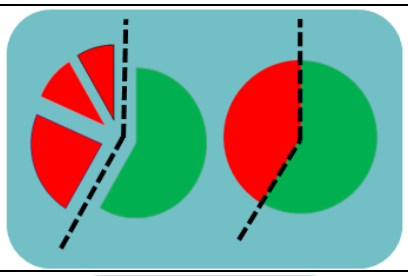
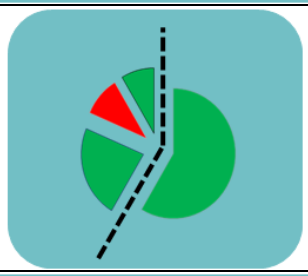
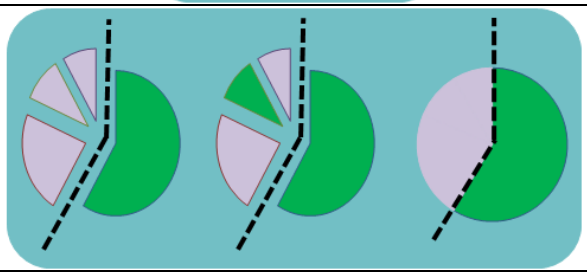
As decided in the GW TG, the result of the status assessment is solely to be provided for the whole national part of an ICPDR GW-body (so called: aggregated GW-body).

If a national part of an ICPDR GW-body consists of several individual national-level GW-bodies then the poor status of only one national-level GW-body is decisive for characterising the whole national part of an ICPDR GW-body in poor status.

3.2.3. Confidence in the status presentation

At the 7th Meeting of the GW TG in October 2008 the issue of confidence was intensively discussed. Based on the comment that confidence in status assessment is not being requested in the relevant WFD reporting sheets, it was decided to report on the confidence in status presentation for the whole national part of an ICPDR GW-body.

Regarding the level of confidence of groundwater status presentation at ICPDR level the following procedure is proposed. It considers that national parts of ICPDR GW-bodies might consist of either one national GW-body (or a group of GW-bodies) or aggregated GW-bodies (national GW-bodies or groups of GW-bodies). Confidence is indicating the (in)homogeneity of the status within an aggregated GW-body.

High confidence 1.) Status assessment is based on WFD compliant monitoring data. **2.)** If the national part of an ICPDR GW-body is formed by more than one GW-body or groups of GW-bodies, all have the same status.	
Medium confidence - If the national part of an ICPDR GW-body is formed by more than one GW-body or groups of GW-bodies, the status assessment is based on WFD compliant monitoring data and not all have the same status.	
Low confidence - Status assessment is based on risk assessment data.	

Poor status Good status Risk

[Status of discussion: 7th Meeting of the GW TG in October 2008]

3.3. Data gaps – Differences – Need for harmonisation

As the data collection for the first ICPDR Roof Report happened the first time and such data on groundwater has never been collected in the Danube River Basin before, differences in the progress of WFD implementation in the Danubian countries have become obvious. Danube countries used a broad spectrum of different approaches for the delineation of GW-bodies, their characterisation, for the assessment of the risk of failure to reach good status, for the establishment of threshold values and for the status assessment. An analysis would be helpful to check for differences in the national approaches in order to further harmonise the different methods.

Data gaps and inconsistencies have become apparent in the underlying data resulting in uncertainties in the interpretation of the data. In addition, some countries have identified the need to expand the current monitoring networks to include monitoring stations along the national borders, where transboundary GW-bodies are located. In some cases, countries have assessed the need to adapt their current monitoring programmes to collect better information on water quality and quantity.

This entails the need for intensive bi- and multilateral co-operation to achieve a harmonisation of data sets for transboundary GW-bodies. In addition, the interactions of groundwater with surface water or directly dependent ecosystems would need further attention.

At the moment no harmonised system for coding of the different layers of GW-bodies is available. The aspect of different groundwater horizons needs further discussion and clarification.

On the homepage of the ICPDR the detailed results of the data collection for the preparation of the WFD Roof Report are accessible under the following address: http://icpdr01.danubeday.org/icpdr-pages/river_basin_management.htm.

4. TNMN Groundwater

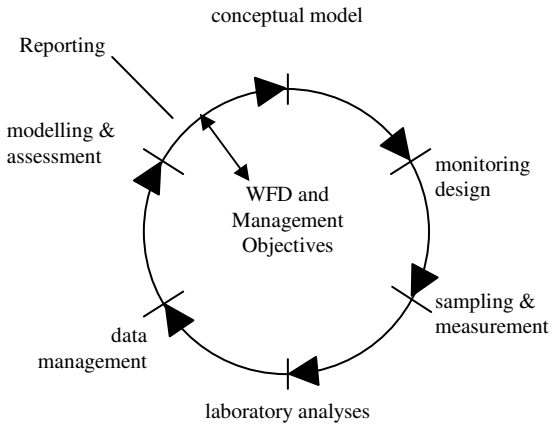
The development of the "Transnational Monitoring Network" (TNMN) of the ICPDR within the last 15 years was exclusively focussing on surface waters. Hence, the network as well as the monitoring and reporting procedures are already well established for surface waters.

The transnational groundwater management activities in the Danube River Basin District started in February 2002 and were triggered by the WFD. Finally 11 transboundary GW-bodies (Table 1) were identified as being of basin-wide importance. Monitoring of these selected GW-bodies is now decided to be an integral part of the TNMN.

For groundwater monitoring under the TNMN a six-year reporting cycle is foreseen, which is in line with the reporting requirements under the WFD. The TNMN has to meet the requirements of the WFD and the ICPDR. Monitoring networks should be at high standards.

Regarding the WFD, reporting on the monitoring network is foreseen according to Article 8 and the results of monitoring are essential components within the RBMP. The monitoring programme includes both quantitative and chemical (quality) monitoring and shall provide the necessary information to assess groundwater status, to identify trends in pollutant concentrations, to support GW-body characterisation and the validation of the risk assessment, to assess whether drinking water protected area objectives are achieved and to support the establishment and assessment of programmes of measures and the effective targeting of economic resources. According to the WFD, monitoring programmes meeting these requirements must have been operational by 22 December 2006 at the latest.

Monitoring follows a cyclic procedure and each step in this process needs proper attention and the consideration of integrated and verifiable quality assurance and quality control in order to produce reliable and comparable monitoring data[8].



Monitoring results reported to ICPDR will be the basis for the preparation of the TNMN Yearbook and furthermore the basis for the development of a joint Programme of Measures within the DRBMP.

Since the joint groundwater activities within the TNMN are in an initial implementation phase, further efforts for the harmonisation of monitoring are still needed. Main emphasis is to be put on:

- Development of conceptual models of GW-bodies.
- Achievement of harmonised monitoring networks.
- Establishing of criteria for the selection of parameters

[8] Guidance Document No. 15: Groundwater Monitoring. (2007).

4.1. Monitoring strategies and network design

To design the monitoring network different criteria have been applied by the countries to select appropriate sites. Important criteria are aquifer type and characteristics (porous, karst and fissured, confined and unconfined groundwater) and the depth of the GW-body since deep GW-bodies are more difficult and costly accessible than shallow GW-bodies. For deep GW-bodies the flexibility in the design of the monitoring network is very limited. The flow direction was also taken into consideration by some countries as well as the existence of associated drinking water protected areas or ecosystems (aquatic and/or terrestrial).

The current monitoring network designs are mainly based on already existing national monitoring programmes which were in some cases still under adaptation to the requirements of Article 8 WFD. The Monitoring report according to Article 8 WFD represents the state of information of August 2006. There is still further development and harmonisation of the monitoring programmes until the compilation of the RBMP.

4.2. Transboundary aspects

With respect to groundwater the WFD requests information on the chemical and quantitative status of groundwater. Specific provisions concern those bodies of groundwater, which cross the boundary between two or more Member States (see also Chapter 6). For the ICPDR this concerns the identified 11 transboundary GW-bodies of basin-wide importance.

With the view of establishing a basin wide coherent monitoring approach, bilateral agreements should be reached on monitoring strategies (i.e. sampling procedures, network design etc.) and principles, which require coordination of conceptual, model development, the exchange of data and QA and QC aspects (in line with the requirements of Article 13(2) WFD).

According to Annex V 2.4 WFD the provisions for surveillance monitoring require sufficient monitoring sites to be selected for bodies which cross a Member State boundary and transboundary GW-bodies to be monitored for those parameters, which are relevant for the protection of all uses, supported by the groundwater flow.

The surveillance monitoring programme is also useful for characterising GW-bodies, validating the risk assessment defining natural background and assessing trend developments within the GW-body. This will enable future changes in conditions to be assessed, reference data to be acquired and typologies to be investigated.

According to Annex V 2.2 WFD the quantitative monitoring network shall be designed so as to provide a reliable assessment of the quantitative status of all GW-bodies or groups of bodies of basin-wide importance including an assessment of the available groundwater resource. For GW-bodies within which groundwater flows across a Member State boundary, is has to be assured that sufficient monitoring points are provided to estimate the direction and rate of groundwater flow across the Member State boundary. Sufficient frequency of measurement to estimate the direction and rate of groundwater flow across the Member State boundary shall be ensured.

4.3. Selection of parameter sets

4.3.1. Chemical monitoring

The following core set of determinants was agreed by the GW TG[9] to be monitored within TNMN groundwater:

- Mandatory by the WFD
  - dissolved oxygen,
  - pH-value,
  - electrical conductivity,
  - nitrate,
  - ammonium,
- Recommended
  - temperature and
  - a set of major (trace) ions.

Parameters such as temperature and a set of major and trace ions are not formally requested by the WFD but may be helpful to validate the Article 5 risk assessment and the conceptual models. Selective determinants (e.g. heavy metals and relevant basic radio nuclides) would be needed for assessing natural background concentrations.

For the selection of parameters, the provisions of the Groundwater Directive (GWD, Directive 2006/118/EC, Annexes I and II) have to be considered. Helpful information can also be found in the CIS Monitoring Guidance[10] which was elaborated within EU WG C 'Groundwater'.

Additional indicators of anthropogenic contaminants typical of land use activities in the area and with a potential to impact groundwater might also be required on an infrequent basis for validating the WFD risk assessments and to check for any new identified pressure turn up to be relevant.

In addition it is recommended to monitor the water level at all chemical monitoring points in order to describe (and interpret) the 'physical status of the site' and to help interpreting (seasonal) variations or trends in chemical composition of groundwater.

In addition to the core parameters, selective determinants will need to be monitored at specific locations, or across GW-bodies, where the risk assessments indicate a risk of failing to achieve WFD objectives. Transboundary water bodies shall also be monitored for those parameters, which are relevant for the protection of all of the uses supported by the groundwater flow (see Chapter 6).

The selection of parameters depends on the results of the risk assessment, the characterisation of a GW-body, considering existing water quality data and local expert knowledge. The chemical monitoring sites must be reviewed on a regular basis to ensure that they provide representative information and data on groundwater quality and fully support the risk assessment process.

Generalised land use/cover categories can be used as a basis for the initial selection of parameters. An in-depth analysis of land use/cover and the nature and approximate amounts of chemicals being used should be made in cooperation with competent local bodies in order to identify potential pollutants.

[9] 3rd Meeting of the ICPDR Groundwater Task Group on September, 25–26 2006 in Vienna

[10] Guidance Document No. 15: Groundwater Monitoring. (2007).

4.3.2. Quantity monitoring

The WFD requires only GW-levels but it was recommended by the GW TG to monitor the following parameters for the purposes of quantitative assessment of groundwater:

- Groundwater levels in boreholes or wells (only this parameter is mentioned in WFD, the other parameters are recommended as supportive);
- Spring flows;
- Flow characteristics and/or stage levels of surface water courses during drought periods (i.e. when the flow component directly related to rainfall can be neglected and discharge is sustained substantially by groundwater);
- Stage levels in significant groundwater dependent wetlands and lakes.
- Optional: water abstraction

4.4. Monitoring frequency

4.4.1. Chemical monitoring

The selection of appropriate monitoring frequency should generally be based on the conceptual model and, in particular, the characteristics of the aquifer and its susceptibility to pollution pressures. Sampling for operational monitoring must be continued until the GW-body is determined, with adequate confidence, to be no longer at poor status or at risk of being at poor status and there is adequate data to demonstrate a reversal of trends.

Sampling frequency and sample timing at each monitoring location should furthermore consider:

- Requirements for trend assessment;
- Whether the location is up-gradient, directly below, or down-gradient of the pressure. Locations directly below a pressure may require more frequent monitoring;
- The level of confidence in the Article 5 risk assessments, and changes in the assessments over time;
- Short-term fluctuations in pollutant concentrations, e.g. seasonal effects. Where seasonal and other short-term effects are likely to be encountered, it is essential that sampling frequencies and timings are adjusted (increased) accordingly and that sampling takes place at the same time(s) each year, or under the same conditions, to enable comparable data for trend assessment, accurate characterisation and status assessment; and
- Land use management patterns, e.g. the period of pesticides or nitrate application. This is especially important for rapid flow system like karstic aquifers and/or shallow GW-bodies.

4.4.2. Quantity monitoring

The amount and frequency of monitoring should be determined by the data needed to determine risk and status, and where necessary to support the design and assessment of the programme of measures.

Frequency of monitoring predominantly depends of the characteristics of the water body and the monitoring site respectively. Sites with significant annual variability should be monitored more frequently than sites with only minor variability. In general monthly monitoring will be sufficient for quantity monitoring where variability is low but daily monitoring would be preferred (particularly when measuring flows). The frequency should be revised as knowledge of the aquifer response and behaviour improves and in relation to the significance of any changes in pressures on the GW-body. This will ensure that a cost-effective programme is maintained.

4.5. Data aggregation

The provision of data is not foreseen under the WFD reporting, but for the purpose of reporting to the ICPDR for the TNMN Yearbook the GW TG agreed[11] to provide the following aggregated data for each aggregated GWB (whole national part of ICPDR GW-body – see definition in chapter 2.1).

Remark: All aggregated data are based on the arithmetic mean values per monitoring point per year. The following statistical key-values are proposed:

- Minimum
- Mean
- Maximum
- Standard deviation
- 10, 25, 50, 75, 90 Percentile

Table 6 provides details on the aggregation procedures for the relevant parameters.

4.6. Reporting

The procedure for the development of the DRBMP and the reporting is outlined by an ICPDR Strategic Paper[12]. All data reported to ICPDR will be integrated in the ICPDR databases. The major tool for this purpose is the Danube GIS. The interoperability with the European Information System on Water (WISE) is foreseen through the work of the GIS EG of the ICPDR.

4.6.1. For the purpose of the WFD

For the preparation of the ICPDR Roof Report on Monitoring according to Article 8 WFD as well as for the preparation of the DRBMP the following templates were distributed for collecting and updating appropriate data and information on monitoring networks in the transboundary GW-bodies of basin-wide importance.

[11] 3rd Meeting of the ICPDR Groundwater Task Group on September, 25–26 2006 in Vienna

[12] Development of the Danube River Basin District Management Plan Strategy for coordination in a large international river basin

Table 4 covers a description of the chemical (surveillance and operational) and quantitative monitoring network for each GW-body. Table 5 collects relevant information and data on the level of monitoring points. The latter template was prepared in accordance with the GIS-templates.

The detailed description of the country specific approaches of the monitoring network design for each GW-body can be found in the Roof Report 2007 on Monitoring according to Article 8, Annex 1[13].

For GIS purposes templates for data collection were elaborated by the GIS EG. The templates relevant for groundwater issues are as follows and are attached in the Annex:

- GWBody
- GWBodyAggr
- GWStn

The detailed content of the templates is explained in the related code lists.

The templates need to be submitted to DANUBIS by the national GIS experts in close cooperation with the groundwater experts (GW TG members) who are mainly responsible for the groundwater related content.

4.6.2. For the purpose of the TNMN Yearbook

The agreed six-year reporting cycle which is foreseen under the TNMN, is in line with the reporting requirements under the WFD. This will allow for making any relevant statement on significant changes of groundwater status for the GW-bodies of basin-wide importance. A possibility of annual reporting of groundwater status was considered (as part of future TNMN Yearbooks) but it was pointed out that the slow character of changes in groundwater quality in response to the emerging pressures makes the added value of annual reporting questionable. Moreover, an informative note[14] on the regular reporting on the groundwater status within the DRBMP will be included in each TNMN Yearbook to provide public with a complete overview of the ICPDR monitoring activities. The note will be amended by explanation on which GW-bodies are of basin-wide importance. In case that any significant changes in status of monitored GW-bodies will occur, the GW TG will consider publishing this in the TNMN Yearbook.

Reporting to the ICPDR for TNMN purposes is foreseen in the following way[14] and summarised in Table 6:

- Groundwater quantity
  - Status/risk information and in case of poor status or risk the particular reason.
- Groundwater quality
  - Status/risk/trend information and in case of poor status or risk the particular reason;
  - Aggregated quality data on the level of GW-bodies for selected parameters e.g.:
    - Electrical conductivity, ammonium, nitrate;
    - Parameters characterising the GW-body; and
    - Parameters causing risk/poor status

[13] Monitoring Roof Report 2007

[14] 3rd Meeting of the ICPDR Groundwater Task Group on September, 25–26 2006 in Vienna

Table 4: Template monitoring networks

Please use for **each relevant transboundary GW-body** or a group of GW-bodies belonging to one transboundary GW-body **a separate document**.

EUCD_BODY	Unique code(s) of GW-Body(ies) (=MS_CD of Art.5 Annex 12 report) **within one transboundary GW-body**	
NAME	GW-body(ies) name	
Country	country name	

CHEMICAL MONITORING	
Criteria for chemical monitoring network design (e.g. referring to characterisation and pressures) & site selection (max. 2000 characters)	
Criteria for selection of parameters (max. 2000 characters). Please attach a list of parameters expected to be monitored (surveillance / operational) as a separate **attachment** if too long.	
Sampling and analysis methodologies (max. 2000 characters)	
Criteria for chemical monitoring frequency (max. 2000 characters)	
Measures taken for QA/QC (laboratories, data control, data flow, standards, …) (max. 2000 characters)	
Justifying why chemical monitoring programme/s are delayed (max. 2000 characters)	
Need of further development of the chemical monitoring programme (max. 2000 characters)	

QUANTITY MONITORING	
Criteria for quantity monitoring network design (e.g. referring to characterisation and pressures) & site selection (max. 2000 characters)	
Criteria for selection of parameters (max. 2000 characters)	
Sampling and analysis methodologies (max. 2000 characters)	
Criteria for quantity monitoring frequency (max. 2000 characters)	
Measures taken for QA/QC laboratories, data control, data flow, standards, …) (max. 2000 characters)	
Justifying why quantity monitoring programme/s are delayed (max. 2000 characters)	
Need of further development of the quantity monitoring programme (max. 2000 characters)	

MONITORING SITES	
Monitoring start date (max. 2000 characters)	
Number of sites (quantity) (max. 2000 characters)	
Number of sites (chemical) (max. 2000 characters)	
Number of sites associated to drinking water protected areas (Art.7) (max. 2000 characters)	
Additional monitoring requirements in relation to drinking water protected areas (max. 2000 characters)	
Number of sites associated to aquatic and/or terrestrial ecosystems (max. 2000 characters)	

[Source/Status: WFD Roof Report 2007]

Table 5: Template for the description of sampling stations

template description							
attribute name	**field name**	**field type***		**description of the attribute**	**obligation***	**values and codelists**	**example values**
EuropeanGWStCode	**EUCD_GWST**	string	24	International code for the GW station	m	ISO3166_CD Domain & [MSCD_GWst]	ATPG4000622
MSGWStCode	**MSCD_GWST**	string	22	National code for the GW station	m		PG4000622
Name	**NAME**	string	100	Locally used name of the GW Station	o		Hinter Heinrichs Hühnerhaus
EuropeanWaterBodyCode	**EUCD_BODY**	string	24	Unique code of parent GW Body	m		ATGK100158
Quantity	**QUANTUM**	string	1	Monitoring station of the groundwater level monitoring network for the quantitative status	m	Y=Yes, N=No	Y
Operational	**OPERAT**	string	1	Station Type (operational monitoring)	m	Y=Yes, N=No	N
Surveillance	**SURVEIL**	string	1	Station Type (surveillance monitoring)	m	Y=Yes, N=No	Y
ScreenRangeFrom	**SCREENFROM**	double	6,1	Screened range of depth **from** "m" below the surface of well	m		13,5
ScreenRangeTo	**SCREENTO**	double	6,1	Screened range of depth **to** "m" below the surface of well	m		18,5
ScreenDepth	**SCREENDEPTH**	string	1	What is the screen depth of the well within the vertical extension of the GW Body: U=upper, M=middle, L=lower, X=mixed. Field is empty for springs.	m	U, M, L, X, " "	L
WellOrSpring	**WELL_O_SPR**	string	6	Is the site a well or spring	m	well, spring	well
UseOfSite - Monitoring	**MONITOR**	String	3	Monitoring site is only used for monitoring	m	Y=Yes, N=No, U=unknown	N
UseOfSite - Drinkwater	**DRINKWATER**	String	3	Is the monitoring site part of the drinking water supply?	m	Y=Yes, N=No, U=unknown	Y
UseOfSite - Industry	**INDU_SUPPL**	String	3	Is the monitoring site part of the industrial water supply?	m	Y=Yes, N=No, U=unknown	N
UseOfSite - Irrigation	**IRRIGATION**	String	3	Is the monitoring site part of the irrigation water supply?	m	Y=Yes, N=No, U=unknown	N
UseOfSite - Other	**OTHE_SUPPL**	String	3	Is the monitoring site part of any other usage?	m	Y=Yes, N=No, U=unknown	U
Longitude	**LONGITUDE**	double	8,5	Longitude (decimal degree) in ETRS89 that represents EUCD_GWST	o		16,39586
Latitude	**LATITUDE**	double	8,5	Latitude (decimal degree) in ETRS89 that represents EUCD_GWST	o		48,20154
Part of Monitoring Network	**PART_O_NET**	string	100	Is the site part of other international monitoring networks (e.g. EIONET-water)?	m		EIONET, Nitrate-D
InsertedWhen	**INS_WHEN**	date		Moment of insertion in the database	m		01.11.2006
InsertedBy	**INS_BY**	string	15	Acronym of operator	m		scheidleder
MetadataID	**META_ID**	string	24	Link to Metadata	m	"GWST_" & ISO3166_CD Domain & RBDCode Domain	GWStn_AT1000
All sampling stations of all relevant national parts of transboundary GW-bodies (See Art 5) can be included in one list.							

[Source/Status: WFD Roof Report 2007]

Table 6: Aggregation procedures

Groundwater Quality Data			**Groundwater Quality Status**			**Groundwater Quantity Status**	
EUCD_BODY			EUCD_BODY			EUCD_BODY	
Reporting period from - to	2008-2013		reference year			reference year	
reference Year	2007, 2013,	every 6 years…	"at risk"	yes / possibly / no		"at risk"	yes / possibly / no
Parameter	parameter [unit]		Status	good / poor / (unknown - *decision until 2009)*		Status	good / poor / (unknown - *decision until 2009)*
Threshold value - TV			***if at risk or in poor status***			***if at risk or in poor status***	
Number of sites			for which parameter(s)			exceedance of available GW resource	Y/N / unknown
Number of sites > TV		***for Parameter***	increasing trends exceeding 75% TV	Y/N / unknown		failured achievement of Article 4 objectives for associated surface waters	Y/N / unknown
aggregated data per GW-body							
Minimum (of all sites - mean per site)	parameter unit	Conductivity	failured achievement of Article 4 objectives for associated surface waters	Y/N / unknown		significant damage to GW dependent terrestrial ecosystem	Y/N / unknown
Mean (based on mean per site)	parameter unit	NH4	significant damage to GW dependent terrestrial ecosystem	Y/N / unknown		uses affected	Y/N / unknown
standard deviation	parameter unit	NO3	intrusions detected	Y/N / unknown		intrusions detected or likely to happen due to alterations of flow directions resulting from level changes	Y/N / unknown
Maximum	parameter unit	+ all parameters at risk and poor status	Art 7 drinking water protected area affected	Y/N / unknown			
10 Percentile	parameter unit						
25 Percentile	parameter unit	+ additional parameters characterising the GW-chemistry					
50 Percentile	parameter unit						
75 Percentile	parameter unit						
90 Percentile	parameter unit						

[Source/Status: 3rd Meeting of the GW TG September 2006]

5. Need for bilateral information exchange

As river basin management according to the WFD is focusing on river basins, transboundary aspects are of immense importance. Bi- and multilateral cooperation and harmonization is needed since the adoption of the WFD, starting from the delineation of international river basins and river basin districts, the delineation and characterisation of transboundary GW-bodies, monitoring, the establishment of threshold values and continuing for the development and implementation of programmes of measures. This chapter provides the relevant legal findings of the WFD and the GWD concerning transboundary issues and as a consequence bilateral information exchange.

5.1. Coordination within RBDs (WFD)

WFD, Preamble

> *(35) Within a river basin where use of water may have transboundary effects, the requirements for the achievement of the environmental objectives established under this Directive, and in particular in all programmes of measures, should be coordinated for the whole of the river basin district. For river basins extending beyond the boundaries of the Community, Member States should endeavour to ensure the appropriate coordination with the relevant non-member States. This Directive is to contribute to the implementation of Community obligations under international conventions on water protection and management, notably the United Nations Convention on the protection an use of transboundary water courses and international lades, approved by Council Decision 95/308/EC and any succeeding agreements on its application.*

WFD, Article 3 - Coordination of administrative arrangements within river basin districts

Article 3 of the WFD clearly expresses the need of coordination between Member States sharing a river basin district and even with non-Member States coordination should be endeavoured to be established.

> *4. Member States shall ensure that the requirements of this Directive for the achievement of the environmental objectives established under Article 4, and in particular all programmes of measures are coordinated for the whole of the river basin district. For international river basin districts the Member States concerned shall together ensure this coordination and may, for this purpose, use existing structures stemming from international agreements. At the request of the Member States involved, the Commission shall act to facilitate the establishment of the programmes of measures.*
>
> *5. Where a river basin district extends beyond the territory of the Community, the Member State or Member States concerned shall endeavour to establish appropriate coordination with the relevant non-Member States, with the aim of achieving the objectives of this Directive throughout the river basin district. Member States shall ensure the application of the rules of this Directive within their territory.*

5.2. Characterisation (WFD)

Annex II, 2.3. - Review of the impact of human activity on groundwaters

For those bodies of groundwater which cross the boundary between two or more Member States or are identified following the initial characterisation undertaken in accordance with paragraph 2.1 as being at risk of failing to meet the objectives set for each body under Article 4, the following information shall, where relevant, be collected and maintained for each groundwater body: […]

5.3. Groundwater Monitoring (WFD, GWD)

GWD, Preamble

(16) In order to ensure consistent protection of groundwater, Member States sharing bodies of groundwater should coordinate their activities in respect of monitoring, […].

WFD, Annex V, 2.2. - Monitoring of groundwater quantitative status

2.2.2 Density of monitoring sites

[…] - for groundwater bodies within which groundwater flows across a MS boundary, ensure sufficient monitoring points are provided to estimate the direction and rate of groundwater flow across the Member State boundary.

2.2.3. Monitoring frequency

[…] - for groundwater bodies within which groundwater flows across a MS boundary, ensure sufficient frequency of measurement to estimate the direction and rate of groundwater flow across the Member State boundary.

WFD, Annex V, 2.4. - Monitoring of groundwater chemical status

2.4.2 Surveillance monitoring

[…] Sufficient monitoring sites shall be selected for

- *bodies which cross a MS boundary*

[…] Transboundary water bodies shall also be monitored for those parameters which are relevant for the protection of all of the uses supported by the groundwater flow.

5.4. Groundwater threshold values (GWD) and chemical status assessment

Common principles for establishing groundwater threshold values (TVs) and harmonization and coordination at setting such values within transboundary GW-bodies are the basis for comparable and harmonised assessment of groundwater chemical status and trend development.

GWD, Preamble

(16) In order to ensure consistent protection of groundwater, Member States sharing bodies of groundwater should coordinate their activities in respect of monitoring, the setting of threshold values, and the identification of relevant hazardous substances.

GWD, Article 3 –Criteria for assessing groundwater chemical status

2. Threshold values can be established at the national level, at the level of the river basin district or the part of the international river basin district falling within the territory of a Member State, or at the level of a body or a group of bodies of groundwater.

3. MS shall ensure that, for bodies of groundwater shared by two or more MS and for bodies of groundwater within which groundwater flows across a MS's boundary, the establishment of threshold values is subject to coordination between the MS concerned, in accordance with Article 3(4) of Directive 2000/60/EC.

4. Where a body or a group of bodies of groundwater extends beyond the territory of the Community, the MS(s) concerned shall endeavour to establish threshold values in coordination with the non-MS(s) concerned, in accordance with Article 3(5) of Directive 2000/60/EC.

At the 6th Groundwater Task Group Meeting[15] it was agreed that in the DRBMP for each transboundary GW-body the status will be reported for each national part separately, applying relevant national threshold values. The process of future coordination/harmonization of TVs and of the status assessment will be mentioned in the DRBMP making reference to GWD Article 3.3.

5.5. River Basin management Plans (WFD)

WFD, Article 13 – River basin management plans

2. In the case of an international river basin district falling entirely within the Community, Member States shall ensure coordination with the aim of producing a single international river basin management plan. Where such an international river basin management plan is not produced, Member States shall produce river basin management plans covering at least those parts of the international river basin district falling within their territory to achieve the objectives of this Directive.

3. In the case of an international river basin district extending beyond the boundaries of the Community, Member States shall endeavour to produce a single river basin management plan, and, where this is not possible, the plan shall at least cover the portion of the international river basin district lying within the territory of the Member State concerned.

5.6. Programme of measures (WFD)

WFD, Preamble

(33) The objective of achieving good water status should be pursued for each river basin, so that measures in respect of surface water and groundwaters belonging to the same ecological, hydrological and hydrogeological system are coordinated.

[15] Minutes of the 6th Groundwater Task Group Meeting, Vienna, 10-11 April 2008

6. Link to European Legislation and the EC-activities

6.1. The Water Framework Directive

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0060:20011216:EN:PDF

6.2. The Groundwater Directive

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0019:0031:EN:PDF

6.3. European Commission, DG Environment

The European Commission provides access to all legal provisions via EUR-Lex http://eur-lex.europa.eu; and offers access to monitor the decision-making process between institutions via PreLex http://ec.europa.eu/prelex/apcnet.cfm?CL=en

DG Environment provides a comprehensive website where all (ground)water relevant processes are described and related documents can be accessed:

- http://water.europa.eu/
- http://ec.europa.eu/environment/
- http://ec.europa.eu/environment/water/water-framework/groundwater.html
- CIRCA

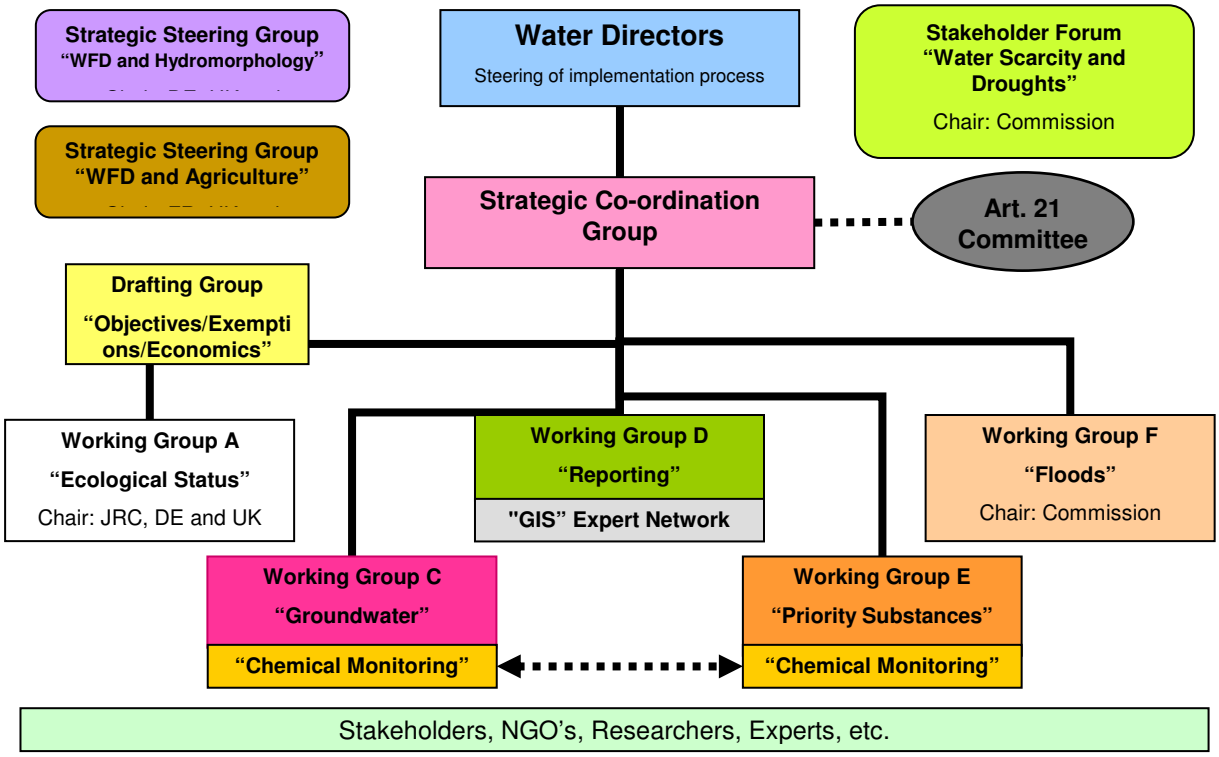
6.4. CIS Working groups

In order to address the challenges of the WFD in a co-operative and coordinated way, the MS, Norway and the Commission agreed on a Common Implementation Strategy (CIS) for the WFD. Furthermore, the Water Directors stressed the necessity to involve stakeholder, NGOs and the research community in this joint process as well as to enable the participation of Candidate Countries in order to facilitate their cohesion process. The main aim of this strategy is to ensure the coherent and harmonious implementation of the directive through the clarification of a number of methodological questions enabling a common understanding to be reached on the technical and scientific implications of the Water Framework Directive. In this framework, working groups or ad hoc expert groups carry out activities under the umbrella of a Strategic Coordination Group (SCG) composed of Member States and representatives of stakeholder organisations under the supervision of the Commission and EU Water Directors. [16]

Since the first phase of this joint process, a number of guidance documents were prepared and these documents were tested in Pilot River Basins across Europe. All guidance documents are available for download at the EC website.

[16] Groundwater Brochure: The new Groundwater Directive – Consolidating the EU regulatory framework.

Figure 2: Common Implementation Strategy (CIS) of the WFD



[Source: WFD CIS Progress and work programme for 2007-2009]

6.4.1. CIS Guidance Documents

All CIS guidance documents can be downloaded from CIRCA. Some selected guidance papers with strong relation to groundwater are listed below:

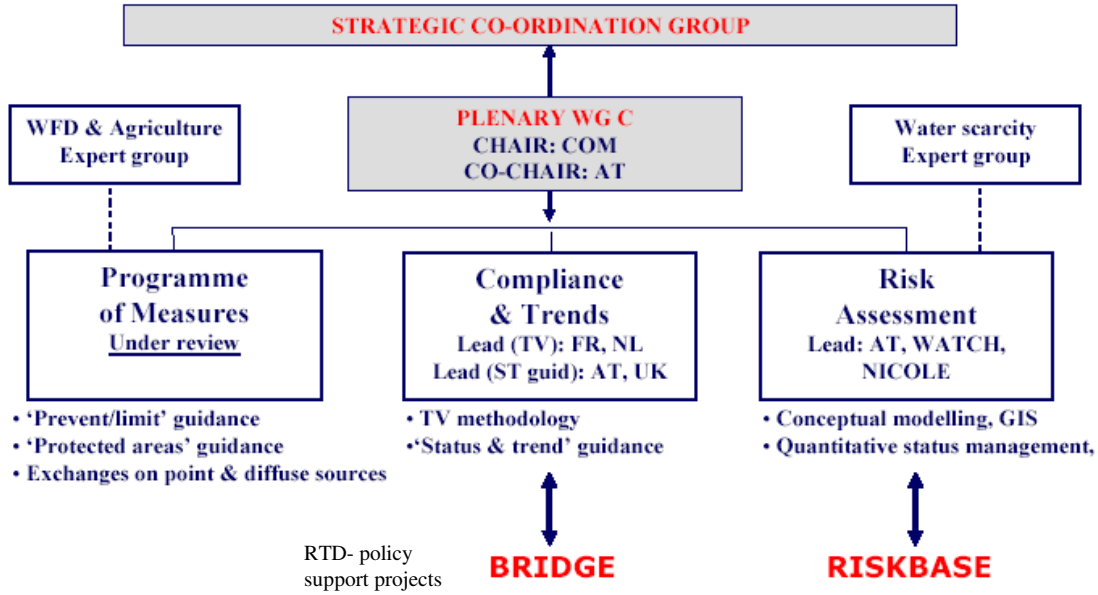
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC) Guidance No 2 - **Identification of water bodies**
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 3. **Analysis of Pressures and Impacts**.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 7. **Monitoring under the Water Framework Directive**.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 12. **The Role of Wetlands in the WFD.**
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 15. **Guidance on Groundwater Monitoring.**
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC) Guidance No 16 - **Groundwater in Drinking Water Protected Areas**
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC) Guidance No 17 – **Preventing and Limiting Direct and Indirect Inputs**

6.5. Working Group 'Groundwater' (WG C)

Within the framework of the CIS a technical Working Group on Groundwater (WG C) was established. Its original mission was to help the European Commission in the development phase of

the Groundwater Directive proposal, which took place in 2002–2004. The aim of the group then evolved in exchange of information and experiences on groundwater issues as they related to the WFD (e.g. characterisation, risk assessment, monitoring, chemical status and trends, programmes of measures). The members of the working group share information and experiences via different means such as workshops, technical reports and guidance documents which gather participants' experiences. The second phase of the working group (2004–2006) was successful and resulted in the publication of three technical reports (see below). The Working Group on Groundwater is now in its third period (2007–2009). The aim is to focus on implementing the new Groundwater Directive and the groundwater elements of the WFD, in particular monitoring and the preparation of the first River Basin Management Plan.[17]

Figure 3: Working Group C 'Groundwater'



6.5.1. Technical Reports on Groundwater

Technical Reports on groundwater provide information which has been developed on the basis of the CIS Guidance Documents and contributions from the participants of the Workshops of WG C 'Groundwater'. The reports highlight the main findings for Groundwater. Additionally the reports summarize the experience and experts knowledge of the Member States regarding the implementation of the WFD. The following reports are currently available. The technical reports can be downloaded at the EC website or from CIRCA

- Groundwater Trends,
- Groundwater Characterisation,
- Groundwater Monitoring,
- Groundwater Risk Assessment;
- Groundwater Management in the Mediterranean;
- Guidance on Groundwater Compliance & Trends-Interim Version Nov. 2007.

By the end of 2008 it is envisaged to provide a guidance document on the assessment of chemical and quantitative status, on how to establish groundwater threshold values and on how to assess trend and trend reversal.

[17] Groundwater Brochure: The new Groundwater Directive – Consolidating the EU regulatory framework.

6.6. Research and technological development projects (RTD-projects)

European Commission information on RTD: http://ec.europa.eu/research/rtdinfo/index_en.html

WISE-RTD (http://www.wise-rtd.info/): Consolidated experiences in water management. This web portal forwards to websites with focus on information relevant for the implementation of the WFD. Information is presented from all over Europe (and even beyond), at European, national and regional level as well as for river(sub-)basins.

BRIDGE (www.wfd-bridge.net): Background cRiteria for the IDentification of Groundwater thrEsholds. FP6 project developing a common methodology for establishing groundwater threshold values. (2005–2006)

RISKBASE (http://www.riskbase.info): The objective of RISKBASE is to review and synthesise the outcome of EC FP4–FP6 projects, and other major initiatives, related to integrated risk assessment-based management of the water/sediment/soil system at the river-basin scale.

NORMAN (www.norman-network.net): Network among European Reference Laboratories and Related Organisations Dealing with Emerging Environmental Pollutants. A self-sustained network of reference laboratories for monitoring emerging environmental pollutants.

EAQC-WISE (www.eaqc-wise.net): European Analytical Quality Control in support of the Water Framework Directive via the Water Information System for Europe. An FP6 project which aims at producing a blue print of an efficient and potentially sustainable QC system for WFD implementation.

SWIFT (www.swift-wfd.com): **S**creening methods for **W**ater data **I**n**F**orma**T**ion in support of the implementation of the WFD. It is a 6th FP project (2004–2006).

AQUATERRA (www.eu-aquaterra.de): Integrated project of FP6 that aims to provide the scientific basis for an improved river basin management.

BASELINE (www.bgs.ac.uk/hydrogeology/baseline/europe/home.html): Natural Baseline Quality in European Aquifers: A Basis for Aquifer Management.

FOOTPRINT (http://www.eu-footprint.org): Functional Tools for Pesticide Risk Assessment and Management. An FP6 project which provides three software tools to evaluate - and reduce - the risk of pesticides impacting on water resources at different scales (national and EU scale / catchment and regional / farm scale).

WATERCOST (http://www.watercost.org): The project is focusing on identifying and establishing a usable cost-effective analysis methodology based on existing knowledge, experience and expertise from different European regions. (2006–2007).

WFDvisual (www.WFDvisual.com): A comprehensive set of visualisation tools developed to support the communication on groundwater with the general public and decision makers. It includes the visualisation of a variety of pressures, groundwater aquifers, path ways and interactions with surface waters and ecosystems in 3-D. This image library (~1,200) is freely available for download.

7. Literature

EC (2003): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 2. Identification of water bodies.

EC (2003): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 3. Analysis of Pressures and Impacts.

EC (2006): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Improving the comparability and quality of the Water Framework Directive implementation. Progress and work programme for 2007-2009.

EC (2007): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 15. Guidance on Groundwater Monitoring.

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ICPDR (2005): The Danube River Basin District. River basin characteristics, impact of human activities and economic analysis required under Article 5, Annex II and Annex III, and inventory of protected areas required under Article 6, Annex IV of the EU Water Framework Directive (2000/60/EC). Part A – Basin-wide overview, (WFD Roof Report 2004), 18 March 2005.

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UN/ECE Programme Area III Monitoring and Assessment:
http://www.unece.org/env/water/cooperation/area423.htm

8. Annex

8.1. GIS Templates

The respective GIS templates relevant for GW issues are as follows and are attached in a separate file (Draft_Guidance_v-1_2008-11-04_Annex.xls):

- GWBody
- GWBodyAggr
- GWStn

The detailed content of the templates is explained in the related code lists.

The templates need to be submitted to DANUBIS by the national GIS experts in close cooperation with the groundwater experts (GW TG members) who are mainly responsible for the groundwater related content.