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Inception Report

Geographic Information System for the Danube River Basin (DRB GIS)

System Definition

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1 INTRODUCTION

This **inception report** of the system definition for a **Geographic Information System for the Danube River Basin** (**DRB GIS**) aims at specifying the Umweltbundesamt's approach to an efficient, high-quality implementation of the workpackages defined in the proposal[1].

The **paramount aim** of the system definition is the determination of a **system architecture consisting of state-of-the-art technology components** that meet the requirements of the institutions involved and the population of the Danube river basin most appropriately. Several documents devised by the EC and the ICPDR are taken into account to guarantee the comprehension of preparatory work for the DRB GIS as well as standards devised.

Since the methodological approach chosen as most appropriate for the development of a DRB GIS is an iterative one, feedback and the recurrent comprehension of requests and suggestions from the future users of the system is vital for project implementation. The inception phase for the definition of a DRB GIS started effectively on 16 August 2004 and will be completed by obtaining and including user's feedback at the meeting of the GIS ESG in Zagreb (23-24 September 2004). The Umweltbundesamt can then continue with the definition of the DRB GIS system in more detail.

1.1 Background

One of the central elements of the **Water Framework Directive (WFD)** is the integrated approach within a river basin. This demands a profound master data set for retrieving adequate information on the current situation. The Water Framework Directive's success therefore crucially depends on the effort to co-operate beyond regional and national borders. This commitment to co-operation is all the greater if the tasks to be performed are made as transparent as possible and the respective responsibilities and competencies are specified precisely. The appropriate instrument for this is the **management plan** as defined in Article 13 of the Water Framework Directive. The management plan will be supported by appropriate tools, one of which is a Geographical Information System providing the means for a strategic decision support system for policy making.

1.2 Umweltbundesamt

The Umweltbundesamt was founded in 1985 by the Austrian Environmental Control Act and acquired the status of a limited liability company (ownership is represented by the Minister of Agriculture, Forestry, Environment and Water Management) in 1999. As the environmental expert authority of Austria's Federal Government, the Umweltbundesamt is working for and in close cooperation with the Austrian Federal Ministry of Agriculture, Environment, and Water Management, the European Environment Agency, and the European Commission, its key tasks being

- environmental control (state of the environment reporting)
- technical expertise and innovation
- support of law enforcement

[1] Proposal: Geographic Information System for the Danube River Basin (DRB GIS): System Definition. Umweltbundesamt, Vienna, August 6, 2004.

The Umweltbundesamt employs specialists from all environmentally relevant disciplines to allow an integrative approach to environmental protection issues. The Agency has 360 staff members, about half of which have a university degree and are working predominantly in applied scientific research on environment-related issues.

The Umweltbundesamt is especially concerned with the WFD implementation on a national and international level and has therefore extensive experience in this field. As members of various bodies and working groups, our experts have been actively participating in the WFD implementation process since its earliest stages.

1.3 Water Framework Directive in Austria

The implementation of the WFD in Austria will be supported by **WISA,** the Water Information System Austria. On behalf of the Austrian Ministry for Agriculture, Forestry, Environment and Water Management, experts of the Umweltbundesamt and the Land-, forst- und wasserwirtschaftliche Rechenzentrum (LFRZ) are working on the system definition.

The project is subdivided into three modules: The **thematic and technology feasibility study** of WISA will be finished by November 2004; currently, our water management experts are working on the **analysis study**, its principal aim being the definition of the required system functions and the master data input list. Although on a smaller scale, the requirements for the WISA are comparable to those of a DRB GIS: The various datasets are maintained in the nine Austrian Federal States and at the Umweltbundesamt. They have to be retrieved from the data providers and merged to provide a basis for the roof report. The WISA implementation phase will start shortly.

Module 1	definition of objectives and as-is analysis, description of the nominal condition
Module 2	requirement specification, description of different options
Module 3	decision for preferred option, system specification

Table 1: Modules of the WISA project

2 DRB GIS: SYSTEM DEFINITION

2.1 Task 1: Overview of the desired system

2.1.1 Overview of the system, scope and restraints

The system architecture definition process is vital for obtaining a **short list of suitable options** for the implementation of the Danube River Basin GIS. These options include instructions how to develop and support a system that will satisfy the **involved users' needs**[2]. As defined in the "Strategic Plan for the development of the DANUBE RIVER BASIN GIS"[3] document, the system will primarily be a platform for exchanging geo-information and related issues. The vision outlines the intention of a DRB GIS to become a tool for reporting, management, and planning, while its system architecture remains as flexible as possible to be able to meet future requirements.

The **general system architecture** has to be approved by the institutions involved before the initial system starts. Once the initial implementation is operational, the **system environment** can be further tuned and adjusted to fit specific (further) user requirements.

The requirements can be broken down into the following issues, the main objectives of the system architecture thus being:

- support **WFD reporting** and **map making**
- integration of **existing and future information data sources** (e.g. Danubis) to increase usage effectiveness
- optimisation of **costs**
- anticipate **analysis and modelling functionality** for future system expansion and take this into consideration in the system definition and design phase. These functions will, however, not be conceived as a priority component of the DRB GIS now

The current system for document exchange and communication is the **DANUBIS** web portal. Since important information on the Danube River Basin and its riparian countries is already available there, the DRB GIS has to guarantee that the current platform will be integrated. No unnecessary duplication of data is intended. The mode of integration of the Danubis into the DRB GIS will have to be defined in the course of system definition. Also, the **existing infrastructure** will be taken into account. The **questionnaires** on "national GIS capabilities", "data inventory and data exchange" as well as the "EGM evaluation report" represent the framework on which a future system will be built up.[4] Also, the requirements of all ICPDR expert groups concerned have to be taken into account.

Software and hardware costs have decreased in recent years. Following the mainstream trend guarantees reasonable prices and good valued software packages (e.g. open source products). A **state-of-the-art specification** of hardware, software and network solutions

[2] Towards a Danube River Basin GIS: Needs Assessment and Conceptual Design for a Danube River Basin GIS System, Final Draft, KTH, Department of Land and Water Resources Engineering, Stockholm, 2003.

[3] Strategic Plan for the development of the DANUBE RIVER BASIN GIS, Zagreb, 16.02.2004.

[4] see questionnaires dispensed to the members of the GIS ESG (available in DANUBIS)

based on existing **prerequisites** and future **user needs** will provide the vantage point for the DRB GIS.

The starting point for the implementation of a DRB GIS as described in the Strategic Plan (p. 9: Technology and Implementation Plan) is the development of a system as described in the 2nd phase, i.e. a centralised DRB Web GIS. This centralised Web GIS will, however, already anticipate its future enhancement towards a decentralised system architecture.

	System architecture	Storage	Quality assurance	Access
2nd phase 2005-2008	centralised system	one database including all datasets	implementation based on one validation mechanism	one gateway
3rd phase 2008 -.....	decentralized DRB WebGIS	distributed data providers	implementation of validation per data provider	standards and protocols

Table 2: System architecture options as described in the Strategic Plan

The two options for the system architecture of a DRB GIS as described in the Strategic Plan are summarized in Table 2. Following this paper, the implementation of a centralised system that can later be modified to function as a data node in a future decentralised system is planned:

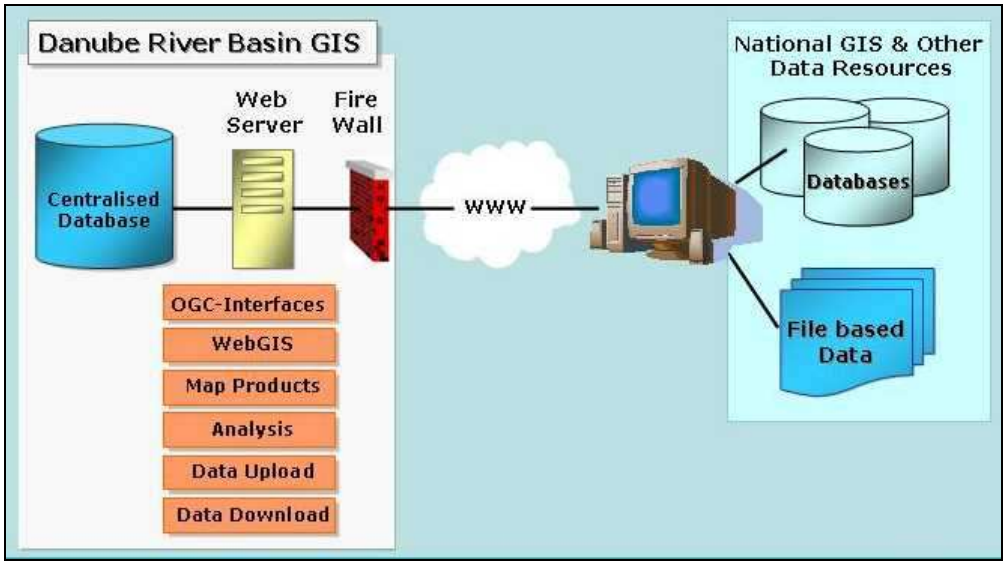

Figure 1: System Architecture: Centralised System

A **centralised system** provides one single database with harmonised datasets. These datasets can be queried and viewed with the same mechanism because one data model within one single database management system is used. Quality assurance checks can be implemented more easily because they are part of the underlying system's software. Access is provided in a specified way that may be a proprietary **industry solution** (e.g. ESRI) and/or

an **OGC-compliant system** (Web Feature Service, GML etc.). The advantage of this kind of system as opposed to a decentralised system architecture is that it can be **implemented faster and easier**. Therefore, this system architecture will be implemented in the first stage of a DRB GIS (see Figure 1).

In further years of usage, however, the enhancement of the centralised system towards a distributed and decentralised system should take place. The initial centralised system can then function as a special data node with aggregation functionality.

A **decentralised system** will provide access to distributed databases via the Internet. Aggregated information (e.g. necessary for the roof report) can only be retrieved if every database provides the implemented interfaces and these are permanently available online. Querying, download, upload and error checking should be made possible via **OGC** (Open Geospatial Consortium)**-Interfaces**.

The advantage of this option is that the transfer of data is reduced to a minimum. The main task here is to **define and setup the system**. During the follow-up years the effort required for maintaining several databases, web mapping services, web feature services and web servers should not be underestimated. Thus, we plan to already implement OGC-Interfaces in the DRB GIS as it will be developed now, so as to provide experience in the implementation for the second phase.

The intended system architecture will undergo the quality assessment procedures as described in chapter 2.1.3. The indicators to define the system's quality include the following:

- **availability** vs. down time (e.g.24hours/7days or 8 hours per day for 5 days/week)
- **performance tests** of server architecture, software, database, dynamic webpages, coding of system function → benchmarking
- **system updates (**e.g. security updates for operating system)
- **automated maintenance routines** to guarantee optimal system performance
- **predefined workflow for data handling** (e.g. for data upload)

As for the system maintenance, a high level of quality will be guaranteed by a **Service Level Agreement (SLA)** that determines which maintenance services are provided by an operational DRB GIS. Maintenance costs will depend on the specifications in this agreement. The system defined by the Umweltbundesamt does definitely not necessarily have to be implemented at the Umweltbundesamt, but can be run in any place.

Conclusion:

The system architecture will be designed to support reporting, whereby the main focus is on reporting according to the WFD, but other reports may be generated as well. State-of-the-art GIS-technology must incorporate Open GIS Interfaces and Services. Implementation of e.g. web mapping services and web feature services opens a wide range of applicability now and for the future. The definition will be the result of a wide range study of available and realizable solutions which will be tested to meet the specific demands for the Danube River Basin.

2.1.2 System measures

In the course of an overall risk analysis, measures of success for a DRB GIS system will be defined. These measures can then be used to evaluate the success of the system when completed.

2.1.3 Quality Assurance

Quality assurance is a crucial point in the development of a DRB GIS. To be able to guarantee the development of a high-quality product, the system's components as well as its content will undergo extensive quality assessment procedures. Wherever applicable, we will hereby follow the relevant ISO standards[5]. It is important to note that our commitment to the relevant ISO Standards does not imply any obligations (e.g. concerning data quality principles and procedures) for the Member States.

The quality assurance process is a continuous one throughout the DRB GIS development and implementation process, beginning with the definition of system measures and quality indicators, continuing with formalised control mechanisms and culminating in the assessment of the achievement of objectives and – if required – the necessary modifications. As for data quality, automated checks built into the system on the one hand and the clear definition of procedures and responsibilities for error correction on the other hand will support the optimization of the data input to the DRB GIS. A description of the quality assurance measures taken and a presentation of the results will be delivered in recurrent reports throughout the course of the project.

The **quality objectives for the system components** include aspects of performance, usability and availability (see 2.1.1), which will be defined in more detail once the principal system architecture has been agreed upon.

Data quality will be assured in a manifold manner. Firstly, data are checked according to their conformity to quality elements and standards defined: During the first upload of data by the data input user, automated quality checks (e.g. concerning attribute conformity and the existence/completeness of metadata) will be performed. A feedback message will then be generated and sent to the data input user. Secondly, reconcile users will be responsible for checking the data's seamless matching at country borders. Once this step has been taken, the decision maker as final authority for the national data sets can officially release the data. The procedures and responsibilities in this process will be clearly defined and included in the report.

2.1.4 Methodology

Taking the project's framework and the given organizational structures into account, we consider an iterative approach most appropriate for the development of a DRB GIS. In this methodological framework, the progress of work will regularly be presented to future users and the institutions involved. Input from these groups will then be used to continue and further refine our work, so that the final product fully matches the user's requirements. User input will be obtained in regular meetings or alternatively via requests for comments by e-mail or in an online discussion forum (as already existing in Danubis). As the reports to be delivered, meetings and other input requests constitute points of time when user feedback is be-

[5] ISO 19113: Geographic Information – Quality principles, ISO 19114: Geographic Information: Quality information procedures

ing included in the project, each of these dates represents the finalization of one iteration in the project process.

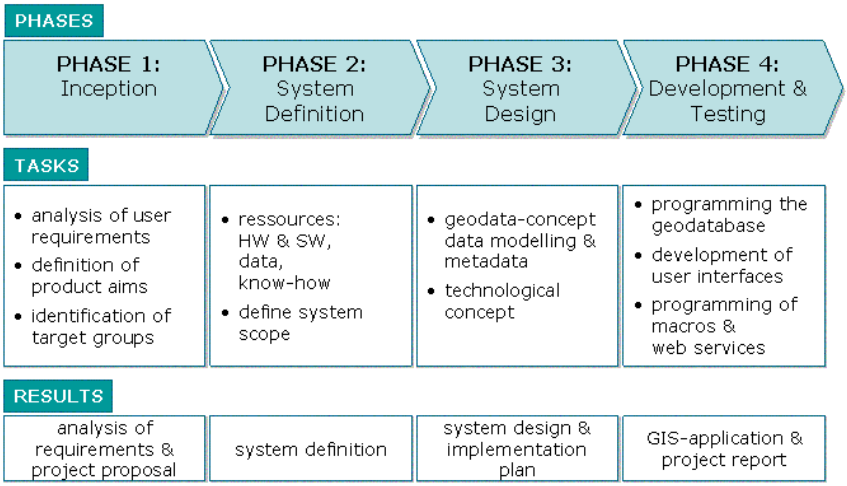

Figure 2: GIS Methodology

Figure 2 gives an overview of our methodological framework, showing the basic phases a GIS project should undergo in a linear manner. (For the DRB GIS, the completion of the Inception Report marks the end of Phase 1, which has in fact already begun with the preparation of papers like for example the DRB GIS Needs Assessment[6]. Currently, we are in the System Definition Phase.) In every phase, recurrent cycles of reporting to and feedback from future users are added to support our user-oriented approach. In that way, our methodology reflects the approach taken e.g. by the Rational Unified Process (see figure 3). We will, however, not commit ourselves to a proprietary software package for methodological planning.

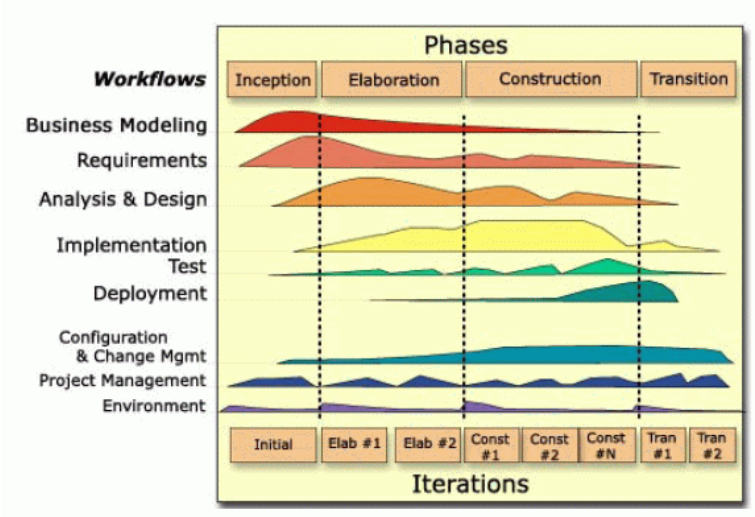

Figure 3: Example for Iterative Planning[7]

[6] „Towards a Danube River Basin GIS: Needs Assessment and Conceptual Design for the Danube River Basin GIS System“, KTH, Department of Land and Water Resources Engineering, Stockholm, 2003.

[7] Source: http://www-106.ibm.com/developerworks/rational/library/content/RationalEdge/jan01/WhatIstheRationalUnifiedProcessJan01.pdf (17. 9. 2004)

2.2 Task 2: Geo-Information Products

The list of products from the DRB GIS mainly contains three features: maps, tables and diagrams.

2.2.1 Maps

One of the principle functionalities of a WebGIS is the production of interactive maps. Apart from viewing the maps on-screen, the system will provide the possibility for users to print the maps they generated or save them (in pdf of graphic format) on their own hard-disk. For that purpose, there will be templates for maps to be printed out from the WebGIS. That is, the user chooses from the list of layers he/she wants to be included in the map. The result of this action plus the choice of the style (page size and orientation) will constitute the final map.

Furthermore, a style guide for Danube maps will be defined. This style guide can either be composed of map templates users can download and use directly in their GIS or of picture graphics. For either possibilities, a proposal will be made for the character set to be used in the maps and for the placement of the different map elements (title, scale bar, source, ...), which has to be based on cartographic principles.

The maps that can be created in the DRB GIS can serve for working purposes only. Since there will not be any interaction with a cartographer during map creation, the system can only give guidelines for map production rather than delivering a finished high-quality map product.

Apart from the possibilities of the production of working maps, all already finished map-products (like the maps for the Roof Report 2004 and others disposable in Danubis) will be made available for download or print-out via the system. Since these map products will be subject to updates and by 2006 further WFD reporting maps concerning "monitoring" will follow, the Umweltbundesamt will offer an extra item (outside of the DRB GIS System) of cartographic work on WFD reporting maps.

2.2.2 Tables

Tables as an extract of the Danube GIS-databases can be either displayed on screen or exported to a file (e.g. XML or XLS). The Danube GIS user can choose out of a list of data themes and their attributes. The output of this action can be amended by queries.

A list of predefined queries will be available for standard table outputs (e.g. for the public user). The expert user can store his/her advanced queries. However, there will be no final query tables stored in the system - the tables will be created on the fly based on the data in the system.

2.2.3 Diagrams

Charts will be created directly from the data stored in the GIS system. The expert user can choose out of a list of data themes and their attributes and create a chart based on a chart template (e.g. bar chart, pie chart, ...). The chart can be exported to a graphic format.

The public user can choose a chart out of an assortment of choices and the chart will be created based on standard queries (comparable to the creation of public user tables).

2.2.4 Other Products

As soon as the reporting requirement definitions for the different European administrative units (European Commission, Environment Agency, …) are finished, a translation tool from DRB GIS to the different European data formats can be implemented in a next stage of the DRB GIS extension. This tool would include schema and codelist mapping.

The list of Geo-Information Products will be completed and worked out in detail for the final report of the DRB GIS definition phase.

2.3 Task 3: Master Input Data List

Data in the DRB GIS will be used for different purposes, the most important being the following[8]:

- River Basin Management (RBM) within the ICPDR
- EU Water Framework Directive support for reporting
- Strategic decision-making
- Public information dissemination

The fact that the DRB GIS will be used for different purposes leads to the differentiation of several data user groups with varying user rights (see use cases shown in Figure 5).

To reach a DRB GIS data set fulfilling all the purposes required, it will be necessary to start working in a pragmatic way and to keep the data list as well as the system handling open for future enlargement and enhancement of the data set. In the DRB GIS needs assessment[9] a three stages scenario with a short, a medium and a long term view has been drafted. These scenarios can be "translated" into three different eras for the DRB GIS: the short time view represents the pre-DRB GIS era. The medium time frame must be seen as an era of pragmatic work, which means that (basic) data available have to be adjusted as good as possible, but going for best quality. The pragmatic era also is the period when standards have to be set and data models have to be fully developed. The long term time frame can be called the enhancement era and will allow substituting inferior data with higher quality data.

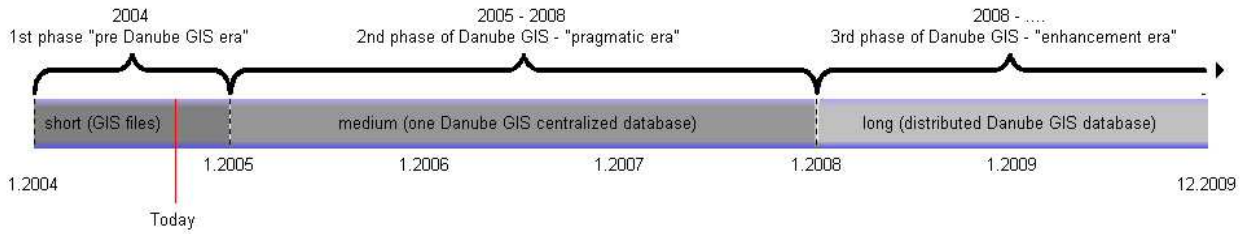

Figure 4: Timeline for data preparation

[8] Strategic Plan for the development of the DANUBE RIVER BASIN GIS, Zagreb, 16.02.2004

[9] „Towards a Danube River Basin GIS: Needs Assessment and Conceptual Design for the Danube River Basin GIS System“, KTH, Department of Land and Water Resources Engineering, Stockholm, 2003.

2.3.1 Data Harmonisation

Data harmonisation is an imperative for obtaining a functioning common DRB GIS. The centralised administrator or a centralised contractor of the DRB GIS can contribute to the harmonisation process, but it will not be possible to carry out the total amount of harmonisation work necessary.

Why is it not possible for the DRB GIS administrator/contractor to do data harmonisation?

Data harmonisation has to be carried out on at least two levels:

1. Harmonisation as regards data content
2. Harmonisation of the geometry

Because it is mainly a semantic task, the **harmonisation regarding data content** has to be carried out in the appropriate committee. For example, several classifications for river types are in use in the Danube River Basin's countries. The harmonisation of river types should lead to a concerted code list of river types.

The **harmonisation of geometry** has to be carried out on the basis of bilateral agreements/cooperations of the Danube River Basin states. It is not possible for one centralised user to intervene with national data, because there is no mandate for such an intervention.

Contributions of the DRB GIS administrator/contractor to data harmonisation

Templates:

Templates for attributes will be provided for every thematic layer. For any differences between national naming and DRB GIS naming of attributes, a **schema mapping** tool for the translation of the national attribute name to the DRB GIS attribute name will be provided. For the matching of codes there will be a **code-translator** available.

Geometry Framework:

To obtain a common geometry, the adoption of common standards (e.g. common geodetic reference system for DRB GIS data, approved positional accuracy) will be the basis, but this will not be enough. For the positional data fitting, which as pointed out above mainly is a bilateral national task, a DRB GIS framework of steps to be fulfilled will finally lead to a seamless data set. The quality principles of ISO 19113[10] will be applied to this framework and the framework will be close to the WFD GIS Guidance Document[11].

[10] ISO 19113: Geographic Information – Quality principles

[11] Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No 9 Implementing the Geographical Information System Elements (GIS) of the Water Framework Directive. Produced by Working Group 3.1 – GIS

	2nd phase - pragmatic	3rd phase - enhancement
agree on common data quality for reporting	EGM data quality - the tolerance for connection at borders and the related accuracy should be better or equal to 1/10 of the accuracy of the EGM dataset	ERM data quality - the tolerance for connection at borders and the related accuracy should be better or equal to 1/10 of the accuracy of the ERM dataset
discuss and harmonise the boundaries of trans-national river basin districts, including the connection of the river network	National task	National task
use/adopt the harmonised boundaries for national purposes	National task	National task
maintain the agreed boundaries as long as possible	National task	National task
re-start the process of harmonisation in case of changes	National task	National task
check that the agreed boundaries are used/maintained	National task	National task

Table 3: Harmonisation steps

The data can be put into the DRB GIS for working purposes, where the person responsible (data input user) can observe problems of mismatched data position. Problems concerning inadequate topology (holes in data, overlapping data or data reaching outside the input user's national territory) or missing data components (attributes, metadata) will be detected by the data input procedures and reported to the data input user. A list of persons who are responsible for the transnational harmonisation of the data (reconcile users) will be available in the system. At the national level, the cooperation between the authorities responsible for RBM or the WFD implementation process and the national mapping agency is necessary.

2.3.2 Metadata

The metadata model should be based on ISO 19115[12]. The mandatory core metadata for geographic datasets have to be included to meet future requirements, but it would be advisable to create a DRB GIS Community Profile or find a registered Metadata Profile that fulfils the DRB GIS needs.

Mandatory core metadata for geographic datasets are:

1. Dataset title
2. Dataset reference date
3. Geographic location of the dataset
4. Dataset language
5. Dataset character set
6. Dataset topic category
7. Abstract describing the dataset

[12] ISO 19115: Geographic Information - Metadata

8. Metadata language
9. Metadata character set
10. Metadata point of contact
11. Metadata date stamp

Optional core metadata for geographic datasets are:

1. Dataset responsible party
2. Spatial resolution of the dataset
3. Distribution format
4. Additional extent information for the dataset (vertical and temporal)
5. Spatial representation type
6. Reference system
7. Lineage
8. On-line resource
9. Metadata file identifier
10. Metadata standard name
11. Metadata standard version

It is recommended to use at least 1., 2., 5., 6., 7. of the optional metadata, as well as data constraints (e.g. legal issues, responsibilities, …) as mandatory metadata items in the DRB GIS. Furthermore, a series of metadata extensions to cover all the metadata that is already included in data used in Danubis should be added. A proposal will be made after reviewing the information available in Danubis. The model will be formulated using UML.

2.3.3 DRB GIS Data List

The Master Input Data List for the 2nd phase of the DRB GIS consists of the layers promoted by the WFD GIS Guidance Document[13] plus the data already available in the Danube information system. Table 4 (continued on the following page) gives an overview of the datasets (layers) required for WFD reporting classified by the maps proposed in the Guidance Document.

Map Name	Layer Code	Layer Name	Feature Type	Availability and Reporting Dates[1]
1: RBD-Overview				
	SW1	River basin district (RBD)	polygon	12/2003 (RBD) 06/2004 (CEC)
	SW2	River basin, sub-basin	polygon	
	SW3	Main Rivers[2]	line	
2: Competent Authorities				
	D7	District of competent authorities	polygon	12/2003 (RBD) 06/2004 (CEC)
3: Surface Water Bodies (SWB) – categories -				
	SW4	Surface water bodies - Rivers - Lakes - Transitional waters - Coastal waters if applicable, indicated as artificial SWB or heavily modified SWB	line polygon polygon polygon	12/2004 (RBD) 12/2009 (CEC)*
4: Surface Water Bodies (SWB) – types -				
	SW4a	Types of Surface Water bodies	attribute of SW4	12/2004 (RBD) 12/2004 (CEC)* 12/2009 (CEC)*
	D6	Ecoregions	polygon	
5: Groundwater Bodies				
	GW1	Bodies of groundwater	polygon	12/2004 (RBD) 12/2009 (CEC)*
6: Monitoring Network for Surface Water Bodies				
	SW5a	Operational monitoring sites. Inclusive monitoring sites for habitat and species protected areas	point	12/2006 (RBD) 12/2009 (CEC)
	SW5b	Surveillance monitoring sites	point	
	SW5c	Monitoring sites drinking water abstraction points from surface water	point	
	SW5d	Investigative monitoring sites	point	
	SW5e	Reference monitoring sites	point	

[13] Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No 9 Implementing the Geographical Information System Elements (GIS) of the Water Framework Directive. Produced by Working Group 3.1 – GIS. p. 15f.

Map Name	Layer Code	Layer Name	Feature Type	Availability and Reporting Dates[1]
7: Ecological Status and Ecological Potential of Surface Water Bodies				
	SW4b	Ecological status	attribute of SW4	12/2009 (RBD) 12/2009 (CEC)
	SW4c	Ecological potential	attribute of SW4	
	SW4d	Bad status or potential causes by (non-) synthetic pollutants	attribute of SW4	
8: Chemical Status of Surface Water Bodies				
	SW4c	Chemical status	attribute of SW4	12/2009 (RBD) 12/2009 (CEC)
9: Groundwater Status				
	GW1a	Quantitative status of groundwater bodies	attribute of GW1	12/2009 (RBD) 12/2009 (CEC)
	GW1b	Chemical status of groundwater bodies	attribute of GW1	
	GW1c	Pollutant trend	attribute of GW1	
10: Groundwater Monitoring Network				
	GW2a	Groundwater level monitoring network	point	12/2006 (RBD) 12/2009 (CEC)
	GW2b	Operational monitoring network chemical	point	
	GW2c	Surveillance monitoring network chemical	point	
11: Protected Areas				
	PA1	Drinking water protection areas	polygon	12/2004 (RBD) 12/2009 (CEC)
	PA2	Economically significant aquatic species protection areas	polygon	
	PA3	Recreational waters	point	
	PA4	Nutrition-sensitive areas	polygon	
	PA5	Habitat protection areas (FFH)	polygon	
	PA6	Bird protection areas	polygon	
12: Status of Protected Areas				
	PA7	Status of protected areas	attribute of PA1-PA6	12/2009 (RBD) 12/2009 (CEC)

Table 4: Input Data List according to the GIS Guidance Document

The list will be extended after finishing the review of the Danube information system. Most importantly, it will be refined and extended so that the layers already used for the production of the Roof Report 2004 are included. Further possible sources for data that should be included in the Master Input Data List are the WasserBLIcK, the EU reporting sheets and the current Prototype, and any data already available in the Danubis.

For the 3rd phase the list can be extended with further topics discussed in the committees.

2.3.4 Data Constraints

It has already been pointed out that it can not be expected that all datasets required will be available for the DRB GIS immediately and in the accuracy desired. Thus the possible data constraints have to be listed, the most important being

- lack of data
- harmonisation problems
- generalisation problems
- coding problems

The resolution of the input data sets requested for the DRB GIS plays a significant role in dealing with the tasks listed above.

2.4 Task 4: System Functions

The system functions are designed using UML (Unified Markup Language). The **Use Case Diagram** is a state-of-the-art way to discuss system functions on the basis of a common language. To facilitate mutual understanding, comments describing the use cases are added.

Based on the Needs Assessment[14], the core needs of a DRB GIS can be identified as follows: With the help of a **toolset for information production, handling, and dissemination**, the DRB GIS will make environmental information available via the Internet. The DRB GIS should be the foundation database for further common datasets of the Danube River Basin. Furthermore, the DRB GIS will aid in enhancing a common "**Danube identity**" which will be strengthened by transboundary analysis, maps and, consequently, concerted decision-making.

The four **common needs** of user groups identified in the Needs Assessment are:

- maps
- a system on the overview scale
- centrally initiated and developed GIS database
- public access

The most important **functionalities** of the DRB GIS determined in the Strategic Plan[15] are:

- **Provide data** for Member States GIS
- **Receive information** from Member States GIS
- **Provide information** for ICPDR users, Member States GIS, and external users including the public

Information provision will be extended to national experts and several working groups of the Danube river basin, most importantly the RBM Expert Group.

[14] Towards a Danube River Basin GIS: Needs Assessment and Conceptual Design for the Danube River Basin GIS System, KTH, Department of Land and Water Resources Engineering, Stockholm, 2003.

[15] Strategic Plan for the development of the DANUBE RIVER BASIN GIS, Zagreb, 16.02.2004

The following graphic (figure 5) provides a broad outline of **use cases** necessary to differentiate. A detailed view of the use cases will be portrayed in the final report. From top to bottom, the roles successively receive more tools and rights to change the input of the system. For example, the data input user may access every tool from the user above (the expert user), but not from the user below (e.g. the administrator).

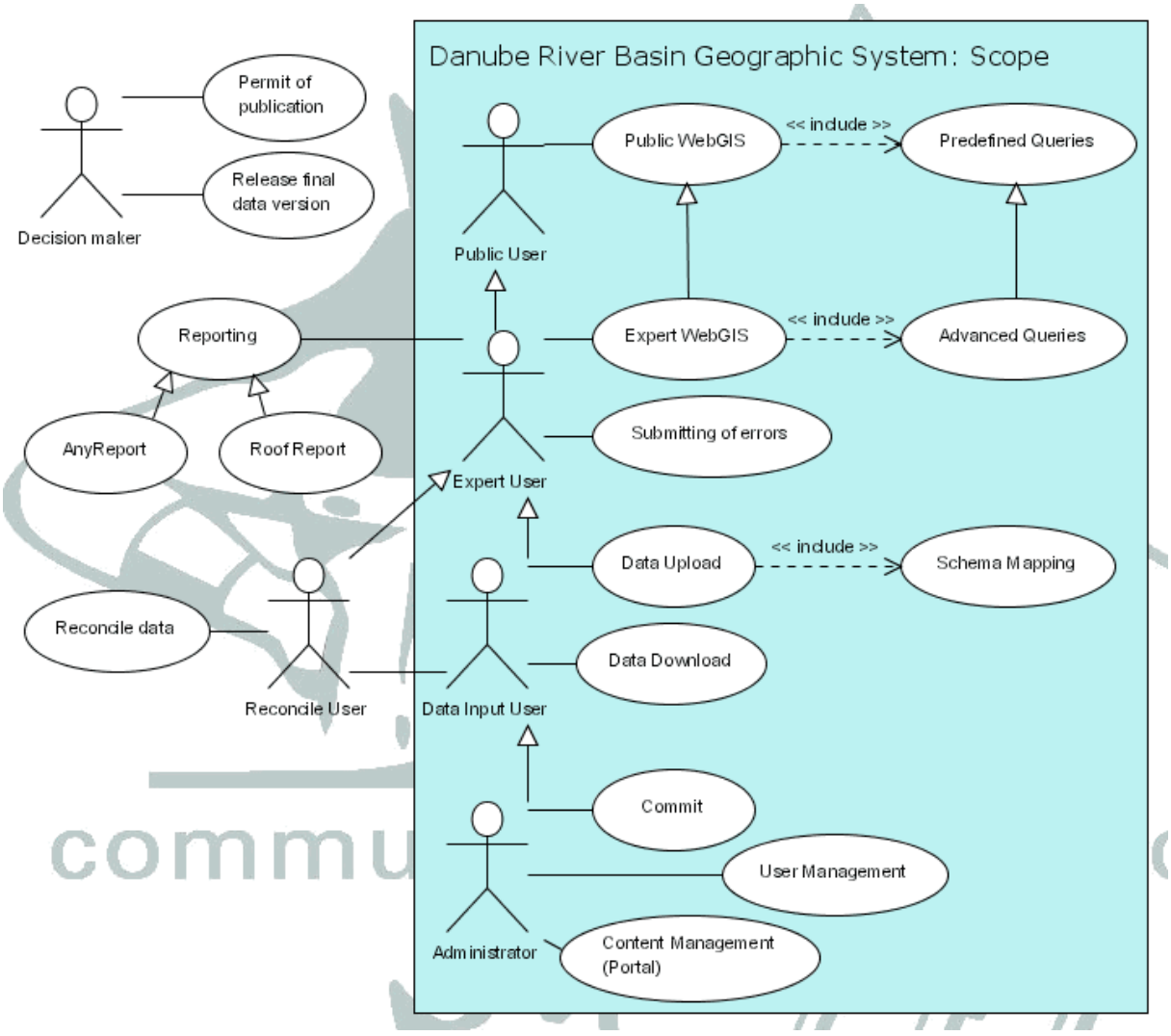

Figure 5: Use Cases of DRB GIS (created with Poseidon for UML, Community Edition)

- Outside the DRB GIS system, there is one **decision maker** per country who is responsible for the data in a legal sense and thus represents a national focal point in this matter. She/he accepts the results of national GIS data input and the result of reconciling in Danube River Basin GIS. She/he decides whether a new version of aggregated and simplified data should be made available for the public via WebGIS and querying tools.

- **Public User**: any web user who is interested in the condition of the Danube. He/she will be able to view dynamic maps with a WebGIS application. Querying of the database is integrated, but only "pre-defined", simple queries are available and not the whole content

can be viewed. No authentification is necessary. This user represents the external users including the public.

- **Expert user**: this user also has access via the Internet but to gain more information than the anonymous user, special system roles are provided (authorized user). The expert user inherits all user rights from the public user, and the rights are extended to viewing more complex maps and retrieving more information from the database. Authentification is obligatory. This user's main interest lies in creating reports (table, text, diagram and/or map). This may be the WFD roof report or any other kind of report. The expert user supports the "national focal points" and in finding political consensus on the national data sets before releasing/committing the final version. If the expert user detects problems concerning the available datasets (attribute data errors) or the system functions, he/she can automatically submit the errors to the administrator or to the responsible contact person (administrator, data input user or reconcile user).

- **Data input user**: This user's main activity is the submitting of data to the Danube River Basin GIS. The data input user represents the ICPDR Member States' GIS user who submits the data (and metadata) required for WFD reporting and who wants to retrieve GIS data from the DRB GIS (e.g. EuroGlobalMap). When the transaction is committed, quality assurance mechanisms check whether the uploaded data have any errors (topology, data type of attributes, compliant with schema...) and feedback of success or error is then provided (e.g. email, workflow webpage). If the upload of datasets is successful, attribute data and geometry suits the specific requirements of WFD reporting. Schema mapping via a secure webpage will allow the automatic "translation" of field names and attributes from national coding systems into WFD coding. The data input user may update/change only datasets of his own country; for other countries' datasets and maps only viewing is allowed. The user role of the data input user needs authorisation (e.g. to upload/delete/change own data) and authentification.

- **Reconcile user**: This user is a special data input user with extended rights. The institution/person responsible has to be nominated by neighbouring countries. She/he is supervises the matching of transboundary datasets and thus has to communicate with national data input users to get commitment to the shared boundary areas. The result of the matching process is submitted to the data input user. Since the data input user remains responsible for his/her national data and thus can also reject the reconcile user's suggestion, the reconcile user is an optional role.

- **Administrator**: The administrator is responsible for maintenance of the whole system architecture with all its functions. This user controls the workflow of data input, data change and data commitment by the data input user and the reconcile user. Working products are not committed to the public but remain in the secure part of the DRB GIS until the administrator commits the final versions to the database. The installation of users and their associated roles is one of the main tasks of the administrator. She/he is not involved in the thematic content of the portal but in the appropriateness of the web application and the database. The administrator is represented by the GIS manager or one of her/his technical team.

Quality assurance for the system functions will comprise a set of the following features:

- **Usability**: self explaining user interfaces with minimum training effort and a help system will be available. An integrated help system enables users' selfhelp. A tutorial for first usage may be included.
- **Training:** users of DRB GIS will get training based on workshops
- **Check on GIS-datasets:** geometry type, extent of geometry, projection, topology if available by the chosen system, completeness of attribute data (see also chapter 2.3)
- **Check on metadatasets:** metadatasets should be ISO 19115 compliant

As soon as the overview of the system as described in chapter 2.1 has been discussed with the members of the GIS ESG and agreed by the ICPDR representatives, the detailed specification of the system functions will proceed.

2.5 Task 5: Workplan and costs for the DRB GIS implementation

The detailed composition of the workplan for the implementation of the DRB GIS can begin as soon as the principal system functions have been coordinated with and agreed by the members of the GIS ESG and the ICPDR. The workplan will include an estimation of costs for different alternatives for the DRB GIS development (i.e. with proprietary software / open-source solution / mixed solution using both open source and proprietary software products).

3 WORKPLAN

The work plan for the System Definition of the DRB GIS includes an Inception Report, to be presented at the 10th meeting of the GIS ESG in Zagreb (23 – 24 Sept. 2004 in Zagreb), a Progress of Work report which is due for the 15th RBM EG meeting 11 – 13 Oct. 2004 in Brussels and a draft of the Final Report by mid-December 2004. The finalized version of the Report will be delivered by the end of January 2004. An optional meeting in November has been included for possible further consultation with the project coordination group (consisting of a member of the UNDP/GEF DRP, the chairperson of the GIS ESG, a representative of the Secretariat and of the Umweltbundesamt's project team).

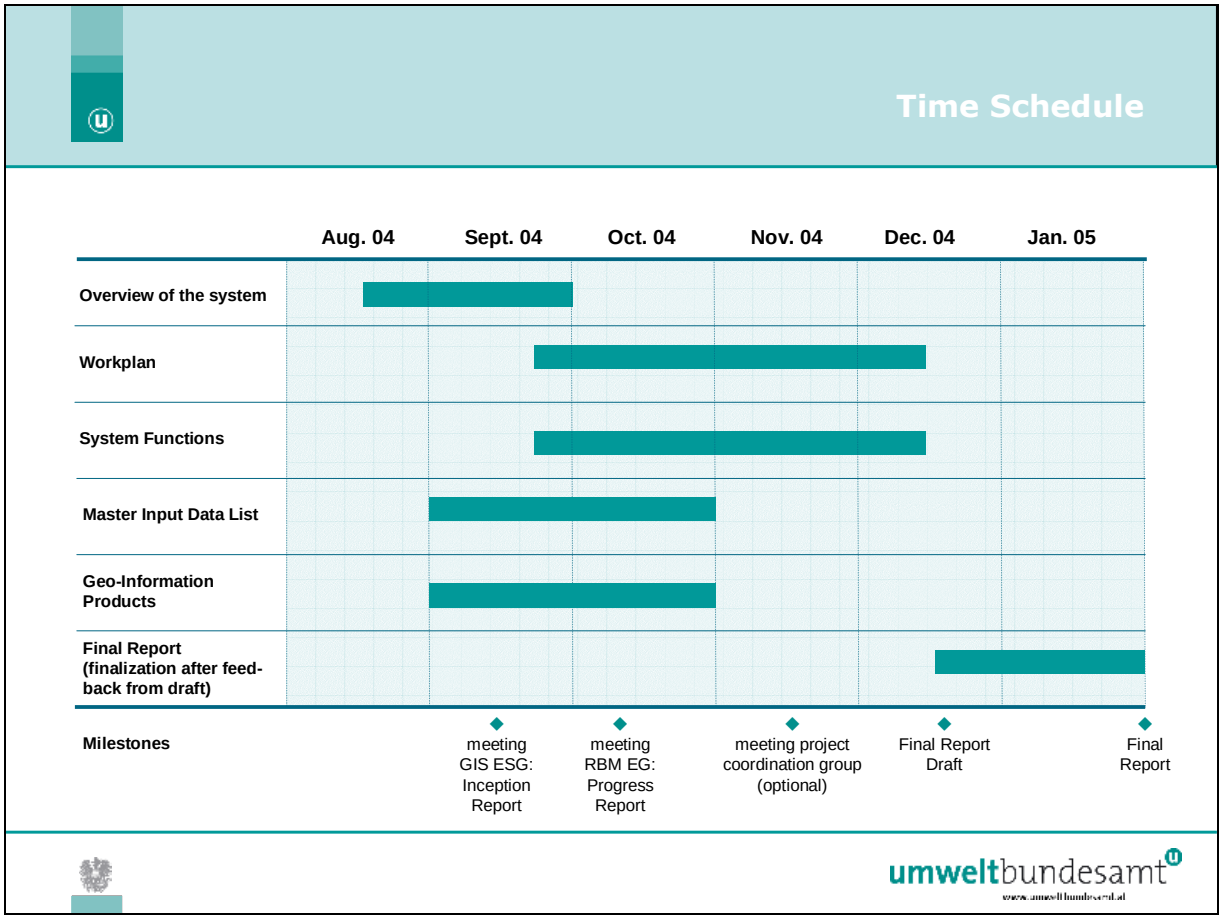

Figure 6: Workplan for the DRB GIS Definition

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