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Objekttyp: **Article**

Zeitschrift: **Wasser Energie Luft = Eau énergie air = Acqua energia aria**

Band (Jahr): **98 (2006)**

Heft 3

PDF erstellt am: **12.07.2024**

Persistenter Link: https://doi.org/10.5169/seals-939345

«Alpreserv Database: Sharing Information on Reservoirs»

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Abstract

In order to facilitate access and sharing of the information on the reservoirs Alpreserv database was created. The database enables storage of data in large quantities and extent data mining and also successful editing and technical administration of the collected data. At the first stage the Alpreserv database was prepared and tested on a simplified level and the extent of data has been reduced. At this level Alpreserv database is already accessible on the Alpreserv homepage by using the Alpreserv database application. So far the data of seven pilot action projects has been collected.

1. Introduction

In the frame of an international established project called Sustainable Sediment Management of Alpine Reservoirs considering ecological and economical aspects (hereinafter Alpreserv project) several typical reservoirs were selected for pilot projects. The activities are focused on different strategies to transfer or remove sediments in a larger scale taking into consideration the fragile environment of the Alps. The measurements in those pilot projects are accompanied by extended measurements of biotic and non-biotic parameters using experiences from different nations and competent authorities. Information of sediment removal efforts throughout the Alps will add valuable data not only for project but also for future management tasks.

One of mayor results of the Alpreserv project is the established database which will support several activities from collecting to analysis of information on reservoirs of different geometry and operational procedures. By means of intensive cooperation within the partner network database could be extended by collecting datasets of several monitoring stations or from other sources if applicable.

Proactive collaboration of the involved public authorities on all relevant levels ensures the solid basis and expertize of common sediment management approaches for reservoirs. It is already provided that the database is accessible via internet allowing data input. It serves as a basic information and communication tool between the partners as well as public administrations, research institutes and commercial businesses (e.g. planning and engineering companies).

2. Alpreserv database

Database was prepared for the purpose of collecting as much valuable information about different types of reservoirs with different types of managing operations. On the other hand Alpreserv database must be operative from the very first beginning even if we haven't got all the data. Data are stored in many tables that have to be logically connected as unique data storage which can provide not only basic queries about reservoir but also nested queries with which we can calculate large amount of datasets for decision making processes on different levels.

The best way to build a database

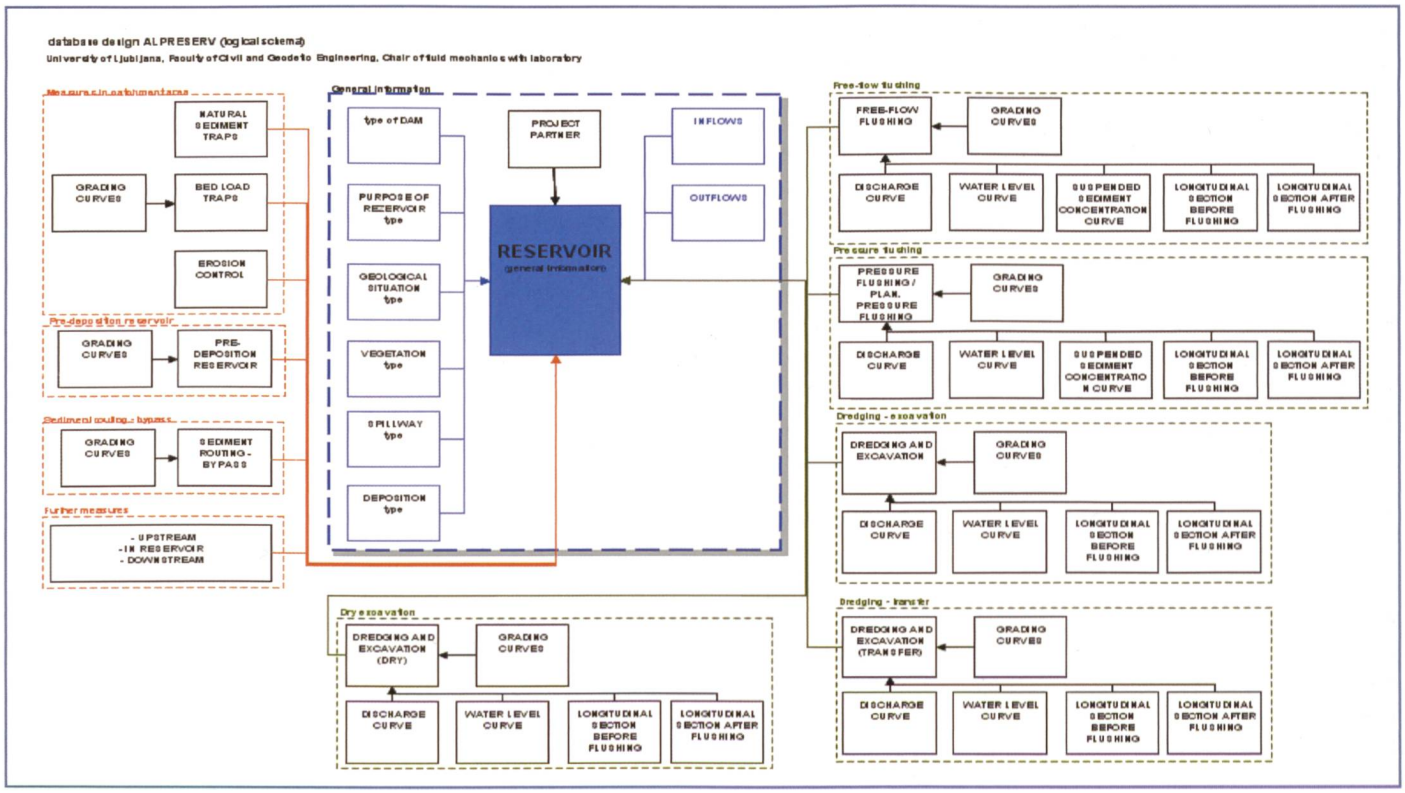

Figure 1. Alpreserv database structure.

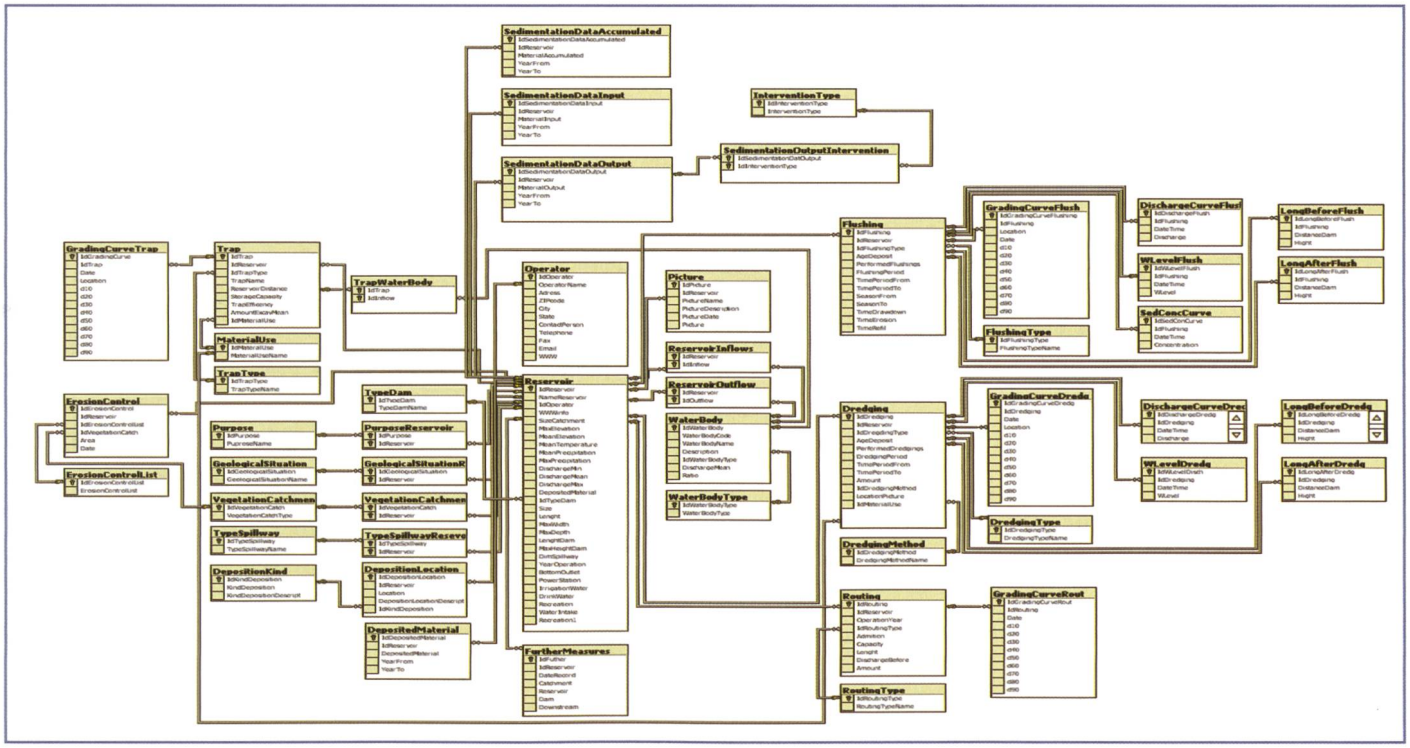

Figure 2. Alpreserv database logical schema (software Microsoft SQL server 2000).

is to know the answers that database can provide. However, each answer is almost always unknown. For this reason databases have been built to store large amount of datasets in the so-called data warehouses. Alpreserv database is set up as a data warehouse to store a large amount of data which can be only basic information about reservoirs or extended information about management of reservoirs or activities related to the reservoirs. Database structure *(figure 1)* and logical schema *(figure 2)* of Alpreserv database allows future extension of the database structure and also extended database management such as data mining and OLAP (On-line Analytical Processing).

Alpreserv database can support users' needs with data about:

- general information on the reservoir;
- measurements in the catchment area;
- measures in reservoir catchment area;
- pre-deposition reservoir;
- free-flow flushing;
- pressure flushing;
- dredging and excavation;
- dredging transfer;
- dry excavation;
- further measures.

This list is not limited respectively inadaptable – additional issues could be added at any time. In the following paragraphs on step deeper information about contents of Alpreserv database is presented:

General information on the reservoir:

- type of the dam;
- purpose of the reservoir;
- geological situation type;
- vegetation type;
- spillway type;
- deposition type.

Information on measures in reservoir catchment's area:

- natural sediment traps;
- bed load traps (grading curves);
- erosion control.

Information on predeposition reservoir:

- grading curves;
- sediment routing-bypass.

Information on further measures:

- further measures upstream from the reservoir;
- further measures in reservoir;
- further measures downstream from the reservoir.

Information on performed freeflow flushing:

- grading curves;
- discharge curves;
- water level curve;
- suspended sediment concentration curve;
- longitudinal section before flushing;
- longitudinal section after flushing.

Information on performed pressure flushing:

- grading curves;
- discharge curves;
- water level curve;
- suspended sediment concentration curve;
- longitudinal section before flushing;
- longitudinal section after flushing.

Information on performed dredging and excavation:

- grading curves;
- discharge curves;
- water level curve;
- longitudinal section before flushing;
- longitudinal section after flushing.

Information on performed dredging and excavation (transfer):

- grading curves;
- discharge curves;
- water level curve;
- longitudinal section before flushing;
- longitudinal section after flushing.

Information on performed dry excavation:

- grading curves;
- discharge curves;
- water level curve;
- longitudinal section before flushing;
- longitudinal section after flushing.

All the data are recorded in the database only once. How they are interlinked is shown on *figure 2* where the logical structure of different contents can be seen.

Alpreserv database is composed of 49 tables where logical connection between key identificators builds relation database. In Alpreserv database 11 external classifications are used to classify different characteristics of reservoirs and sediment management. All external classifications can be supplemented or updated or upgraded.

3. Summary of the data of limited extension for the first stage of Alpreserv database

For the first stage of the Alpreserv database some very detailed pieces of information have been simplified and the extent of data

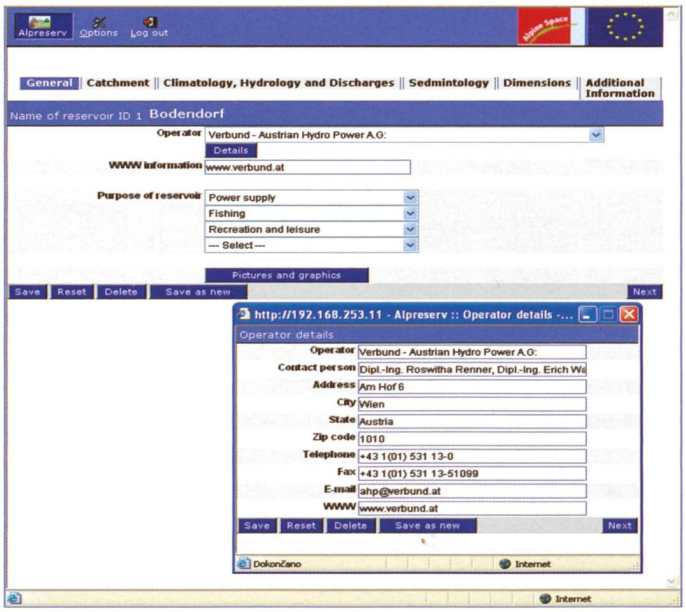

Figure 3. Alpreserv database internet user interface.

has been reduced. In the following text the basic data of reservoirs in the first stage of Alpreserv database will be described and summarized.

In order to keep clear overview the data on the reservoir were sorted in six main sublists: «General», «Catchment», «Climatology, Hydrology and Discharges», «Sedimentology», «Dimensions» and «Additional Information».

3.1 General informations

The general data starts with the identification number of the reservoir which is set automatically and presents a code of the reservoir in the frame of the Alpreserv project. The identification number does not refer to any other (e.g.: local, state) code classification for the reservoirs but can be extended to unique identification number in Alpine space.

The general data consists also of the name of the reservoir and information on the operator of the reservoir. Detail information about the operator is edited separately and includes the official name of the operator, contact person, address, ZIP code, city, state, telephone, fax, e-mail and information on the web about the operator. Each operator whose details have been added in the database can be chosen out of the list of operators and the detail information can be used more than once (in case there is an operator responsible for more than just one reservoir in the database). With this approach Operator is recorded in the database only once.

Usually there are already many reach pieces of information on the reservoirs presented on the internet. Websites with information about the reservoir are unique and are therefore added in the database as an additional source of valuable information for users who are anxious to learn more about a specific reservoir.

The last section of general information covers purpose of the reservoir. Since multiple use of a reservoir is very common the number of chosen purposes is unlimited (of course in the frame of the given options). There is a variety of options a user can choose out from the list «Purpose of Reservoir»:

1. Storage
2. Regulation (flood control, low flow, etc.)
3. Power supply
4. Re-regulating
5. Sedimentation
6. Irrigation
7. Water supply
8. Fishing
9. Recreation and leisure
10. Navigation

Besides textual information a user can also add any kind of digital graphics data by using the button «Pictures and Graphics». It is advisable to provide digital pictures or design sketches of the reservoir.

3.2 Catchment data

The information on drainage basin is given in the section Catchment data. This information includes size of the catchment area, maximal elevation above sea level within the catchment and mean elevation above sea level of the catchment.

3.3 Climatology, hydrology and discharges data

The data on climatology and hydrology consists of basic climatological information such as mean temperature at the reservoir area, mean annual precipitation and maximal observed precipitation in the entire catchment.

The data on the discharge on turbines consists of minimal observed discharge, maximal observed discharge and mean discharge. In the future the complete set of annual data on the discharge could be added.

3.4 Sedimentology data

The frame of the data on sedimentation was limited and simplified for the first stage of filling in the Alpreserv database. The sedimentology data are separated into three divisions:

«Input» covers data on coarse material entering the reservoir within a specified time period.

«Output» deals with the removed material respectively with the amount of material that was removed from the reservoir within a specified time period. At the same time also the measures of the material removal have to be defined and they are to be chosen out from the list of the «Intervention type»:

1. Free-flow flushing
2. Pressure flushing
3. Dredging-excavation
4. Dredging-transfer
5. Dry dredging and excavation
6. Routing-bypass

It is possible to choose more than one of the measures listed as the given options.

«Accumulated» deals with the total amount of material that was accumulated in the reservoir within a specified time period.

The time period is defined with the first year and with the final year of observations and has to be specified separately in each division («Input», «Output» and «Accumulated»). This enables the collection and free editing of the sedimentology data even when the dates (years when the pieces of information on sedimentation were registered) are incompatible.

3.5 Dimensions data

Dimensions data include several dimensions of the reservoir (size of the reservoir at the maximal water level, length of the reservoir at the maximal water level, maximal width of the reservoir at the maximal water level and maximal depth of the reservoir at the maximal water level), dimensions of the dam (length of the dam at its crest, maximal height of the dam), spillway capacity and year set in operation.

In the section «Dimensions» also the type of the dam has to be defined with choosing the suitable type out of a list «Type of the Dam»:

1. Arch dam
2. Buttress dam
3. Gravity dam
4. Embankment dam
5. Barrage

Only one type can be chosen for each reservoir at this stage. In the future

also more diversity of types and combinations would be added.

3.6 Additional information

The additional information covers the discharge capacity of bottom outlet(s), the installed capacity of power station(s), annual amount of water used for irrigation system(s), annual amount of water used for drinking water system(s) and information concerning recreational use. For the first stage of Alpreserv database no detail data on recreational use was collected – only the answer whether the reservoir is being used for recreational purposes or not has to be given.

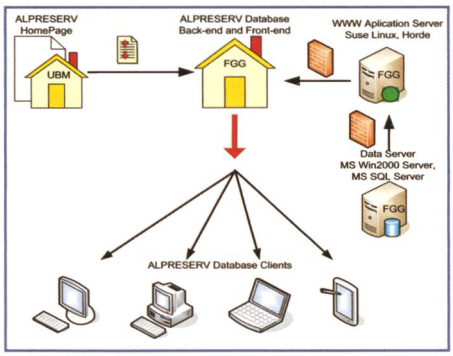

Figure 4. Alpreserv database network, Legend: UBM-leading partner (Germany)/ FGG-database service provider/clients-partners of the project.

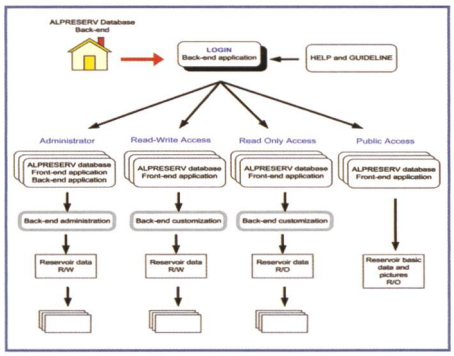

Figure 5. Overview of the Alpreserv database user authorization structure.

4. Alpreserv database network

The data on the reservoir structures contain plenty of pieces of information that need to be stored in a database and organized in a proper manner. The database enables storage of data in large quantities and extent and also successful editing and technical administration of the collected data. Therefore the database of Microsoft SQL Server 2000 that is supported by the operational system Microsoft Windows 2000 Server is being used for the attribute part of the Alpreserv database. The user can access the database in local network by using a user interface developed with Microsoft Access XP/2003. These user interfaces are more useful when working with complex databases in fast local network.

For 1st stage Alpreserv database network within partners (as clients) was established. The Alpreserv database internet clients *(Figure 3)* can view the Alpreserv database when visiting Alpreserv homepage or directly on website «kmte.fgg.uni-lj.si/alpreserv».

The data is collected in the database on the FGG Data Server (University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia) which provides data for the Application server (based on Linux operating system and PHP internet technology) and further publishing on Internet server *(figure 4)*. All the information is protected by firewalls.

Each user has to sign up to get own account. The administrator then gives him the access to the database and allocates the user's rights. After this step the user can access the database by using his password and username.

Besides the administrator there are three more types of Alpreserv database user groups *(figure 5)*. There is no free access and all users have to log in.

User with Read-Write Access can access Front-end application and he can change or add reservoir data. He can not administrate the Back-end application where user rights or user groups permissions are managed but he can customize it.

User with Read Only Access can access Front-end application where he can view the reservoir data but he can not change them. He can also customize the Back-end application but he can not administrate it. All these users could benefit of analyzing, aggregating or data mining crossover the database.

General public access is designed for project result disimination purposes. So user with Public Access can access Front-end application and he can view the basic data and pictures of the reservoir. Gradually also the results of the project would be given for the public use.

In the future development new user groups with different permissions (e.g. operators, public access, authorities, etc.) can be added. In this manner also knowledge exchange inside particular fields of interests could be supported.

5. Conclusions

Alpreserv database first aims at fulfilling basic data exchange between project partners. On the ground of the usage of the database the most relevant data needs will turn up and in the gained experience the fields of interest of the Alpreserv database (information on the reservoir) will be redirected. Future work will closely follow project goals and objects. In the next stage of development the effective connection of biological data with management procedures of Alpine reservoirs will be established. Finally Alpreserv database would serve as an example of an organized data pool as a decision supporting tool.

References

Morris, G.L., Fan, J. (1997): Reservoir and sedimentation handbook: design and management of dams, reservoirs, and watersheds for sustainable use. McGraw-Hill Companies.

Gosar, L., Prešeren, T., Kozelj, D., Steinman, F. (2005) The Structure of the Alpreserv database. Interreg IIIB – Projekt Apreserv. Gestion durable des sédiments dans les réservoirs alpins: conférence sur la problématique de la sédimentation dans les réservoirs, Sion, mardi 20 septembre 2005: Tagung über die Problematik der Stauseeverlandung, (Communication, 22). Lausanne: Laboratorie de Constructions Hydrauliqes, pp. 97–107.

Prešeren, T., Steinman, F., Klasinc, R., Gosar, L. (2005) Hidravlično modeliranja obratovanja hidroenergetskega objekta. (Hydraulic Modelling of Hydropower structure's operation) 16. Mišičev vodarski dan 2005, Maribor, 9. Decembre 2005, Maribor, pp. 88–95.

Petrovič, D. (2003) Cartographic design in 3D maps. Proceedings of the 21st International Cartographic Conference, ICC 2003, Durban, South Africa, 10–16 August 2003: Cartographic Renaissance. Durban, pp. 1920–1926.

Šumrada, R. (2002) Modeling methodology for cadastral subdivision process. Spatial information management: Electronic newsletter 2002. Istanbul: FIG Commission 3, pp. [1–9].

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