Global Aquifer Development Foundation

MALI - Proposed Action Plan

"Start small but start"

The May 2007 audit, conducted following a visit to Mali, has revealed that there is no process in place to collect information on groundwater and aquifers on a continuing basis. The work to date has been project related, with data collection terminating at the end of each project. This proposed action plan focuses on setting up a system along with the necessary protocols for implementing a permanent groundwater monitoring program. GADF proposes to start small, by conducting a "pilot" project in a selected watershed or sub-watershed with the assistance of a local team. Once in place, this process of monitoring groundwater and aquifers could be duplicated in other watersheds and sub-watersheds with the objective, over time, to include the whole country.

This document is produced based on:

- ✓ Information gained during an audit conducted by Dr. Gilles Wendling (GADF) and Dr. Diana Allen (SFU – GADF) in May 2007 (http://www.globalaquifer.org/gallery-mali-07.htm)
- ✓ A review of the Rapport Provisoire Plan d'Action Gestion Intégrée des Resource en Eau (PAGIRE 26 04 2007); the present document describes the implementation of a process similar to one of the recommended actions - Action 7.8 ; and
- ✓ A review of the Rapport National sur la Mise en Valeur des Ressources en Eau (Janvier 2006).

1. Choose a watershed and sub-watershed

Selection of a watershed team

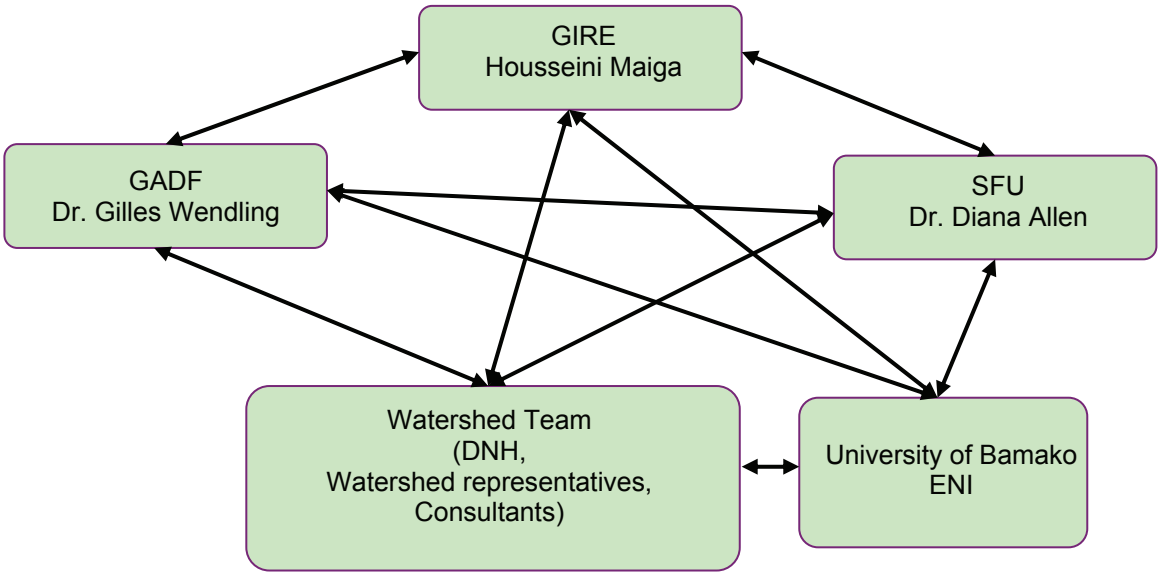
GADF will select the watershed or sub-watershed (the study area) in coordination with the GIRE (Gestion Intégrée des Resources en Eaux) team, which has good knowledge of the present strengths and weaknesses of the existing teams and infrastructure in the various regions of Mali.

> To be successful, we need a motivated group: the group that will start the work in the study area need to be aware of the global and long term purpose and extreme importance of their roles, even the small ones (measuring a depth to water both manually and using a datalogger, locating the well and placing a dot on a map or using a GPS and recording the x-y coordinate). This motivation can be stimulated by training (simple workshop) and being part of a process where the information flows readily between the parties involved so they can see the results of their work in the "big picture" and realize that without their part, there is no definition and build-up of the "big picture".

The study area team will typically consist of half a dozen people from:

- ✓ The Direction Nationale de l'Hydraulique (DNH);
- ✓ Private industry (consultants) ;
- ✓ Watershed-based associations; and
- ✓ Universities.

The study area team will need training at the start of this process and will need to understand where they can get help or directions when a problem occurs. Communication will be a key element in the success of this initiative. Therefore, the role and responsibilities of the various players will need to be clearly defined and known.



GADF recommends that a one-day workshop be conducted at the outset of the project and at least once a year, preferably in the region itself, where the advancement of the project will be discussed.

Select software

GIRE currently uses an access database (Sigma 2) to store groundwater information. The database contains well information (location, lithology, water depth) collected over the years. It is uncertain whether this database has been kept current. Water chemistry data are also available, but these data have not been kept up-to-date.

The existing database may be suitable for ongoing monitoring, particularly in that data may be easily exported to a geographical information system (GIS). However, currently the database is not accessible to all staff at the DNH or to university researchers. GIS capabilities are very limited.

GDAF will review the functionality of the existing database, and investigate other database management systems (e.g. ORACLE) that may provide a more useful interface for the storage and use of groundwater data. Ideally, such a database management system would be available through a server or website to allow for remote access to the information by regional offices and possibly other users. Also, the software should not be language-limited (with database transferable from the English to French version and vice-versa) and must contain user-friendly input and output interfaces.

The database will be selected considering that the process started in one watershed will be extended in the near future to the other watersheds in Mali. A suitable database management system will be selected and implemented for the project.

Educate watershed team

The watershed team will be educated to enter data in the database. They will be responsible for verifying the quality of the data being entered. This quality control process will lead to better understanding of the need for collecting good quality data. The team will also be given guidance for interpreting data in the database. For example, periodic review of data can provide information on trends in groundwater levels, and point to data errors (either during collection or data entry) that can lead to false indications of trends.

Training will take place at the outset of the project, and at least once per year for the duration of the project.

Generate base information

This task will consist of compiling existing data and entering the information in the selected software. Data, maps and information on the following will be entered:

- ✓ Topography;
- ✓ Precipitation;
- ✓ Vegetation/land use;
- ✓ Evapotranspiration;
- ✓ Infiltration;
- ✓ Depth to groundwater;
- ✓ Aquifers;
- ✓ Wells;
- ✓ Monitoring wells;
- ✓ Surface water;
- ✓ Surface water intakes;
- ✓ Surface water monitoring network.

This task will also provide the opportunity to gather historical information available in reports and which will be very valuable in defining the subsurface conditions (water levels, water quality) in the past. BURGEAP is providing access to all the reports of the projects completed in Mali. A M.Sc. student at Simon Fraser University is currently reviewing the existing data to obtain an overview of what data are available, their quality, etc. Preliminary interpretation of these data are being carried out to obtain an overview of the hydrogeology and groundwater resources of Mali.

2. Select team in Bamako for "central" system

A team will be selected in Bamako to design and implement a central system. This central system will work with the same tools selected and developed for the study area. The central system will be designed and implemented to become the dynamic node of information for other study areas, when the process developed in the study area is duplicated to other watersheds.

The team would include technical people aware of the operation of the information system, but also a small team from GIRE, universities and the consulting industry. This will be done to promote communication and to involve all who should provide information to the groundwater monitoring and management system and benefit from it.

3. Involve Local Universities

The proposed action plan is not an academic exercise, but will require input from universities. Understanding and monitoring the aquifers and the groundwater is very important and very practical as it provides information for decision-making on land use and human activities. Such decision-making must be founded on good and reliable science. Therefore, academics and students should be involved with the process, but should not lead the process.

The involvement of the universities (both the University of Bamako and the Ecole Nationale des Ingénieurs-ENI) will be done to:

- ✓ Give technical support to the local study team. As part of promoting communication and educating the study team, workshops should be scheduled twice a year. The academics would provide their support describing the "why" and "how" of the study and identifying scientifically valid practical solutions.
- ✓ Involve students in the process. They will realize the practicality and importance of hydrogeology and will link with people in the field who will need their expertise when they complete their training. Typically the students will be involved through completing year end projects or thesis on the study area.
- ✓ Include in the curriculum what is being done in the study area. Use practical examples encountered in the study area (pumping tests, delineation of aquifer boundaries, assessment of groundwater regimes, etc.) to cover these topics in the classroom.

4. Partnerships

Partnerships are an important component of the proposed work. Currently, Simon Fraser University has agreed to be a partner in the initiative. Other potential partners within Europe and elsewhere in Canada have been identified.

Simon Fraser University

Technical advice for the development and implementation of the monitoring program will be provided by Dr. Diana Allen at Simon Fraser University (SFU). Specifically, guidance will be provided for identifying what data are needed to address specific questions in the study area, and how frequently and at what spatial resolution these data should be collected. Simon Fraser University will also provide guidance on development of the central system, ensuring that adequate flexibility is incorporated into that system to accommodate the range of aquifer and groundwater monitoring data that will be collected. As indicated above, a preliminary investigation is currently underway at SFU to review the existing data, identify data and knowledge gaps, and develop an understanding of the hydrogeology and groundwater resources of Mali.

In partnership with academics at the University of Bamako and ENI, Mailian student projects will also be identified and planned. Dr. Allen will act as an external student advisor and provide assistance to students in interpreting data.

5. Project Management and Quality Control

The GIRE group will be responsible for the management and quality control of the project. They will report to GADF and to the funding agencies. They will also communicate on the advancement of the project with the participants of the project.

6. Cost Estimate and Funding

The project is designed with an implementation phase of three years. The proposed budget is approximately $ 300,000 and presented in the attached table. Groundwater monitoring and management must be done on a continuing basis. The project will be re-assessed and evaluated at the end of year 2 and a five-year plan will be designed.

It is important to design a system which allows continuous funding of the process. Water management is such an important aspect of life that adequate funding should ideally come from the general revenue of every country. GADF understands that Mali is not yet in the position to fund the proposed project, therefore, GADF will rely on

international funding sources (the Canadian international Development Agency - CIDA, others) and its own funds.

In partnership with GIRE, GADF proposes to identify ways to locally license water. This way of raising fund should not be presented and perceived by the population as a tax but as a mean to understand, monitor, protect and manage water. The money would go to a fund used to build and operate a water-centered structure to manage and protect the resource (even starting small) with publicly available database (both technical data and accounting data) to make it as transparent as possible and to promote involvement and interest from the public. This process should not wait for the legislation to get things in place. With the agreement and the involvement of the main players, it should be implemented rapidly at a small scale.