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North-West Sahara Aquifer System (NWSAS), Phase II

GEF

Terminal evaluation of the UNEP/Swiss/FFEM Project "Protection of the North West Sahara Aquifer System (NWSAS) and related humid zones and ecosystems –GF/2731-03"

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Executive summary

Algeria, Tunisia and Libya have acted jointly in order to evaluate the usable water resources of the North-Western Sahara Aquifer System (SASS) and to set up shared management tools, both technical and institutional. Project management was entrusted to the Sahara and Sahel Observatory (OSS) based in Tunis (Tunisia). The OSS has set up a dedicated project unit.

Phase 1 of the project led to developing a multi-layer model for this aquifer system which established a balance (budget) of the water resources over this whole transboundary zone; it also identified the risks attendant upon any major future abstractions:

- Disappearance of artesianism and risk of salinisation of the waters,
- Excessive water pumping depths,
- Drying up of the Tunisian outlet in the region of the chotts.

In addition, the use of the model highlighted the vulnerable aquifer zones. Proposals of a rationalised distribution of abstractions have been formulated, allowing a slight increase in abstractions by creating new tapping fields that are better distributed in zones which are currently little used or not used at all (Grand Erg occidental (Grand Western Erg), boundaries of the Erg Oriental (Eastern Erg)). Emphasis has been placed on the need to define development options and to further refine knowledge of the system.

The second phase of the project (2003-2006) aimed at enhancing the performance of the integrated management system of this set of transboundary aquifers, based on the development of more precise data, with a particular focus on the risk zones identified during the first phase. New socio-economic, ecological and environmental data have been taken into consideration in this phase, and new national institutional partners from the three countries are involved.

The evaluation has been based, for the major part, on the documentation produced up to the end of 2006; it has involved a one-week visit to the OSS in March 2007, as well as discussions with the three parties concerned. It has build upon the a previous evaluation mission of the technical components, done in 2005 for FFEM, and on the mid-term evaluation of the component “Mechanism for Concerted Action” (Mark Halle, May 2005)

Phase 2 comprises 6 components:

- The hydraulic component,
- The socio-economic component,
- The environmental component,
- The Information System (IS) component.
- The Consultation Mechanism Component
- The project Management, Evaluation and Monitoring structure

For each component, as well for most of the project sub-components, the evaluation has sought to analyse:

- the relevance of the objectives, which corresponds to matching the project objectives with the stakes envisioned;
- the effectiveness of the project actions: Do the means deployed correspond to the results sought?
- the efficiency of the project: Do the results allow the achievement of the initial objectives?
- the impact of the project: Difference between the pre-project situation and the post-project situation with regard to the initial objectives;
- the viability of the project in terms of development: The latter parameter relates traditionally to ownership of the project or of the results by the beneficiaries, the support policy extended by the governments concerned, use of appropriate technologies, environment protection, institutional management capacity and economic and financial viability.

The evaluation follows the parameters set by UNEP in the Terms of reference namely:
The evaluation has drawn upon the project presentation report (FFEM, 2003), the GEF Project brief, and, more particularly, upon the project log-frame which proposed the impact and result indicators for each component.

Attainment of objectives and planned results, Assessment of Sustainability of project Outcomes, Catalytic Role, Achievement of outputs and activities, Assessment of Monitoring and Evaluation Systems, and Assessment of processes that affected attainment of project results. The main criteria were rated in the Rating table for each individual project component and for the overall project implementation.

Project results

The main project results are summed up hereinafter:

Hydraulic component:

- the Djeffara model has been constructed and calibrated under permanent and transitory regimes, and the qualitative model has been developed. The hydraulic and salt transport calibration has been finalised and simulation have been performed;
- the Biskra model (North of the Chotts zone) has been completed and validated;
- the conceptual model of the Bassin Occidental (Western Basin) has been constructed, calibrated and used for predictionof abstraction. Precise inventories of the boreholes and surveys of the foggaras have been completed;
- the studies related to understanding the exchanges between the Chotts/ Sebkhas and the underlying aquifers have been initiated but not completed;
- The update of the SASS model in the border region of Ghadames has been completed, allowing for the three countries to agree on the way to consider water abstractions and their transboundary impact.
- the study of the piezometric network has been completed and validated. The network is identified on the ground and national focal points have integrated it in their national networks;
- the water quality monitoring network has not been put in place.

Socio-economic component:

- the water demand, as well as the projection, have been evaluated;
- the efficiency of the irrigation modes has been evaluated;
- the water costs have been addressed, but the detailed and comparative analysis has not been completed. This is a decisive component for the definition of alternative scenarios for the use of water resources.

Environmental component:

- the cartography of salty waters and of wetlands based on the interpretation of satellite data has been made,
- national and synthesis reports analysing the causes and distribution of salty-soil zones have been drafted,
- the wetlands have been inventoried in an exhaustive way in the three countries, their ecological and physical features have been described and their vulnerability has been analysed,
- a study of the recharge of the SASS aquifers has formed the subject of an academic doctoral dissertation,
- the analysis of the phenomena of water level rises in the surface aquifers has not been conducted,
- a synthesis of the environmental impacts connected with the exploitation of the SASS has been done and an Action Plan has been proposed, together with monitoring indicators.

“Information System” component:

- the GIS-connected SAGESSE data base has been complemented and enhanced,
- dedicated data bases have been established in the three study zones of the Djeffara, Biskra and bassin occidental (Western Basin),
- a geographic server, allowing cartographies of aggregate data has been developed (GEO-SASS),
- the link Data Base – Mathematical Model of the aquifer is operational,
- the link modes between the SAGESSE Data Base and new local Data Bases have not been clearly established as yet,
- training sessions have been organised for data base webmasters (administrators).

Permanent structure for the Consultation Mechanism between the three countries

A formalised agreement is signed by the three ministers of water. It creates a permanent Consultation Mechanism (“Mécanisme de concertation”, better translated as “Mechanism for concerted Action”) for the SASS, defining the role and missions, and requesting support from OSS to put in place a secretariat.

The report outlines brief recommendations on project follow up, after evaluation of the overall project impact and assessment of processes that affected attainment of project results.

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LIST OF ACRONYMS AND ABBREVIATIONS

1.	FAO	Food and Agricultural Organization of the United Nations
2.	FFEM	Fonds français pour l'Environnement Mondial (French GEF)
3.	ISARM	International Shared Aquifer Resource Management
4.	MC	Mécanisme de Concertation (Mechanism for concerted action)
5.	NGO	Non-Governmental Organization
6.	NWSAS	North West Sahara Aquifer System
7.	OAS	Organization of American States
8.	OSS	Observatoire du Sahara et du Sahel
9.	SASS	Système Aquifère du Sahara Septentrionnal
10.	SDC	Swiss Agency for Development and Cooperation
11.	UMA	Union du Maghreb arabe
12.	UNECE	United Nations Economic Commission for Europe
13.	UNEP/GEF	United Nations Environment Programme/Global Environment Facility
14.	UNESCO (IHP)	United Nations Education, Science and Culture Organization (International Hydrological Programme)

I Introduction and background

I.A Context

UNEP has contracted Mr Serge Puyoô (ANTEA) to carry out the Terminal Evaluation of the UNEP GEF/Swiss/FFEM project “Protection of the North West Sahara Aquifer System (NWAS) and related Humid zones and Ecosystems”- GF/2731-03-.

The NWAS is a system of superimposed aquifer layers of the North-Western Sahara sedimentary basin, shared between Algeria, Tunisia and Libya. It comprises mainly two horizons : the ***Intercalary Continental(CI)*** and the ***Terminal Complex(CT)***. The water resources of this set of aquifers are only partially renewed at present, due to almost non existent precipitations (rainfall), except for the northern catchment of the basin. The resources are, therefore, non renewable for the major part and exploitation is of “mining” type. A general map, abstracted from the presentation report for Phase II, is given below for purposes of geographic reference. (Figure 1)

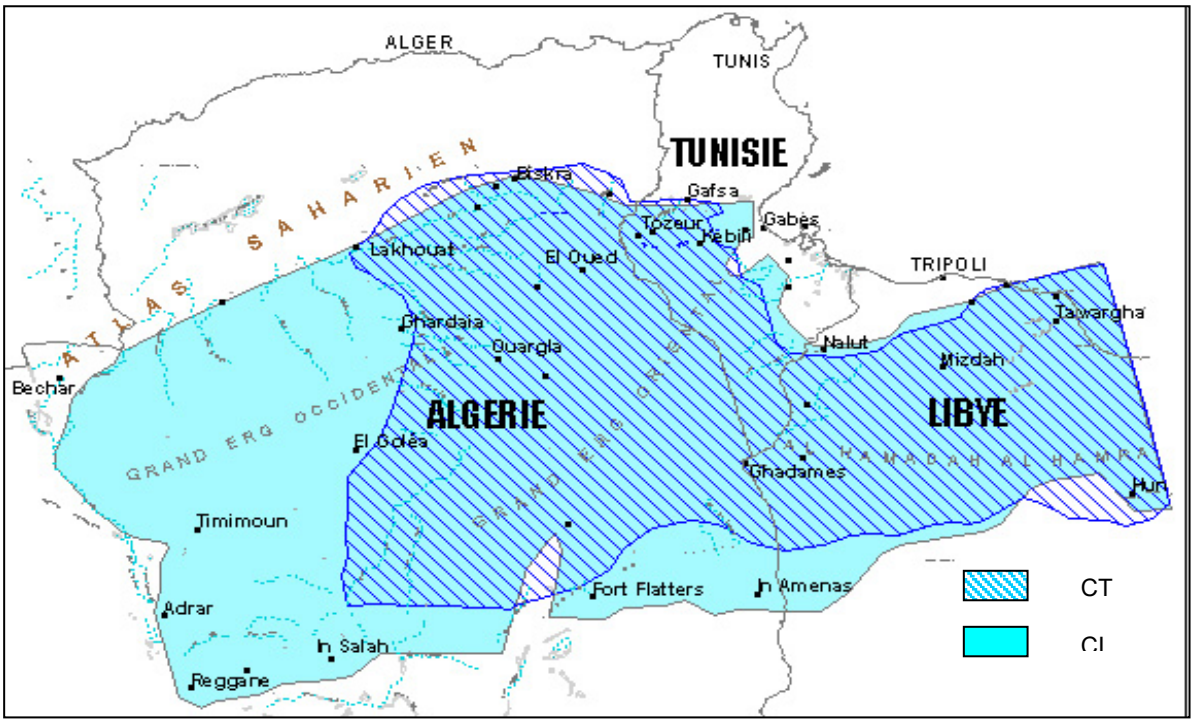


Figure 1 – SASS Map (North-Western Sahara Aquifer System)

The first phase of the project was executed by the Observatoire du Sahara et du Sahel (OSS), financially supported by International Fund for Agricultural Development I(FAD) and (terminated in 2002) The Mathematical Model constructed during the first phase has allowed exploratory simulations to be conducted which highlight the risks attendant upon substantial future abstractions. These are:

- Disappearance of artesianism and risk of salinisation of the waters,
- Excessive water pumping depths,
- Drying up of the Tunisian outlet in the region of the chotts.

In addition, the simulations have highlighted the vulnerable zones of the artesian basin (CI), the Tunisian outlet (CI), the Ghadamès basin (CI), the basin of the Algerian – Tunisian Chotts (CT), and the Khoms – Zliten coastline (CT). Proposals for a rationalised distribution of abstractions have been formulated, allowing a slight increase in exploitation by creating new tapping fields that are better distributed in zones which are currently little used or not used at all (Grand Erg occidental (Grand Western Erg), boundaries of the Erg Oriental (Eastern Erg)). Emphasis has been placed on the need to define development options and to further improve knowledge of the system.

I.B Project background

The second phase of the project (2003-2006) aimed at enhancing the performance of the integrated management system of this set of transboundary aquifers, based on the development of more precise data, with a particular focus on the risk zones identified during the first phase. New socio-economic, ecological and environmental data have been taken into consideration in this phase, new national institutional partners from the three countries are involved, and the phase II put emphasis on the creation of a transboundary management structure.

The second phase of the project was designed to be supported by the Global Environment Facility through the United Nations Environment Programme (UNEP). In December 2002, the GEF approved grant funds to the value of US$600,000, and this GEF funding is matched with the funding from the Fond Français pour l'Environnement Mondial (FFEM) (US$300,000) and SDC-Switzerland (US$400,000) together with in-kind contribution from the participating governments. The UNEP/GEF component has been under execution since May 2003 and completion was initially scheduled in July 2005. The SDC-Switzerland component has been under execution since January 2003, and the FFEM component has been under execution since July 2004. The OSS is designated as the agency for the coordination of the execution of the project for all three components.

The objectives of the project were: (i) to update "the evaluation for the SASS water resources in order to define sustainable exploitation modalities"; and (ii) implement "a consultation mechanism at the basin level for the three participating countries with a view to encouraging homogeneous management of these common water resources". At the first meeting of the Project Steering Committee (September 2004), the following five components of the project were re-defined to streamline the project activities:

(i) hydraulics component;

(ii) socio-economic component;

(iii) environment component;

(iv) information management component;

(v) consultation mechanism component.

For further reference, the components (i) to (iv) are mentioned as “technical components”, and component (v) as institutional component.

Monitoring and evaluation of project implementation formed a sixth component.

Relevance to GEF Programmes

The project conforms to the GEF Operational Programme 9: Land and Water Cross-focal area Operational Programme.

Executing Arrangements

The project was executed by the Observatoire due Sahara et du Sahel (OSS). A Steering Committee was established, composed of:

- the OSS representative;
- the countries' representatives;
- the financial partners' representative(s);
- a representative of the national executing agency;

The national level coordination was under the responsibility of the national co-ordinator appointed in each country with scientific and technical skills adapted to the project and belonging to the national organization involved in the project.

Project Duration

The initial project duration was 27 months starting May 2003, which was later revised and extended to 38 months ending June 2006.

Budget

The total budget was US$ 1,416,000, with US$ 600,000 funded by the GEF Trust Fund and co-funding from; Switzerland US$ 400,000, FFEM US$ 300,000. The participating governments (Algeria, Tunisia and Libya) provided their in-kind contribution of US$116,000.

I.C Status of the Project technical components

The objective of the project technical components is to provide the tools for a detailed evaluation of the water resource and the means for environmental and socio-economic forecasting such as to allow for an effective and sustainable approach to the management of the groundwater resources.

In this context, taking into consideration the socio-economic dimension leads to adding the notion of management of the water demand to the more traditional notion which consists in developing the resource, i.e. increasing the offer, in order to meet the rise in demand. The advisory team of the joint water partnership programme of the World Bank, GW – MATE (Groundwater Management Advisory Team), has defined a few principles accompanying the evolution of groundwater management.[1] GW- MATE thus defines the “vicious circle” of an

[1] A. Thuinof, C. Dumars, S. Foster, K. Kemper, H. Garduno, M. Nanni, “Groundwater Resource Management: An Introduction to Its Scope and Practice”, GW-MATE, Briefing note 1, Briefing Note Series, World Bank, Washington DC, USA

increase in abstractions following absence of control over the resource and a non controlled water demand which induces a degradation of the resource as well as the exacerbation of the adverse impacts on the environment. By contrast, a “virtuous circle” of a sustainable integrated management of the groundwater resource involves the following management actions:

- evaluation and monitoring of the resource,
- defining the allocation of the resource available,
- risk assessment,
- control over pollution,

as well as setting up an appropriate institutional framework, comprising:

- a legal framework,
- definition of the rights of allocation of the water resource,
- participation of stakeholders (users and decision-makers),
- use of economic instruments.

Speaking of the North-Western Sahara Aquifer System (SASS), it is worth saying that this is a water resource of a large geographical expanse covering part of the territory of three countries, Algeria, Tunisia and Libya. The “Mécanisme de Concertation” (Mechanism for Concerted Action) should thus allow the participation of the stakeholders on the regional level.

Integrated (offer – demand) management should include:

- taking into account all the constraints and advantages of an optimal use of groundwater resources of the SASS zone,
- the necessary participation of the stakeholders, i.e. the users and decision-makers at the three levels : local, national and regional,
- monitoring and forecasting the socio-economic evolution, but also, eventually, achieving control over the actions and parameters allowing to adaptive changes in due recognition of the impacts.

The offer - demand check should be regularly questioned, updated and evaluated against the mutual impacts of the hydro-geological and socio-economic parameters. This requires continuous consideration and monitoring of both the resource and the socio-economic and environmental parameters governing water use.

I.D Establishment of the consultation mechanism

The international dimension of the resource calls for setting up a rationalised shared management whose purpose is to ensure control over the transboundary impacts of abstractions and to guard against any possible conflicts of interest. In addition, shared management offers the considerable advantage of eliciting the joint management effort of the three countries to address the broadly similar problems of exploitation of the resources, impact and water use. Hence the opportuneness of developing common or standardised tools that are conducive to ensuring sustainable monitoring and exchange of information between the three countries and to supporting decision making with regard to the relevant strategic choices on the regional level. These tools will be subsequently used on the national and local levels.

From this perspective, the tools involved in the evaluation of the project's technical components have an intrinsic value, whereas the Mechanism for Concerted Action needs to be operational in order to allow joint updating and use of the tools developed and put in place a process for joint decision making.

I.E Initial GEF Project Brief

The initial GEF Project brief stated as **core objective** the implementation of strategic actions agreed by the three countries through prior actions carried out in the last several years, and should include policy and legal measures, institutional arrangements, resource mobilisation, mainstreaming environment into the relevant sectors, and monitoring and evaluation; Indicators regarding achievement of these objectives were threefold:

- A management model covering the share aquifer, with emphasis on protection of recharge areas and the humid zones,
- Observatory of trends in water quantity and quality,
- Permanent group for exchange and actualisation of data

Expected Project outcomes

- Completion of a study on the NWAS,
- Analysis of the legal and institutional issues surrounding management of the shared resource,
- Completion of a management model encompassing : the protection of recharge areas and humid zones, provision of best possible scenario for sustainable exploitation of water resources, identification of indicators for sustainable resource use, definition of a water policy for the arid and semi arid zones of the 3 countries promoting the protection of recharge areas and humid zones and sustainable used of the shared resources,
- Establishment of a consultation mechanism to ensure sustained monitoring of water resources with funding from non-GEF sources, and addressing issues such as reforms in policies and institutional framework at national level that would be needed to foster sustainability, including the environmental aspects.

Initial expected planned activities

To achieve the above mentioned outcomes, a number of sub-projects (technical assessments, socio economic evaluations, analysis and studies), and workshops were planned, which were later detailed (during the inception phase of the programme) under a number of components as listed in paragraph III below.

II Scope, Objectives and methods of the final evaluation

Evaluation's purpose, evaluation criteria used, questions to be addressed

II.A Objectives of the evaluation

(Abstract from the ToR)

The primary objective of this terminal evaluation is to establish project impact with reference to objectives and outcomes and evaluate implementation of planned project activities and outputs against actual results. The principal focus will be on three main questions:

1) *What is the extent of the applicability and relevance of the assessments/studies in assisting the participating countries to develop appropriate joint actions to reduce risks to shared groundwater resources? To what extent have the specific needs of the target groups of stakeholders been considered in the process?*

2) *To what extent has the project succeeded in establishing a joint policy framework for future cooperation and collaboration on the issues identified by the assessment/studies? What is the likelihood that such a framework can actually influence the actions of the governments and local stakeholders in the withdrawal and use of groundwater resources?*

3) *What is the extent of use of scientific and technical information generated through the project activities, to what extent has this provided basis for policy discussion and decisions at regional national and local levels?*

The "achievement" indicators and verifiers provided in the log frame of the project document should be used together with the evaluation parameters of sustainability, replicability, stakeholder participation, effectiveness and efficiency.

II.B Methods

The evaluation is based on Achievement indicators corresponding to the "impacts and results indicators" as they were listed in the initial logical framework (attached as appendix 1) along with all project evaluation parameters as defined in the ToR (paragraph 3).

Each component/Sub component is separately evaluated through achievement indicators and Project evaluation parameters "A- attainment of objectives and planned results", "B Assessment of Sustainability of project Outcomes", C- Catalytic role and "D-Achievement of outputs and activities".

The parameters "E-Assessment of Monitoring and Evaluation Systems" and "F-Assessment of processes that affected attainment of project results" are addressed in separate chapters for the entire programme.

III Project performance and impact

The six components forming the subject of the evaluation and their sub-components are proposed in the table below:

WP10000 Hydraulic Component: Improvement of hydraulic knowledge about the basin
WP11000 – Development of three Regional Models: • Djeffara, • Bassin Occidental (Western Basin) and • Biskra WP12000 – Conducting specific studies: • Monitoring network dedicated to the Chotts and drawing up a research programme • Simulations on the Ghadamès basin WP13000 – SASS monitoring indicators • Setting up common monitoring networks (quality and piezometry) • Definition of a set of monitoring indicators

WP20000 Socio-economic Component: Enhancing the hydraulic results based on a socio-economic analysis with a view to designing a long-term development strategy
WP21000 – Socio-economic study of the SASS WP22000 – Irrigation modes on the level of the whole SASS basin WP23000 – Crop types and impacts in the SASS basin WP24000 – Long term development
WP30000 – Environmental Component Diagnosis of the state of the environment and protection strategy
WP31000 – Soil quality indicators WP32000 – Water rise indicators WP33000 – Recharge WP34000 – Wetlands WP35000 – State of the environment and protection strategy

WP40000 Information System (IS) Component The objective consists in strengthening the Information System established based on mainstreaming socio-economic and environmental data, as well as setting up an administration system (webmaster) and ensuring anchorage of the system
WP41000 – Building the topographic and geological map collection WP42000 – Analysis of the data WP43000 – Data base: Development of a common Data Base WP44000 – Long term development: Development of an integrated information system WP45000 – Data analysis tools WP46000 – Development of a cartographic server

WP50000 – Consultation Mechanism The objective consists in strengthening the Mechanism initiated during the first phase of the project and establish a permanent structure based on consensus
WP51000 – Information and sensitisation workshop WP52000 – Data collection and exchange modalities WP53000 – Observation Systems WP54000 – Permanent structure for the Consultation Mechanism

WP6000 – Monitoring and evaluation System Put in place adequate indicators and structures to monitor Project implementation and results
Steering Committee Monitoring-Evaluation activities

The evaluation has formed the subject of a 5-day mission at the SASS Project Unit offices in Tunis in March 2007. A previous mission took place in October 2005 as part of the evaluation of technical components of projects for FFEM. All attendants to the third steering committee in November 2005 listed in appendix 2 were met by the consultant in October and November 2005; In addition, a meeting was held in DGRE (Tunis) in October 2005, and a specific meeting took place in Tunis with M. D. TAIBI, director general of ANRH (Algeria). Interviews of project team and Dr BEBES, water resources and modelling expert took place in October 2005.

During a second mission in March 2007, the consultant met with the OSS/SASS project team and Dr Pizzi, involved as consultant in the Western Basin modelling and the workshop on Ghadames area, and exchanged information in the form of e-mail with ANRH, DGRE and GWA. Officers in charge of project financial management in OSS were met as well.

III.A WP 10000 Hydraulic Componen:

III.A.1 Development of regional models (WP 11000)

The initial impact and results indicators for the three models are as follows:

- Enhanced results to serve as a basis for the decision-makers of the three countries,
- The three countries can decide on the level of abstractions and on the exchange models,
- The three regional models (Djeffara, Bassin occidental (Western Basin) and Biskra) will be finalised.

Outcomes were Threefold: elaboration of sub regional models, initiating consideration of changes needed in groundwater extraction and provide the basis for better consultation mechanism.

The Terms of Reference drafted by the SASS project team for a restricted solicitation of experts comprised 3 logical phases, in line with the expected outcomes and the state of the art regarding groundwater modelling:

Phase 1

Documentary and inventory study of Bibliographic Data; Analysis of the recorded data: Water points, piezometry, salinities, exploitation; Joint design of the geological DB; Drafting of the Hydrogeology report.

Phase 2

Design of the Conceptual Model; Construction of the Model; Link with SASS Model; Preparation of data for calibration of the Model; Calibration of the Model under permanent regime; Calibration of the Model under transitory regime; Drafting the report on Phase 2. Mathematical model.

Phase 3

Development of the scenarios to be simulated; Conducting the exploratory simulations; Conducting the provisional (forecast) simulations; Observation networks dedicated study Drafting of the Simulation phase report; Drafting of the final report on the sub-model.

Model of the groundwater aquifer of the Djeffara (WP11100)

A -Attainment of objectives and planned results

Relevance of the project objectives

The Djeffara lies outside of the SASS; however, this aquifer is supplied for the major part by the Tunisian outlet of the SASS. It is an aquifer shared by Tunisia and Libya.

The Djeffara Model should inform the Tunisian and Libyan parties about the volumes available, the impacts of the abstractions, the interferences between Tunisian and Libyan abstractions likely to lead to an agreement on respective abstractions. The Model should also ensure better understanding of the salinity variations of the aquifer horizons and seawater intrusion, particularly in the region of Tripoli, in order to simulate an exploitation mode likely to help avoid degradation of water quality. Finally, the development of the Djeffara Model should improve knowledge about the boundary conditions in the upstream part of the SASS Model.

Effectiveness of Results achieved

All 3 Phases have been completed, but calibration of the solute transport model and corresponding simulations were achieved at a late stage, in 2006 :

- Setting up a Data Base comprising 320 boreholes, with geological data, and a total of 5200 exploitation wells,
- Geological and hydro-geological synthesis: Three aquifer horizons have been identified with a differentiated piezometry for each of them: Upper aquifer, Middle aquifer (Senonian and Miocene), and Lower aquifer (Triassic sandstone),
- Analysis of recharge by infiltration, networks loss and back irrigation based on soil and crop classification by interpretation of satellite images
- Historical analysis of piezometric evolution: drawdowns of up to 60 m (1950 - 2000),
- Detailed analysis spring flows, abstractions, etc. in Libya by deduction of irrigated areas (satellite image) and revision of the data related to water demand,
- Construction of a multi-layer model. The model used is MODFLOW PM6,
- Calibration in permanent regime is conducted for the 3 horizons. Calibration in transitory regime is compared to level evolutions. Leakage parameters have been calibrated,
- The Tunisian and Libyan parts of the aquifer seem to indicate a slight potential interference between the abstractions of the 2 countries,
- A transport model has been developed, but its calibration has raised problems and revealed the complexity of the system (need to reduce in an excessive way the porosities in order to reproduce the state of marine intrusions in the region of Tripoli). Nevertheless, the model could be calibrated and could be used for simulations.
- Three superimposed aquifer layers were modelled, as the result of a thorough assessment of existing data.

Efficiency of methodology and mobilisation of resources

The Terms of Reference (TOR) for the study are clear and precise, and they encompass correctly the activities to be conducted. The intervention time-periods have, however, been under-estimated. While they largely contribute in mobilising the Focal Points operators, as part of the contribution of the member States, and in capacity building, the implementation modes make it difficult to meet the deadlines. The experts, particularly Mr. Besbes, technical leader of the operation, have served beyond the time-periods initially set, without financial implications.

Seven (7) workshops on the hydro-geological synthesis, of which 5 joint Tunisia – Libya meetings have taken place. Nine (9) experts from each of the two countries, together with an additional team of 8 experts, have intervened. In spite of the willingness and the competence of the intervening parties, there remains a problem of availability of the intervening persons who have to meet the tasks of their departments. This requires great flexibility on the part of the experts.

The data base system (on the SAGESSE model) under MS ACCESS coupled with ARCVIEW and the modelling software used (MODFLOW MP6) are commonly used, updatable and commercially sustainable. They are perfectly appropriate to the problem under question, as well as to the will to ensure sustainability of the actions of monitoring the resources.

Achievement of objectives

Phase 1 has been completed; Phase 2 (model calibration) was completed after some delays due to a late validation by the national teams. Tunisia has remarked on the inconsistency of the incoming calibration flows with respect to the outgoing flows of the SASS (Tunisian outlet), and the Libyan party wanted to refine the representation of the water chemical aspect, as well as the evaluation of the current abstractions before moving on to the simulations. A two-week session bringing together the technical leader (Mr. Besbes) and both the Tunisian and Libyan parties was organised in January 2006 to complete the model before moving on to the simulations, carried out in April 2006 (Phase 3).

B - assessment of sustainability of project outcomes

The Tunisian and Libyan parties consider, that they have enhanced their knowledge (particularly through the production of a geological map of this Tunisian – Libyan basin), developed a useful tool for their use and benefited from data made available to the project by the two parties.

As part of the Concertation Mechanism, the models are supposed to be updated after a number of years.

The conclusions regarding the potential abstraction in the various layers of the Djeffara aquifer underlined the evidence of non-sustainable water abstraction in the Djeffara Plain, in particular in the Libyan part. The Libyan authorities are now considering alternative water sources in order to reduce abstraction levels and are on the way to develop new water management concepts and strategies for application to the local water balance in the Djeffara plain (water demand management, change in priorities regarding water uses). Among them are:

- the transfer of water from the South (Ghadames aquifer, Great man made river),
- increase the abstraction in the deep Trias aquifer, if possible, and allocate the resource to the domestic water supply systems as a priority;
- In the long term, adapting the policy regarding the use of groundwater for irrigation (by reducing the irrigation water use and/or increasing the efficiency of irrigation systems) appears now as a necessity along with the development of desalination to meet the water demand.

C - Catalytic Role

The joint approach of assessment and water monitoring principles are said to be emphasised in the identification and design of downstream projects.

Both the exchange of data and joint work are among the most important results of this component, at this stage.

D - Achievement of outputs and activities

As explained above, the planned activities were completed, but on a much longer period than initially planned. There were practical and technical reasons for that, such as the harmonisation of topographic maps between Tunisia (scale 1/200000) and Libya (scale 1/250000), collection of a full set of background information and standards, the lack of sufficient data on water salinity to perform the transient flow calibration of the model, the lack of adequate knowledge regarding the aquifer layer tapped by various wells, etc. . There was, in addition, a human and managerial reason, in that the mobilisation of government officers for such joint activity took time and effort.

However, these difficulties have been overcome. The main conclusion regarding water abstraction planning is that the current abstraction level in the Djeffara is not sustainable and would entail a dramatic increase of water salinity in the near future if efforts are not made to reduce it. Such a conclusion can be established with a good degree of confidence on both the Tunisian and Libyan part.

Model of the Western Basin (Bassin Occidental) (WP 11200)

A -Attainment of objectives and planned results

Relevance of project objectives

The SASS Western Basin (Bassin Occidental) relates mainly to the non confined part of the Intercalary Continental (CI) aquifer. The zone has been identified, in Phase 1 of the SASS project, as a target zone for additional studies in view of scarcely exploited potential of the unconfined aquifer resources. New exploitation zones could be created allowing a transfer of abstractions from the region of the Chotts, thus reducing the pressure in the risk zones.

The main issues to be addressed relate to:

- Preservation of the foggaras, which currently constitute the outlet of the South-Western part of the SASS,
- Evaluation of the SASS reserves,
- The conditions of recharge of the Intercalary Continental (CI) aquifer in the North-Western fringe of the Western Basin (Bassin Occidental).

The model should constitute a decision-making support for the exploitation of the aquifer.

In order to meet the 3 issues outlined above, the model should represent the foggaras and their hydraulic functioning. There is a need, therefore, to also conduct a precise diagnosis of the foggaras, based on topographic surveys, flow measurement of the foggaras, and *in situ* examination of the maintenance level (possible warping). The detailed study on the recharge conditions could equally call for a dedicated analysis comprising field observations.

Effectiveness of results achieved

- Synthesis of borehole cross-sections (about 300 boreholes) and lithological interpretation of the cross-sections (geological logs) in order to carry out basin cross sections by interpolation of borehole data, based on the Rockworks software,
- Simplification of stratigraphic series with a view to the conceptual model,
- Development of an outcrops map,
- Cartography of useful thicknesses of the CI, top map, piezometric level map, and map of saturated thicknesses of the CI. The mesh-based data are developed under ACCESS/ Arcview and are directly transferable to MODFLOW,
- Identification and cartography of the most favourable zones of the CI based on marks of belonging to the non confined zone, of depth of water level, of saturated thickness of the CI, of useful thickness,
- Study of the recharge after the outcrops map, the isohyets map, taking into account an infiltration rate in the range of 3 to 6%, estimate of infiltration based on floods of the Wadis, according to the runoff level, average rain on the catchment and basin mean slope,
- Development of the Data Base comprising 2840 water points. Twenty (20) water points serve as control points for level evolution (average level decrease of 6 m in 20 years),
- Compilation of the T and S values existing in the documentation (65 values for the whole zone),
- Analysis of the flow of the foggaras and its evolution,
- Cartography of the foggaras: 1400 are inventoried in 238 palm-tree groves, of which 138 marked out with precision. A detailed analysis of 20 foggaras has formed the subject of an in situ survey,
- Analysis of the evolution of abstractions as per well and borehole.
- Model calibration and prediction of abstraction (The late report dated September 2006 was produced by ANRH in Algeria with its own resources) : The report is not very clear on the applied scenarios (80 or 108 m^3/s?) Dr J. PIZZI made comments and suggested to improve concluding remarks and recommendations: The model shows that new wellfieds will generate a new resource for export northwards, but with impact on the foggaras flow from 2.08 m^3/s under current withdrawal conditions to 1.35 in 2050.

Efficiency of methodology and mobilisation of resources

The area under consideration is highly relevant to strategic decision-making at the SASS level, though the area is located wholly in Algeria. The Consultant (Mr. Besbes) has received very efficient support by ANRH staff, with a great availability by the model-expert (Mr. Larbes) and a major contribution by the field teams under the oversight of Mr. Merzougui.

The hydro-geological synthesis, based on borehole cross sections, could have been usefully complemented by a structural reinterpretation of the whole « Bassin Occidental » (Western Basin).

The study of the Foggaras alone would claim much more time and many more means than provided. Indeed, it has been possible to analyse only about twenty foggaras; the results are, however, significant enough to allow progress in modelling the foggaras.

The data base system (on the SAGESSE model) under MS ACCESS, coupled with ARCVIEW and modelling software used (MODFLOW MP6), are commonly used, updatable and commercially sustainable. They are perfectly adapted to the problem addressed and in line with the will to ensure sustainability of the resources monitoring activities.

Achievement of objectives

The Consultant's contract covers only the first phase which was completed in June 2005. The whole set of hydro-geological parameters and the hydraulic conditions of the foggaras have been made much more precise, by comparison with the initial modelling of the whole SASS. Phases 2 (construction of the model) and 3 (simulations) were delayed but could be completed in 2006 with a major input from ANRH.

B - Assessment of sustainability of project outcomes

The development of this phase has shown the involvement of the relevant services on the national and local levels, as well as a real capacity building, though not easily quantifiable.

The impact of the project on the sustainable management of the resources by preserving the foggaras is not yet effective, for its effects will result from decision-making after evaluation of the model results. At this juncture, the activities conducted allow sensitisation of decision makers to the arising issues and call for an improvement of the SASS regional model in this sector.

C - Catalytic Role

The development of this component with a great support and involvement from ANRH (Algeria) should serve as an incentive for reactivating and updating the full SASS model under supervision and guidance from the three countries and their Consultation Mechanism.

At the national level, this project was mainly based on ANRH in-house resources with a dominant capacity building aspect, while many other aquifer modeling projects in Algeria are contracted to professional consultant groups. Such capacity building should help strengthening the sense of ownership and help inform the decision-making process about strategic uses of water resources in Algeria.

D - Achievement of outputs and activities

As for the Djeffara aquifer study, the project took much more time than initially expected, and was completed more than a year later than the planned end of project. Whilst all activities were performed, time was too short to see the results in terms of water resources "change-management";

Model of North of the Chotts (Biskra) (WP11300)

A -Attainment of objectives and planned results

Relevance of project objectives

The region of Biskra constitutes the northern boundary of the SASS model. It is a zone where abstractions are quite considerable, while the complexity of the aquifer systems remains little known. The object of the study was to better assess the relations between the compartments of the superimposed and overlapping aquifers, with a view to constructing an operational model on the local level, thus making it possible to plan the use of the resources. The model was also expected to provide precise indications on a sector that remained uncertain and, hence, a source of error in the first phase of the SASS project.

Effectiveness of results achieved

- Establishment of a data base comprising 10 000 water points.
- Hydro-geological synthesis with a view to the conceptual model, leading to an identification of a complex system, but simplified into 4 hydraulically differentiated horizons:

  - The upper aquifer in recent sediments, superficial and non continuous,
  - The Mio-Pliocene aquifer (Continental Terminal of the SASS),
  - The TOLGA limestone aquifer, and
  - The Pontian aquifer on part of the zone, isolated from the Mio-Pliocene and the Tolga limestone.

  The hydraulic relations between the various levels and their hydraulic connection to the Terminal Complex (CT) of the generalised SASS model in the south-eastern part of the Biskra zone are elucidated.
- Construction of a multi-layer model calibrated both in permanent and transient flow conditions.
- Establishment of scenarios and processing: The scenarios used during phase 1 of the SASS project are revised and their impact detailed in each of the 4 horizons. Alternative scenarios are also tested.
- The exhaustive compilation of the whole set of abstractions in the Biskra zone has highlighted an abstracted volume that is far larger than the volume considered in the first phase of the SASS project, which illustrates the state of overexploitation, particularly of the Mio-Pliocene, in this sector.
- Substantial reserves have been highlighted in the limestone aquifer.

Efficiency of methodology and mobilisation of resources

The preparation and geological synthesis have benefited significantly from the Algerian part (ANRH and local departments of Ouargla and Biskra), particularly with regard to compilation, critical review and capture of data, as well as to construction of the model, in close cooperation with the technical team of the SASS and the contracted modelling expert (Mr. Besbes). The workshops scheduled have been held. The Tunisian party (DGRE: General Directorate of Water Resources) has equally been able to attend these workshops, for the sake of information.

The data base system (on the SAGESSE model) under MS ACCESS, coupled with ARCVIEW and modelling software used (MODFLOW MP6), are commonly used, updatable and commercially sustainable. They are very well adapted to the problem addressed and in-line with the will to ensure sustainability of the resource monitoring activities.

Achievement of objectives

The hydro-geological complexity of the sector has been elucidated and the relations with the generalised aquifers of the SASS have been established. So-called alternative scenarios, leading to a decrease in excessive abstractions, have been developed, based on realistic hypotheses of better use of water.

B - Assessment of sustainability of project outcomes

ANRH is an active user of models allowing a simulation of abstraction impact and, thus, quantifying the risks attendant upon any new abstraction. The results of the models also serve to investigate requests for borehole authorisations, and are demonstrative didactic tools in order to persuade the oversight bodies of the validity or otherwise of a request for authorisation to exploit the waters of a given horizon. In this sense, the model becomes a tool for the management of the aquifer, and ANRH intends to use the models developed in phase 2 (Biskra and Western Basin) in quite an operational way.

In the case of Biskra, the current exploitation, at least of the Mio-Pliocene, cannot be pursued in the same way for any considerable time, and the model now offers the opportunity to suggest management actions while seeking to promote a more conservative management of the resources. The fairly long term impact of the current overexploitation remains to be evaluated, though it is considered that, on the whole, the zone of Biskra is partially isolated from the main SASS zone by the region of the Chotts.

C - Catalytic Role

Lessons learned and replicable experiences relate to data management and interpretation through aquifer modelling, along with the development of technical information and consultation between Algeria and Tunisia.

D - Achievement of outputs and activities

The model was the first one to be completed as part of the phase II project. All methodologies used were sound and credible.

III.A.2 Hydraulic Component, conducting dedicated studies and SASS monitoring indicators (WP12000 and 13000)

Basin of the Chotts (WP 12100)

A -Attainment of objectives and planned results

Relevance of project objectives

The region of the Chotts is a zone of high-evaporation closed depressions which constitute an outlet of the groundwater reservoir. A salinisation risk of the underlying aquifers (CT and CI) has been identified during the first phase, which would be due to the high abstractions and to the resulting piezometric (water level) decrease.

The water balance (budget) of these systems is little known, and a detailed study is necessary to better define the risk and prepare to address it.

Effectiveness of results achieved

During the inception phase of the project, it was planned to hold a first workshop, then to develop specific monitoring activities on the Chott issue, and then to develop modelling/research activity and organise a restitution workshop.

There was only one workshop held. The workshop held in July 2005 brought together 2 participants from ANRH (Algeria), 2 from CRDA (Regional Commissionership for Agricultural Development, Tunisia), 3 from GWA (General Water Authority, Libya) and the OSS-SASS representative. An overall approach to the problem was defined, comprising a demarcation of the aquifer zones potentially exposed to the risk of salinisation from the Chotts and the Sebkhas, an intensification of water quality monitoring, a conceptualisation of the hydro-chemical functioning, with a view to a modelling of the salinisation process.

Efficiency of methodology and mobilisation of resources

The approach was to raise-awareness among the participants to help mobilise the academic and research institutions to conduct scientific studies in this regard. However, such activity remains at the very initial stages. Research and study activities may have been conducted on national level by academic and research institutions, but such experiences have not been as yet evaluated under the project.

The representatives of the countries have pledged to provide a location map of the zones connected with the risk of salinisation in the Chotts and Sebkhas, as well as a synthesis of the problem posed, in order to define practical recommendations to be implemented within the framework of the "Consultation Mechanism" (Mécanisme de Concertation).

Achievement of objectives

Limited to recommendations and guidance for further studies.

B - Assessment of sustainability of project outcomes

No sustainability has been secured at this stage. It is still dependant on the downstream impact of the approach initiated during the project.

The OSS/SASS team seeks to develop actions related to this issue in connection with international research programmes, particularly the IAEA, the AQUIFER programme of the European Union, the TIGER programme developed by the European Space Agency.

C - Catalytic Role

Limited.

D - Achievement of outputs and activities

Limited.

Basin of Ghadamès (WP 12200)

A -Attainment of objectives and planned results

Relevance of project objectives

Significant abstractions are planned by Libya, with likely interferences in Tunisia and in Algeria. The stake connected with this component is particularly important insofar as it

belongs in the heart of the process of shared management, in a sensitive border zone. The tasks envisioned were:

- conducting a study on the long term needs in the basin;
- conducting large-scale simulations;
- organisation of a workshop to present the results.

The tasks are a necessary step to harmonise the views of the three countries on available joint water resources, prior to agreement on their possible allocation.

Effectiveness of results achieved

After a number of postponements, a workshop was finally organised uin June 2006 in Tunis, and the expected results could be implemented and they were detailed in the workshop report. The workshop made it possible for the participants to reach a consensus from a previous situation where country representatives had different or opposite views. The argument was about the level of abstraction planned in the Libyan side of the basin and its impact on the water level in neighbouring countries.

Between 2000 and 2006, several data sets have been collected in the three countries and they were checked and integrated in the SASS model. On the basis of these new data, the model was improved in the zone of Debdeb-Ghadames-Tiaret, with negative repercussions elsewhere. To correct these repercussions (in the global coherence of the model) would require one period of calibration longer than the week of the workshop.

A common understanding was reached on the expected drawdown resulting from the abstraction scenarios, which were tested.

Efficiency of methodology and mobilisation of resources

In the case of the Ghadames basin, the new data could clearly improve the details of the SASS model and provide reliable results. The expected resources were mobilised (one expert contracted by the project team and contribution of the three countries at the right level of representation).

Achievement of objectives:

The consensus on the available resources was reached (in terms of common assessment of drawdown versus abstraction)

<u>B - Assessment of sustainability of project outcomes</u>

Outcomes of the project should be understood as technical (joint approach of data validation and impact assessment of the planned abstraction) and human in terms of confidence building. Both aspects were successfully developed.

<u>C - Catalytic Role</u>

The process of data gathering, checking, validating was a good example of consensus building on the basis of sound technical grounds. The component shows that it is possible to allocate water resources in a shared water body, through joint validation of technical assessments and reach a final agreement.

D - Achievement of outputs and activities

New data was included in the common data base and the SASS model could be updated, re-calibrated in the Ghadames area, allowing for prediction of impacts of potential abstraction in the area. The workshop report was communicated to all parties as part of the Consultation Mechanism.

Common monitoring networks on SASS-scale (WP12300)

A - Attainment of objectives and planned results

Relevance of project objectives

Stake: The SASS networks constitute the first large-scale action of consultation (concerted action) insofar as their setting up and the data collected and exchanged represent the basis of monitoring the Basin and of the likely modes to be implemented by the three countries within the framework of shared management. Without a piezometric (water level) and water quality monitoring of the various superimposed aquifers, no proactive management could obtain.

The objective of the component is to develop the following activities:

- validation of the selection of the existing water points;
- identification of the sectors to be provided with new measurement points.

The main functions of the piezometric network have been identified as follows:

- monitoring the generalised drawdowns and abstraction flows;
- control of the risk zones identified by the SASS study;
- proper control of the future drawdowns (2000 – 2050) calculated in the provisional (forecast) simulations of the SASS.

As regards the quality network, the project presentation report pointed out that « the establishment of such a network is necessary and urgent. It will be done based on the analysis of the Tunisian network and the possibilities of its extension to the rest of the basin».

The development of a monitoring network on SASS level requires preliminary management on the national level of a network validated by the 3 countries, then implementing a mechanism of data exchange via the SASS Information System (IS).

Effectiveness of results achieved

A tri-partite task force (working group) was set up, and it carried out the tasks outlined below, related to the piezometric network:

- identification of a historical reference network (1st phase of the project);
- rationalisation of the network (2nd phase of the project).

The selection and rationalisation of the network have formed the subject of the doctoral dissertation of F. Horriche, entitled « Contribution à l'analyse et à la rationalisation des réseaux piézométriques" (Contribution towards the Analysis and Rationalisation of the Piezometric Networks), ENIT (Tunis National School of Engineers) - 2004.

- The procedure for the selection of water points has led to an initial short-listing of 73 points out of the 8800 points of the SAGESSE data base. This network constitutes the historical reference network.

- The rationalisation of the network consisted in a detailed analysis of the needs in water points corresponding to each criterion:

  - Better space coverage,
  - Representation of major drawdowns,
  - Better coverage of the non confined zones of Erg Occidental (Western Erg) in order to enhance the reliability of the model,
  - Coverage of risk zones,
  - In fine: 78 points in the CI (Intercalary Continental) and 52 points in the CT (Terminal Complex) were selected after rationalisation (as against 46 and 27 at the start). The consolidation relates mainly to the Algerian and Libyan networks.

Efficiency of methodology and mobilisation of resources

National teams have conducted site visits in order to identify the rationalised network, which does correspond to the sequence of operations initially scheduled. A workshop was organised in May 2005 in Tozeur (Tunisia) in order to finalise agreement on the method of selection of the network points and conduct field visits as regards the Tunisian network. In addition to the SASS team, the workshop brought together three officials from the DGRE (Tunisia), two officials from GWA (Libya) and one representative from ANRH (Algeria). Similar workshops were due to be held in Algeria and Libya, but they have not been scheduled to date.

Achievement of objectives:

The network proposed so far, after validation by the national teams, comprises 100 water points (as against the 130 above). However, new water points must be integrated or constructed, particularly in the Bassin Occidental (Western Basin) where the list of 100 water points leaves certain gaps. National willingness is clearly expressed in this regard.

Certain difficulties have been noted: Indeed, while in Libya the network is composed of piezometers intended exclusively for measurement (observation wells), in Tunisia and in Algeria, exploitation wells and boreholes are used for this purpose. A stay period of several days is provided, however, prior to the measurement rounds in order to guard against any immediate pumping influence, in which case the measurement would not be representative of the overall state of the aquifer.

The report on setting up the SASS piezometric network puts forward the following recommendations:

- Data acquisition protocol: A data marking nomenclature is mentioned. This provides for an annual measurement, which may seem to be sufficient in view of the slow evolution of the overall level of the aquifers, subject to the measurements being representative of this state,
- The procedure of validation and analysis of the data which should comprise enough features related to the measurements to allow for analysis,
- The formalisation of the data exchange modes (a centralised system is envisioned),
- The dissemination of the annual status reports and analytical reports every 3 years,

- Within the Consultation Mechanism (Mécanisme de Concertation), a technical task force is proposed.

B - Assessment of sustainability of project outcomes

This component has led to a real mobilisation of the national teams that have benefited from the study conducted under the project, insofar as the network will, on the one hand, meet the national needs and, on the other hand, supply the data base common to the three countries. Substantial progress in the rationalisation of the networks on national level has been noted, and some harmonisation has begun between the three countries.

C - Catalytic Role

As stated above, there is a direct link between the development of a common monitoring network to meet the objective of global management of the SASS and national monitoring of water resources, in terms of standards; procedures and equipment.

D - Achievement of outputs and activities

The work of definition of the SASS piezometric network has been well advanced; however, there remains the task of carrying out the whole set of activities which will make the network operational. The quality monitoring network has formed the subject of a workshop that has also considered a number of studies dedicated to the interferences between the chotts and sebkhas, on the one hand, and the aquifers , on the other hand (see above), though the activities related to this network have remained quite limited.

III.B WP 20000 Socio-Economic Component

A - Attainment of objectives and planned results

Relevance of project objectives

The overall objective is to ensure a grasp over the relevant socio-economic parameters in order to develop an approach of management of water demand coupled with a management of the resource. The initial objective is « to consolidate the hydraulic results with a socio-economic analysis with a view to setting out a long term development strategy.» This component was initially intended to comprise the following sub-components:

WP21000 – Socio-economic study of the SASS
WP21100 Overall socio-economic study of the SASS
WP21200 Detailed socio-economic studies (in the identified risk zones)
WP22000 – Irrigation modes on the level of the whole SASS basin
WP23000 – Crop types and impacts on the SASS basin
WP24000 – Long term development

According to the initial project presentation document, the studies should relate to a diagnosis and evaluation of the current state, and more particularly to:

- Distribution of the population,
- Distribution and typology of the livestock,
- Distribution of land use and of irrigated zones,
- Agricultural and agro-pastoral practices,
- Irrigation modes and their impacts,
- Crop types and their yields,
- Soil types,
- Impacts on the soils and their productivity,
- Existing infrastructures.

These data, coupled with the hydraulic and environmental data (WP30000), should subsequently be integrated in an optimisation model in order to direct decision makers towards economic solutions adapted to the SASS zone, in general, and to the specific sites, in particular, and meeting the needs of the population. The task consists particularly in setting out recommendations related to:

- Establishing a water saving policy,
- Selecting the most appropriate irrigation mode,
- Conversion of certain activities and proposal of alternative activities.

The socio-economic analyses would serve, in this context, the objective of proposing various estimations of water up to the time-frame 2025 according to simple hypotheses and models, with a view to subsequently introducing such scenarios in the model developed in phase 1, and enabling decision makers to define strategies based on tried and tested alternatives.

Effectiveness of results achieved

The project team has established, as a complement to the scheduled tri-partite workshops, a set of dedicated studies that have formed the subject of restricted consultations for:

- The services in each of the countries of a National Agronomist or Geographer Expert based on the following programme (3 months per country):
    - Inventory of the crop growing and stock-breeding systems, with cartography,
    - Description of each crop growing system and of the farming practices related thereto,
    - Collection of data related to the yields obtained from each crop,
    - Collection of the water volumes consumed as per crop and as per crop growing system,
    - Inventory of the livestock and of stock-breeding practices,
    - Inventory of irrigated areas,
    - Site visits, if possible.

- The services of a National Socio-Economist Expert based on the following programme (4 months per country):
    - Collection of sale prices of each agricultural product,
    - Collection of water prices and water and land access terms,

- Collection of costs of water conveyance infrastructures,
- Collection of crop costs (inputs, etc.),
- Data on total population and urban population,
- Projections of domestic water consumptions,
- Information on urban water drainage,
- Data on the use of industrial water.

The following reports have been produced. For each of them, we provide herafter a very brief summary of results.

Essai de synthèse socio-économique, Pierre HUBERT (Socio-Economic Draft Synthesis) - September 2005

This report proposes a synthesis of the socio-economic elements allowing a definition of water demand.

The national reports were presented in Tunis on 9 December 2004. These national reports are as follows:

Slimane BEDRANI and Fouad CHEHAT « Données agronomiques et socio économiques sur la zone SASS en Algérie » (Agronomic and Socio-Economic Data on the SASS Zone in Algeria - 73 pages:

Agriculture in the SASS zone, results of farm surveys, socio-economic data.

Mohamed ELLOUMI and Mongi SGHAIER, « L'agriculture et les différents usages de l'eau dans la zone SASS en Tunisie, Analyse socio-économique » (Agriculture and the Various Water Uses in the SASS Zone in Tunisia : Socio-Economic Study), January 2005 - 67 pages:

Presentation, analysis and evaluation of the current situation in Tunisia, and a data base (BD_SASS-1 and 2).

Ali MHIRI, « Les systèmes de culture et d'élevage de la zone SASS du Sud Tunisien, projet SASS phase II » (Crop-Growing and Stock-Breeding Systems in the SASS Zone of the Tunisian South) - 96 pages:

Resources and factors of agricultural production, land use and crop-growing and stock-breeding systems, regional analysis of agricultural systems in the SASS zone in Tunisia.

Omar SALEM, Sadek KADRI, OSS/SASS phase II, socio economic aspects of Hamada El Hamra Sub-basin:

Description of the overall SASS zone: current exploitation and future water demand.

Omar SALEM, Sadek KADRI, Socio-economic aspects of Jeffara basin:

Estimate of water demand and forecasts. Irrigation water is estimated based on satellite images, as well as on power consumption of farmers.

The synthesis report presents a synthesis of demographic projections per wilaya (administrative province) for 2000, 2010, 2020, and 2030, as well as consumption figures per country as obtained from the national reports.

- Industrial water demand: mainly oil. In Algeria and Libya, the industrial water demand, other than that for oil industry, as a percentage of domestic consumption: 35% in Algeria, 14 l/day/inh. in Libya.

- Crop growing systems:

  8 crop growing systems are considered (cf. environmental impact report). Together with statistics on the number of farms and irrigated areas, as well as their evolution and estimates of current and future water demand.

- Livestock: A detailed account is proposed for the 3 countries.
- Evaluation of water cost: Algeria: The subsidy/ grant mechanisms make it difficult to disaggregate certain cost items. Tunisia : Statistics on water costs are produced. Libya: The report only mentions the water cost as a means of action in the water policy.
- The economic valuation of water is estimated based on the production prices of grain crops and other in Algeria and Tunisia. No figures are provided for Libya.
- Recommendations of the 3 reports:
  - Using water in a more efficient way and investing in water saving techniques, particularly in agriculture, in view of lack of knowledge by up-starting farmers;
  - In urban environments, there is a need to pass from a supply-based policy to a demand-based policy, coupled with support (subsidy) to incomes and not to water price, which induces wastage. Need to adapt luxury equipment to scarce water. Better manage the networks (Tunisia);
  - Promoting non agricultural activities. The « water cost » of an agricultural use is higher than that of a non agricultural use. Alternative tourism (Tunisia);
  - Developing research in all fields, including participatory research and agronomic research (plants to be grown, techniques and technologies). Improving farming techniques in rainfed crop systems (collection of flood spreading water);
  - Developing biological farming, promoting high added-value products, rehabilitation of pastoral rangeland;
  - Establishing an integrated management. Regionalisation of strategic studies. Economic comparison of alternatives. Political actions (Libya: prohibit the exportation of agricultural products, cancel certain subsidies, use treated wastewater, etc.), re-allotment of the GMMR (Great Man Made River) water resources, with a new priority for domestic water at the expense of irrigation, set water prices, raise awareness of the populations, etc.

Efficiency of methodology and mobilisation of resources

Besides the specialised studies entrusted to the experts, a presentation workshop took place on 9 December 2004 which reported that the profile of current and future water demand is difficult to evaluate in comparable terms in view of the disparities between countries with regard to the statistical tools, the policies and concepts which govern water management. At this stage, it seems that the Steering Committees have not contributed much to these studies.

The participation of other stakeholders than those of the water sector, in the strict sense of the term, should be an objective, in order to set up an efficient system for the collection, management and analysis of socio-economic data.

Achievement of objectives

The synthesis report noted that the national reports had provided « data varying considerably in scale of the area on national level, which data were at times contradictory and imprecise». According to the said report, « the data are disappointing with regard to prices, cost or valuation of water. The national reports differ too much because there was not enough precision in defining what was sought, and which socio-economic data would be useful for the Consultation Mechanism. The analysis of water cost has remained embryonic.

There may also be noted a certain number of new and useful elements expressed by these syntheses, of which in particular a better grasp over the efficiency of the crop and irrigation patterns from a technical perspective, in terms of 'productivity' of a cubic meter of water and, from an economic perspective, in terms of cost and added value.

While the alternative scenarios have been mentioned and described, they remain to be defined in detail and formulated quantitatively so that they may be integrated as forecast scenarios in the models. There is also need to define, either at the national level or at the regional level, the actions (incentive policies, regulations, agricultural extension, technological development, etc) likely to help towards alternatives ensuring sustainable management of the aquifers.

B - Assessment of sustainability of project outcomes

The workshops and studies conducted have remained at the stage of reflection on the level of regional strategy. The orientations expressed by the analysis of water use, in the same way as the environmental component of the programme related to salinisation of the soils and protection of wetlands, have no doubt contributed to promoting better use of water on national level. Thus, one notices, for instance, the recent developments in Algeria, with the National Plan for Agricultural Development (PNDA) setting out new orientations for the pricing of drinking water, encouraging water-saving irrigation modes, and including a sanitation fee.

The approach of officials has developed towards a better integration of the socio-economic and environmental parameters in decision-making processes. However, principles of participatory management are invoked by officials.

C - Catalytic Role

The implementation of the socio economic component remained at the level of "paper work"; However, the dissemination of results and recommendations have played the role of a 'kick-off' activity to bring new issues and concepts regarding the economic value of water and new reflexions regarding the optimisation of use and protection of the water resource.

Approaches consisting of imagining alternative economic scenarios have gained new ground. The three countries can thus better appreciate the similarity of the problems faced in their respective contexts and envision joint efforts to resolve them.

D - Achievement of outputs and activities

Despite the above mentioned shortcomings of recommendations expressed by the reports, the planned reports have been produced, and one workshop was organised.

III.C WP 30000 Environmental Component

A -Attainment of objectives and planned results

Relevance of project objectives

The objective set for this component was to identify all sources likely to cause the resources and the ecosystems to be vulnerable, as well as to develop environmental indicators based on monitoring the evolution of the SASS.

The following sub-components have been defined:

31000 Soil quality indicators,
32000 Water rise indicators,
33000 Recharge,
34000 Wetlands.

They correspond to the main environmental hazards likely to result from the exploitation of groundwater, either directly (analysis of the recharge), or indirectly:

- The rise in the water of shallow aquifers, related to network losses or to disposal of water previously pumped in the deep aquifers,
- Salinisation of the soils, due to irrigation by mineralised water,
- Protection of the wetlands endangered by wastewater and the economic activities related to the use of groundwater.

This component was intended in particular « to set out recommendations related to the safeguard of the ecosystems of the zone (oasis, Chotts, Sebkhas, etc.) both from the ecological and biodiversity perspectives. The promotion, dissemination and access to environmental information, as well as the instilling of safeguard practices upstream are guarantors of a better future in the zone. In order to achieve this objective, the regular design and production of environmental indicators will be necessary in order to ensure monitoring of the main environmental issues in the zone » (Excerpt from the Presentation Report of Phase II of the Project).

The same report offers a succinct description of the various activities:

WP31000 – SOIL QUALITY INDICATORS

A soil quality indicator will be developed based on the combination of several parameters, mainly typology, farming practices and water rises. This indicator will be established in order to back up the recommendations as to the development possibilities in the zone.

WP32000 – WATER RISE INDICATORS

Certain zones undergo intense exploitation in their deep-lying aquifers, which generates high additional supply to the shallow aquifers and induces level rises whose effects are harmful to the oasis and to urbanisation (which impacts are visible in the region of El Oued in Algeria). In order to better grasp this problem, an inventory of shallow aquifers, particularly those located in the vicinity of deep boreholes, will be conducted. A water rise indicator in this zone will be established and regularly adjusted in order to ensure monitoring leading to recommendations for a protection strategy.

WP33000 - RECHARGE

The activities recommended under this item aim at refining knowledge about the recharge of the system. These involve in particular:

- a detailed cartography of the outcrops (recharge areas);
- study of the hydro-dynamic and hydrological conditions of the recharge.

These activities relate mainly to the North of the Basin, which is the main supply zone and will integrate the results of the AIEA study in which the OSS is a partner.

WP34000 - WETLANDS

The importance of wetlands in the SASS zone is paramount. The activities conducted in this regard relate to:

- the inventory of wetlands based on cartography,
- the identification of pollution sources,
- proposing recommendations for a protection of these zones.

WP35000 – STATE OF THE ENVIRONMENT AND PROTECTION STRATEGY

Technical specifications for these studies have been drafted with a view, on the one hand, to establishing cartographies of salty zones and wetlands based on the processing of satellite images and, on the other hand, to developing the related national syntheses:

TOR for the remote-sensing based environmental component:

- Bases: Low and high resolution images, studies of salted soils and wetlands, acquisition of Low Resolution images: NDVI and gross canals (5 years: 1999 to 2003).
- Preliminary processing of Low Resolution images and formatting with the same cartographic references as those of the SASS data.
- Wetlands Maps at 1/1000000 and development of evolution profiles.
- Salty zones: characterisation, cartography at 1/1000000, evolution over time, choice of zones to be studied in further detail.

- Selection of periods and HR (high resolution) images, preliminary processing of HR images and processing, maps at 1/50000 of the zones studied. Cartography of salinity risks based on 4 classes.

These ToR were subject to a restricted solicitation in June 2004, with implementation scheduled for 6 months.

TOR for national experts, environmental component:

- Inventory of salted soils and evaluation of salinisation impacts. Develop a map of farmland at 1/1 000 000 and a map (ranging from 1/100 000 to 1/20 000) demarcating the various soil salinity classes, with mapkey and file;

- Wetlands throughout the Sahara. List the wetlands on cartographic support with name, coordinates, area, geographic framework, type, RAMSAR criteria, physical features, ecological features, flora, fauna, risks and threats to biodiversity.
  (3 months per country)

A synthesis of environmental impacts connected with SASS exploitation has also formed the subject of a contract entered with a consultant.

The Terms of Reference (TOR) of the studies commissioned cover in a fairly comprehensive way the activities scheduled under WP31000 (Soil quality indicator), WP33000 (Recharge of aquifers) WP34000 (Inventory and description of wetlands), and 35000 (State of the environment and protection strategy). However, the component WP 32000 (Water level rise) has not been specifically scheduled during the phase II.

Effectiveness of results achieved

<u>Soil quality indicators and Wetlands:</u>

- Several detailed reports were produced on salinisation of soils.

- General maps of wetlands have been made (1/ 2 300 000 for Algeria)
- Each national report comprises a description of Wetlands: Sebkhas, Chotts, Water sheets, Seasonal salty lakes, Oases, together with a detailed file for each identified wetland.
- A second Remote sensing study was completed in 2006 (Etude composante environnementale, étude haute résolution: Environmental Component study, Second Phase, High resolution study: May 2006.): 3 sites have been selected for the study: Chott Melghir et Chott Merouane in Algeria, Chott elDjerid in Tunisia, Tawurgha Sebkhat in Libya . The objective was to characterise wetlands and salted soils at a scale of 1/50,000 with Aster (thermal emission and radiometer reflection tool embarked on the TERRA satellite (15 m resolution) and data was validated by field survey.

- The main environmental risks for each of the wetlands are described:
  - Wastewater disposal sites,
  - Unregulated deposit sites of solid and materials wastes, etc.,
  - Lack of upkeep,
  - Overexploitation and irrational use of water (particularly in the Oases),
  - Silting up and degradation of lakes and dams,

- Risks of extinction of species, especially migratory ones.

- The recommendations relate to:

  - Evaluation of the lands used in the oases in order to reduce water consumption, as well as control seawater infiltration in the sebkhas in Libya,
  - Awareness-raising (maps, publications, films, involvement of universities, associations, etc.)
  - Development of alternatives activities: fish-farming, tourism, sports, etc,
  - Taking in charge wastewater treatment, training of managers,
  - Listing of wetlands, legislative adjustments, international cooperation,
  - Enhancing a quantitative knowledge of the environmental features of wetlands (fauna and flora inventory).

The reports constitute a good description of the wetlands and their vulnerability. The diagnosis of threats remains quite qualitative.

Recharge:

Work on recharge was developed through university of Tunis, and was synthetised in two main documents:

- Mr. Besbes and Mr. Babasy: Study of the Recharge of the North-Western Sahara Aquifer System: Progress Report; Oct. 2004.
- "Study of the Recharge and Paleo-recharge of the SASS », doctoral dissertation of Mr. Babasy, defended in January 2005). This research work rests on the SASS mathematical model, the isotopic analyses and the modelling of efficient rains and of the infiltrations from the Wadis in the outcrop zones of the formations concerned.

Recharge is estimated as 7 m^3/s in the outcrop zones of the CI (Intercalary Continental) of the Saharan Atlas**.**

State of the environment and protection strategy:

- The cartography of salted soils has been developed based on satellite imagery,
- A synthesis report on SASS exploitation related environmental impacts has been drafted:

  The synthesis report draws upon the whole set of data, i. e. the cartography made by interpretation and classification of satellite data, the national environmental appraisals on the state of irrigated zones and the salinisation risks, as well as the reports on agriculture and the various uses of water (socio-economic aspect). It notes the extension of irrigated farming from the SASS in previously uncultivated and sparsely inhabited zones. The incentive policies for the development of irrigated farming, with investment financing, have at times had perverse effects, because, due to lack of expertise, part of these new irrigated zones have been abandoned after a few years. On the whole, irrigated lands have passed from 60 000 to 250 000 ha. The average salt content of the SASS waters is of 2g/l, that is 44 million tons of total salts for 2.2 billion m^3 in 2000.

  The new crop growing systems (single crop, open irrigated systems, greenhouse farming, mixed systems) induce the forsaking of relatively balanced traditional farming methods (traditional oasis)

The impacts are partly classified and quantified:

Impacts on the aquifer : piezometric decrease, reduction of artesianism and hence drying up of springs, together with a rise in pumping costs, deterioration of chemical quality of the aquifer water due to a change in the hydraulic balance (marine intrusion via the chotts or any other aquifer);

Impacts on irrigated zones: salinisation, hydromorphy, combination of salinisation and hydromorphy, loss of fertility, dysfunction of oases and loss of biodiversity;

Indirect impacts: steppe rangelands (urban settlement of nomads, overexploitation of load capacity, degraded wetlands and landscapes (sanding up), impacts of disposal of industrial and urban effluents.

The environmental performance of use of the SASS would translate into a drop in the yield per hectare due to salinisation (in the range of 23% in Algeria, 7 to 8% in Tunisia and in Libya). At the same time, the current economic efficiency of irrigation water is mediocre; it would be about half of the potential performance.

Traditional preventive measures (choice of the soils and of the crops, drainage, etc) and the curative measures (maintenance of drainage ditches, adapting of irrigation doses and frequencies, etc) have been suggested.

The Action Plan as deriving from national activities and a regional action plan includes:

- Dissemination of SASS results : seminar, CD, annual newsletter on the state of the resource and its use,
- Building the capacity of the management operators in efficient water management: dedicated modules on monitoring – evaluation methods,
- Development of scientific and technical research on various topics related to mobilisation through to use of water in the area common to the 3 countries,
- Implementation of the regional monitoring – evaluation of exploitation, use and environmental impacts, with a balanced score card (performance chart) for purposes of the “Mécanisme de Concertation”/ Mechanism for Concerted Action (given in annex with monitoring – evaluation grid of indicators, distributed into:
  - SASS indicators: volume abstracted, number of water points, drawdown, dried up springs, map, drop in artesianism, water quality,
  - Irrigated zones indicator: total area irrigated, drained, salinised, hydromorphous, crop productivity,
  - Livestock Indicator: number and evolution,
  - Wetlands : total area, degraded area,
  - Human resources: total population, agricultural assets, exploitation area,
  - landscape: affected compartments.

Efficiency of methodology and mobilisation of resources

The scheduled studies have been conducted for the major part by consultants, as well as by academic research activities. Data collection has been done with the contribution of the national project teams. The difficulties met relate mainly to the non availability of precise statistical data and the disparateness of information sources. A presentation workshop, bringing together the relevant parties in the 3 countries, would have been useful (unless this has actually taken place, though we have not seen the minutes of any such workshop).

Achievement of objective:

The analysis of environmental impacts is clear, fairly complete and concise. The quantitative deficiencies of statistical data have been identified. With regard to the recommendations, emphasis should be placed on further details on the indicators. In particular, the sources of degradation of the wetlands should be clearly identified with a view to mainstreaming their amelioration in the development actions (sanitation or other).

The phenomena of water rise (in certain palm-tree groves, they result from wastewater infiltrations in the depressions and are highly harmful to palm-trees) are mentioned; however, their scope remains little known and no precise study has been undertaken thereon.

As regards the recharge of the aquifers, activities have been conducted on a research and academic level, the SASS project team carried out coordination and facilitation activities.

B - Assessment of sustainability of project outcomes

On actual environmental management in risk zones

As of the present stage, the studies conducted and documents produced allow a classification and ranking of the problems encountered and actions to be undertaken; yet they have not had any measurable effect on the ground, except for a better knowledge of the vulnerable zones, the degradations in progress and problems encountered by officials in neighbouring countries. Information must now circulate via the actions recommended in the reports. Recommendations emanating from the scientific studies should be further promoted.

On SASS management

It is now advisable to revisit the elements of the diagnosis to specify the quantification of the impacts and enter the quantified elements in an updatable data base. The identified environment monitoring indicators (wetlands and salted soils) could be made operational by setting up a network for environmental observation and monitoring, as well as by the development of alternative scenarios which rest on a concerted strategy and take into account both the environmental and socio-economic parameters.

C - Catalytic Role

- Some feedback from Algeria and Tunisia, regarding lessons learned and replicability has been obtained through a questionnaire we sent in March 2007.
  The reports have been distributed among governmental and other institutions and stakeholders in both countries. Some of the results were presented in conferences and technical workshops.

- In Algeria, specifically, the protection of wetlands is integrated in a National Water Master Plan, and a wetland evaluation and development project is planned for implementation in 2007. The Ministries in charge of wetland monitoring and protection, namely the Ministry of Environment and the Ministry of Agriculture, benefited from the project assessment and recommendations.
- As far as agriculture is concerned, Algeria and Tunisia promote new irrigation practices, such as drip irrigation in the newly developed farming areas. In Algeria, the « Agence du Bassin Hydrographique – Sahara » (Water agency for the Sahara region) is currently developing a programme of sensitisation adressed to the farmers.
- Regarding the salinisation process incurred by the exchanges between the surface bodies and aquifers, the policy is moving towards the prevention of drilling new wells in the vicinity of the Chotts. A research programme is being designed between ANRH and University.

D - Achievement of outputs and activities

It may, therefore, be considered that at least four out of the five constituents of the environmental component have been addressed and that the initial inventory and diagnosis objectives have been achieved. Dedicated situation studies remain to be finalised, of which in particular the impact of dams on the recharge.

III.D WP 40000 Information System (IS) Component

A -Attainment of objectives and planned results

Relevance of project objectives

This component aims at reinforcing the achievements and acquired experience of Phase 1, by complementing them with other than hydraulic data and defining the modes of administration and anchorage of the Information System (IS). In the initial presentation of Phase 2, a series of activities has been envisaged under the form of sub-components:

WP 41000 – Building up the topographic and geological map collection and constructing a Digital Ground Model (MNT)
Acquisition of topographic maps at scales ranging between 1/250.000th [e] and 1/50.000th then digitisation. Development of a Digital Ground Model (MNT).

WP42000 – Analysis of relevance of the data

WP43000 – Structuring the data base (DB)
Adapting the structure of the existing DB and of its conceptual model in order to integrate the socio-economic and environmental data..

WP44000 – Construction of the Information System (IS)

WP45000 – Refining combine analysis tools
The tools should be likely to combine data from various sources (hydraulic, socio-economic and environmental) in order to conduct the necessary queries and develop the indicators mentioned above.

WP46000 – Final validation of the Information System (IS)

WP47000 – Development of the gateways between the Regional Models and the SASS Model

WP48000 – Final implementation of the information system
Technical construction and organisation of training workshops

WP49000 – Development of a cartographic server
Implementation of a cartographic server connected to the Data Base and to the Model.

The project log-frame has simplified this list by splitting it into 6 sub-components:

WP41000 Building up a topographic map collection,
WP42000 Data analysis,
WP43000 Establishment of a common data base (DB),
WP44000 Establishment of an integrated Information System (IS),
WP45000 Data analysis tools,
WP46000 Development of a cartographic server.

The whole set corresponds to an integrated Information System which was to be made accessible to the 3 countries, with access and management rules to be defined in Phase 2. This tool was intended to allow the provision of all the data available and necessary for decision- making in relation to the shared resource. The Information System (DB + GIS) is the indispensable foundation on which the « Mechanism for Concerted Action » rests, subject to its being properly supplied, updated and managed.

In order to develop this activity, the OSS/SASS provided a GIS – Data Base expert consultant's contract, who's Terms of Reference (TOR) were as follows:

- Design 3 new dedicated data bases for the Djeffara, the region of Biskra and Bassin Occidental (Western Basin) which would be compatible with the SAGESSE data base;

- Transfer to SAGESSE the whole set of data.

Programme:

- Complement and improve the SAGESSE structure with new tables and the necessary management tools,
- Structure the whole set of data,
- Set up the data control, display and analysis tools,
- Develop the DB – GIS interface for combine use of queries and simulation.

As regards the GIS:

- Organise the available data,
- Draw up and implement a programme for the acquisition of additional data (images, digitisation, etc.),
- Assist the national teams in gaining mastery over the DB and the GIS,
- Define the attributes,
- Develop tools for spatial analysis, cross-checking of subjects, geographic queries, utilities,
- Develop the technical mechanisms for passing from the SASS (SAGESSE) to the local level,
- Propose options for information exchange within the group, administration and management of the Data Bases, training of the users, updating the Information System and ensuring consistency on local and regional level.

2 missions per country and 3 missions at the OSS.
– Project time-period : 15 months,
– Bids submitted on 30/03/2005. Mr. Belkacem ABDOUS has been selected.

These Terms of Reference (TOR) cover part of the objectives defined above, the other part being conducted by the national teams and the SASS project team.

Effectiveness of results achieved

The consultation of the documents produced (and listed as appendix to the current report) has been complemented by testing certain functionalities of the Data Base and a demonstration of the GEO-SASS geographic server conducted at the project offices in Tunis. However, there was not enough time available to explore the whole set of functions of the Information System (Data Base + GIS) and pronounce on the body of data available, the analysis and processing potential and the user-friendliness of the system.

The activities envisioned included a technical component (development of tools, validation of data, training, installation) and an organisational component related to the data exchange modes and the operating of the system. On the technical level, the results are as follows:

- Establishment of three local data bases and GIS corresponding to the models developed in Phase 2: Plain of the Djeffara (6000 water points), Biskra (10000 water points) and Bassin Occidental (Western Basin). These data incorporate the wells of the surface aquifers, unlike in the initial Base.
- The data bases are structured in a manner identical to the main data base, SAGESSE, which rests on ACCESS, ARCVIEW, MAP-OBJECT, together with an interface under MODFLOW-PM5 and PM6. SAGESSE and the three new local bases operate under WINDOWS XP and will be updated in an automatic way with the future MS Windows versions. The data may be extracted from the base or imported from Excel files.
- There were a few problems of installation of the system in Libya, due to non adjusted formats between the French and English versions of the software; however, these problems have been resolved, and the data bases operate in each of the three focal points.
- The data may be represented graphically under ARCVIEW. A common alpha digital and geographic referential has been adopted. In fact, the coordinates used in Libya and in Algeria are the UTM coordinates and degrees, the grades in Tunisia, or Lambert South in certain cases in Algeria. X and Y are converted into Decimal Degrees. The standardisation is made at country level; but validation procedures are provided for the webmaster (administrator).
- The temporal data (for instance, piezometric campaign, flow time-series, rainfall records) are stored in annex tables.
- The grid used by the models (MODFLOW) is workable under ACCESS based on ARCVIEW (but directly within ACCESS). The tables may be called up in MODFLOW.
- An operating mode of management of the data bases has been sketched out: each focal point can introduce changes only in its own data (i.e. those of its own country). Only the webmaster can update the SASS common data base by importing files/bases that are updated separately in each of the countries. This operating mode has not, to our knowledge, been tested in real time.
- Extracts are possible for purposes of processing, such as, for instance, conducting automatic geological cross-sections based on the « Rockworks » software, or reproducing the data under graphic or cartographic form.
- A geographic server, GEOSASS, has been developed (javascript Applet Java J2EE under STUTS framework). GEOSASS displays pre-established results based on data base queries.

- The local data bases (of the 3 models of Phase 2) have been installed in each of the focal points.
- A workshop on data exchange and validation was organised in July 2005. This workshop has made it possible to introduce corrections in the SAGESSE application. It brought together the officials of the Information Systems of DGRE (2 persons), of ANRH (1 person), and of GWA (3 persons)
- A GEO-SASS webmaster's guide was produced, and a training workshop for users and webmasters (administrators) was organised in June 2005.
- An instructions booklet for the SAGESSE software was produced.

Efficiency of methodology and mobilisation of resources

- Use of common, user friendly and practical software;
- Several expert's missions in the three countries have taken place, and national and regional validation workshops have been held;
- The data have been collected, clustered, prepared and entered in the data base by the national counterparts;
- Significant technical input by the SASS project team.

Achievement of objectives

Considerable data capture, validation, analysis and representation work has been done in each of the three zones forming the subject of modelling (Biskra, Djeffara and Bassin Occidental/ "Western Basin", Ghadames area). New information layers are now available and usable in the GIS/ DGM; abstractions, recharge, demographic data with projections, irrigated zones, crop maps, physical data (catchment basins) or administrative data are also available.

One task remains to be addressed, though, and it relates to systematising, in these same zones, the availability of the socio-economic and environmental data, under a factual or temporal form, then extending such functionalities to the whole SASS.

The dedicated tools are available: Projection of populations, recharge, interpolation, abstraction time-series. It is also worth mentioning the new possibilities of capturing the geo-referenced data in a graphic manner.

The link between the data base and the mathematical models is operational.

The modes of linkage between the SAGESSE data base and the new local Data Bases are not clearly established as yet. The set of water points stored in the new bases will not be integrated in the SASS, but it would probably be desirable to define the selection modes in order to import the most significant data into SAGESSE.

<u>B - Assessment of sustainability of project outcomes</u>

The information system was developed and the tool was used during the modelling components, and is used regularly on a national basis to store monitoring data. The system of updating the data base is the responsibility of national entities for each national component. Exchange of data and updating of all components accessible to the three countries should occur once a year, and be organised by the means of a tripartite workshop.

Therefore, the system sustainability, as a joint functional system, depends on the permanent structure to be put in place within the Consultation mechanism.

The GEO-SASS server is probably not yet operational in the offices of the focal points.

C - Catalytic Role

Feedback remains limited, as the set up of the tools is quite recent. However, there is a strong demand on the part of the countries to use the established structure of the data base/ GIS and apply it to other items/ geographical zones.

D - Achievement of outputs and activities

Outputs and activities have been achieved in accordance with initial plans. The system sustainability needs to be improved in terms of a permanent structure for operation, maintenance and updating.

III.E WP 50000 Consultation Mechanism

A - Attainment of objectives and planned results

Relevance of project objectives

Between Algeria, Tunisia and Libya, the aquifer system is in such a state of exploitation that sooner or later there will be a need to consider joint control over the pumping flows. How to control these flows within the framework of a desire by the States to mutually contribute in ensuring the future of the zone, based mainly on a concerted policy of safeguarding the water resources? Among the objective reasons which urge for consultation, the major one relates to conflict management and, particularly, the risk of degradation of the resource due to overexploitation.

The technical components of the project gave ground for constructive cooperation between the three countries, and helped develop exchange of data, agree on common standards, implement a joint technical approach and initiate decision making activities.

The role that consists of ensuring maintenance, development and continuous updating of the tools developed by the SASS project needs to be entrusted to a permanent body with the qualities necessary to ensure sustainability of the operation.

For project implementation a ***provisional coordination unit*** was established, with the Objective of coordinating, promoting and supporting rational and concerted management of the SASS water resources. The structure of the provisional unit consists in:

a) a Steering Committee composed of the national structures in charge of water resources, acting as national focal points

b) a Coordination Unit animated by a Coordinator

c) an ad hoc Scientific Committee for evaluation and scientific orientation

Finances: The Coordination Unit is managed and hosted by the OSS. Each country finances the operating costs of its focal point. The operating of the Coordination Unit is funded by subsidies and donations granted to the OSS by the countries concerned, the cooperation partners, etc.

The component on the Consultation Mechanism was structured in the initial project design as an evolution of the provisional coordination unit (Project management unit) to become a permanent consultation mechanism with sub-components as follows:

WP51000	Information and awareness-building workshops
WP52000	Conditions for collecting and exchanging data
WP53000	Agreements on joint observation networks
WP54000	Permanent consultation mechanism
WP54100	Technical specifications for the mechanism
WP54200	Establishing the permanent mechanism
WP54300	Signing ceremony

The three first sub-components were addressed under the technical components through the deployed activities and workshops. The objective of creating a permanent and sustainable structure corresponds to the component WP54000, “Permanent Consultation Mechanism”.

The contents of the “Permanent Consultation Mechanism” were further elaborated during the first year of project implementation. The relevance of such a component lies in the fact that there is a need to formalise the coordination procedures to provide for a transboundary institutional framework to foster cooperation and joint decision making.

Effectiveness of results achieved

The following activities were completed:

- Workshop (march 2005) grouping the three national steering OSS and the consultant in charge of the mechanism audit,
- development of a declaration of the Ministers in charge of water and on adoption at the time of the OSS Board of directors held in Tunis on April 4, 2005
- development by the OSS of a note of awareness intended for the ministers in accompaniment of the declaration
- the draft of the structure of the mechanism and the definition of its attributions

Methods of exchange and data collection
Two workshops grouping six engineers (two per country) were organized by the project on the aegis of an expert. By the end of these two workshops, the methods of administration of the common data base were defined with a distribution of tasks between the administration cell of the common data base and the national governments. There was , in addition, an agreement on monitoring common networks

Permanent consultation structure :

- the Declaration of creation of the consultation mechanism was signed by the three countries between mid 2005 and the first quarter of 2006. The structure of the consultation mechanism functioning was adopted (annexe2)

The elaboration of the « Mechanism for Concerted Action » during Phase II, was based on:

- Setting up the National Steering Committees in each of the three countries,
- Involvement of NGOs,
- The expression of political will by the countries (as attested by the Declaration of the Ministers in Charge of Water),
- Presentation of an « Articles and Conditions » document related to the permanent structure for concerted action (Permanent “Mechanism for Concerted Action” of the North-Western Sahara Aquifer System – SASS).

The declaration of Ministers

In late 2005, the Steering Committee stressed that it would be necessary to:

- define the profiles of the coordination team ,
- involve the regional organisations, in particular the UMA (Union of the Arab Maghreb), in the Steering Committee,
- revise the mode of financing per country,
- approach the mechanism as a permanent framework which would be upgraded according to the confidence it would gather in view of its serious action.

Pursuant to the Declaration of the Ministers in Charge of Water of the countries sharing the North-Western Sahara Aquifer System, the General Managers of the Agence Nationale des Ressources Hydrauliques (ANRH - Algeria), the Direction Générale des Ressources en Eau (DGRE - Tunisia) and the General Water Authority (Libya) agreed in November 2005):

- to proceed to an effective establishment of the « Mechanism for Concerted Action » (Mécanisme de Concertation) for the North-Western Sahara Aquifer System as starting from 1st January 2006;
- To endow the mechanism with a permanent secretariat whose functioning will be financed by the countries. The secretariat will be located at the Sahara and Sahel Observatory. The planned budget of this secretariat for the year 2006 was estimated 100000 €.

  In view of the administrative procedures necessary for releasing national funds, the cooperation partners were exceptionally requested to contribute to the initial costs of the secretariat.
- to provide this « Mechanism » with a Permanent Secretariat, whose financing shall be ensured by the three countries and which will be initially hosted by the Sahara and Sahel Observatory (OSS). The annual forecast budget of this Secretariat is estimated, for the year 2006, as about 100000 €. Exceptionally, the cooperation partners are requested to facilitate a rapid establishment of the Secretariat, in view of the slow administrative procedures necessary to mobilise the national funds;
- that this « Mechanism for Concerted Action » be managed by a Steering Committee comprised of the three General Managers of Water Resources in the three countries, assisted by their National Steering Committee, the OSS Executive Secretary, the potential cooperating partners, and any physical or legal entity whose contribution they deem useful in their work.

This Steering Committee shall meet at least once a year to draw up the action programme of this “Mechanism for Concerted Action”, as well as the activities to be implemented by the Permanent Secretariat.

It shall also be entrusted with the task of organising any ministerial meeting which the three countries may deem necessary.

Efficiency of methodology and mobilisation of resources

The component was developed as a side activity of other components (agreement on database management, agreement on piezometric network, etc) and as an stand-alone project, mainly under the direct supervision of the Steering Committee and involving the higher level authorities at political level.

Achievement of objectives:

The Common declaration by the three Ministers of Water is the translation of a political will build upon joint technical work, communication at technical level, development of a negotiation process between countries, which should lead to enhance their capacity for joint decision-making processes on the shared groundwater resource.

It is the most developed agreement in the world regarding internationally shared aquifers, in a similar way as older agreements on shared river basins, as for instance, in Africa, the Senegal river (OMVS), the Niger river (ABN), the Nile river, the Zambezi river (ZAMCOM), the Orange river (ORASECOM), the Limpopo River (LIMCOM),.

B - Assessment of sustainability of project outcomes

The permanent body, being placed under the OSS, will secure the stability of the secretariat. With OSS being a multi-country, well-established organisation with an adequate funding structure. The direct financing of the secretariat by countries was agreed upon. However, the level of contribution, regularity and details of operation were not accessible to our evaluation. We could note the very apparent political will, the good spirit of cooperation at technical level and the statements regarding the development of weaker points such as the integration of socio economical parameters in water use and associated decision making, the move towards water demand management concepts, or stakeholders contribution and participation in consultation and decision making structures.

C - Catalytic Role

Other project development will benefit from the experience of the SASS, for instance the current project under OSS related to the shared aquifer system of the Illumeden Basin. This example of cooperation between the three countries may also have a beneficial effect on the general level of cooperation outside the water sector.

D - Achievement of outputs and activities

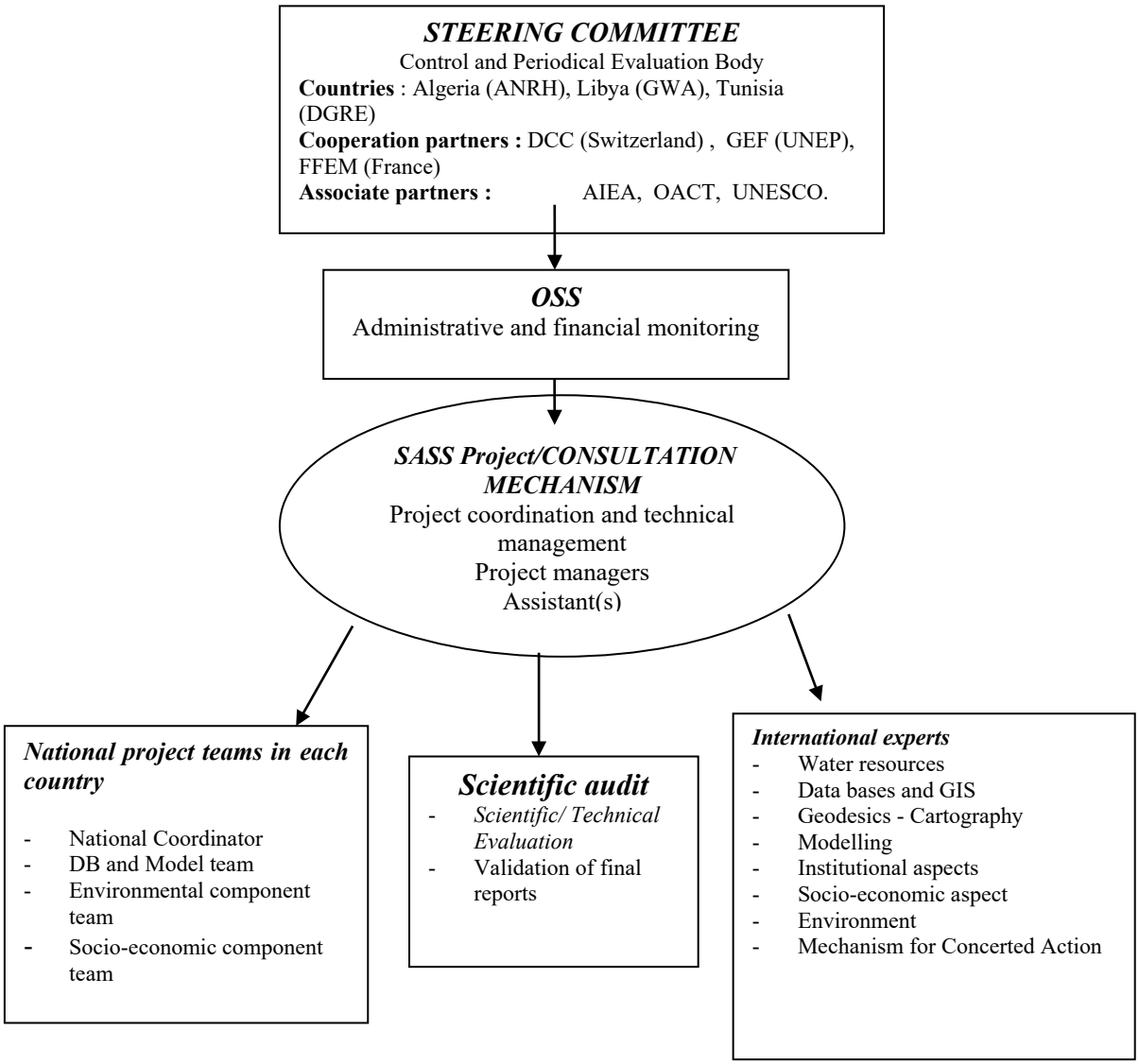
All workshops and most necessary planned assessments and negotiation were implemented according to the initial time schedule. Dissemination of results was developed, at national level and through international forums.

III.F Assessment of Monitoring and Evaluation Systems (Project evaluation parameter E)

III.F.1 Project operating structure

The project organogram is given in the figure below, as appearing in the presentation report (Rapport de présentation, Système Aquifère du Sahara Septentrional, secrétariat du FFEM (FFEM Presentation Report, North-Western Sahara Aquifer System, November 2003).

The project team was composed of a Director, a Scientific Advisor and a Technical-Administrative Assistant. A Scientific Assistant has been attached to the team in order to ensure coordination of the « Data Base », « Modelling », « Geographic Server » activities.



Relevance of the management structure

In order to implement the set of components of Phase 2 of the SASS project, the project management team needed to ensure the following roles were performed:

- secretariat of the Steering Committee
- coordination activation and monitoring of the national contributions
- management of the contracts entered with consultants (consultancy, contract, monitoring of work done)
- interface with donors (cooperation partners)
- administrative and financial monitoring of the project
- overall reporting.

The experience from several cases of establishment of international waters shared management mechanisms reveals that it is necessary to have a multinational secretariat whose legitimacy is recognised by the countries concerned. The project team acts as a catalyst that is indispensable to the continuity and sustainability of the actions, while at the same time the accomplishment of the project actions depends very much on the national contributions.

The national contributions depend, in turn, on; political will, allotting necessary working time to the staff entrusted with implementing the actions on national level, as well as proper coordination so as to allow each and everyone to consider the contributions of each party as effective and balanced.

III.F.2 Effectiveness of project reporting, monitoring and evaluation set up

- The achievements described in the chapters above have been made, though with the limitations and reserves mentioned in each chapter.
  - The reports on workshops, Steering Committee meetings, project progress and quarterly progress have been drafted and circulated normally. 14 quarterly activities reports were regularly addressed to the partners of co-operation.
  - Three steering committee meetings were organized (Algiers – Tripoli – Tunis) with development of three (3) reports comprising the whole of the activities and appreciation of the results. Minutes of meetings were addressed to all parties (country national focal points and co-operating partners).
  - The financial reports were drawn up during steering committee meetings with the members approval.
  - Missions were organized with the participation of the partners of co-operation (DDC-Switzerland, GEF/PNUE and FFEM-France)
  - The results of the SASS were the subject of presentation to the international forums (Mexico City, Bangkok, Rio de Janeiro) on financing of international organizers and to their request.

On the whole, the officials of the 3 countries have expressed satisfaction as to the project team and its coordination role. The spirit of cooperation between the three countries, incepted during Phase 1 of the project, has further developed in Phase 2.

- The National Steering Committees were set up during the first quarter of 2004 and involved the CEOs of the institutions in charge of water resources, as well as representatives of the ministries of agriculture and the environment. Terms of Reference (TOR) have been set out for these National Steering Committees. In the course of the evaluation mission, certain oral statements were recorded to the effect that these committees have established concrete awareness-raising actions, though we have not been able to collect any detailed reports such as to allow for verification thereof.

- The members of the project team sometimes had a direct technical role in the implementation of the technical components. There is no doubt as to the judiciousness of a clearer separation between the role of initiation, supervision and coordination, on the one hand, and the technical implementation services, on the other hand, in order to avoid the confusion between « Client » and « technical partner ».

- It is not always easy to reconcile the technical activities conducted by contracted consultants with the provision of data or of syntheses deriving from the national contributions. More flexibility is requested from the consultants. Such items may be better taken into consideration in the content of the technical prescriptions (terms and conditions) of the contracts.

- The roles of each party, the reporting and the modes of circulation of the information could be rationalised and formalised, in the missions of the permanent Consultation Mechanism.

III.G Assessment of processes that affected attainment of project results

Preparation and readiness

In the initial stage, the project team concentrated efforts on preparing all activities and preparing terms of reference, communicating with national teams, put in place the management structure, etc. At national level, there was a less proactive attitude in early stages, national focal points may have been waiting for the project team to initiate progresses in the implementation of various components. It is likely that there was some weaknesses in the preparation at the level of National steering Committees, and little mobilisation of stakeholders outside the Water sector.

Country ownership/drivenness

It is observed that mobilisation of national teams has improved over time, together with the confidence gained through the common work and results achieved that were perceived at national level as positive (win-win situation). The signing of an agreement (ministers declaration establishing a permanent consultation mechanism in September 2006) is a concrete achievement of the project phase II and at the same time a decisive element to support and develop the contributions from individual countries.

Stakeholder involvement

There was some weaknesses in terms of stakeholder involvement as most activities were driven by the national focal points and the SASS team in OSS in Tunis. It is likely that national steering committees were not active enough to provide evidence of stakeholders participation or at least, reporting, monitoring and evaluation on their activities was insufficient.

Financial planning

We did not identify during the evaluation any drawback or inconveniences due to inadequate financial planning.

UNEP supervision and Backstopping

UNEP was involved in the Steering Committee at technical and financial level. Financial procedures were considered by project officers as inevitably cumbersome, which may have resulted in some delays in implementation of some components.

Co-financing and project outcomes and sustainability

The contributions of the countries have been generally met, such as provided initially, if not exceeded. The effort of the national contributions may be estimated so far as 123 man/months of engineer work and 100 man/months of technician work, for such tasks as studies, synthesis and calibration of the models, development of regional models, design of geological maps, data collection, processing and validation, field campaigns, inventory of water points and analysis. The logistics put to the task has involved the use of vehicles, the deployment of measurement equipment and the conducting of analyses in the national laboratories.

Delays and Project outcomes and sustainability

The initial time-periods have been extended, the project having claimed on the whole about 1.5 years of delay with respect to the initial schedule proposed. These delays are due to the sometimes complex effecting of funding, the validation mechanisms required by funding agencies and by the three countries, and the difficulties inherent in the progress of the projects, particularly those related to the synchronisation of the national contributions. The implementation pace of the activities (studies, syntheses, establishment of computer tools, training, workshops) has accelerated in the late period, i.e. in 2005, and first half of 2006 to partially cover part of the ground lost, though with activities that are at times too close to each other.

IV Conclusions and rating

IV.A Project results as of December 2006

The project objectives were quite ambitious in view of the number of components to be more or less implemented simultaneously.

The results of the project are summed up below:

Hydraulic component:

- the Djeffara model has been constructed and calibrated under permanent and transitory regime, and the qualitative model has been developed. The hydraulic and salt transport calibration has not been finalised yet;
- the Biskra model (North of the Chotts zone) has been completed and validated;
- the conceptual model of the Bassin Occidental (Western Basin) has been constructed. Precise inventories of the boreholes and surveys of the foggaras have been completed;
- the studies related to understanding the exchanges between the Chotts/ Sebkhas and the underlying aquifers have been initiated but not completed;
- The update of the SASS model in the border region of Ghadames has been completed, allowing for the three countries to agree on the way to consider water abstractions and their transboundary impact.
- the study of the piezometric network has been completed and validated. The network is identified on the ground and national focal points have integrated it in their national networks;
- the water quality monitoring network has not been put in place.

Socio-economic component:

- the water demand, as well as the projection, have been evaluated;
- the efficiency of the irrigation modes has been evaluated;
- the water costs have been addressed, but the detailed and comparative analysis has not been completed. This is a decisive component for the definition of alternative scenarios for the use of shared water resources.

Environmental component:

- the cartography of salty waters and of wetlands based on the interpretation of satellite data has been made,
- national and synthesis reports analysing the causes and distribution of salted-soil zones have been drafted,
- the wetlands have been inventoried in an exhaustive way in the three countries, their ecological and physical features have been described and their vulnerability has been analysed,
- a study of the recharge of the SASS aquifers has formed the subject of an academic doctoral dissertation,

- the analysis of the phenomena of water level rises in the surface aquifers has not been conducted,
- a synthesis of the environmental impacts connected with the exploitation of the SASS has been done and an Action Plan has been proposed, together with monitoring indicators.

"Information System" component:

- the GIS-connected SAGESSE data base has been complemented and enhanced,
- dedicated data bases have been established in the three study zones of the Djeffara, Biskra and bassin occidental (Western Basin),
- a geographic server, allowing cartographies of aggregate data has been developed (GEO-SASS),
- the link Data Base – Mathematical Model of the aquifer is operational,
- the link modes of SAGESSE Data Base and new local Data Bases have not been clearly established as yet,
- training sessions have been organised for data base webmasters (administrators).

In the table below, we have sought to offer a summary of the rate of implementation of each technical component (WP10000 to WP 40000), marked from 0 to 100, with regard to the initial objectives put forward.

TECHNICAL COMPONENTS OF THE PROJECT

		Implementation progress rate										Observations
0											**100**	
WP 10000 – HYDRAULIC COMPONENT												
WP 11100	Djeffera Model											Completed
WP 11200	Bassin Occidental (Western Basin) Model											Remaining to be done : revision of scenarios
WP 11300	North of the Chotts Model											Finalised
WP 12100	Basin of the Chotts											Activity initiated (workshop) and salinisation study
WP 12200	Basin of Ghadamès											Workshop held and simulation of the scenarios achieved
WP 12300	Common monitoring networks on SASS level											. Quality network to be validated
WP 13000	SASS regional monitoring indicators											Needing synthesis
WP 20000 – SOCIO-ECONOMIC COMPONENT												
WP 21000	Socio-economic studies											The water cost analysis remains embryonic
WP 22000	Modes of irrigation in the whole SASS basin											Synthesis done
WP 23000	Crop types and impacts in the SASS basin											Synthesis done
WP 24000	Long term development											Alternative modes barely developed
WP30000 – ENVIRONMENTAL COMPONENT												
WP31000	Soil quality indicators											Inventory conducted, phenomena analysed
I	Water rise indicators											Activity limited to a meeting of the working group
WP 33000	Recharge											Academic dissertation. Results remaining to be valorised
WP 34000	Wetlands											Inventory and diagnosis done
WP 35000	State of the environment and protection strategy											Synthesis done
WP 40000 – INFORMATION SYSTEM												
WP 41000	Building a topographic collection with MNT											Done in the 3 modelled zones
WP 42000	Analysis of available data											Done
WP 43000	Structuring the data base											Done
WP 44000	Building the Information System											Done
WP 45000	Refining the analysis tools											Partly done
WP 46000	Final validation of the Information System											Experiment feedback necessary
WP 47000	Devpt. of gateways between Regional and SASS Model											To be done. Initiated for the Ghadames area
WP 48000	Study of setting up an administration unit of the SASS Information System											To be confirmed
WP 49000	Cartographic server											Done, but experiment feedback necessary

Consultation Mechanism component:

A formalised agreement is signed by the three ministers of water. It creates a permanent Consultation Mechanism ("Mécanisme de concertation", better translated by "Mechanism for concerted Action") fro the SASS, defining the role and missions, and requesting support from OSS to put in place a secretariat.

IV.B Overall rating table

The rating is based on the criteria set in the terms of reference as summarised below:

RATING OF PROJECT OBJECTIVES AND RESULTS

Highly Satisfactory (HS): The project had no shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Satisfactory (S): The project had minor shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Moderately Satisfactory (MS): The project had moderate shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Moderately Unsatisfactory (MU): The project had significant shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Unsatisfactory (U) The project had major shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Highly Unsatisfactory (HU): The project had severe shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

Rating system for sustainability sub-criteria

On each of the dimensions of sustainability of the project outcomes will be rated as follows.

Likely (L): There are no risks affecting this dimension of sustainability.

Moderately Likely (ML). There are moderate risks that affect this dimension of sustainability.

Moderately Unlikely (MU): There are significant risks that affect this dimension of sustainability

Unlikely (U): There are severe risks that affect this dimension of sustainability.

The Project monitoring and evaluation system will be rated on 'M&E Design', 'M&E Plan Implementation' and 'Budgeting and Funding for M&E activities' as follows:

Highly Satisfactory (HS): There were no shortcomings in the project M&E system.

Satisfactory(S): There were minor shortcomings in the project M&E system.

Moderately Satisfactory (MS): There were moderate shortcomings in the project M&E system.

Moderately Unsatisfactory (MU): There were significant shortcomings in the project M&E system.

Unsatisfactory (U): There were major shortcomings in the project M&E system.

Highly Unsatisfactory (HU): The Project had no M&E system.

All other ratings will be on a six point scale:

HS = Highly Satisfactory
S = Satisfactory
MS = Moderately Satisfactory
MU = Moderately Unsatisfactory
U = Unsatisfactory
HU = Highly Unsatisfactory

Rating table by project components
WP 10000 Hydraulic Component
WP11000 – Development of regional models

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**	Use of models as a joint management tool.	S
Effectiveness	Few disappointing results compared to expectations.	S
Relevance	Shared management.	HS
Efficiency	Difficult mobilization of national teams.	MS
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial	Governments (ANRH, DGRE, GWA) are clean beneficiaries as outcomes were required by them.	L
Socio Political	The shared management concept is growing and strengthening but still vulnerable. Uncontrolled abstractions may entail some risks.	ML
Institutional framework and governance	National focal points are strong but the joint management structure needs to be reinforced.	ML
Ecological	--.	ML
Achievement of outputs and activities	Delays	HS
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall programme only).	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	Good impact on aquifer assessment at national level, and replicable elsewhere as a joint management experience.	S
Preparation and readiness	Limited country mobilisation at initial stage.	MS
Country ownership / driveness	Increased over time during project implementation.	S
Stakeholders involvement	Limited during project. Should be increased for downstream activities.	MS
Financial planning	Time (and cost) of experts underestimated.	MS
UNEP Supervision and backstopping	Contribution steering Committee.	S
Overall Rating		S

Rating table by project components
WP 10000 Hydraulic Component
WP12000 and WP 13000 – Dedicated studies and SASS monitoring

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		MS
Effectiveness	Water quality networks not completed – regional monitoring indicators not finalised.	MS
Relevance	Specially Ghadames project, a core component regarding the "joint management" issue.	HS
Efficiency	Ghadames project: (HS) Monitoring indicators: (MS) Water quality monitoring: (MU) Study of the chotts: (MS)	MS
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial	Finances secured at national level for water monitoring.	L
Socio Political	Political risk on the Ghadames issue (although reduced during project implementation).	ML
Institutional framework and governance	Already in place at the national level moderate risk at the tripartite level.	ML
Ecological	No specific risk.	L
Achievement of outputs and activities	WP 12000 and WP 13000 not completed.	MS
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall programme only)	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	Hight for development of water resources monitoring non existent for components that have not been completed.	MS
Preparation and readiness	Good for piezometric network, limited for other components.	MU
Country ownership / driveness		MS
Stakeholders involvement	Limited.	MS
Financial planning	OK.	S
UNEP Supervision and backstopping	Contribution steering Committee.	S
Overall Rating		MS

Rating table by project components
WP20000 – Socio-economic Component

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		MU
Effectiveness	Water cost analysis not completed, alternative modes for long term development not achieved.	MU
Relevance	Project objectives were too ambitious in terms of socio-economic scenarios for water uses in the whole SASS.	MS
Efficiency	Limited resources mobilised.	MS
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial	No financial risks regarding development of studies.	L
Socio Political	Potential political risks on decision making at various levels neglecting the value of water.	ML
Institutional framework and governance	Authorities in charge of water resources management are willing to develop socio-economic assessments.	L
Ecological		ML
Achievement of outputs and activities	Long term development scenarios not developed.	MU
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall programme only)	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	The process of socio-economic issues integration in water management practices is initiated.	MS
Preparation and readiness	Components were prepared.	MS
Country ownership / driveness	---	MS
Stakeholders involvement	Limited outside the water sector.	MU
Financial planning	---	MS
UNEP Supervision and backstopping	Contribution in steering Committee.	MS
Overall Rating		MU

Rating table by project components
WP30000– Environment Component

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		S
Effectiveness	All scheduled objectives were completed.	HS
Relevance	Component on water rise indicators was not scheduled.	S
Efficiency	Dissemination activities workshop / meetings were insufficient.	S
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial	Funding through national budgets.	L
Socio Political	No politically sensitive issue.	L
Institutional framework and governance	Need more coordination at regional level.	ML
Ecological	Risk on water rise.	ML
Achievement of outputs and activities	---	HS
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall programme only)	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	Initiated downstream activity at national level.	S
Preparation and readiness	Early planning and mobilisation of research institutions.	S
Country ownership / driveness	3 countries involved in most components.	S
Stakeholders involvement	Activities remain at the level of specialists.	MS
Financial planning	---	S
UNEP Supervision and backstopping	Contribution to steering Committee.	S
Overall Rating		S

Rating table by project components
WP40000 – Information system

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		MS
Effectiveness	Some components need to be complemented.	MS
Relevance	Adequate objectives though a little too ambitious regarding the management of the Information system.	S
Efficiency	Good combination of experts, national teams and SASS team involvement.	S
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial	Depends on adequate budgeting at national level.	ML
Socio Political	---	L
Institutional framework and governance	National allocation of resources.	ML
Ecological	Not relevant.	L
Achievement of outputs and activities	Permanent flow of progress.	HS
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall programme only).	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	Incentive to upgrading National Information Systems.	HS
Preparation and readiness	Timely planning.	S
Country ownership / driveness	Permanence of driveness to be severed.	MS
Stakeholders involvement	---	MS
Financial planning	Adequate.	S
UNEP Supervision and backstopping	Contribution to steering Committee.	S
Overall Rating		MS

Rating table by project components
WP50000 – Consultation mechanism

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		MS
Effectiveness	It took time but results were achieved.	S
Relevance	Initial objectives were too vague.	MS
Efficiency	Weakness: limited continued work.	MS
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**	Agreement at ministerial level.	ML
Financial	Countries have pledged allociation of resources.	ML
Socio Political	Potential conflict of interest still exists.	ML
Institutional framework and governance	Firm structure agreed.	L
Ecological	---	ML
Achievement of outputs and activities	---	S
Monitoring and Evaluation (overall rating) **Sub criteria (below)**	(rating for the overall project only).	
M&E Design		
M&E Plan Implementation (use for adaptive management)		
Budgeting and Funding for M&E activities		
Catalytic Role	For other shared water bodies in other countries.	HS
Preparation and readiness	At technical level.	S
Country ownership / driveness	Serious involvement at government level.	HS
Stakeholders involvement	Limited out of the water sector.	MS
Financial planning		S
UNEP Supervision and backstopping	Emphasis put on CM during steering committee meetings.	S
Overall Rating		S

Overall Project
Combination of the five components
(WP 10000, 20000, 30000, 40000 and 50000)

Criterion	Evaluator's Summary Comments	Evaluator's Rating
Attainment of project objectives and results (overall rating) **Sub criteria (below)**		MS
Effectiveness		MS+
Relevance		S
Efficiency		MS
Sustainability of Project outcomes (overall rating) **Sub criteria (below)**		ML
Financial		L
Socio Political		ML
Institutional framework and governance		ML
Ecological		ML
Achievement of outputs and activities		S+
Monitoring and Evaluation (overall rating) **Sub criteria (below)**		MS
M&E Design	Based on classical steering Committee and management structure.	MS
M&E Plan Implementation (use for adaptive management)	Shortcomings in follow up of indicators.	MS
Budgeting and Funding for M&E activities	Sporadic.	MU
Catalytic Role		S
Preparation and readiness		MS
Country ownership / driveness		S
Stakeholders involvement		MS
Financial planning		MS+
UNEP Supervision and backstopping		S
Overall Rating		MS+

V Conclusions, Lessons learned and Recommendations

V.A Conclusions

- *Ownership :* There is strong ownership by the beneficiaries; the relevant authorities in the 3 countries have largely contributed to the results achieved, in spite of objective the difficulties which included; the ambitious nature of the project, the implementation of various components concurrently and the complex nature of integrated actions between 3 countries.

- *Sustainability of the results*: The tools developed in particular (Information System, socio-economic and environmental approach) may subsequently be financially supported by the States; indeed, the latter have already been able to assign the staff and provide the equipment necessary for a proper follow-up of the various project components.

- Cooperation has been positive, with all parties contributing equally in conducting the studies; data that have so far been considered as sensitive or of an exclusively national nature have been actually exchanged with a view to ensuring success to the project components and step up solidarity among the three countries to address the challenge of management of the SASS.

- *Replicability of the results:* The tools established have national implications which complement the objectives of shared management. The modes of implementation and the data bases may be extended to other geographic sectors.

- Engineers from each of the directorates most concerned by the project (ANRH, DGRE, GWA) have received additional training and have been placed in a position of responsibility.

- The time-periods initially provided have been extended, with the project gathering about one and a half years of delay overall with respect to the schedule proposed initially. This delay was mainly due to the complex procedure of financing mechanisms as well as of validation by the project operators, i. e. to the project's multinational character.

- The project's technical and progress reports have been issued and circulated normally. On the whole, the officials of the 3 countries have expressed their satisfaction as to the project team and its coordination role. The spirit of cooperation between the three countries, which was incepted during the first phase of the project, has been strengthened during phase 2.

- The country contributions have on the whole been observed, such as initially provided, if not exceeded.

- The National Steering Committees have been appointed and involve the general managers of water resources institutions and representatives from the ministries of agriculture and the environment.

V.B Recommendations and lessons

- The socio-economic and environmental syntheses, the related workshops, and the setting up of National Steering Committees, made it possible to broaden the scope of the project stakeholders by involving the ministries (namely those of Agriculture and the Environment) which were not part of the initial decision-making process of the project. Accordingly, cross-sector synergies have been developed. The involvement of other stakeholders (water users, institutions, professional associations, etc) has been initiated but now needs to be further developed.

- The roles of each party, the reporting and modes for circulation of information may be rationalised and formalised towards a possible "Mécanisme de Concertation" (Mechanism for Concerted Action) whose purpose and roles have already been identified in outline.

The recommendations made in each of the chapters imply a broadening of the stakeholders based on a greater involvement of services that have not been much consulted so far.

The results derived from Phase 1 of the project are quite promising and constitute a common base between the three countries which needs to be strengthened and developed so that the impact of the project would actually extend beyond the offices of the relevant institutions in order to reach the water users and so that the actions should have measurable effects on the ground.

The tasks that constitute, in our view, the pursuance and strengthening of the technical aspects of the programme are listed below:

- Finalise the tasks provided under Phase 2 that have not been completed:
  - Initiate the study on the connections between the Chotts and Sebkhas, on the one hand, and the underlying aquifers, on the other hand,
  - Initiate the study on water level rises,
  - Make the SASS piezometric network and the data exchange operational,
  - Implement the construction of a quality network,
  - Develop analysis tools for, in particular, the socio-economic and environmental data in connection with the Information System.

- Strengthen the data bases and the information updating, consultation and management mechanism, especially the procedures for integrating SASS monitoring data;

- Provide for potential evolution of the monitoring networks (piezometry, water quality, other indicators), including automatisation of measurements and telemetry-based transfer;

- Operate the Information System and conduct real-size testing of the administration of the system. This aspect also assumes formalisation of the modes of data exchange (defining confidentiality levels, ect);

- Refine the collection of socio-economic data, as well as the consideration of the water uses, which should lead to a concerted programme of conservation of water resources;

- Strengthen the SASS model by integrating the corrections and adjustments induced by the construction of the 3 « local » models;

- Envision possible sub-models which meet exploitation and impact analysis objectives on various scales;

- Promote Research – Development activities based on partnership with research institutes and universities.

- Refine the method and planning of the implementation of the water resources integrated management, GIRE (IWRM), involving development operators, and this based perhaps on implementing integrated management show-cases and defining training and education actions;

- Identify and implement extension and communication actions in order to disseminate the results and decisions related to shared management;

- Formalise the project management procedures at the level of the « Mechanism for Concerted Action ».

The whole set of actions outlined above may form the subject, for the SASS project team supported by the cooperation partners, of a dedicated programming activity which would consist in reviewing and developing the whole recommendations of the various components of Phase 2, defining the actions, the means to be deployed and the implementation schedule in a precise manner, as well as their financial evaluation, together with a financing model.

APPENDICES

APPENDIX 1

Initial log frame of the project

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
- Improving of basin knowledge	**Year 2 :** Adoption by the three countries decision makers of results relative to aspects : Hydraulic – socio-economic – Environment, as well as integrated information system, including common data base as a tool of management and exchange of data.	Reports produced Letters of result approval by the three countries	Adoption but no application of results: change of decision-makers / partners change of the country politics,
- Strengthening of the management of a shared resource	**Year 2 :** a consulted management plan is defined.	Report concerning the consensus on consulted management plan	Difficulty to converge toward a consensus
- Setting up of a permanent consultation structure	**Year 3 :** Approval of the Consultation mechanism	Signature of the Consultation Mechanism by the three countries.	Financing of the structure
	Year 3 : Institutionalization of the permanent consultation structure and its appropriation by the three countries.	Setting up of the permanent structure	Perenisation of the structure

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP10000 Hydraulic Component			
Improving of hydraulic knowledge of the basin	**Year 2:** Improved results to serve basis to decision-makers of the three countries	- report of study	Results can include some elements hard to be implemented or very sensitive for decision-makers
WP11000–Establishment of three regional models.	**Year 2:** the three countries will be able to enact on the level of abstraction and modes of exchange**.**	- Minutes of meeting relative to the presentation of results and their approval - Results of distributed simulations	Instability in technical teams nominated in the beginning of the project
WP12000–Establishment of specific studies	**Year 2 :** The three regional models (Djeffara, Basin Western and Biskra) will be finalised.	Reports edition and their presentation to the Steering Committee	
	Year 2 : The specific monitoring network to chotts and setting up of a research program	Reports edition and their presentation to the Steering Committee	
	Year 2 : simulations to big scale on the basin of Ghadames are elaborated	Reports edition and their presentation to the Steering Committee	
	Year 2 : setting up of the common monitoring networks (quality and piezometry) to the scale of the NWSAS	Reports edition and their presentation to the Steering Committee	
WP13000–NWSAS Monitoring indicators	**Year 2 :** Definition of monitoring indicators of the NWSAS	Reports edition and their presentation to the Steering Committee	

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP20000 Socioeconomic component			
Reinforcement of Hydraulic result by a socioeconomic analysis in view to elaborate a strategy of long-term development	**Year 2:** Taking into consideration of alternatives and propositions of survey results and adjustment of foreseen scheduling .	- Reports presented to countries and the Steering Committee - Minutes of meeting of results presentation workshop	Adherence of decision makers/politics to results of the survey. The proposed strategy can appear no realist what makes its implementation by decision-makers difficult.
WP21000–NWSAS socioeconomic survey	**Year 2 :** socioeconomic survey to the scale of the elaborated Basin	- Report on socio-economy	
WP22000– irrigations methods to the scale of NWSAS basin	**Year 2 :** the efficiency of methods in practice is evaluated	- Report on irrigation impact	
WP23000–type of cultures and impacts in the NWSAS basin of	**Year 2 :** Impact of the different type of cultures on roles and outputs are analyzed and are evaluated	- Report on types of culture and impact	
WP24000–long-term development	**Year 3 :** A long-term strategy is established	- Report on socio-economy - approval workshop - Presentation to the Steering Committee	

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP30000–Environmental component Diagnosis of the state of the environment and protective strategy	**Year 2:** are taken in account in the factor environment and impacts bound in all formulation of project **Year 2:** to Base water policies on environmental factors .	- reports on the environment and presentation to countries and the Steering Committee Minutes of meeting of results presentation and their approval	Constraints risk to put back in reason of projects and to give make difficult the new project formulation The factor environment can generate over costs of projects hardly acceptable.
WP31000–soil quality indicator	**Year 2 :** monitoring indicator of identified soils quality	Reports on indicators and presentation to the Steering committee	
WP32000–water ascent indicator	**Year 2 :**risky zones are inventoried and monitoring indicators defined	Report on indicators and presentation to the Steering committee	
WP33000–recharge	**Year 2 :** recharge areas are mapped and the infiltration quantified	Report on the recharge and presentation to the Steering committee	
WP34000–wetlands	**Year 2 :** The humid zones and a set up protective strategy is inventoried	Reports on the strategy and presentation to the Steering committee	
WP35000–state of the environment and protective strategy	**Year 2 :** An environment protective strategy is approved by countries	- Report on the strategy and minutes of meeting of approval by countries - Presentation to the steering committee	

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP40000 Information system component The objective is to strengthen the system of information established by the socioeconomic and environmental data integration, to establish a system of administration and anchorage.	**Year 2:** an integrated system of information available for help to the setting up of development politics **Year 2:** The system will serve basis to the definition of exchange protocols between countries.	Report and presentation of results to the steering Committee	The mass of data to treat is considerable and various what can require a lot of times for this phase.
WP41000–constitution of the topographic and geological map	. **Year 1:** topographic map development and geological maps	Report to the steering committee	
WP42000 – data analyse **WP43000** – data base	**Year 2:** Development of a common data base.	Report to the steering committee	
WP44000 – long term development	**Year 2:** Development of an integrated information system	Report to the steering committee	
WP45000 – data analyse tools	**Year 2:** other tool Development	Report to the steering committee	
WP46000 – Development of cartographic server	**Year 2:** operational cartographic Server	Access to the server	

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP50000–CONSULTATION MECHANISM The objective is to reinforce the initiated Mechanism during the first phase, to make it operational and appropriated by the three countries by a permanent structure,	**Year 2:** national committees grouping the different partners (agriculture, water, environment, civil society) are set up **Year 2:** The whole of stakeholders parties (policies, users, ONG…) will be sensitized and involved in the politics of established management. **Year 3:** A consensus on a consulted management of the basin is gotten and a permanent structure of management, own to the three countries is created.		Disagreements on: - the location of the structure - the legal statute of the structure Difficulties in the implementation of the mechanism Efficiency and long-term functionality
WP51000–workshop of information and sensitization	**Year 2:** The different partners (decision-makers, users, politics,…) will have been informed and associated and their adherence acquired to methods and results.	Workshop reports and minute of meeting to present to the Steering Committee	
WP52000–modes of collection and exchange of data	**Year 2:** Modes of collection and exchange of data approved **Year 2**: approved and operational Networks	Workshops reports Report to the Steering Committee	
WP53000– monitoring networks	**Year 2 :** Terms of reference relative to the established permanent structure and approved by countries	Report to the Steering Committee	
WP54000–permanent structure consultation	functional permanent Structure	Permanent reports of the structure	

PROJECT OBJECTIVES	IMPACTS AND RESULTS INDICATORS	CONTROL AND MONITORING TOOLS	RISKS
WP6000- MONITORING EVALUATION COMPONENT			
Steering Committee	Yearly meeting	Yearly report	
Monitoring Evaluation (S/E)	**Year 2:** the plan of S/E between partners of cooperation is established	Document of harmonization and evaluation report	The FFEM, the FEM and DDC-Switzerland risk not to accept the harmonization of monitoring evaluation procedures
	Year 2: Assessment to mi-project and to the terminal phase	Evaluation report	

APPENDIX 2 List of interviews and contacts

All attendants to the third steering committee in November 2005 listed in appendix 2 were met by the consultant in October and November 2005; In addition, a meeting was held in DGRE (Tunis) in October 2005, anda specific meeting took place in Tunis with M. D. TAIBI, director general of ANRH (Algeria). Interviews of project team and Dr BEBES, water resources and modelling expert took place in October 2005.

During a second mission in March 2007, the consultant met with the OSS/SASS project team and Dr Pizzi, involved as consultant in the Western Basin modelling and the workshop on Ghadames area, and exchanged information in the form of e-mail with ANRH, DGRE and GWA.

List of participants to the 3rd Steering committee, November 2005

Prénoms & Noms	Organisme	Coordonnées
Mme KAMOUN Sondes	DGRE Tunis	Tel : 71 493 196 Fax : 71 390 200
Mr MHIRI Ali	Consultant	Tel : 98 464 074 E-mail : mhiri.ali@planet.tn
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List of participants (continued)

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Mr Meftah FELLAH	GWA LIBYA	Tel/Fax : 0021821 4872064
Mr Chedli FEZZANI	Conseiller spécial OSS	Tel : 0021698337421 E-mail : fezzani@planet.tn
Mr Sadek KADRI	GWA LYBIA	Tel : 00218 91 3785505 E-mail : sadekkad@hotmail.com
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Mme wafa JOUINI	OSS	Tel : 00216 71 961 028 E-mail : sass@oss.org.tn

APPENDIX 3 - Documents consulted

WP 10000 HYDRAULIC COMPONENT

WP 11000 Three Groundwater models

WP11100 Djeffara model (Tunisia-Libya)

- *Initial project presentation and log-frame, terms of reference (TOR) for the modelling studies, study reports, workshop reports.*

- *Etude sur modèle mathématique de la Djeffara tuniso-libyenne, rapport de phase 1, élaboration du Modèle conceptuel (Study based on a mathematical model of the Tunisian – Libyan Djeffara, Report on Phase 1), M. BESBES, P. PALLAS, A. MAMOU, November 2004*

- *Etude sur modèle mathématique de la Djeffara tuniso-libyenne, rapport de phase 2 (Study based on a mathematical model of the Tunisian – Libyan Djeffara, Report on Phase 1), M. BESBES, P. PALLAS, G. PIZZI, A. AYOUBI, M. BABASY, S. EL BARUNI, F. HORRICHE, June 2005.*
- *Study on mathematical model of Tunisian Libyan Djeffara – second part – construction and calibration of the model – recovery of hydrodynamic and transport model (janv 2006)*
- *Study on mathematical model of tunisian libyan Djeffara - part III – Previsional simulations (april 2006)*

WP11200 Western Basin NWAS

- *Study of Western basin water resources – preliminary analyses of hydrogeological data (dec. 2004)*

- *Modelling of occidental basin, NWAS, Report on first phase: Hydro-geology and Conceptual Model Rapport de fin de première phase Hydrogéologie et modèle conceptuel, Mr. Besbes, A. Larbes, Mr. Babasy, Mr. Merzougui, June 2005*
- *Study on mathematical model of the Occidenta lbasin, Septentrional sahara occidental basin – construction, calibration and simulations (sept 2006)*

WP11300 Model of North of the Chotts (Biskra)

- *Etude sur modèle mathématique de la nappe de Biskra - Nord des Chotts, rapport final (Mathematical Model-Based Study of the Biskra – North of the Chotts Aquifer), Mr. BESBES and A. LARBES (May 2005)*

WP12000 Conducting specific studies

WP 12100 Basin of the Chotts

- *Report on the Workshop on the SASS Quality Network and the Issue of the Chotts (Compte rendu de l'atelier sur le réseau qualité du SASS et la problématique des Chotts), SASS Tunis, 21-22 July 2005*

WP 12200 Basin of Ghadamès

- *Workshop Report: debdeb-ghadames-borj el khadra area modeling workshop, TUNIS, JUNE, 12-16TH, 2006*

WP 12300 Common monitoring networks on SASS-scale

- *F. Horriche: « Contribution à l'analyse et à la rationalisation des réseaux piézométriques" (Contribution towards the Analysis and Rationalisation of the Piezometric Networks), ENIT (Tunis National School of Engineers) - 2004.*
- *Establishment of the SASS Piezometric Network (Mise en place du réseau piézométrique du SASS), M. BESBES, D. LATRECH, Faten HORRICHE, Brahim Ben BACCAR, Mourad FEDEL, Ali LARBES, H. TALLUA (July 2005)*

WP 20000 SOCIO ECONOMIC COMPONENT

- *Omar SALEM, Sadek KADRI, Socio-economic aspects of Jeffara basin, October 2005*
- *Omar SALEM, Sadek KADRI, OSS/SASS phase II, socio economic aspects of Hamada El Hamra Sub-basin, June 2005*
- *Ali MHIRI, « Les systèmes de culture et d'élevage de la zone SASS du Sud Tunisien, projet SASS phase II » (Crop-Growing and Stock-Breeding Systems in the SASS Zone of the Tunisian South) - 96 pages, September 2004.*
- *Mohamed ELLOUMI and Mongi SGHAIER, « L'agriculture et les différents usages de l'eau dans la zone SASS en Tunisie, Analyse socio-économique » (Agriculture and the Various Water Uses in the SASS Zone in Tunisia : Socio-Economic Study), - 67 pages, January 2005.*
- *Slimane BEDRANI and Fouad CHEHAT « Données agronomiques et socio économiques sur la zone SASS en Algérie » (Agronomic and Socio-Economic Data on the SASS Zone in Algeria - 73 pages, January 2005*
- *Essai de synthèse socio-économique, Pierre HUBERT (Socio-Economic Draft Synthesis) - September 2005*
- *Quantification of socio economic and environmental impacts of the use of SASS water in agriculture, March 2006*

WP 30000 ENVIRONMENTAL COMPONENT

- *Rapport zones humides : « Les Zones humides au Sahara Septentrional (Algérie,Tunisie et Libye) » (Report on Wetlands « Wetlands in the North-Western Sahara : Algeria, Tunisia and Libya »), September 2004*
- *EL HILI A. Les zones humides du Sud Tunisien (Wetlands of the South of Tunisia) (2004)*

- *BEN BRAHIM. Les zones humides au Sahara Septentrional (Wetlands of the North Western Sahara), Algeria (2004)*

- *FORJANI et al., Environmental component by Remote sensing western Libya, the Wetlands throughout the Sahara), OSS/SASS 2004*

- *MHIRI Ali, for OSS/SASS. Projet SASS phase II. Les impacts environnementaux actuels et potentiels liés à l'exploitation et l'utilisation des eaux du SASS en Algérie, Tunisie, et Libye. Recommandations pour un Plan d'action régional (SASS Project Phase 2 : Present and Potential Environmental Impacts Connected with the Exploitation and Use of SASS Water in Algeria, Tunisia and Libya. Recommendations for a Regional Action Plan), October 2005.*

- *Abderrazak KHADRAOUI, Les sols salés au Sahara septentrional : inventaire des sols salés et impacts de la salinisation (Salted Soils in the North-Western Sahara: Inventory of Salted Soils and Salinisation Impacts) : 63 pages, OSS/SASS - September 2004.*
- *MHIRI Ali, La salinisation des terres irriguées et évaluation de ses impacts dans la zone du SASS en Tunisie (Salinisation of Irrigated Lands and Evaluation of Its Impacts in the SASS Zone in Tunisia) : 63 pages, OSS/SASS - September 2004.*
- *Environmental Component by Remote sensing western Libya, salted soil inventory and assessment of salinisation impacts, 17 pages, OSS/SASS 2004.*

- *O.Labidi, Rapport utilisation des données basse résolution pour la caractérisation des zones humides et des sols salés , Contrat de travail à durée déterminé (Report on Use of Low Resolution Data for the Characterisation of Wetlands and Salted Soils; Fixed Term Contract) - N° : 44/04 , OSS/SASS, March 2005*

- *Report on Use of High Resolution Data for the Characterisation of Wetlands and Salted Soils; Fixed Term Contract, May 2006 (not consulted during the evaluation)*

- *Mr. Besbes and Mr. Babasy: Study of the Recharge of the North-Western Sahara Aquifer System: Progress Report; Oct. 2004.*

- *"Study of the Recharge and Paleo-recharge of the SASS », doctoral dissertation of Mr. Babasy, defended in January 2005)*

- *Study of the recharge of the north-western sahara aquifer system (SASS), final report, December 2005*

WP 40000 INFORMATION SYSTEM

- *Procès verbal de la Table ronde sur la gestion concertée des eaux partagées (Minutes of the Roundtable on the Concerted Management of Shared Waters) - April 2005*
- *PV de l'atelier sur l'échange et l'administration des données (Minutes of the Workshop on Data Exchange and Administration) - July 2005*
- *Compte rendu de l'atelier de formation GeoSASS (Minutes of the GEO-SASS Training Workshop) - June 2005*

- *Notice d'utilisation du logiciel SAGESSE (Instruction Booklet on the SAGESSE Software)*
- *Serveur cartographique GEO-SASS v 1.0, guide de l'administrateur (GEO-SASS Cartographic Server v. 1.0, Webmaster's Guide) - 10 May 2005*
- *Information System, Synthesis report, June 2006*

WP 50000 CONSULTATION MECHANISM

- *Three reports of the Steering committee meeting (Sept 2003, February 2005, November 2005)*
- *OSS/SASS report : Consultation Mechanism for the North Western Sahara Aquifer System joint management, setting up of SASS permanent commission, English and French version, March 2005*
- *Mark Halle, International Institute for Sustainable Development (IISD),Consultant to SDC and UNEP/GEF: Mid-term Review of the "Mécanisme de Concertation" component of the North West Sahara Aquifer System project,May 2005*

WP 60000 PROJECT MANAGEMENT MNITORING AND EVALUATION

- *Three reports of the Steering committee meeting (Sept 2003, February 2005, November 2005)*
- *14 quarterly reports*
- *Questionnaire for DWA(Libya), DGRE (Tunisia), ANRH (Algeria)*
- *Responses from DGRE and ANRH (see appendix 4)*

APPENDIX 4

Questionnaire sent to ANRH (Algeria), DGRE (Tunisia), GWA (Libya) in March 2007 as par of the evaluation process

English version

1) ***Expected results:*** In which way do you think that the SASS project met your expectations, at the national level, regarding:
   - Understanding of groundwater resources,
   - Implementation of water quality, abstraction, and water level monitoring programme,
   - Setting up of data management tools (databases), their usefulness and current and future uses ,
   - Current and future data exchange and consultation with neighbouring countries ?

2) ***Lessons learned***: Do you think that the lessons learned during the projects in terms of results and implementation process act as incentive for implementation of other national projects ?

3) ***Project reports***: Have the project reports been disseminated among national departments, organisations, NGOs or concerned communities? In particular reports related to environmental assessment, wetlands, agriculture practices, threats linked to the use of groundwater (such as salination, etc.) Is there any measurable impact of project results on environmental protection in the SASS area in Libya?

4) ***Is there any strategic change*** about the use of SASS aquifers (and the Jeffara basin) following the implementation of phase 2 projects, in particular the aquifer modelling and improvement of water level and abstraction monitoring ?

5) ***Capacity building:*** What is, in your view, the SASS phase II project impact on improvement of organisation and capacity of your department/service ?

6) ***About the consultation mechanism*** between the three countries: Do you think that the mechanism and structure put in place to develop exchange of information and shared management of water resources will be sustainable in the long run ? Do you see any technical advantage in such a mechanism to facilitate data exchange and improving groundwater management sustainability, or a mere forum for information and negotiation of respective withdrawals?

How do you figure out the future operation (technical, financial, and institutional) of the consultation mechanism ? Have you any suggestion or remark to formulate in that respect?

7) ***Project Management***: Are you satisfied in the way the project was hosted and coordinated by OSS ? Do you have any critics, remarks or suggestions about project managemernt in the future?

8) ***Was the contribution of your national steering committee*** significant, in your view? Could you list or specify the various contributions to the project from external bodies such as NGOs, other governmental agencies or departments ? Did the project generate a leverage of national funding to convert the various recommendations of the project reports from theory to reality ?

9) ***Open question*** : In your opinion, which major elements and objectives should be included or stressed in the final evaluation report to GEF ?

10) Do you recommend any ***project proposal*** to deepen, strengthen or develop the results of the SASS phase II project ?

French version

2) Dans quelle mesure pensez-vous, du point de vue national, que le projet ait répondu à vos attentes vis à vis :
- de la connaissance de la ressource exploitable,
- de la mise en oeuvre du suivi de la ressource en quantité (piézométrie et pompages),
- de la mise en œuvre des bases de données, de leur utilité et de leur usage présent et futur,
- de l'échange des données et des concertations nécessaires avec les pays voisins présents et futurs ?

2) Dans quelle mesure les enseignements tirés du projet (de ses résultats, de son déroulement) sont-ils éventuellement bénéfiques pour d'autres projets à l'échelle nationale ?

3) Les documents produits dans le cadre du projet ayant trait au diagnostic environnemental, en particulier des zones humides, à l'analyse des pratiques agricoles et aux menaces issues de l'utilisation des eaux souterraines (modification des échanges entre nappe et surface, salinisation, etc.) ont –ils été diffusés à l'échelle nationale auprès des services, institutions, organisations, ONG ou communautés concernées ? Ont-ils ou vont-ils avoir un impact sur les pratiques environnementales dans les bassins du SASS ?

4) Est ce que les résultats de la phase 2 du projet SASS (modélisations localisées en particulier, amélioration du suivi piézométrique et des prélèvements) ont ou vont avoir une incidence sur la stratégie d'utilisation des nappes du CI et du CT ?

5) Renforcement des capacités : Quel est l'effet, bénéfique ou non, du projet SASS et en particulier de la coopération entre les trois pays à laquelle il a donné lieu, sur l'organisation et l'amélioration des compétences du personnel de vos services ?

6) Sur le mécanisme de concertation entre les trois pays : Ce dispositif permet il selon vous de poursuivre sur le long terme la « gestion partagée » de l'aquifère ? Y voyez-vous un avantage technique, permettant l'échange des données et une meilleure prise en compte de la gestion durable de la ressource, ou un lieu de négociation concernant les prélèvements respectifs ?

Comment voyez-vous le fonctionnement futur (technique, financier et institutionnel) de ce mécanisme ? Avez- vous des remarques ou suggestions à formuler à ce sujet ?

7) Fonctionnement du Projet : Etes vous satisfaits de la façon dont le projet a été coordonné par l'OSS? Avez-vous des critiques, remarques ou suggestions à ce sujet ?

8) Pensez vous que la contribution du comité de pilotage national de votre pays a été importante ? Pouvez vous préciser ou lister les contributions diverses au plan national des organismes, services, ONG, etc. aux différents éléments du projet ? Le projet a-t-il généré des financements nationaux pour faire passer les recommandations des rapports du projet SASS au stade de la réalisation ?

9) Question ouverte : Quels éléments importants et objectifs pensez vous devoir figurer dans le rapport d'évaluation final du GEF ?

10) Quelles propositions de projets doivent être formulées pour approfondir les résultats du projet SASS phase 2 ?

Appendix 5

Filled in questionnaire received from DGRE and ANRH

2 7 AVR. 2007

REPUBLIQUE TUNISIENNNE
MINISTERE DE L'AGRICULTURE
DIRECTION GENERALE
DES RESSOURCES EN EAU

N° A.S.L.H.../16

TELECOPIE

DESTINATAIRE : Monsieur Serge Puyôo
Antéa, Direction Internationale
FAX : **0033(0)2 38 64 30 30**
ADRESSE : s.puyoo@antea-ingenieurie.fr
DATE : 12/04/2007
NOMBRE DE PAGE : 06 pages y compris celle-ci

EXPEDITEUR : Direction Générale des Ressources en Eau
F A X : 216 71 391 549 **TEL** : 216 71 399 320 – 216 71 560 000
ADRESSE : 43, Rue de la Manoubia Montfleury – 1008 Tunis- Tunisie

O B J E T : Evaluation rétrospective du projet SASS

REFERENCE : Votre télécopie du 15 Mars 2007-04-19

En réponse à votre télécopie ci-dessus référenciée et relative à l'évaluation rétrospective du SASS, j'ai l'honneur de vous communiquer ce qui suit :

1) – Le projet et sa réponse à nos attentes :

a) – Vis-à-vis de la ressource exploitable:

Le projet a étudié le Système Aquifère du Sahara Septentrional (SASS) dans son intégralité. C'est pour la première fois qu'on a une vision d'ensemble et complète de l'extension de cet aquifère partagé et de sa problématique dans chacun des pays concernés.

Le projet a déterminé la ressource exploitable par pays et les risques encourus par une exploitation démesurée.

De même il a permis de mettre en évidence la ressource supplémentaire qu'il est possible de prélever dans l'avenir sans risque majeur pour répondre aux besoins futurs dans chaque pays.

b) – Vis-à-vis de la mise en œuvre du suivi de la ressources en quantité (piézomètrie et pompages)

- En Tunisie, un réseau de suivi de la piézométrie a été déjà mis en œuvre et développé dans tout le pays, y compris dans la zone d'extension du SASS. Il en est de même pour le suivi des pompages par forages. A cet effet des annuaires de suivi piézometrique et des annuaires d'exploitation des nappes profondes sont élaborés et édités chaque année.

Ministère de l'Agriculture et des Ressources Hydrauliques
Direction Générale des Ressources en Eau - 43 Rue la Manoubia – Montfleury 1008 Tunis
Tél : 71.560.000 - Fax : 71.391.549

- Le projet a permis de renforcer le suivi de la ressource et d'optimiser le réseau piézometrique essentiellement dans les zones à risques dans le territoire Tunisien mais surtout la mise en œuvre du suivi de cette ressource dans les pays voisins par l'instauration d'un réseau piézometrique commun.

c) - <u>Vis-à-vis de la mise en œuvre des bases de données, de leur utilité et de leur usage présent et futur</u> :

Les bases de données ont été élaborées et mises en place. Elle ont été d'une grande utilité pour la réalisation de l'étude hydrogéologique, du modèle mathématique, et des simulations prévisionnelles de l'exploitation future.

Toutefois il est nécessaire d'alimenter constamment ces bases de données installées dans les services concernés de chaque pays, et de les mettre à jour continuellement dans le cadre du mécanisme de concertation pour leur usage futur lors de la reprise du modèle.

d) - <u>Vis-à-vis de l'échange des données et des consultations nécessaires avec les pays voisins présents et futurs</u> ?

Le projet a répondu à nos attentes vis-à-vis de l'échange des données et des concertations nécessaires avec les pays voisins lors de l'élaboration de l'étude du SASS.

En effet les services concernés des pays étaient complètement impliqués et ont travaillé ensemble.

Ceci a abouti à la mise en place d'un « mécanisme de concertation » qui permettra d'assurer l'usage rationnel présent et futur de la ressource ;

Toutefois ce mécanisme de concertation bien qu'il ait été accepté puis défendu par les pays tarde à se concrétiser.

2) - <u>Les enseignements tirés du projet (de ses résultats, de son déroulement) sont-ils bénéfiques pour d'autres projets à l'échelle nationale</u> ?

Ce projet a permis d'orienter le développement de la région du Sud du pays tout en mettant l'accent sur l'attention particulière à donner aux zones à risques.

Il a mis en évidence une possible délocalisation des prélèvements supplémentaires dans les zones sahariennes lointaines accompagnée d'un transfert d'eau vers les zones en développement.

Il a montré comment aborder la question des ressources en eau partagées, comment les traiter et les gérer en commun d'une manière rationnelle et réfléchie, manière qui a réconforté les pays par l'amélioration de la connaissance de la ressource dans sa zone d'extension.

Les résultats enregistrées pourront nous encourager à lancer d'autres études similaires notamment l'étude des ressources en eau de surface et souterraines partagées avec l'Algérie le long de la frontière commune au Nord et au Centre du pays.

Ministère de l'Agriculture et des Ressources Hydrauliques
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3) – Les documents produits dans le cadre du projet ayant trait au diagnostic environnemental, en particulier des zones humides, à l'analyse des pratiques agricoles et aux menaces issues de l'utilisation des eaux souterraines (modification des échanges entre nappe et surface, salinisation, etc ….)ont –ils été diffusés à l'échelle nationale auprès des services, institutions, organisations, ONG, ou communautés concernées ?

Ont-ils ou vont-ils avoir un impact sur les pratiques environnementales dans les bassins du SASS ?

Les documents produits ont été diffusés à l'échelle nationale auprès des services concernés des commissariats régionaux au développement agricole des gouvernorats du Sud du pays, auprès des institutions de recherche, offices de mise en valeur et autres institutions et organismes concernés. Cette diffusion reste encore limitée et devrait être plus large.

Les documents diffusés ont déjà un impact sur les pratiques environnementales dans la région du sud du pays (région d'extension du SASS) et ont généré le lancement de plusieurs campagnes intensives de vulgarisation en économie d'eau d'irrigation et d'études se rapportant à l'évaluation de la qualité de la ressource et de la piézomérie et à l'élaboration de sous modèles-modèles régionaux de détail (Rejim Maatoug ……).

Avec une diffusion plus ample et une sensibilisation plus large des différents usagers, les documents produits auront un impact plus important sur les pratiques environnementales dans les zones d'extension du SASS au Sud de la Tunisie.

4) – Est ce que les résultats de la phase 2 du projet SASS (modélisations localisés en particulier, amélioration du suivi piézometrique et des prélèvements) ont ou vont avoir une incidence sur la stratégie d'utilisation des nappes du CI et du CT.

Les résultats de la phase 2 du projet SASS vont avoir une incidence certaine sur la stratégie d'utilisation des nappes du CI et du CT pour une meilleure répartition de l'exploitation, la délocalisation des prélèvements vers de nouvelles zones de captage et la préservation des zones sensibles et à risques conformément aux résultats du modèle SASS.

5) – Renforcement des capacités : quel est l'effet, bénéfique ou non, du projet SASS et en particulier de la coopération entre les trois pays à laquelle il a donné lieu, sur l'organisation et l'amélioration des compétences du personnel de vos services ?

L'effet bénéfique du projet SASS et en particulier de la coopération entre les trois pays à laquelle il a donné lieu sur l'organisation et l'amélioration des compétences du personnel des services de la DGRE est évident.

En effet le projet a impliqué complètement toute l'équipe concernée qui a suivi le travail depuis son démarrage jusqu'à sa réception, a participé aux réunions, séminaires, ateliers, visites de terrain … et a contribué activement à la mise en place des bases de données, à la conception et à la construction du modèle et l'élaboration des simulations prévisionnelles.

De même la coopération entre les trois pays a été relancée et pratiquée au sein du projet SASS mais celle-ci reste en deçà des ambitions et des attentes.

La structure qui s'est dégagée de cet important projet pour s'assurer de la gestion optimale de cette ressource sans risque majeur est un important acquis et une évidente assurance aux trois pays mais elle tarde à se concrétiser.

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Cette structure permettra d'améliorer davantage les compétences de notre personnel dans la mesure où il sera encore impliqué dans l'exécution des taches à confier au mécanisme de concertation.

6 – Sur le mécanisme de concertation entre les trois pays : ce dispositif permet-il selon vous de poursuivre à long terme la "gestion partagée" de l'aquifère ? Avantage technique, lieu de négociation des prélèvements …

Comment voyez vous le fonctionnement futur de ce mécanisme ? Avez-vous des remarques et des suggestions à ce sujet ?

Le mécanisme de concertation permettra de poursuivre à long terme la "gestion partagée de l'aquifère" et ce en poursuivant les actions techniques, scientifiques et socio-économiques du SASS et en présentant les résultats, les conclusions pratiques et les orientations.

Il permettra de continuer l'échange des données et une meilleure prise en compte de la gestion durable de la ressource.

Il peut être aussi un lieu d'information et de concertation ou de négociation concernant les prélèvements respectifs.

Concernant le fonctionnement futur (technique, financier et institutionnel) du mécanisme la DGRE a proposé une structure permanente mais assez légère qui aura pour tache : l'administration des bases de données, le suivi et la gestion des réseaux communs et le maintien d'une dynamique de coopération et pourra se composer :

- d'un secrétariat permanent : gestion collégiale, concours …
- d'un conseil scientifique (comité de pilotage par pays …)
- d'un groupe de travail (techniciens des pays, contractuels …)

Les trois pays participeront au financement de cette unité.

7 – Fonctionnement du projet : Etes vous satisfaits de la façon dont le projet a été coordonné par l'OSS ? Avez-vous des critiques, remarques ou suggestions à ce sujet ?

Durant la première phase le projet a été bien coordonné par l'OSS, et il a impliqué une partie importante des compétences de la DGRE et surtout de ses représentants régionaux dans la zone d'extension du SASS.

Cet élan n'a pas continué avec le même rythme durant la deuxième phase.

De même les séminaires et les actions de vulgarisation n'ont pas été menés de manière satisfaisante au niveau régional.

Le travail mené n'a pas abouti à un plan d'action précis bien que des recommandations aient été avancées mais leur application reste au gré des pays puisque le mécanisme de concertation n'est pas encore fonctionnel.

De même plusieurs actions programmées n'ont pas été réalisées (sous-modèles des chotts, simulation de la réduction des prélèvements ….) ; la question de l'évolution de la qualité des ressources en eau du SASS n'a pas été bien élucidée ….

Nous espérons que ces insuffisances seront levées au niveau du mécanisme de concertation ou lors de la troisième phase

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8 – Pensez vous que la contribution du comité de pilotage national de votre pays a été importante. Pouvez vous préciser ou lister les contributions diverses au plan national des organismes, services, ONG et .... aux différents éléments du projet ? Le projet a-t-il généré des financements nationaux pour faire passer les recommandations des rapports du projet SASS au stade de la réalisation ?

La contribution du comité de pilotage national de la Tunisie a été réellement importante à tous les stades d'avancement de l'étude et à toutes les étapes de validation de toutes les missions. De même d'autres services extérieurs à la DGRE ont contribué efficacement à la conduite de l'étude du SASS tels que la Direction Générale du Génie Rural et de l'Exploitation des Eaux au Ministère de l'Agriculture et des Ressources Hydrauliques, la Direction Générale de l'Environnement et de la Qualité de la Vie au Ministère de l'Environnement et du Développement Durable.

Il en est de même des Commissariats Régionaux au Développement Agricole de Tozeur, Kebili, Gabès, Medenine et Tataouine par le biais de leurs techniciens en ressources en eau, Génie Rural et Perimètres Publics Irrigués.

Nous mentionnerons particulièrement les institutions de recherche et notamment l'Institut des Régions Arides de Medenine rattaché au Ministère de l'Enseignement supérieur et de la Recherche Scientifique.

Le SASS par ses résultats a généré des financements nationaux pour faire passer les recommandations au stade de la réalisation notamment l'optimisation du réseau piézométrique (programmation de plusieurs piezometres de contrôle et d'observation dans les zones d'extension du SASS ...) et le lancement d'études spécifiques sur l'évolution de la qualité de la ressource et de sous modèles régionaux (Régim Maatoug)

9 – Question ouverte : Quels éléments importants et objectifs pensez vous devoir figurer dans le rapport d'évaluation final du GEF ?

Notre reconnaissance à GEF et à tous les autres partenaires pour le soutien. Nos félicitations à l'OSS pour la conduite de ce travail de qualité. Nos remerciements à tous les pays qui se partagent la ressource pour leur collaboration fructueuse et leur volonté d'aller de l'avant.

Toutefois malgré la qualité du travail accompli, ce dernier reste inachevé.

Nous pensons qu'il y a lieu de tenir compte des doléances des pays et d'achever les actions programmées et qui restent à faire (sous modèle des chotts, simulation de réduction des prélèvements, évolution de la qualité de la ressource ...) au niveau du mécanisme de concertation ou encore au cours de la 3ème phase du projet.

10 – Quelles propositions de projets doivent être formulées pour approfondir les résultats du projet SASS phase 2 ?

- Achever les actions prévues de la phase 2 qui n'ont pas pu être terminées.
- Etude approfondie de l'évolution de la qualité de la ressource en fonction des prélèvements
- Elaboration de sous modèles au niveau des zones à risques (qualitatif et quantitatif)

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- Etudes socio-agro-economiques sur l'utilisation et la valorisation de l'eau dans les zones pilotes (Tunisie, Libye et Algérie)
- Etude d'évaluation des eaux de drainage et des possibilités offertes par leur reutilisation
- Modèle de gestion et d'aide à la décision des zones à risques (zone des chotts, zone des foggoras etc …)
- Etude sociale sur la population agricole du SASS et les mutations subies par cette population au niveau des pratiques culturales.

Espérant que ces données vous permetteront d'actualiser l'évaluation, je vous prie d'agréer, Monsieur l'expression de mon profond respect.

Le Directeur Général
des Ressources en Eau

MEKKI HAMZA

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Le 03 Avril 2007

Mr Rachid TAIBI,
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Objet : Evaluation rétrospective du projet SASS phase 2

Monsieur Puyoo,

Me référant à votre mail du 15 Mars 2007, je vous prie de trouver ci après les éléments de réponse à vos questions.

Avec toutes mes salutations

Question1) : **Dans quelle mesure pensez vous, du point de vue national (Algérie), que le projet ait répondu à vos attentes vis à vis :**
:

- de la connaissance de la ressource exploitable,
- de la mise en oeuvre du suivi de la ressource en quantité (piézométrie et pompages),
- de la mise en œuvre des bases de données, de leur utilité et de leur usage présent et futur,
- de l'échange des données et des concertations nécessaires avec les pays voisins présents et futurs ?

Réponse 1 :
La mise en œuvre de ce projet a permis de faire le point sur l'état de l'information disponible et sur l'état des connaissances.

--Les actions engagées dans la collecte de toutes les données et auprès des différents organismes notamment les entreprises d'explorations pétrolières puis le contrôle et la validation de ces données ont abouti à la réalisation d'une banque de données fiable et opérationnelle qui a pu être intégrée à celle du SASS avec les autre pays.
Les activités menées par la suite, telles la modélisation et les simulations ont affiné les résultats obtenus dans les études précédentes menées conjointement avec la Tunisie. Elles permettent aussi d'assurer une meilleure évaluation des débits qui peuvent être exploités car le modèle

développé constitue un outil précieux d'identification de champs captants et d'estimation des volumes à soutirer. Dans ce dernier cas, nous l'avons utilisé pour les études de transfert des eaux du Sud vers les Hauts Plateaux mais aussi pour un transfert d'eau de la région de In Salah vers Tamanrasset.
Ce modèle constitue aussi un outil didactique et psychologique de sensibilisation aux effets pervers de la surexploitation. Nous avons eu à faire des démonstrations de simulations où sous la pression d'une demande forte en réalisation de forages, nous avons convaincu et associé à notre démarche les responsables mais aussi les agriculteurs sur l'utilisation optimale de la ressource déjà exploitée.
Les sous modèle de Biskra est venu à point nommé répondre à une demande en eau d'une région qui connaît un fort développement agricole. Il a permis d'une part de restreindre les prélèvements dans les zones surexploitées et d'autre part de réorienter vers d'autres zones dont les ressources en eau étaient mal connues ou sous estimées auparavant les spéculations agricoles.

-- Le travail effectué dans le projet a établi un certain nombre de mécanismes dont les procédures sont claires. Celles-ci portent sur

- l'inventaire permanent des points d'eau et le suivi piézomètrique ainsi que le suivi de la qualité des eaux
- introduction de ces données dans la banque qui a été implantée dans chaque pays

Un réseau piézomètrique commun a été identifié. La collecte de données s'effectue au niveau national.

-- La banque de données mise en place, gérée par une institution de l'Etat, en l'occurrence l'ANRH s'intègre dans la banque de données nationale ce qui assure sa perrénité.
Elle s'enrichit au fur et à mesure de nouvelles données et à titre d'exemple une actualisation des points d'eau des zones pétrolifères a été finalisée en 2006. L'ensemble de ces données est utilisé pour les besoins de gestion et de développement des ressources en eau d'une région de prés de 700 000 km2.
Les principaux utilisateurs, en plus des services de l'ANRH, sont les services des directions de l'hydraulique et de l'agriculture qui connaît un essor important lié au soutien apporté par l'Etat.

-- Le mécanisme de concertation crée par les trois pays est en cours de mise en place.
Un réseau piézomètrique commun a été identifié. La collecte de données s'effectue au niveau national. L'assemblage des données se fera automatiquement, d'autant plus que les techniciens des trois pays ont appris à travailler ensemble sur les mêmes outils.

Question 2) : Dans quelle mesure les enseignements tirés du projet (de ses résultats, de son déroulement) sont-ils éventuellement bénéfiques pour d'autres projets à l'échelle nationale ?

Réponse 2 :

-- D'une manière générale, du point de vue méthodologique, la démarche adoptée est en fait très simple : collecte, contrôle et validation des données ; mise en place d'un SIG; développement d'un modèle et simulations ; Conclusions.
La particularité dans ce projet a été l'implication des pays dans toutes les actions projetées et menées par la suite, ce qui a permis une appropriation des résultats.

Comme indiqué au point 1, nous considérons que les outils développés sont d'un apport certain et sûr dans les projets de connaissance, de mobilisation et de préservation des ressources en eau de la zone du SASS. Nous l'appliquons dans la gestion des zones actuelles de prélèvements et dans l'identification de zones de développement agricole. Nous l'avons utilisé dans les études de mobilisation et de transfert des eaux vers les hauts plateaux et aussi de transfert sur 750 kms entre In Salah et Tamanrasset.

Question 3) :**Les documents produits dans le cadre du projet ayant trait au diagnostic environnemental, en particulier des zones humides, à l'analyse des pratiques agricoles et aux menaces issues de l'utilisation des eaux souterraines (modification des échanges entre nappe et surface, salinisation, etc.) ont –ils été diffusés à l'échelle nationale auprès des services, institutions, organisations, ONG ou communautés concernées ? Ont-ils ou vont ils avoir un impact sur les pratiques environnementales dans les bassins du SASS ?**

Réponse 3 :

- Les documents produits sont ont tous été diffusés auprès des institutions, organismes et services concernés. Les résultats ont fait l'objet aussi d'exposés et de présentations lors de conférences ou de journées techniques.

- En ce qui concerne les zones humides : ce point est dans les priorités du Ministère des ressources en eau puisque ces zones sont considérées comme zones à protéger et à valoriser dans le Plan National de l'Eau qui vient d'être approuvé par le Gouvernement. D'autre part, une opération de diagnostic et d'aménagement sera inscrite en 2007.
Les zones humides sont aussi suivies par le ministère de l'environnement et le Ministère de l'agriculture (-Direction générale de forêts en charge de la Convention de Ramsar)

- Pour les pratiques agricoles, l'utilisation du goutte à goutte est généralisée dans toutes les nouvelles concessions agricoles. Des efforts de sensibilisations pour une utilisation rationnelle de l'eau sont déployés, principalement par l'intermédiaire de l'Agence du Bassin Hydrographique – Sahara, vers les agriculteurs.

- Pour les risques de salinisation liés aux échanges chott- nappe, les mesures prises et engagées par les directions de l'hydraulique et l'ANRH visent à interdire tout forage autour des chotts. Ces mesures sont bien suivies et sont maîtrisées. Un projet de recherche ANRH-Universités sur ce thème est en préparation.

Question 4) : **Est ce que les résultats de la phase 2 du projet SASS (modélisations localisées en particulier, amélioration du suivi piézométrique et des prélèvements) ont ou vont avoir une incidence sur la stratégie d'utilisation des nappes du CI et du CT ?**

Réponse 4 :
-La réponse est dans le point 1 en ce qui concerne le modèle de Biskra (Nord des chotts) et le suivi.
-Le 2eme sous modèle (Erg occidental) , indique des potentialités importantes en eau. Cependant l'exploitation reste limitée du fait surtout du faible développement agricole.. Il s'agit de préserver le système ancestral de captage (les foggaras).

Question 5) : Renforcement des capacités : Quel est l'effet, bénéfique ou non, du projet SASS et en particulier de la coopération entre les trois pays à laquelle il a donné lieu, sur l'organisation et l'amélioration des compétences du personnel de vos services ?

Réponse 5 :
Comme mentionné précédemment, il y a eu appropriation du projet par les 03 pays ce qui signifie automatiquement une assimilation et une maîtrise des méthodologies appliquées et des outils développés ainsi qu'une amélioration des compétences et des capacités du personnel impliqué directement dans le projet ou travaillant autour du projet.
Cela a permis aussi de nouer et de développer des relations entres techniciens, responsables et politiques des 03 pays au bénéfice d'une coopération régionale.

Question 6) : Sur le mécanisme de concertation entre les trois pays : Ce dispositif permet il selon vous de poursuivre sur le long terme la « gestion partagée » de l'aquifère ? Y voyez vous un avantage technique, permettant l'échange des données et une meilleure prise en compte de la gestion durable de la ressource, ou un lieu de négociation concernant les prélèvements respectifs ?
Comment voyez vous le fonctionnement futur (technique, financier et institutionnel) de ce mécanisme ? Avez vous des remarques ou suggestions à formuler à ce sujet ?

Réponse 6: La création et la mise en place d'un mécanisme de concertation sont une nécessité et un devoir envers les générations futures.
Le SASS est un système aquifère partagé qui ne pourra survivre que dans le cadre d'une gestion commune. Le renier, c'est aller à la catastrophe. Il s'agit en premier lieu de disposer d'une banque commune, d'un réseau témoin commun mais surtout de faire périodiquement l'état de la ressource et d'en tirer les conclusions et décisions nécessaires.
J'estime que l'OSS doit continuer d'assurer encore pendant 03 ou 04 ans la locomotive ou la coordination tout en préparant les 03 pays à prendre en charge ce mécanisme. Les pays doivent eux-mêmes fournir le financement ou s'atteler par leurs propres soins à rechercher des financements extérieurs pour la réalisation d'études particulières.

Question 7) : Fonctionnement du Projet : Etes vous satisfaits de la façon dont le projet a été coordonné par l'OSS? Avez vous des critiques, remarques ou suggestions à ce sujet ?

Réponse7 :

Dans l'ensemble, le projet a très bien fonctionné. Nous aurions aimé faire un peu plus de formation sur les aspects de modélisation mais l'essentiel a été assuré.

Nous aimerions aussi que, dans la phase de mise en oeuvre du mécanisme de concertation, l'OSS continue d'assumer la fonction de coordinateur chevronné qu'il a assumé auparavant.

8) Question 8 : Pensez vous que la contribution du comité de pilotage national de votre pays a été importante ? Pouvez vous préciser ou lister les contributions diverses au plan national des organismes, services, ONG, etc. aux différents éléments du projet ? Le projet a-t-il généré des financements nationaux pour faire passer les recommandations des rapports du projet SASS au stade de la réalisation ?

Réponse 8:

Le Comité de pilotage national a été crée suite à une décision du Comité de pilotage du projet et à un moment où les premiers résultats du projet arrivaient. En Algérie, il est constitué de représentants :

- du Ministère des ressources en eau : lequel apporte son soutien et ses orientations,
- du Ministère de l'agriculture, concerné par le développement agricole dans le Sud et les pratiques agricoles mais aussi par les zones humides dont la gestion est assurée par un organisme sous sa tutelle (Direction Générale des Forêts) ,
- du Ministère de l'Environnement concerné par les aspects de désertification et de protection de tous les milieux naturels,
- de l'Agence du Bassin Hydrographique Sahara dont l'une des missions principales est la sensibilisation à l'utilisation rationnelle de l'eau et à sa préservation,
- d'ONG travaillant dans le domaine de l'environnement et du développement durable, de
– de l'ANRH

Toutes les actions décrites au point 3 ont été initiées par le comité de pilotage et réalisées dans la pratique par les différentes institutions membres de ce comité.

Des financements sont assurés par l'Etat pour la généralisation du goutte à goutte et les zones humides feront l'objet d'une étude qui doit aboutir à leur protection et aménagement.

Question 9) Question ouverte : Quels éléments importants et objectifs pensez vous devoir figurer dans le rapport d'évaluation final du GEF ?

Réponse 9:

- Montrer tout d'abord que ce projet a rassemblé 03 pays qui travaillaient séparément auparavant et surtout qu'il a sensibilisé aussi bien les techniciens que les politiques sur la nécessité pour ne pas dire l'obligation de collaborer et d'œuvrer en commun pour la gestion et la préservation de ce système aquifère.

- Montrer aussi que le projet a été bien assimilé par les différentes parties, qu'il a crée une dynamique de coopération et qu'il a abouti à des résultats ou au développement d'outils concrets qui permettent aujourd'hui d'assurer une gestion cohérente des ressources en eau et que ces outils sont utilisés pour la mise en œuvre d'autres projets de développement.

Question 10) : Quelles propositions de projets doivent être formulées pour approfondir les résultats du projet SASS phase 2 ?

Réponse 10 :

Continuer à soutenir la mise en œuvre du mécanisme de concertation et tout ce qui va avec(réseau piézo de suivi, banque de données, actualisation du modèle et des simulations…) et inscrire un certain nombre de projets fédérateurs ou d'actions d'intérêt commun et au caractère spécifiquement transfrontière, tels la problématique de l'hydrogéologie et de l'hydrogéochimie des Chotts, ou des thèmes généraux du contexte saharien , tels le comportement du complexe eau-sols-plantes dans l'environnement saharien : impact de l'irrigation localisée avec des eaux chargées, l'élasticité de la demande agricole en eau vis-à-vis de la tarification, ….Autant de sujets, conduits en commun par des équipes mixtes sur des périodes de moyenne ou longue durée, qui ne peuvent que renforcer l'esprit de solidarité.

- **Ajouter un volet environnement lié aux zones humides**, à leur protection et aménagement d'autant plus que ce thème semble être l'objet d'un intérêt des politiques.