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AGRICULTURE RECONSTRUCTION AND DEVELOPMENT PROGRAM FOR IRAQ

STRATEGY FOR WATER AND LAND RESOURCES IN IRAQ
Phase 1 Project Completion Report
Volume 2 - Phase 2 Work Plan

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The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

Strategy for Water and Land Resources in Iraq - Phase 2
Draft Work Plan

1	Introduction.....	1
1.1	Background.....	1
1.2	Principles and Goals	2
1.3	Achievements of Phase 1	5
2	Requirements in Phase 2.....	7
2.1	Introduction.....	7
2.2	Development of Planning Framework.....	7
2.2.1	Consensus Building	8
2.2.2	Promoting Integrated Planning for the Water Sector.....	10
2.2.3	Transitional Arrangements for Water Planning.....	10
2.2.4	Attending to the Legal and Regulatory Framework	11
2.3	Capacity Building	11
2.4	Physical and Human Infrastructure.....	12
2.5	Further Development of Planning Tools.....	12
3	Detailed Activities	13
3.1	Development of SWLRI Planning Competencies	13
3.1.1	Consolidation of the Stage A Data Sets.....	13
3.2	Development of Intervention Packages	15
3.2.1	Process Infrastructure.....	15
3.2.2	Decision Infrastructure.....	17

1 Introduction

1.1 Background

The proposed Work Plan for Phase 2 of the Strategy for Water and Land Resources in Iraq (SWLRI) is the final deliverable of Phase 1 carried out as a Task Order under the USAID Agricultural Reconstruction and Development Program for Iraq (ARDI).

The Phase 2 Work Plan is based on a three and a half year (46 month) term. Together with the 14 month Phase 1 period, this amounts to a five year long project aimed at implementing the permanent arrangements for long term strategic water and land resources planning and management in Iraq.

A water resources planning document was prepared between 1972 and 1982, by the Iraq Ministry of Irrigation and the USSR institution Selkhozpromexport, and this has guided much of the country's policies and actions since then. It covered water, salt and soil management, agriculture and irrigation, fisheries, water supply, hydropower, flood control, erosion control, and navigation.¹ Thorough data collection, mathematical modelling, and evaluation of various scenarios led to a detailed proposal for action called the 'General Scheme Second Stage', with a proposed investment over the twenty-year period to 2000 was about 15 billion Iraqi Dinars (equivalent to roughly US\$ 50 bn at 1982 prices, and much more at 2006 prices). The final report of 1982, written in English, contains a very comprehensive and thorough compilation of data, and a full account of the planning and reasoning that led to it.

An initiative in the 1990s to update the General Scheme, called the Third Stage, was not able to be completed. Due to the passage of time, to infrastructure changes, to the effect of wars, and to significantly changed external circumstances since 1982, there is now a need for a new effort to provide Iraq with an updated integrated strategy plan for developing and managing its water resources.

In 2003 Iraq's Ministry of Water Resources (MoWR) requested the US Army Corps of Engineers (USACE) to prepare a concept proposal for Water and Land Resources Planning. The resulting document forms the starting point for the SWRLI project. Dated October 2004 and titled "Strategic vision for management of Iraq's water resources – a concept proposal", it is referred to in this document as USACE 2004. The document comprises some 47 pages and gives a useful description of the present situation with regard to the country's water resources, together with suggestions for the work needed to prepare a strategy plan.

USACE 2004 proposed a two-phase approach to the task, with a preparatory Phase 1 lasting up to 18 months and an implementation Phase 2 taking four or five years. In June 2005 a fourteen month work plan for Phase 1 was drawn up by the interested parties, as a task within USAID's Agricultural Reconstruction and Development Program for Iraq (ARDI), to be undertaken by a team of consultants. Although the

¹ *The 1982 report describes its main purpose as "to reveal the country's water and land resources, to determine the ways and rate of developing certain branches of the national economy implying the use of the water resources, to elaborate engineering measures with due regard for the socio-economic and technical potentialities and natural conditions of the country" (main report, page 14).*

Phase 1 studies were terminated prior to completion of the programme considerable ground was covered prior to termination.

An important element of the background to the planning effort is the complex and very significant set of transborder facts and issues. As described in USACE 2004 and elsewhere, the flows entering the country via the Euphrates have already been reduced by the activities of Syria and Turkey, and in the next few decades further drastic reduction on the Euphrates flows are likely to occur. Developments in neighbouring countries will also deplete flows in the Tigris and at least some of its left-bank tributaries. Although not as substantial as for the Euphrates, these reductions will also be significant in view of the growing demands.

1.2 Principles and Goals

In line with countries all over the world Iraq's sustainable future development depends on managing its available water resources in a way that is perceived to be equitable in meeting the needs of the populous. Securing long term water availability in Iraq in part depends on planning and investing in large water development projects, but more importantly depends on ensuring sustainable and rational water use through proficient water allocation with effective cost recovery for operation and maintenance.

Modern water resources management requires strong institutional arrangements that permit decision making serving interests across the socio-economic sectors. The integrated approach for water resources management was formally endorsed at the World Summit on Sustainable Development in Johannesburg in 2002, which called for all countries to develop integrated water resources management and efficiency strategy plans by the end of 2005. In line with this many countries are now reforming their water sectors by introducing arrangements that ensure commitment at the highest level of government to integrated planning and assign the task of developing the national strategy to a multi-sector steering group.

The first goal of this SWRLI project is to put in place the suitable and enduring institutional arrangements for Iraq's water sector.

The adopted planning approach established for Phase 1 will be the continuing basis for preparing the strategy in Phase 2, working towards a permanent framework for integrated water resources management.

Figure 1 presents a diagrammatic representation of the approach to the development of the Water Resources Strategy Plan which has the following particular features:

- It emphasises a distinction between **facts** and **needs**: facts about the present state of the country's water resources and its physical infrastructure (both natural channels and man-made infrastructure), and on the other hand needs and desires for water use, flood control and environmental conditions.
- It emphasises, alongside facts and needs, a third data set concerning **opportunities** for the future; these include not only potential physical interventions like completing the Bekhme Dam but also policy changes like a shift to different crops on irrigated land, a changed way of using hydropower

stations within the national energy sector, or a different way of interacting with upstream countries.

- It emphasises interventions, and packages of interventions, as units of the planning process.
- It emphasises the iterative nature of the evolution of a strategy plan.

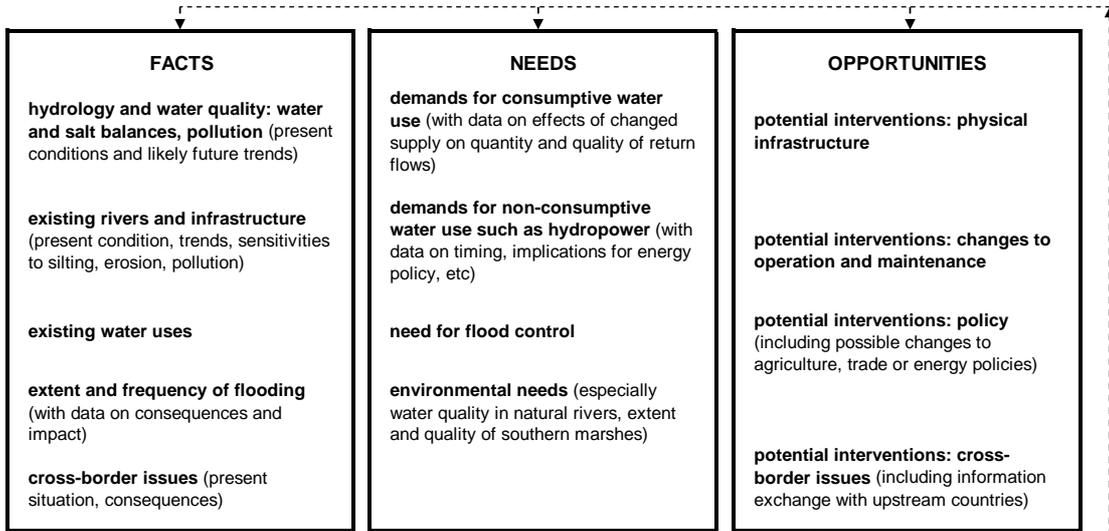
The approach is thus based on three data sets – not only facts about the present situation and forecasts of need and demand, but also opportunities for intervention. Ideas and information about the opportunities will naturally be collected at the same time as the facts about the present situation, but they will be regarded as a separate data set, one which forms an essential prerequisite for the planning process and which can be updated independently of the other sets. It is envisaged that the three data sets, having been partially assembled during first phase of the work, would become permanent features of the ongoing planning process; they would be updated continually or periodically, and would form the basis of revisions of the water resources strategy. Figure 1 includes, as part of the ‘facts’ data set, possible or likely future trends in hydrology and water quality: this will include any estimated effects of climate change, as well as external factors like developments in upstream countries.

The diagram also emphasises the iterative nature of the planning process. Its Stage B begins with the formulation of possible packages of interventions, using the set of opportunities prepared at Stage A, and also the preparation of models, analysis tools and comparison criteria. These will assess not only technical but also social, economic and environmental considerations. They will be used to examine the consequences of each hypothetical package of interventions (which may be quite complex because of the nature of Iraq’s interconnected rivers, canals, reservoirs and groundwater) and to compare them. The next step is to consider whether at least some of the packages are substantially beneficial and well-packaged, and if appropriate to revisit the formulation step and develop new packages in the light of the analysis so far; this is followed by a repeat of the examination and comparison steps. During this iterative process it may prove necessary to go back and seek additional data.

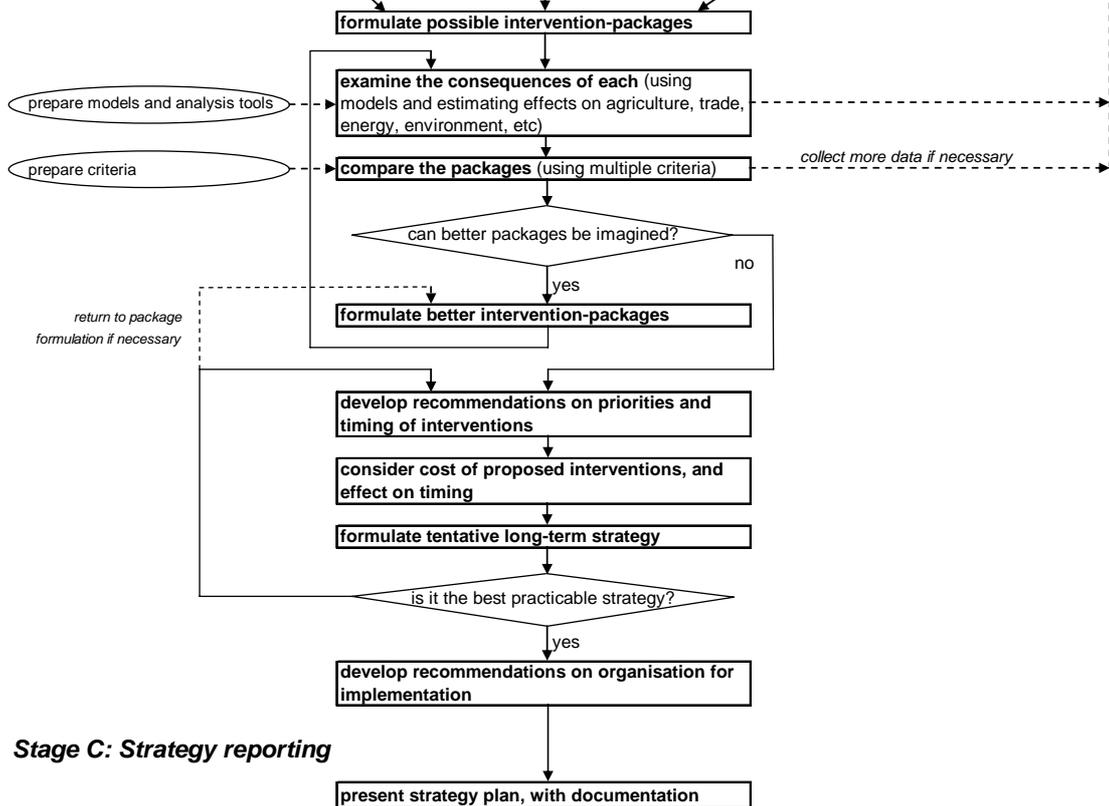
Acceptable packages proceed to the stage of formulating the strategy, which is in effect a prioritised set of intervention-packages, and this again is iterative. The formulation will make use of the earlier analyses of individual intervention-packages, and repeat them if necessary to refine the strategy. Costs will be considered, to ensure that the timing of interventions is balanced from year to year to match the available or probable human and financial resources.

Figure 1: Planning Approach

Stage A: collection of necessary data



Stage B: evolution of the strategy plan



Stage C: Strategy reporting

Much of the effort in Phase 1 was devoted to the preparation of the three data sets.

Phase 2 will consolidate and add to the work done on the three data sets with particular attention being paid to improving the quality of hydrometric data and enhancing the ‘needs’ and ‘opportunities’ data sets with more active inter-departmental and inter-agency collaboration.

The second main element of Phase 1 was the preparation of models and analysis tools, and of criteria for comparing intervention-packages building on the pre-existing water management models, in particular a reservoir simulation model for the Tigris and Euphrates river basins in Iraq prepared jointly by HEC and MoWR. This model is intended to serve both for long-term planning and for real-time operation, and can be progressively refined as more data become available.

Phase 2 will focus on enhancing the reservoir model to include additional transboundary data and upstream water demands. In addition, Phase 2 will continue with the elaboration and development of the intervention packages to progress the Stage B iterative tasks and evolve the Strategy Plan.

The Stage C end product of a Present Day Strategy Plan ‘Report’ should not be simply seen as the final deliverable of this SWRLI project, but as the establishment of a permanent Strategy Plan, endorsed and adopted by Government and maintained in an updated form by a future continuing SWRLI institution.

Phase 2 will help to define the suitable institutional arrangements and provide the capacity building for the permanent SWRLI solution.

1.3 Achievements of Phase 1

Phase 1, running from June 2005 to September 2006, largely focused on Stage A, but from May 2006 a start was made on Stage B.

An extensive data collection exercise has been undertaken with the assistance of 11 ministries with an interest in water and land resources. The project established a web-based collaboration system and by the end of Phase 1 over 10,000 items had been uploaded and were available as a shared resource for the planning team. The data had been divided in to three sets: facts, needs, and opportunities. Organising and checking this volume of data continued throughout Phase 1, and will need to continue in the future, leading to the formation of databases of essential information for planning.

The Consultants have been developing models of the water management system infrastructure to allow alternative future scenarios of water usage country-wide to be compared. The modelling includes preliminary estimates of past, present, and future condition river flows at the borders of Iraq. Other models and analytical tools to support the planning process have been developed, with the scope for further tools outlined.

A start was made on the preliminary assessment of potential projects to demonstrate the use of the various models and analytical tools within the recommended planning approach (Figure 1). Data constraints were identified in most cases and often the tools were demonstrated with data that was over 20 years old (usually deriving from the General Scheme studies by the Russians). The testing highlighted areas where more work on data collection and processing would be needed in Phase 2.

Capacity building included a number of training courses and two study visits. The three training courses for users of the web-based collaboration system (Claromentis), and the four GIS and remote sensing courses, run during Phase 1 were attended by participants from the 11 participating ministries. The MoWR benefited from field and office-based training in modern hydrometric methods, the administration of the Claromentis system, and six of their staff made study visits to the UK.

In addition to these formal courses, Phase 1 included some 8 data collection meetings and two GIS cluster meetings. These were attended by delegates from all participating ministries and have encouraged networking among professionals in the water sector.

During the two UK study visits MoWR staff worked with the consultants to develop a multi-criterion decision model (MCDM) for Iraq. This demonstrated one potential planning technique. The MoWR staff have carried on testing the MCDM on further projects and reported on their results to the Steering Committee. They have also arranged to give a course of instruction on the MCDM to colleagues so that the number of people familiar with the technique is already expanding. This concept of “training trainers” is one area that should be given more attention in Phase 2.

The SWLRI project addressed the urgent need for more reliable and comprehensive river flow measurements in Iraq by providing capacity building and technical support from the United State Geological Survey and U.S. Army Corps of Engineers. The assistance benefited an ongoing MoWR initiative to renovate the Iraqi hydrometeorological network, and proceeded in complementary partnership with other support from the New Eden project.

2 Requirements in Phase 2

2.1 Introduction

The core aim of the SWRLI project is to establish the new planning and management system for Iraq's water and land resources by the beginning of the next decade. The vision is for SWRLI to be a permanent institution entrusted with the continuous maintenance of the nation's strategy plan to be routinely endorsed by an inter-departmental steering committee of Government. The SWRLI organisation should be independent of individual ministries, and be led by a chairperson with sufficient authority to arbitrate inter-ministerial disputes, and exercising full control over the day-to-day operations. The SWRLI mandate should be flexible, and subject to updates as national priorities change or details of government evolve.

In such a system all public water and land resources projects would require SWRLI approval for funding and all significant projects impacting on water availability and the environment would require sanction by SWRLI. In order to provide this service SWRLI would use the data sets (Stage A) and intervention packages (Stage B) to compare and prioritise public investment opportunities and use its models together with transparent evaluation criteria to permit private sector projects.

Phase 2 will be a transition from the current situation to the above targeted permanent state. The Work Plan for Phase 2 is designed to supply the technical attributes and the capacity building required to support this implementation.

Phase 2 therefore requires the following core assets for SWRLI to be put in place:

- a) a Steering Committee with cross-ministerial representation of appropriate seniority and decision making authority (access and empowerment), supported by appropriate logistics (office, equipment, transport, etc);
- b) a SWRLI Secretariat (or executive branch) with a full time core staff and part time inputs from all the SWRLI-concerned Ministries.

The schedule of main activities during Phase 2 is given in Figure 2, with more detailed discussion of the tasks included in the following section.

2.2 Development of Planning Framework

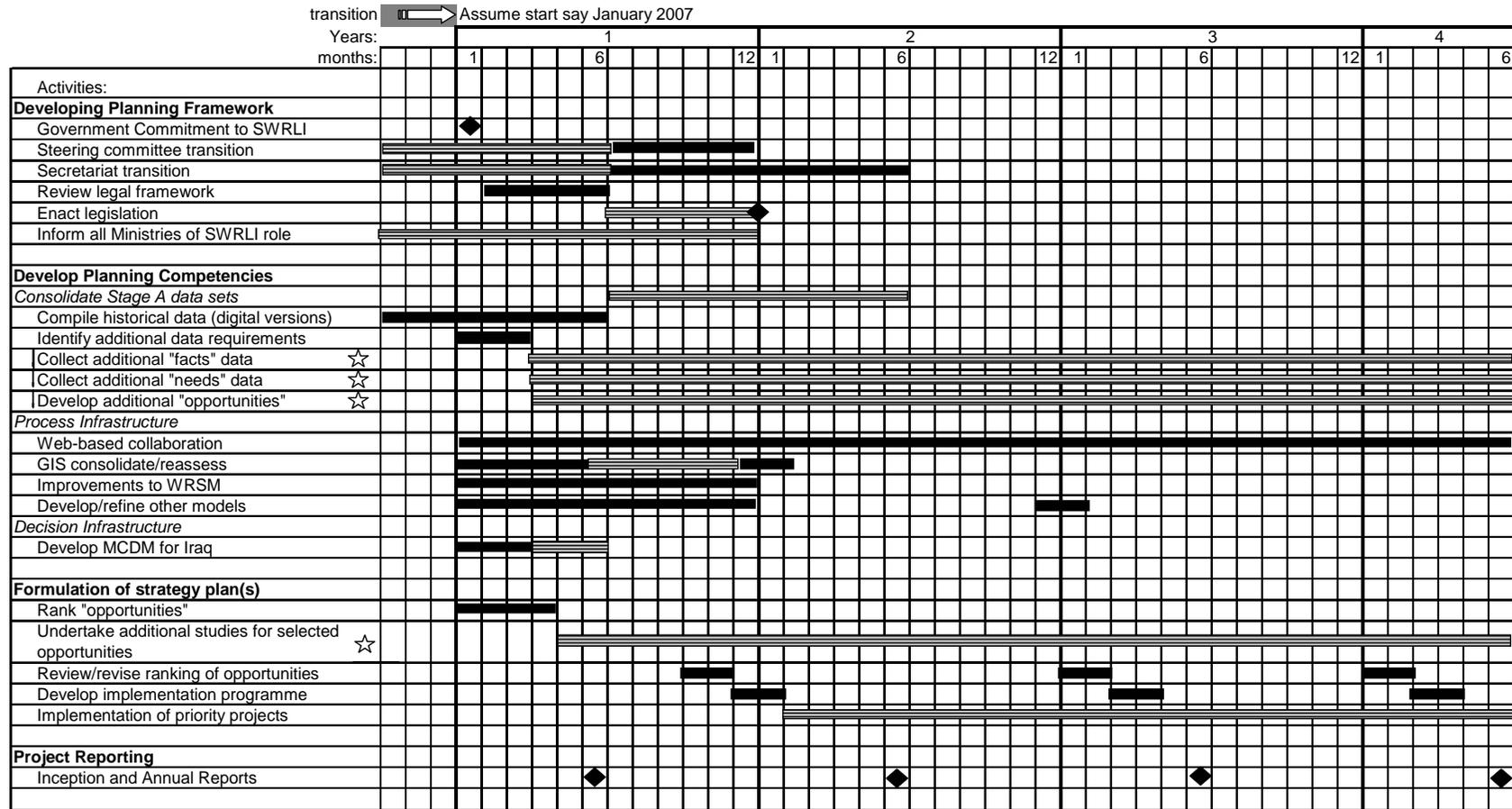
The main purpose of the SWRLI project is to establish the permanent system for long term strategic water and land resources planning and management in Iraq consisting of a reliable planning framework backed by strong institutional arrangements.

To achieve this end a Government of Iraq sponsored institutional study work is required to determine the best configuration for the permanent SWRLI planning unit and its relationship with the wider government planning authorities. The Phase 2 elements that will complement that institutional study and assist the reform process are presented below.

2.2.1 Consensus Building

Phase 1 achieved impressive progress towards integrated planning with the formation of an inter-Ministry Steering Committee with significant information and data sharing. It will be a Phase 2 priority to build on this through a concerted consensus building program.

Figure 2: Proposed Activity Schedule for Phase 2



Full time effort, possibly with TA/Consultant support
 Part time effort by SWLRI team (might require full time by ministries)
 SWLRI team have a supervisory role ministries have key role

In principle 11 Ministries are represented on the SWRLI Steering Committee at Director General level as a consequence of the efforts made in Phase 1. It will be an important basic requirement of Phase 2 to sustain and develop the inter-ministry collaboration and build in the participation of wider government water sector stakeholders to procure the required ‘buy-in’ necessary for the integrated planning approach.

An early Phase 2 review will be undertaken of the inter-Ministry Steering Committee functioning arrangements to:

- ensure that the effective routine representation is sufficiently senior and empowered;
- identify the parameters for decision making and forward governance to be implemented by the Committee
- ensure that the resources necessary support services for the Committee are made available.

On the above basis the Committee will set the agenda for Phase 2 participation and consensus building.

2.2.2 Promoting Integrated Planning for the Water Sector

The aim of the Phase 2 SWRLI program is to anticipate a comprehensive Government Institutional Study for the water sector and develop the attributes for a reliable future integrated water resources planning and management system.

The following broad axes for promoting integrated planning will be pursued within program through the direct management of the SWRLI Steering Committee:

- building links between SWRLI and Ministries to introduce SWRLI planning criteria to their investment plans and processes;
- progressive application of SWRLI competencies as they become available for planning;
- Steering Committee participation in Ministries annual investment plans.

2.2.3 Transitional Arrangements for Water Planning

Once the management structure for SWRLI has been reviewed and the Steering Committee is fully operational for Phase 2, transitional arrangements for implementing integrated water resources management during the Phase 2 period need to be put in place.

Areas to focus on are:

- protocols for sharing information between Ministries;
- raising awareness of the role of SWLRI so that Ministries submit proposed water development schemes for scrutiny.

2.2.4 Attending to the Legal and Regulatory Framework

For the SWLRI team to take the leading role in strategic planning for the water sector will require a number of changes to the legislative framework to give SWLRI the authority to provide the planning and management leadership for the sector and particularly to override other parties on matters of national importance to the water sector.

Early on in Phase 2 a review of present legal and regulatory framework will be carried out to establish the current powers vested in the MoWR and to assess what role the SWLRI team could sustain for integrated water planning and management with no legal reform.

Later on in Phase 2, on the basis of a Government institutional study and through the management of the SWLRI Steering Committee, a review of possible alternative models for new powers will be undertaken to assess their relevance and suitability for the water sector and the specific needs of strategic planning. The review should lead to recommendations for specific changes in legislation where appropriate. These will then need to be taken forward for parliamentary approval. To get to this stage will require strong ministerial support. Therefore from the outset of the legal studies the experts must have regular discussions with top level management in the MoWR and access to the Minister.

2.3 Capacity Building

Recent history has left most Iraqi institutions with a lack of capacity for modern, comprehensive and strategic water resources planning. Phase 1 of this planning effort could not by itself redress this, but it has contributed. Phase 1 itself built on the work already done in earlier years by USACE and others.

The planning capacity of staff in MoWR and other ministries and institutions will be further enhanced in the first instance by their involvement in the Phase 2 work, which will be as collaborative as possible given the geographical distribution of participants. Early drafts of working papers, models, analysis tools and such elements will be circulated for discussion whenever possible, both to further their preparation and to foster wide involvement which will help to make considerable numbers of Iraqi professionals more familiar with the planning process.

Under a program separate from the SWLRI Phase 1, some Iraqi professionals were able to spend time at HEC's offices in California, learning the use of various HEC software products for water resources planning analysis. It is hoped to continue this sort of involvement under Phase 2. Study Visits, if carefully tailored and using where possible regional centres of excellence, could also be arranged to good effect.

There is also the possibility that Iraqi professionals may undertake study periods at universities or similar institutions under the financing arrangements of Phase 2.

2.4 Physical and Human Infrastructure

The SWLRI project requires reliable facilities for collaboration among various ministries and consultants. Some of the main requirements include:

- Computer network and servers for storing data and sharing information, along with IT staff for support, and various software licenses for partners.
- Translation, scanning, digitization, quality assurance, and cataloguing staff and equipment, to help update or collect additional data, standardize the language, recognize and inventory the submittals, convert to digital information, organize along with prior submittals and identify conflicting or redundant information, and interface with technical specialists for clarifying the content or requesting additional follow-up material.
- Office space required for staff and facilities above, including meeting rooms and classrooms. Probably need to have several locations throughout Iraq.
- Security staff – probably including multiple levels of training, trust, and armament, depending on needs of task (i.e., minimal for security support on delivery of maps from Nasiriyah to Basra, but much different for steering committee meeting).
- Transportation and logistics, such as a motor pool and drivers, shipping and receiving department, reproduction center for maps and reports,

2.5 Further Development of Planning Tools

In order to provide a sound basis for strategic planning the SWRLI team needs access to credible analytical tools to ensure that the full consequences of a particular intervention (or lack of intervention) are properly assessed. Planning tools provide the means whereby these assessments are made. In essence these incorporate the methodologies that are the basis of feasibility studies (FS) and detailed designs (DS).

From the water resource perspective, the limited resources, the complexity of the existing conveyance system (both natural and man-made) and the current pattern of use means that assessing the impact of a new development is far from straightforward. As noted above, a significant effort has been put into the development of water management system model (WMSM) using the Corps' Reservoir Simulation Modelling software, HEC-ResSim, for the Tigris and Euphrates river basins in Iraq. Whilst the WMSM is now operational, further work is required in Phase 2 to improve that tool and to develop additional tools that will enable greater value to be derived from the model, in terms of quantifying the system response to a proposed development as a series of impacts throughout the system.

The ongoing and anticipated changes regarding flows from upstream nations also require careful analysis. The best outcome for this issue includes achieving international consensus concerning the development impacts on the rivers of the Tigris and Euphrates watershed. In addition to continuing analysis of the flows entering Iraq, the SWLRI project should include an outreach to Turkey, Syria, and Iran, providing an institutional framework and technical forums for data sharing and engineering collaboration.

3 Detailed Activities

3.1 Development of SWLRI Planning Competencies

3.1.1 Consolidation of the Stage A Data Sets

Gathering historical data

The SWLRI team will continue to rely on the Iraqi Ministries and other institutions for nearly all data collection work. Much of the necessary data is already available on Claromentis as scanned versions of original paper copy. However, to make it readily usable it needs to be entered in digital form, such as spreadsheets, or entered directly onto Claromentis using specially designed forms.

However, the Phase 1 studies highlighted a number of gaps that need to be filled. This will require the institutions to make staff time available to find it, collect it, collate it in convenient form, and upload it to Claromentis. Counterpart staff assigned to this work will need not only time but also the necessary authority to obtain data from people and offices that keep it; they will thus need strong support from senior levels in the ministries.

The Phase 1 effort also provided techniques for impairing and un-impairing flow data. This conversion of data to past, present, and future conditions is necessary to perform the planning scenarios. While the data on Tigris above Mosul has been through this process, the data on the Euphrates has not. Before a complete intervention analysis can be performed, the Euphrates data must be exposed to the conversion process.

Improving collection for the future

During Phase 1 HEC and the USGS worked with the Italian consultants and the MoWR to improve the performance of the hydrometric network so that future data would be more suitable for planning.

There is further work to be done in this area. One of the key features of network design should be the involvement of stakeholders such as the SWLRI team who need data to work on.

Water quality monitoring also needs to be developed so that appropriate data is collected for future planning activities. The identification of pollutant sources still needs to be obtained so that future interventions can be studied.

Additional technical and institutional training are needed by the MoWR to renovate their hydrologic monitoring network and establish a data management infrastructure that will be well suited to meet the future needs of Iraq.

Sharing Data

Protocols are required to ensure that in the longer term as a minimum there is an annual updating of key information provided by other ministries. There needs to be formal inter-ministry agreement to ensure that the transfer can take place, however, the very good informal links already established in Phase 1 should be robust enough to ensure that data is transferred in the absence of any formal protocol.

Collection and checking of agricultural data and land use data

Research is needed into the development of applied approaches to capture and manage data. Ground truth data will still be needed but using remote sensing tools to get a first estimate of crop areas would ensure that information on key users of water (farmers) was available to SWLRI immediately after the end of the cropping season not after some time for manual data collection in the field.

A similar procedure should be developed to assess the extent of land lost to salinity and water-logging.

Once this data is collected on a regular basis, it will be possible to identify local, regional and national trends. Such information is essential to inform the needs assessment programme and to direct the formulation of appropriate opportunities/interventions.

Information on Water Use

Records of dam releases and extractions from the river system should be maintained and, where necessary additional flow measuring facilities should be installed. These records should be regularly reviewed in conjunction with the records for agricultural land use and productivity, to monitor trends in absolute water use as well as efficiency.

Needs Data

This is a key area for Phase 2 because the needs will set the targets for the strategic assessment of alternative development options. Each ministry has its own planning capability and a mandate to develop to meet future needs. The SWLRI team needs to develop contact with the ministry planners in order to both obtain the data on future demands, and understand clearly the assumptions inherent in the development of the future demands. The SWLRI team, viewing future needs across the water sector, must develop a comprehensive understanding of how each individual ministry is building up its demand forecasts, so that it can decide whether it is possible to combine the other ministry forecasts ie whether the fundamental assumptions are sufficiently compatible (for example, if Ministry X assumes a doubling of demand by the 2030 planning horizon but Ministry Y assumes a lower rate of rise to the same horizon and both purport to be using the same population growth rates).

All demand projections must be viewed in the context of long-term trends in river flows, both in terms of total volumes and distribution within the year.

Opportunities

A clear finding of Phase 1 was that, while there are quite a large number of potential schemes across the sector that have had FS or design studies completed, virtually all of these studies were completed about 20 years ago. It is therefore essential that the SWLRI team work with the other ministries to identify priority schemes for an updating of the FS or design. Particularly there is a need to update the cost-benefit analysis (CBA), to review the design in the wider context, and to undertake a more detailed environmental impact assessment than was considered appropriate 20 years ago. The SWLRI team itself cannot undertake such studies and therefore there is a need to rely on the other ministries' planning teams to carry out the necessary preparatory studies. However, the SWLRI team must be in a position to offer

guidance, and, possibly undertake specific tasks, such as running the WMSM to assess the impacts of a particular proposed intervention.

Without updated data on a significant number of potential schemes it will be impossible for the SWLRI team to make substantial progress with strategic development.

3.2 Development of Intervention Packages

3.2.1 Process Infrastructure

Further development of web collaboration

The Claromentis web collaboration system should be at the centre of Phase 2 developments to improve processes and encourage cross-ministry cooperation.

At the end of Phase 1 the Claromentis system was well structured and was starting to be populated with the various planning tools (models, guidance etc). Moving into Phase 2 the Claromentis Administrator should work with the SWLRI team to promote other features of the system that were available but hardly used during Phase 1. For example, the use of discussion forums as a means of building professional collaboration. Claromentis also offers a document management system that permits documents to be “checked out”, edited and returned, with a record of the author of the edit. This procedure can provide the users with confidence in the quality of the information.

The publishing feature should be used to spread the word of SWLRI activities to all participating ministries. This is a quick and inexpensive way of getting SWLRI known and kept in the forefront of participants’ thoughts.

Given the uncertain security situation and the need to minimise the risks to all parties while encouraging as much contact as possible web based collaboration has a very important role to play. In addition to Claromentis the SWLRI team should make use of other internet techniques such as live meetings.

GIS strategy

The SWLRI team have a requirement for a well structured geo-database that will allow non-specialists to access geographical information. This needs to be linked to new remote sensing information and to develop new data sets by analysis of the existing GIS information already held. Phase 1 has demonstrated a number of these products but with only sample data. A key activity in the early stages of Phase 2 is therefore to complete the filling of the databases and making national map products available to the SWLRI team and to their collaborators in the other ministries.

It has been noted that there is a requirement for updated FS for the majority of the potential interventions. It is essential that the data collected as part of any FS updating exercise is added to the geo-database, to ensure the maximum value is derived from this information.

At the end of the first year there should be a review of the GIS strategy and all stakeholders invited to contribute ideas for new products or developments to improve the planning process.

Improvements to the WMSM

The WMSM (the Water Management System Model or HEC ResSim model) is very complex (as is the real system that it is modelling) and as such is a specialist tool which requires trained operators. During Phase 1 some consideration has been given to the requirements for pre- and post-processing tools to make the model more accessible to the SWLRI team. Of particular importance is the processing of the model output to provide a clear picture of the reliability of supply to the various offtake points in the model. Further analysis tools could be developed to translate any shortfall at a particular offtake point to an estimate of reduction in crop yield, and thus provide an assessment of the financial impact. Such tools would then provide a means whereby different development scenarios can be compared in terms of the impact on the whole system.

Taking this aspect of accessibility forward is a vital activity for the first 6 months of Phase 2 so that in later months all participants including those from other ministries can become familiar with the potential uses of the WMSM.

In the longer-term it may be possible to develop similar analytical processes to model the impact of salinity on the productivity of the river basins, although it should be appreciated that this will be more difficult, given the complex relationship between salinity levels and crop yield. Nevertheless, the potential for some form of modelling has been demonstrated in Phase 1, albeit rather limited as a result of a shortage of calibration data. A decision on the level of effort appropriate to the development of the “salinity model” can only be made in the light of an assessment of the significance of water quality on the effective use of the national water resources.

The WMSM requires further development work jointly undertaken by the Hydrological Studies Centre (HSC,) and Water Control Centre of MoWR, HEC, and the Consultants. In addition to making improvements to the HEC-ResSim model itself, it has been established that a post-processing module could be developed either as an additional feature for the WMSM or else as a stand-alone package that utilised the output from the WMSM. The relative merits of each approach should be assessed early in Phase 2, to formulate an appropriate and effective approach.

Irrespective of the approach adopted there is seen to be considerable merit in seconding 3-4 MoWR staff to work with the team developing the modules (as previously done) for intensive on-the-job collaboration/training. On their return they should then train SWLRI team and others in the use of the pre-and post-processors and promote the fullest possible use of the WMSM. At the end of Year 1 there should be a technical review of the WMSM and a planning review to determine the next steps in development.

3.2.2 Decision Infrastructure

Multi-criterion analysis model for Iraq

Phase 2 will consolidate and add to the work done on the three data sets with particular attention being paid to improving the quality of hydrometric data and enhancing the 'needs' and 'opportunities' data sets with more active inter-departmental and inter-agency collaboration. Once the additional needs and opportunities are identified by the separate ministries, the SWLRI Steering Committee would then be able to review and preliminarily rank the collection of opportunities thereby prioritizing Phase 2 efforts. In addition, the Steering Committee could develop the staffing and budgeting requirements necessary to complete the Phase 2 studies. A formal multi-criteria decision tool could be used to rank and prioritize the highest ranking interventions/opportunities before and after they have been studied.

During Phase 1 the MCDM for Iraq had been through a significant development process within the MoWR. In Phase 2 a priority activity should be to take the development process a step further by actively involving other ministries in the development of scoring rules and weightings. This is a crucial step in the process upon which the later success of this technique will largely depend. Once all parties are agreed upon the rules and weights the subsequent evaluation of possible interventions can be carried out rapidly and in a clearly transparent process that all can support.

A facilitated workshop, or possibly a number, should be held to early in Phase 2 for this purpose. Involvement in the development of the process should raise awareness within the other ministries of the data needs for this analysis.

The MCDM is seen a vital tool at the heart of the SWRLI process, providing a sound basis for decision making. However, it is essential that a wide-ranging consensus is achieved amongst the various ministries, to ensure a wide basis of support. Through the MCDM analysis, the prioritized interventions will be identified and thus more detailed studies of those interventions can commence. Some of the interventions will surely include updating of past FS and DS and other interventions will include initiating new reconnaissance and FS. The completion of these studies will require several years of study before a conclusion can be made. The MCDM method can be used again to evaluate the various interventions studied and provide support for the final decisions that need to be made for the development of a SWLRI strategy.

Updating of old Feasibility and Design Studies

It is the role of the sponsoring organisation for a new scheme to prepare FS and DS with full cost benefit analysis and environmental assessment. The SWLRI team should highlight old data that is not suitable for use in the planning process and provide advice to ministries to assist in bringing the more important studies up to date at the earliest opportunity.