ARAL SEA PROGRAM - PHASE 1

AIDE MEMOIRE

VOLUME 2

World Bank Preparation Mission

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Europe and Central Asia Region
Country Department 3
Country Operations Division I

LIST OF ABBREVIATIONS

DCWM	Department of Coordination of Water Management (under the Technical Director of EC)
DCSREC	Department of Coordination for Socio-Economic Research and Ecological Cooperation (under the Technical Director of EC)
EC	Executive Committee of the ICAS
GEF	Global Environment Facility
ICAS	Interstate Council for Addressing the Aral Sea Crisis
ICSDSTEC	Interstate Commission for Socio-economic Development and Scientific, Technical and Ecological Cooperation
ICWC	Interstate Commission for Water Coordination (this is same as ICCWS used in previous Bank reports)
IDA	International Development Association
IFAS	International Fund for the Aral Sea
RWB	Regional Working Body
RWSG	Regional Water Strategy Group
SANIIRI	Central Asian Scientific Research Institute for Irrigation
SIRC	Scientific Information and Research Center
TF	Task Force
UN	United Nations
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
WQTF	Water Quality Task Force

FOREWORD

A Bank mission visited the Aral Sea region between February 22 and March 26, 1994 with the objective of helping the Executive Committee (EC) of the Interstate Council for Addressing the Aral Sea Crisis (ICAS) to prepare the first phase of the Aral Sea Program. On completion of its work the mission presented to the Executive Committee an Aide-Memoire consisting of two volumes. The first volume included an overview of the Phase I Program and the main recommendations and findings of the mission. This report, which is the second volume of the Aide Memoire, includes detailed project briefs and terms of reference for the preparation of nine projects and outline terms of reference for another ten projects.

The proposed Aral Sea program Phase I is large and complex and requires the resolution of a considerable number of institutional, financial and technical issues. The project briefs and the terms of reference were prepared by the EC teams with the assistance of the Bank mission. The cost of preparing the feasibility studies has been estimated as US$41 million of which the foreign exchange requirements would amount to US$33.5 million. This amount also includes a capacity building project of about US$9 million of which about US$7 million would be in foreign exchange. The probable investments costs for Phase 1 of the Aral Sea Program would amount to about US$ 200 million.

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PROGRAM 1

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3. Sustainability of Dams and Reservoirs

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 1

To prepare a general strategy of water distribution, rational water use, and protection of water resources in the Aral Sea Basin, and to prepare on the basis of this strategy draft intergovernmental legal and normative acts, which will regulate the issue related to the consumption and protection of water from pollution, and the social and economic development of the region.

To prepare and introduce quotas limiting water consumption for agricultural and industrial production, as well as for other technological needs.

Project 1: Regional Water Resources Management Strategy

PROJECT BRIEF

I. BACKGROUND

1. Water plays a vital role in the economic and social life of Central Asia and Kazakhstan. Past water programs were guided by the Water Development Master Plans prepared in the 1970s by the Ministry of Land Reclamation and Water Management of the Former Soviet Union. These plans set out priorities for the water sector in the context of the development of the Syr Darya and Amu Darya basins considered as a single social and economic region of the former USSR without regard to the interests of each republic. The plans were regularly updated until the mid-1980s and, in particular, supported the massive irrigation investments that underlie regional economic and agricultural development, as well as the environmental problems associated with the shrinking of the Aral Sea.

2. Increasing recognition of these environmental problems, in particular water needs of the Aral Sea and the deltas of the Amu Darya and Syr Darya rivers, coincided in the early 1990s with four other important developments:

(a) establishment of the independent States of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan;

(b) moves towards economic reforms and market-based economies;

(c) almost complete utilization of water resources; and

(d) increasing population growth pressures.

Thus, within a radically different political and economic setting, the focus of development policy must shift to more efficient use of the available water resources.

3. Taking into account the new political, economic and social realities, and recognizing the severity of environmental concerns, the Heads of States of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan met in January 1994, and approved an Action Plan for the improvement of environmental situation in the Basin and for the social and economic development of the Basin in the next three to five years. Program No.1 of the Action Plan, provides for the development of a regional strategy for the rational use and protection of water resources in the Aral Sea Basin. Based on this strategy, intergovernmental legal and normative acts would be prepared regulating water consumption and its protection against pollution. Moreover, the strategy would determine international priority action programs for water resources management in the Basin, seen in the broad framework of mutual economic relations among the riparian States.

4. The introduction of a notion of "strategy" for water resources management in the Aral Sea makes seemingly modest but actually very important modifications to the traditional problem solving decision process. The strategy development involves two basic stages:

Stage I: assessment of water resources and their management, which covers full examination of factors that influence the management of water resources, and

Stage II: water strategy formulation, which covers formulation and evaluation of strategic options and presentation of recommendations to the appropriate decision-making body.

Stage I would begin with a full appreciation of the current policies in each riparian State and the existing and on-going developments. This would provide a basic platform upon which strategies could be built. In Stage II, feasible strategy options would be evaluated and compared on technical, economic, sociological and environmental grounds in order to arrive at recommendations for a certain period of time. But strategy formulation is not a one-time effort and countries would have to test, refine, and update their strategies and adapt them to new circumstances and challenges. Formulating a strategy is a long-term, iterative process.

5. In the Aral Sea Basin, the strategy must fully recognize the essential reality that the States are joined together in one water system comprising the basins of the two major rivers and the Aral Sea. However, it must equally recognize that each State is sovereign and will evaluate water management strategy in the light of its own interests and priorities. Thus, regional strategy can have meaning only if it reflects the interests of each state, and national activities can have meaning only if they are consistent with regional

water objectives and measures to address the ecological concerns associated with the Aral Sea. To this end, the establishment of a joint regional water management information system is of fundamental importance.

6. Given these considerations, it is proposed to establish at one of the existing regional institutions a Regional Water Strategy Group (RWSG) charged with the formulation and periodical updating, of a strategic plan for the management of water resources of the Syr Darya and Amu Darya rivers, their tributaries and the Aral Sea. The RWSG will work in close collaboration with a network of interstate Task Forces (TF), each responsible for the specific aspect of water management pertinent to the development of a regional strategy.

7. Through their appropriate ministries, each of the riparian States would collect data and participate in the process of water resources assessment, problem identification, formulating and evaluating strategy options, policies and programs from the national point of view, and interact with the RWSG to ensure consistency of national water policies with the regional constraints and opportunities as well as with international agreements concerning management of the water resources of Central Asia.

II. OBJECTIVES

8. The principal objective of this project is to develop and present for approval by the Interstate Council (ICAS) a regional strategy that addresses problems, needs and opportunities identified in a set of regional land and water resources, related assessments, and to create conditions for ecologically stable socio-economic development of every State of the Aral Sea Basin. To this end, and making full use of past and current planning efforts concerning water resources management in the Basin, the strategy development process would:

(a) strengthen regional institutions, tools, skills and intergovernmental mechanisms which would periodically update and append the strategy as necessary;

(b) formulate a set of legal acts and norms to regulate water resources management in the Basin;

(c) develop appropriate analytical tools, techniques and mathematical models for integrated analysis of the numerous factors affecting water resources management in the Basin; and

(d) recommend appropriate measures to improve water resources management in the Basin, consistent with the need to enhance health and environmental conditions, with particular reference to the Aral Sea Disaster Zone.

III. SCOPE

9. Throughout the strategy development process, special emphasis would be placed on training and capacity-building for introduction of new approaches, methods and techniques. The initial training in the project preparatory phase would focus on creating common understanding of the strategy concept, its purpose and raison d'etre. In the subsequent stages of project preparation, a series of workshops on selected topics would be organized. Beside local and foreign individual training programs, special attention would be given to the hands-on training in implementation of specific project tasks with participation of foreign experts and international consultants.

10. The scope of the Regional Water Management Strategy activity would include the following main tasks:

(a) Based on the readily available data, carry out "rapid assessments" to determine critical issues for prompt consideration by the Interstate Council while longer-term problems and needs are being examined (e.g. information system improvements, modification of reservoir operation rules, water use efficiency improvements, introduction of economic incentives, and others);

(b) Identify the need and the principal areas of the Aral Sea restoration under new conditions aiming at the creation of a new man-made environmental landscape sustaining high productivity. In this regard, the role of the Aral Sea and the Aral Sea zone in the current and the future conditions would be analyzed, considering them as a specific water user to be accounted for and differentiated in water balances of the Amu Darya and Syr Darya rivers.

(c) Obtain from the national and regional institutions inventories of basic information describing:

(i) water (surface and groundwater): such as supply, use, wastewater discharge and ambient quality in the Basin;

(ii) land: resources, use and productivity and condition;

(iii) current treaties, agreements, legislation, rules, standards and regulations;

(iv) institutional arrangements at the regional, national and local levels; and

(v) economic characteristics of supply and demand related to water and land.

(d) Develop a series of assessments on subjects pertinent to water resources management in the Basin, such as:

(i) economic investigations and analyses necessary to understand the interrelationships between water supply, use and quality and important economic factors in a regional and national perspective. These factors include: gross national product; per capita income; income distribution; regional, national and sectoral growth or decline; and known economic goals, objectives and constraints;

(ii) current and future water supplies from precipitation, glaciers, major and minor rivers and groundwater. This would include examination of the operation of flow control measures at different hierarchical levels, runoff and evaporation estimates, and for the long term, inclusion of climate and other natural change potential;

(iii) current water use and future demands in agriculture, industry and municipalities, recognizing water quality characteristics; including anthropogenic changes; current specific water use standards ("norms") and their possible values in the future, including comparison with similar standards used in the foreign countries and the ways they have been achieved; water conservation and demand management; water reuse, especially irrigation return water;

(iv) water quality (see TORs of the Water Quality Management Project; Heads of States approved Program No. 3);

(v) integration of current and future water supplies, water use and/or water demands and water quality to analyze water balances in time and space, to identify water shortages and availability;

(vi) current and projected land use, especially those conditions and uses that affect water supply, demand and quality (agricultural, municipal, industrial uses, as well as the identification of sensitive environmental areas); comparison of present and potential agricultural productivity;

(vii) environmental assessment (see TOR of the Environmental Assessment Project; Heads of States approved Program No. 4);

(viii) legal and institutional aspects such as regulations, treaties, legislation, decrees, normative acts, rules, cooperative agreements,organizational arrangements and processes, and administrative standards and procedures.

The number and type of assessment can be expanded as needed. In addition, each of them may well identify the need for more specialized assessments or studies on a variety of subjects such as soils, geology, river morphology, cropping characteristics, network of experimental stations for the analysis of water use efficiency in irrigation, and others.

(e) Using the assessments identify water and related problems, issues, needs and opportunities that should be addressed to improve water resources management in the Basin:

(i) in the context of the existing international agreements and treaties;

(ii) in the long-term context.

(f) Given the magnitude of the problems and their impacts on the national economies, health conditions, environmental quality, etc., develop a method and establish priorities from the regional perspective;

(g) Assess and identify the entities and institutional arrangements that are most appropriate for resolution of the priority problems and needs;

(h) Present the report on identified problems, needs and opportunities (item d above), their priorities (item e), and entities most appropriate for their resolution (item f) to the Intestate Council for comments and approval;

(i) Formulate and evaluate, using multi-objective analysis, approaches and alternative strategy options to address priority regional problems, needs and opportunities;

(j) Present the recommended strategy, including schedule of implementation to the Interstate Council for comments, and if needed introduce necessary modifications or present alternative strategy, until final strategy approval;

(k) Facilitate implementation of regional strategy within the Basin countries to resolve the specific priority regional issues, problems or needs; issue periodic reports of progress toward implementation for widespread circulation.

IV. OUTPUTS

11. It is envisaged that the following outputs will result from project activities:

(a) A regional strategy for water quantity and quality management and development in the Aral Sea Basin, formulated in the process involving close interaction with the national water entities or participants, including a set of short, medium to long-term action programs to support and implement regional and national development goals and policies;

(b) Recommendations for basin-wide legal and normative acts as well as improved administrative and institutional arrangements for integrated water quantity and quality management in the Aral Sea Basin;

(c) Development of capacity (through training, institutional strengthening, technical and equipment assistance) and provision of computing and analytical facilities needed to ensure rational management and utilization of scarce water resources on the regional, national and local levels.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

12. To formulate the strategy and for its periodical updating, an interdisciplinary Regional Water Strategy Group (RWSG) would be established, staffed by technical personnel seconded by, or directly hired from, various organizations from within the riparian States, supplemented as necessary by international consultants. The RWSG would work with national and regional institutions (e.g. BVOs) to collect data, existing studies, organization charts, rules and regulations, etc. On the basis of information supplied, the RWSG would undertake assessments to identify regional water resources problems, needs and opportunities. To accomplish this task, the RWSG would establish specialized Task Forces, comprising specialists from the riparian States and others, including international consultants. The results of these analyses would be used to identify and prioritize regional water-related problems, needs and opportunities that would be addressed by the respective States or regional institutions to improve water resources management in the Basin. Interacting with the Interstate Council, the RWSG would formulate and evaluate alternative strategy options. Following the approval of a recommended strategy by the Interstate Council, the RWSG would facilitate its implementation in the riparian States and would issue periodic reports on status of implementation.

13. The RWSG would be advised by the Panel of Experts of the Executive Committee inviting, among others, the representatives of the academic community, mass media, local authorities, water user associations, professional associations and non-governmental environmental organizations.

14. It is expected that the Project would extend over about three and a half years and would include the following main activities:

(a) Organizational phase (setting up the RWSG and Task Forces, identify national institutions for information gathering and processing, financial arrangements, etc.); months 1 to 6;

(b) Perform "Rapid Assessments" of current critical issues, based on the readily available data; transmit results to the Interstate Council for review and approval; months 6 to 18;

(c) Collect and process information by national institutions; months 6 to 15, continuing throughout the entire project duration;

(d) Carry the assessment phase by Task Forces and their collaborating national institutions, with the RWSG providing overall coordination and consultations; months 12 to 25;

(e) Identify regional and interstate problems, issues, needs and opportunities by the RWSG and prioritize them and transmit the product to the Interstate Council for review and approval; months 18 to 36;

(f) Formulate and evaluate alternative measures and strategy options for management of Basin's water supplies and water demands, to address priority regional problems, needs and opportunities; and identify entities to undertake resolution of priority problems and needs; months 24 to 39;

(g) Develop a regional strategy that addresses problems, needs and opportunities identified in the process of regional water and related land assessments; present the strategy to the Interstate Council for review and approval; months 36 to 42;

(h) In coordination with national strategies, facilitate implementation of regional strategy in the riparian States, months 42 to 48;

VI. RESOURCES

15. The total resources required for development of the regional water strategy are in the order of US$5 million, including US$ 375,000 needed for the 6 month project preparatory phase (see Terms of Reference attached to this Project Brief for more detailed specification of project preparation costs).

VII. JUSTIFICATION

16. Given the large area of the Aral Sea Basin, its international character, population pressure, scale of irrigation developments, and extensive environmental degradation, development of regional water strategy is of utmost importance to all the riparian States.

VIII. ISSUES

17. Financial: Personnel and other resources from all five States would be involved in the project. Questions of different currencies, exchange rates, pay scales and distribution of international funds need to be addressed in the preparatory phase of the project.

18. Infrastructure: The nature of the project requires good voice and written communication, frequent travel and accommodations and support for the RWSG and its several Task Forces. These matters would be examined in the preparatory phase of the project.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 1
Project 1: Regional Water Resources Management Strategy

TERMS OF REFERENCE

I. BACKGROUND

1. Since development of regional water strategy in the Aral Sea Basin is a complex undertaking involving several regional and national organizations, a six-month preparatory period of institution-building (including creating, staffing and designing the final tasks in detail) is essential.

II. OBJECTIVES

2. The overall objective of the project preparatory phase is to prepare the details of the project so that it can be approved by the Interstate Council and funded through the Global Environmental Facility (GEF). Consultations will need to be conducted among the Aral Sea Basin regional institutions, different ministry staff of the five States, foreign experts, and external support agencies to design specific tasks for the development of a regional water strategy. The preparatory work is to be completed during the six-month period.

III. SCOPE OF WORK

3. In the six-month preparatory period, a Regional Water Strategy Group (RWSG), charged with the responsibility for development of the regional strategy, should be established by the Interstate Council. The RWSG shall be composed of representatives of all five riparian States and specialists who are widely respected for their expertise and objectivity. They should be seconded by, or directly recruited from, various organizations from all the riparian States and others. The RWSG should adequately be supported by foreign experts (including Russian experts who have been involved in earlier water management studies in the Aral Sea Basin).

4. On the basis of the decision made by the Interstate Council, the RWSG should establish and coordinate a network of specialized Task Forces (TF), each responsible for the assessment of a specific subject pertinent to the improvement of water resources management in the Basin. This way duplication of effort would be avoided and problems will be approached in a consistent and coordinated manner. Each TF would consist of local experts responsible for a specific subject in the five States as well as staff from the regional institutions, BVOs, and appropriate international consultants.

5. The RWSG together with TFs should work in collaboration with the ministries, research institutes, design bureaus, universities and other organizations in all five States, for determining the tasks, analyses and equipment required for completing within a three-year period the activities designed to develop a regional water management strategy.

6. Although the number of TFs can be expanded as needed, during the six-month preparatory period organization of the following TFs is foreseen:

(a) Economic and Social Issues TF;

(b) Water Supply, Use and Supply/Demand Balancing TF;

(c) Water Quality TF;

(d) Land Use TF (with particular attention given to agricultural productivity);

(e) Basin-wide Environmental Assessment TF (with particular attention given to the Aral Sea zone);

(f) Institutional and Legal Issues TF;

7. In the six-month preparatory period, the RWSG should also make necessary arrangements with all the riparian States and regional institutions for expedient inventory, testing and assembly of basic data needed for the development of a strategy.

IV. DESIGN OF TASKS

8. STAGE 1. The Interstate Council establishes the Regional Water Strategy Group (RWSG) and determines its functions and formulates Terms of Reference for future operations of the RWSG.

STAGE 2. On the basis of the decision made by the Interstate Council, the RWSG establishes specialized Task Forces, determines how they will function and formulates Terms of Reference for their future operations. A training session is organized for the staff of the RWSG and TFs.

STAGE 3. The RWSG develops a draft detailed plan of work required for formulation of the regional strategy (tasks, approaches, schedules, etc.). As part of Stage 3, leaders of the RWSG are taken for a study tour to visit foreign institutions working on regional water strategy issues.

STAGE 4. The RWSG convenes a regional workshop on draft plan of work for all interested parties, including invitations to UNDP, UNEP and the World Bank. The workshop will serve to present early thoughts on the plan of work and to conduct consultations with all stakeholders (including the non-governmental organizations) and GEF lead organizations on funding the project.

STAGE 5. The RWSG formulates draft Terms of Reference for the three-year effort leading to the development of a regional water strategy. The draft TOR is circulated for review and presented to the Interstate Council for comments.

STAGE 6. The RWSG formulates final Terms of Reference for the Regional Water Resources Management Strategy Project including changes recommended in the review process. The final TOR are presented to the Interstate Council for final review and approval, and to GEF lead organizations (UNDP, UNEP and the World Bank) for review and funding.

V. TIME SCHEDULE AND REPORTING

9. The initial preparation activity is expected to proceed according to the following time schedule:

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Establishment of RSWG	—					
2	Establishment of Task Forces		—	—			
3	Preparation of Detailed Work Plan			—	—		
4	Regional Workshop on Work Plan					—	
5	Preparation Draft TOR's by RSWG					—	—
6	Preparation Final TOR's by RSWG						—

10. Four reports should be prepared during the six-months period. The reports and associated deadlines are:

	Name of Report	Due Date (End of)
1.	Composition of RWSG, TFs and their TORs	Month 3
2.	Arrangements for basic data collection	Month 3
3.	Work Plan - Draft TOR for the Project	Month 5
4.	Final TOR for the Project	Month 6

VI. PROPOSED BUDGET

11. The cost of completing the initial preparation, leading to the formulation of final terms of reference, is expected to be about US$ 375,000 as detailed below:

	Unit	Quantity	Cost (US$Thousand) Local	Foreign	Total
1. Local Specialists					
- Hydrology, - Hydrogeology, - Environmental Protection, - Water Economics, - Agricultural Economics, - Water Law, - Land Reclamation, - Systems Analysis, - Hydropower, - others;					
TOTAL	MM	210	74,000	-	74,000
2. International Consultants					
- Water Economics, - Water Law, - Environmental Protection - Land Reclamation - Systems Analysis - Modeling and others;					
TOTAL	MM	8	-	190,000	190,000
3. Travel	LS	LS	3,000	19,850	22,850
4. Training (workshop, training session, study tour[1])	LS	LS	-	20,000	20,000
5. Equipment, Goods and Materials					
- PC Computers 486	NO	7	-	17,500	17,500
- Laser printers	NO	7	-	10,500	10,500
- Modems	NO	7	-	1,400	1,400
- Fax machines	NO	5	-	3,750	3,750
- Xerox copiers	NO	5	-	35,000	35,000
TOTAL			77,000	298,000	375,000

1/The cost of a three-week long study tour for six RWSG leaders, estimated at about US$30,000, shall be covered by separate grant.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 1

Project 2: Improving the Efficiency of the Operations of the Existing Dams for Irrigation Releases and Hydropower

PROJECT BRIEF AND PRELIMINARY TERMS OF REFERENCE

I. BACKGROUND

1. With the establishment of the five Aral Sea Basin States in 1991, reservoir operational objectives and rules that have been established previously, are no longer fully satisfactory to the affected States. Consequently in 1993, the five Heads of States agreed to reexamine those rules of operation, with special emphasis on reservoir releases for hydropower generation and irrigation water supply.

II OBJECTIVES

2. For the States affected by the operation of a given reservoir or reservoirs, the ultimate objective is to reach agreement on a set of goals, on objectives, operating rules, and compensation or inducement that may be necessary to achieve those goals. This set of rules and procedures regulating the management of the reservoir complex should insofar as possible improve the efficiency of reservoir releases for irrigation and hydroelectric power with due consideration being given to other uses, especially where health matters may be involved.

III. SCOPE

3. The scope of the project would involve the collection of data and analyses such as streamflow, reservoir fluctuations, power production, frequency distributions, load curves, irrigation production functions and reservoir objectives and rules for all reservoirs having at least power and irrigation purposes. The project would also involve the development of various operational scenarios and estimates of their economic, social and environmental effects so as to prepare for each reservoir under review, a tradeoff analysis.

IV. OUTPUTS

4. For the system (cascade) of reservoirs as well as for each single reservoir brought under examination, a report presenting the range of scenarios, including goals and rules used, would be circulated for review and comments. A draft report containing the tradeoff analyses on the most promising scenarios, with the proposed operation rules and a set of compensation and inducement terms, will be circulated for review and comment. A final report containing recommendations would be forwarded to the Interstate Council for approval.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

5. An interstate Reservoir Efficiency Team would be established, drawn from the countries involved, plus one neutral party, for the analysis of the effective management of the system (cascade) of reservoirs and each particular reservoir. Where the same States are involved in more than one reservoir, reviews can be combined. For purposes of coordination and administration, the Team should preferably operate as a special Task Force of the Regional Water Strategy Group.

VI. RESOURCES

6. The total Phase I implementation costs for this project cannot be predicted with confidence at this time because the extent of analyses at complex reservoirs has not been determined so far. This will be assessed in the project preparatory phase, however, project cost may be on the order of US$ 1.5 to 2.5 million. Costs for the preparatory phase are estimated to be US$ 200,000.

VII. JUSTIFICATION

7. The development of appropriate reservoir operation rules, procedures and principles is needed to make better use of water storage facilities serving more than a single country and more than a single purpose in the Aral Sea Basin.

VIII. ISSUES

8. There are appears to be only institutional, administrative and financial details to be resolved.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 1
Project 3: Sustainability of Dams and Reservoirs

PROJECT BRIEF AND PRELIMINARY TERMS OF REFERENCE

I. BACKGROUND

1. There are approximately 70 dams and storage reservoirs in the Aral Sea Basin. Some of these have already had their reservoir capacity significantly reduced by siltation and others are threatened, especially in the Amu Darya basin. There is no regional program to address this problem.

II. OBJECTIVES

2. The objectives are to develop a regional program that assesses useful capacities of storage reservoirs so as to facilitate the implementation of the most appropriate measures to eliminate the causes of capacity losses by the State(s) responsible for the specific structure and its catchment basin.

III. SCOPE

3. The scope would involve the collection of appropriate information such as rainfall-runoff rates, sedimentation and capacity loss rates, sediment types and sources and current land practices, the establishment of criteria to determine priority reservoirs; and development and evaluation of alternative measures for those locations.

IV. OUTPUTS

4. The project would produce a status report prepared on each watershed examined and an in-depth report on each priority reservoir watershed giving the capacity loss sources, rates and impacts (or effects) of that loss. A full range of alternative solutions with their costs and benefits in both economic and environmental terms will be shown with recommendations regarding a preferred solution.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

5. Creation of a Reservoir Capacity/Erosion Team that for purposes of administration and coordination should preferably operate as a special Task Force of the Regional Water Strategy Group. This activity would require three and a half years that includes a six month preparatory phase.

VI. RESOURCES

6. The total Phase I implementation costs for this project cannot be predicted with confidence at this time because the extent of necessary field work is unknown. This will be assessed and valued in the preparatory phase of the project, however, project cost may be on the order of US$ 1 million. Costs for the preparatory phase are estimated to be US$ 200,000.

VII. JUSTIFICATION

7. Siltation of storage reservoirs in the Aral Sea Basin resulted in the deterioration of their performance in controlling river flows, as compared to the time when these reservoirs were built. It reduces significantly operational value of reservoirs for all of their purposes. The project shall recommend specific measures to protect the reservoirs against siltation and extend in long-term their economic life.

VIII. ISSUES

8. There may be very little data available on certain, remote watersheds and some field work will probably be required during the project preparatory phase. Other issues involve financial and institutional matters.

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 2

Projects: 1. Hydrometeorological Services
2. Data Base and Management Information System for Water Quality and the Environment

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 2

To prepare and introduce system of water availability and consumption measurement for the countries of the Aral Sea Basin, as well as a regional system of monitoring the environmental situation. To create data bases and to provide the relevant meteorological station with equipment and special devices.

Project 1: Hydrometeorological Services

PROJECT BRIEF

I. BACKGROUND

1. Information on the water resources of the Aral Sea Basin to measure and monitor their availability and consumption, is collected, processed and disseminated throughout the five countries in a coordinated manner by their 5 National Hydrometeorological Services, and the Central Asian Research Hydrometeorological Institute, working in unison. Unfortunately the economic recession has caused a deterioration in the data gathering infrastructure which is decreasing the quantity and quality of data and information being provided for planning and operations. The project is designed to arrest this decline, and set up five effective hydrometeorological services. To provide for the successful elaboration of the integrated regional water management strategy, which is the main objective of Program No.1, success of Program No.2 of the first stage of the Aral Sea program as well as other programs of this region development, this project would be implemented simultaneously and in accord with Project No.2 which are components of the regional information infrastructure.

II. OBJECTIVES

2. The principal objective would be to provide the five National Hydrometeorological Services with modern data collecting, processing and information dissemination capacity. The detailed objectives of this project would be to facilitate:

(i) Qualitative and quantitative assessment of the water resources; and

(ii) Monitoring climatic changes.

III. SCOPE

3. The scope would be limited to the 5 National Hydrometeorological Services in the five countries.

4. The project would supply and install modern hydrometeorological data gathering, transmission, receiving, and processing equipment in the Aral Sea Basin for the 5 National Hydrometeorological Services and the Central Asian Research Hydrometeorological Institute. This system would have the capacity to disseminate data and information in "real-time" to the regional entities identified in the scope would be accessible to international hydrometeorological and climatological institutes. The project would also includes an extensive training program for the use of this modern equipment; (ii) courses and study tours on "real time" water resource management, water resources forecasting with the establishment of the data base, and (iii) the application of operational hydrology in development.

IV. OUTPUTS

5. The project would provide the Hydrometeorological Institutes with the capacity to supply continuous high quality data and information in "real time" about the behavior of the climate and hydrological cycle in Central Asia.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

6. At the Scientific and Information Center of the Interstate Council, a Regional Working Body (RWB) would be established to develop the regional information infrastructure of the Aral Sea Basin. The RWB would involve specialists widely respected for their experience and objectiveness. They would be seconded from different water organizations of the riparian countries or they could be hired directly. International experts would also be involved.

7. The RWB would establish a network of task force groups (TFG) which would be dealing with the specific issues related to the collection of water resources data, identification of parameters and information flows, structuring the data base and other technical and technological issues of this project. The RWB would be responsible for the TFG activities. Each TFG would include specialists responsible for the relevant issues in the riparian countries, as well as officers of the regional organizations and international experts. TFG will closely cooperate with the relevant departments of Ministries, research institutes, design institutes, universities, and other organizations in the riparian countries to identify the priorities, conduct studies and identify equipment requirements to implement this component of the Aral Sea Program.

8. During the preparatory period the TFG's carrying out the feasibility and design of the Hydromet Project would be working with the five Hydrometeorological Institutes, the Central Asian Research Hydrometeorological Institute and liaising with the data and information receivers. The TFG's would probably carry out the following activities:

(i) optimization of the monitoring network and unification of the program of measurements;
- 6 experts (1 foreign, 5 local)

(ii) equipment requirements for source information points;
- 6 experts (1 foreign, 5 local)

(iii) hardware requirements for the institutes;
- 6 experts (1 foreign, 5 local)

(iv) preparation of the hydrometeorological information dissemination project, and results of the water resources quality and availability
- 6 experts (1 foreign, 5 local)

(v) selection of software for processing data for the following discipline:

hydrometeorology;
- 6 experts (1 foreign, 5 local)

(vi) analyses of present and future information flow;
- 6 experts (1 foreign, 5 local)

(vii) improvement of the methods of the regional evaluation of the snow resources;
- 6 experts (1 foreign, 5 local)

The number of TFG's could be expanded if need be.

9. During the preparatory period the RWB would make all the arrangements with the riparian countries and relevant organizations and agencies with regard to procedures and schedules, equipment provision, and all other supporting logistics.

10. The Preparation Period is expected to take six (6) months and would cover the following stages of work:

Stage 1: The Interstate Council establishes the Regional Working Body to develop the Unified Water, Land and Environment Information Infrastructure, prepares general terms of reference, and appoints Chief of RWB.

Stage 2: The RWB establishes Task Force Groups (TFGs) for the project, prepares specific terms of reference, with the assistance of foreign and local experts, and coordinates their activities.

Stage 3: The TFGs carry out their assigned tasks.

Stage 4: The RWB prepares a draft working plan for the development of the Hydromet project within the Aral Sea Basin Program (Tasks, approaches, schedules Hydrometeorological Services etc.).

Stage 5: The RWB hosts a regional workshop on the draft working plan, with discussion involving all respective parties, including the UNDP, UNEP, and the World Bank.

Stage 6: The RWB finalizes the draft of the three year project implementation arrangements and schedule for Phase I, Program No. 2, Project No. 1 and submits it to the Interstate Council for consideration and approval.

Stage 7: The RWB finalizes the Project taking into account the IC comments, and submits it for appraisal.

11. Project implementation is expected to take about three (3) years.

VI. RESOURCES

12. The proposed budget for preparation is as follows:

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
1. Local Experts	MM	350	140,000	-	140,000
2. Regional Support	MM	180	72,000	-	72,000
3. International Experts	MM	48	-	1,200,000	1,200,000
4. Local Travel	LS	LS	3,000	-	3,000
5. Training	LS	LS	-	50,000	50,000
6. Equipment and Materials	LS	LS	-	35,000	35,000
TOTALS			215,000	1,285,000	1,500,000

13. The total project is expected to cost about US$21 million, including US$1.5 million for the preparation period.

VII. JUSTIFICATION

14. Given:

- the deterioration of the capacity of the National Hydrometeorological Institutes to measure and forecast the annual availability of water resources for the Basin;

- the lack of capacity of these same institutes to monitor consumption and discharge of water where ever it occurs throughout the Aral Sea Basin for water accounting purposes, and monitoring quality and legal protocols;

- the enormous amount of high quality regional hydrometeorological information that will be required by the "Regional Water Strategy Group" proposed in Project No.1, to formulate a comprehensive water development and management strategy for the Aral Sea Basin;

The implementation of this project must be given high priority.

VIII. ISSUES

15. For the system to be sustainable a financing commitment will be required by the five riparian States. This issue must be fully addressed and firm recommendations should be made as to the manner of financing and the possible commercialization of the data and information within and between the States, and with international users. The information policy should be oriented towards free access to data and information, with free exchange between the founders and users. Where commercialization for revenue purposes is thought to be viable, the cost should not interfere with its full utilization.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 2
Project 1: Hydrometeorological Services

TERMS OF REFERENCE

I. BACKGROUND

1. Information on the water resources of the Aral Sea Basin to measure and monitor their availability, and consumption, is collected, processed and disseminated throughout the five countries in a coordinated manner by their 5 National Hydrometeorological Services, and the Central Asian Research Hydrometeorological Institute, working in unison. Unfortunately the economic recession has caused a deterioration in the data gathering infrastructure which is decreasing the quantity and quality of data and information being provided for planning and operations. The project is designed to arrest this decline, and establish a high quality regional hydrometeorological service.

II. OBJECTIVE

2. The principle objective of this Terms of Reference is to prepare the details of the project so that it can be approved by the Interstate Council for funding by the GEF, World Bank and/or other donors.

III. SCOPE OF WORK

3. In the course of the preparatory period at the Scientific and Information Center of the Interstate Council, a Regional Working Body (RWB) will be established to develop the regional information structure of the Aral Sea Basin. The RWB will involve specialists widely respected due to their experience and objectiveness. They could be seconded from different water organizations of the riparian countries or they could be hired directly. International experts would also be involved. They will assist the local experts with the feasibility studies and design. They will also train local experts and staff.

4. The RWB would establish a network of task force groups (TFG) which will be dealing with the specific issues related to the collection of water resources data, identification of parameters and information flows, structuring the data bases and other technical and technological issues of this project. The RWB will be responsible for the TFG activities. Each TFG will include specialists responsible for the relevant issue in the riparian countries, as well as officers of the regional organizations and international experts. TFG will closely cooperate with the relevant departments of the ministries, research institutes, design institutes, universities and other organizations in the riparian states to identify the priorities, conduct studies and identify equipment requirements for the implementation of this component of the Aral Sea Program.

5. During the preparatory period the TFG's carrying out the feasibility and design of the Hydromet Project will be working with the five Hydrometeorological Institutes, the Central Asian Research Hydrometeorological Institute and liaising with the data and information receivers. The TFG's will probably carry out the following activities:

(i) optimization of the monitoring network and unification of the information programs;

(ii) equipment requirements for source information points;

(iii) hardware requirements for the five institutes;

(iv) selection of software for processing data for the following disciplines:

hydrometeorology;
operational hydrometeorology;
analyses of present information flow;

Maintenance services should be involved in the process.

IV. DESIGN OF TASKS

6. The initial preparation of the project is expected to be carried out in seven stages as detailed below:

Stage 1: The Interstate Council establishes the Regional Working Body to develop the Unified Water, Land and Environment Information Infrastructure, prepares general terms of reference, and appoints Chief of RWB.

Stage 2: The RWB establishes Task Force Groups (TFGs) for the three sub-projects, prepares their specific terms of reference, with the assistance of foreign and local experts, and coordinates their activities.

Stage 3: The TFGs carry out their assigned tasks.

Stage 4: The RWB prepares draft working plan for the development of the Hydromet project within the Aral Sea Basin Program (Tasks, approaches, schedules etc.).

Stage 5: The RWB hosts a regional workshop on the draft working plan, with discussion involving all respective parties, including the UNDP, UNEP, and the World Bank.

Stage 6: The RWB finalizes the draft of the three year project implementation arrangements and schedule for Phase I, Program No. 2, Project No. 1 and submits it to the Interstate Council for consideration and approval

Stage 7: The RWB finalizes the Project taking into account the IC comments, and submits it for appraisal.

V. TIME SCHEDULE AND REPORTING

7. The project preparation activities are expected to proceed according to the following schedule.

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Establishment of Regional Working Body	—					
2	Establishment of Task Force Groups		—				
3	Preparation by Task Force Groups			—	—	—	—
4	Preparation of draft Working Plan					—	
5	Regional Workshop on Working Plan						—
6	Final draft of Implementation Arrangements						—
7	Completion of Preparation Report						—

8. Reports would be prepared as provided for in the specific terms of reference.

VI. PROPOSED BUDGET

9. The estimated cost of preparation is given in the following table.

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
1. Local Experts	MM	350	140,000		140,000
2. Regional Support	MM	180	72,000		72,000
3. International Experts	MM	48		1,200,000	1,200,000
4. Local Travel	LS	LS	3,000		3,000
5. Training	LS	LS		50,000	50,000
6. Equipment and Materials	LS	LS	-	35,000	5,000
TOTALS			215,000	1,285,000	1,500,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 2

To prepare and introduce system of water availability and consumption measurement for the countries of the Aral Sea Basin, as well as a regional system of monitoring the environmental situation. To create data bases and to provide the relevant meteorological station with equipment and special devices.

Project 2: Database and Management Information System for Water Quality and Environment

PROJECT BRIEF

I. BACKGROUND

1. Information on water, land and environment resources of the Aral Sea Basin to measure, manage and monitor their quality and availability, is collected, processed, stored and used by the five countries in an independent and uncoordinated manner. To coordinate the use of natural resources, this project would provide the means to collect, process and store, water, land and environment data, in a unified electronic data base. This unified information would then be used in a Management Information System to research the issue of the inter-relationship between water quality, land and the environment, and its socio-economic consequences.

II. OBJECTIVE

2. The principal objective would be to create unified electronic regional data bases for water, land and environment in Ministries and regional scientific research and information centers, for the preparation of credible and relevant regional socio economic analyses of water, land, and the environment, for dissemination to the Ministries and regional development decision makers, for comprehensive Aral Sea Basin development. The data base would be established in the interests of the regional monitoring as its electronic center.

3. The detailed objectives of this project would be:

(i) Quantitative and qualitative evaluation of water, land and environment resources, (maintenance and land reclamation services) considering climatic changes and fertile land potential.

(ii) Assessment of the present and future demands on water, land and environment resources, in the social, economic and environmental context.

(iii) Evaluation of present and future utilization of water and land resources.

(iv) Recommendation as to how people and property could be protected from water induced natural disasters;

(v) Provision of information for planning.

(vi) Assessment of water, land and environmental response to human impact.

(vii) Assessment and prediction of human induced water, land and environmental hazards.

(viii) Preparation of recommendations on water, land and environment preservation.

(ix) Provision of operational information on groundwater, land and natural resources in "real time".

(x) Recommendations for water saving by zones and sectors of the economy to increase water and land productivity.

(xi) Stabilization and improvement of ecological systems of the region.

(xii) Emergency forecast of water deterioration and recommendation of mitigating measures.

III. SCOPE

4. The scope of the project will be restricted to the creation of one regional scientific research and information center in each of the five States, making a total of five.

5. The project would supply and install modern data bases, computer models, laboratories, and processing equipment for interactive water, land and environmental resources research in designated regional scientific research and information centers. The project would also create experimental pilot farming areas to test the control of water quantity and quality by computer and modern devices, and research water quality issues.

IV. OUTPUTS

6. The project would provide the following outputs:

- A regional information center which would house a single management information system of water and land resources to facilitate the study of water quality and natural resources.

- Five modern scientific research and information centers for the region, capable of providing relevant high quality information and recommendation about the socio-economic consequences of the interaction of water, land and the environment, with particular emphasis on water quality.

- The creation of unified management information systems for water quality and environmental research.

- Information about the results of the effects of the use of modern technologies and techniques on on-farm water use.

- The regional character of economic, social and ecological problems.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

7. At the Scientific and Information Center of the Interstate Council, a Regional Working Body (RWB) would be established to develop the regional information infrastructure of the Aral Sea Basin. The RWB would involve specialists widely respected for their experience and objectiveness. They would be seconded from different water organizations of the riparian countries or they could be hired directly. International experts would also be involved.

8. The RWB would establish a network of task force groups (TFG) which would be dealing with the specific issues related to the collection of water resources data, identification of parameters and information flows, structuring the data base and other technical and technological issues of this project. The RWB would be responsible for the TFG activities. Each TFG would include specialists responsible for the relevant issues in the riparian countries, as well as officers of the regional organizations and international experts. TFG would closely cooperate with the relevant departments of Ministries, research institutes, design institutes, universities, and other organizations in the riparian countries to identify the priorities, conduct studies and identify equipment requirements to implement this component of the Aral Sea Basin Program.

9. During the preparatory period the TFG's carrying out the feasibility and design of this project would probably carry out the following activities:

(i) selection of suitable scientific research and information centers;

- 6 experts (1 foreign, 5 local)

(ii) selection of suitable experimental pilot farms;

- 6 experts (1 foreign, 5 local)

(iii) computer hardware requirements for the centers;

- 6 experts (1 foreign, 5 local)

(iv) selection of software for processing data for the following disciplines:

groundwater;
- 6 experts (1 foreign, 5 local)

surface water runoff;
- 6 experts (1 foreign and 5 local)

water quality;
- 6 experts (1 foreign, 5 local)

operational hydrometeorology;
- 6 experts (1 foreign, 5 local)

land resources of the irrigation zone;
- 6 experts (1 foreign, 5 local)

land reclamation situation;
- 6 experts (1 foreign, 5 local)

ecology;
- 6 experts (1 foreign, 5 local)

natural resource socio-economics;
- 6 experts (1 foreign, 5 local)

economics of water management;
- 6 experts (1 foreign, 5 local)

(v) analyses of present information flow;
- 6 experts (1 foreign, 5 local).

(vi) selection of laboratory equipment
- 6 experts (1 foreign, 5 local)

The number of TFG's could be expanded if need be.

10. During the preparatory period the RWB would make all the arrangements between States and relevant organizations and agencies with regard to procedures and schedules, equipment provision, and all other supporting logistics.

11. The Preparation Period is expected to take six (6) months.

Stage 1: The Interstate Council establishes the Regional Working Body to develop the Hydromet and Data Base and Management Information System for Water Quality and the Environment Program, prepares general terms of reference, and appoints Chief of RWB.

Stage 2: The RWB establishes Task Force Groups (TFGs) for the project, prepares specific terms of reference, with the assistance of foreign and local experts, and coordinates their activities.

Stage 3: The TFGs carry out their assigned tasks.

Stage 4: The RWB prepares draft working plan for the development of the Regional Scientific Research and Information Centers and their experimental farming areas, for the Aral Sea Basin (Tasks, approaches, schedules etc.).

Stage 5: The RWB hosts a regional workshop on the draft working plan, with discussion involving all respective parties, including the UNDP, UNEP, and the World Bank.

Stage 6: The RWB finalizes the draft of the three year project implementation arrangements and schedule for Phase I, Program No. 2, Project No. 2 and submits it to the Interstate Council for consideration and approval.

Stage 7: The RWB finalizes the Project taking into account the IC comments, and submits it for appraisal.

12. Project implementation is expected to take about 3 years.

VI. RESOURCES

13. The proposed budget for preparation is as follows:

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
1. Local Experts	MM	200	80,000	-	80,000
2. Regional Support	MM	110	44,000	-	44,000
3. International Experts	MM	33	-	825,000	825,000
4. Local Travel	LS	LS	1,000	-	1,000
5. Training	LS	LS	-	25,000	25,000
6. Equipment and Materials	LS	LS	-	25,000	25,000
TOTALS			125,000	875,000	1,000,000

14. Total project cost is estimated to be about US$9.0 million, including US$1.0 million for the preparation period.

VII. JUSTIFICATION

15. Given the important need to study water quality and its relationship with land within the regional socio-economic and environmental context; the implementation of this project must be given high priority.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 2
Project 2: Database and Management Information System for Water Quality and Environment

TERMS OF REFERENCE

I. BACKGROUND

1. Information on water, land and environment resources of the Aral Sea Basin to measure, manage and monitor their quality and availability, is collected, processed, stored and used by the five countries in an independent and uncoordinated manner. To coordinate the use of natural resources, this project will provide the means to collect, process and store, water, land and environment data, in a unified electronic data base. This unified information can then be used in a Management Information System to research the issue of the inter-relationship between water quality, land and the environment, and its socio-economic consequences.

II. OBJECTIVE

2. The principle objective of this Terms of Reference is to prepare the details of the project so that it can be approved by the Interstate Council for funding by the GEF, World Bank and/or other donors.

III. SCOPE OF WORK

3. In the course of the preparatory period at the Scientific and Information Center of the Interstate Council, a Regional Working Body (RWB) will be established to develop the regional information structure of the Aral Sea Basin. The RWB will involve specialists widely respected due to their experience and objectiveness. They could be seconded from different water organizations of the riparian countries or they could be hired directly. International experts would also be involved. They will assist the local experts with the feasibility studies and design. They will also train local experts and staff. The RWB would establish a network of task force groups (TFG) which will be dealing with the specific issues related to the collection of water resources data, identification of parameters and information flows, structuring the data bases and other technical and technological issues of this project. The RWB will be responsible for the TFG activities. Each TFG will include specialists responsible for the relevant issue in the riparian countries, as well as officers of the regional organizations and international experts. TFG will closely cooperate with the relevant departments of the ministries, research institutes, design institutes, universities and other organizations in the riparian states to identify the priorities, conduct studies and identify equipment requirements for the implementation of this component of the Aral Sea Program. During the preparatory period the TFG's carrying out the feasibility and design of the Data Base and Management Information System for Water Quality and the Environment Project will probably carry out the following activities:

(i) selection of suitable scientific research and information centers;

(ii) selection of suitable experimental pilot farms;

(iii) computer hardware requirements for the centers;

(iv) selection of software for processing data for the following disciplines:

groundwater;
surface water;
water quality
operational hydrology;
land resources;
land reclamation
ecology;
natural resource socio-economics;
economics of water management;

(v) analyses of present information flow;

(vi) selection of laboratory equipment

4. During the preparatory period the RWB will make all the arrangements between States and relevant organizations and agencies with regard to procedures and schedules, equipment provision, and all other supporting logistics.

IV. DESIGN OF TASKS

5. Project preparation would be carried out in seven stages as detailed below:

Stage 1: The Interstate Council establishes the Regional Working Body to develop the Hydromet and Data Base and Management Information System for Water Quality and the Environment Program, prepares general terms of reference, and appoints Chief of RWB.

Stage 2: The RWB establishes Task Force Groups (TFGs) for the project, prepares specific terms of reference, with the assistance of foreign and local experts, and coordinates their activities.

Stage 3: The TFGs carry out their assigned tasks.

Stage 4: The RWB prepares draft working plan for the development of the this project within the Aral Sea Basin Program (Tasks, approaches, schedules etc.).

Stage 5: The RWB hosts a regional workshop on the draft working plan, with discussion involving all respective parties, including the UNDP, UNEP, and the World Bank.

Stage 6: The RWB finalizes the draft of the three year project implementation arrangements and schedule for Phase I, Program No. 2, Project No. 2 and submits it to the Interstate Council for consideration and approval.

Stage 7: The RWB finalizes the Project taking into account the IC comments, and submits it for appraisal

V. TIME SCHEDULE AND REPORTING

6. The preparation activities detailed above would be carried out in accordance with the following time schedule.

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Establishment of Regional Working Body						
2	Establishment of Task Force Groups						
3	Preparation by Task Force Groups						
4	Preparation of draft Working Plan						
5	Regional Workshop on Working Plan						
6	Final draft of Implementation Arrangements						
7	Completion of Preparation and Appraisal Report						

7. Reports would be prepared as provided in the specific terms of reference.

VI. PROPOSED BUDGET FOR PROJECT PREPARATION

8. The proposed budget for preparation is as follows:

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
1. Local Experts	MM	200	80,000	-	80,000
2. Regional Support	MM	110	44,000	-	44,000
3. International Experts	MM	33	-	825,000	825,000
4. Local Travel	LS	LS	1,000	-	1,000
5. Training	LS	LS	-	25,000	25,000
6. Equipment and Materials	LS	LS	-	25,000	25,000
TOTALS			125,000	875,000	1,000,000

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 3

Projects: 1. Water Quality Management
   a. Water Quality Assessment and Management
   b. Agricultural Water Quality Improvement

2. Remodelling of Syr Darya River Bed and Shardarinsk Control Units

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 3

To work out principles of improving the water quality, and limiting pollution. To take measures aimed at reducing and stopping the future discharge of highly mineralized and polluted drainage water, and of unpurified water used for industrial purposes and in the communal sector, into rivers, water reservoirs, and onto the territories of neighboring countries.

Project 1: Water Quality Management

PROJECT BRIEF

I. BACKGROUND

1. The Aral Sea basin is a closed drainage system encompassing about 690,000 sq. km. The basin is primarily within five countries of the former USSR (Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan) whose rivers flow to the Aral Sea. The Sea is the ultimate disposal site for all runoff and discharges within the basin. Because of large developments for irrigation, increased population, and industrial intensification, the Aral Sea has shrunk since 1960 from 68,000 sq. km. to about 37,000 sq. km. and its level has dropped by about 14 m. The Aral Sea salinity level has increased nearly three times, to that of sea water, and serious environmental damage has been caused by increased loadings of agricultural chemicals, municipal wastewater, and industrial effluents in the basin.

2. Two of the largest river systems in Central Asia, the Amu Darya and the Syr Darya, flow into the Aral Sea. Municipal and industrial wastewater disposal directly into the rivers is the primary cause of pollution in the upper reaches of the rivers and irrigated agriculture is the main contributor of pollution in the middle and lower reaches. Health problems have been created as a result of the pollution discharges and they are particularly worrisome in the delta areas of the two river systems as well as near cities and industrial complexes. Fishery resources and the fish processing businesses have been severely impacted and the quality of life in some affected areas has deteriorated significantly.

3. A strong commitment to address water quality and environmental problems exists and is evident in the January 11, 1994 "Action Plan for improving the environmental situation in the Aral Sea Basin", signed by the five Central Asia Heads of States and the Government of the Russian Federation. The Water Quality Management Project includes two components designed to address these needs:

(i) Water Quality Assessment and Management and
(ii) Agricultural Water Quality Improvement.

These two components address Program 3 approved by the Heads of States in the Aral Sea Action Plan. This brief summarizes the anticipated project for implementation of Program 3 of the Aral Sea Basin Phase 1 effort. Attachments 1 and 2 provide Terms of Reference (TOR) for the six-month preparation period for the two components of this project.

II. OBJECTIVES

4. The overall objectives of the project would be to conduct an assessment of all significant sources of water pollution in the Aral Sea Basin; to conduct pilot programs and develop action plans (for priority investments) for reducing pollution from irrigated agriculture; to establish water quality management programs within existing institutions in the region that are effective in achieving pollution abatement from all significant point sources (such as industry and cities) and nonpoint sources (such as agriculture and mining); and to achieve actual reductions of pollution loadings from municipal, industrial, and agricultural sources.

5. Specific objectives for each of the two components are described below.

A. Water Quality Assessment and Management Component

The objectives of this component are to:

(i) establish a system for monitoring water quality and ecological conditions and purchase priority equipment for the monitoring system, especially for improving sampling by BVOs and Hydromet (in conjunction with Program 2);
(ii) conduct a pollution source inventory and water quality assessment;
(iii) assess existing and future alternative schemes of collector drainage water removal and municipal/industrial wastewater treatment, including a plan for stopping or greatly reducing the discharge of highly mineralized and polluted water on rivers, tributaries, and neighboring countries;
(iv) establish effective water quality management programs within existing institutions that can achieve pollution abatement for all significant point and nonpoint sources of pollution in the basin; and

(v) initiate investigations of groundwater quality contamination and protection strategies, in particular the relationships between ground and surface waters.

B. Agricultural Water Quality Improvement Component

The objectives of this component are to:

(i) assemble information on practical strategies for reducing water use and improving drainage water quality from irrigated agriculture;
(ii) identify best management and recycling practices for agricultural pollution control;
(iii) conduct pilot projects, field trials, and demonstration areas for practical use of these strategies and best management practices as part of sustainable agricultural systems; and
(iv) prepare priority infrastructure and equipment investment plans, investigation action plans, and research strategies to solve nonpoint source pollution problems from irrigated agriculture.

III. SCOPE

6. The sustainability of agriculture, environmental quality, public health, and the entire socioeconomic fabric of society in the basin is impaired by poor land and water management practices and by discharges of pollution from industrial, municipal, and agricultural sources.

7. In order to address these very complex problems, sustainable agricultural irrigation systems that use less water from the rivers must be introduced. Also, it is critical that pollution abatement measures be implemented for all significant pollution sources.

8. Component 1 addresses water quality assessment and management issues basinwide. This component would support institutional assessment and planning processes that would be jointly conducted basinwide by representatives from throughout the region. Component 1 would include an analysis of alternative methods for greatly reducing the discharge of municipal and industrial pollutants (such as pollution prevention, closed cycle systems, advanced treatment systems, and irrigation of cropland). Special emphasis would be placed on reducing pollution from industrial areas (such as the zones of Zerafshan, Navoi, Vakhsh, Tashkent, Chimkent, and the Fergana Valley).

9. Component 2 would be limited mostly to the irrigated flatlands of the middle and lower basin. This work would involve procurement of equipment, demonstration projects, action plans, studies, and research for introducing more sustainable irrigated agricultural systems that are necessary for reducing river withdrawals and improving water quality. Special attention would be given to evaluation of schemes and alternatives for collection of polluted and disposal waters along the Amu Darya and the Syr Darya to reduce discharges of poor quality water to these water supply rivers. This activity will be coupled with the irrigation water treatment alternatives and recycling approaches to provide improved provisions for the ecological safety of the lands they are constructed upon. Component 2 would provide actual on-the-ground correction of priority problems.

10. Much of the work would be done by local experts from the region who will be appointed by the Interstate Council. These experts would come from existing ministries, agencies, and institutions (such as the BVOs and regional organizations). These experts would be supported and advised by international experts from interested countries and international institutions. Implementation of pilot projects, field trials and demonstration sites would be done through existing local and regional organizations.

IV. OUTPUTS

11. The outputs for the "Water Quality Assessment and Management Component are expected to be as follows:

(i) improved water quality monitoring systems for the basin (in conjunction with Program 2);
(ii) pollution source inventory and water quality assessment conducted;
(iii) alternative schemes assessed for removal of highly mineralized and polluted water from rivers, tributaries, and neighboring countries;
(iv) water quality management and pollution abatement programs established in existing institutions in the five countries to meet regional needs; and
(v) groundwater contamination inventoried and strategies for protection proposed.

The outputs for the "Agricultural Water Quality Improvement Component" are expected to be as follows:

(i) information assembled on practical strategies for reducing water use and improving drainage water quality from irrigated agriculture;
(ii) best management practices identified for agricultural pollution control;
(iii) pilot projects, field trials, and demonstrations conducted on practical use of these strategies and best management practices adopted as part of sustainable agricultural systems; and
(iv) priority infrastructure and equipment investment plans, investigation action plans, and research strategies prepared to solve nonpoint source pollution problems from irrigated agriculture, particularly resulting in the decrease on river pollution.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

12. Following a six-month period of preparation, components 1 and 2 are both scheduled to be undertaken over a three-year period. Preliminary plans and schedules for both Phase 1 components are as follows:

Component	Activities	Year 1 | Year 2 | Year 3
1.Water Quality	1.1 Monitoring system design, procurement, training	XXXXXXXXXXXXXX
	1.11 Implementation of monitoring	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	1.2 Pollution source inventory	XXXXXXXXXXXXX
	1.21 Water quality assessment	XXXXXXXXXXXX
	1.3 Review and evaluate existing laws, regulations,and programs	XXXXXXXXXXXX
	1.31 Process for improving laws, management,and pollution control programs	XXXXXXXXXXXXXXXX
	1.32 Procure equipment and build capacity for pollution control programs	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	1.4 Groundwater contamination assessment	XXXXXXXXXXXXXXXXXXXXXXXX
	1.41 Protection strategies in priority areas	XXXXXXXXXXXXXXXXXXXX
	1.5 Coordination, linkage, integration with Component 2, Programs 1, 2, and 6, and GEF	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2.Agricul - tural	2.1 Investments in equipment such as computers,laboratory equipment, and vehicles	XXXXXXXXXXX
	2.2 Facility improvement for offices and laboratories	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	2.3 Construction of pilot projects, field trials, water balance stations, and demonstration areas	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	2.4 Basinwide salt balance study	XXXXXXXXXXXXXXXXXXXXXXXX
	2.5 Studies of water reuse, treatment, and disposal	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	2.6 Feasibility studies for regulating flows to improve water quality	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	2.7 Research on minimizing drainage water and best management practices to improve water quality	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

VI. RESOURCES

13. The project is estimated to cost US$ 15 million over a three-year period. Component 1 is estimated to cost US$ 4 million and Component 2 US$ 11 million.

14. The proposed budget for preparation of Components 1 and 2 over the six-month period are presented below:

	Estimated Cost (in US$)		
Item	Local	Foreign	Total
Water Quality Assessment			
1. Local Specialists Water Pollution Control Specialists; Environmental Engineers; Chemical Engineers; Legal Experts; Procurement Specialists; Groundwater Hydrologists; Geologists; Chemists; Aquatic Biologist; Computer Specialist; Economist; Field Technicians; and Data Analyst.	20,000	--	20,000
2. International Experts Environmental Engineer; Legal Expert; Procurement Specialist; Aquatic Biologist	--	60,000	60,000
3. Travel/Accommodations	5,000	15,000	20,000
4. Training (workshops)	--	15,000	15,000
5. Communications/Printing	--	5,000	5,000
6. Goods and Materials	--	5,000	5,000
SUBTOTAL (COMPONENT 1)	25,000	100,000	125,000
Agricultural Water Quality			
1. Local specialists Salinity Specialists; Environmental Specialists; Hydraulic Engineer; Drainage Engineer; Ecologist; Hydrogeologist; Agriculturalist; Economist; Modelers; Irrigation Engineer; Procurement Specialist; Research Specialist; Research Assistants; Field Technicians	80,000	--	80,000
2. International Experts Salinity Control Specialists; Environmental Specialists; Drainage Engineer; Irrigation Engineer; Modeler; Procurement Specialist	--	120,000	120,000
3. Travel/Accommodations	10,000	60,000	70,000
4. Interpreter/translators	--	6,000	6,000
5. Equipment (computers, fax etc.)	--	4,000	4,000
6. Overhead and contingencies	--	10,000	10,000
SUBTOTAL (COMPONENT 2)	90,000	200,000	290,000
GRAND TOTAL FOR PROJECT	115,000	300,000	415,000

VII. JUSTIFICATION

15. To solve the very complex water quality management problems in the Aral Sea Basin, sustainable agricultural irrigation systems must be introduced that use less water from the rivers. Also, it is critical that pollution abatement measures be implemented for municipal, industrial, mining, and agricultural pollution sources. These measures should not only treat wastewaters, but should attempt to prevent pollution at the source where possible.

16. A sustainable agricultural system would require considerations such as integrated pest management, salinity control, water and land protection from deterioration, and numerous other environmental considerations. The implementation of agricultural water quality improvements should ultimately result in:

- sustainable irrigated agriculture due to proper water quality improvement and management;
- water savings due to proper on-farm water management;
- health benefits (most significantly in the disaster area);
- socio-economic improvements throughout the basin; and
- environmental improvements, such as a stabilizing effect on the Aral Sea levels and quality.

The implementation of basinwide water quality management activities will ultimately result in:

- improved water quality monitoring systems for the basin;
- removal of highly mineralized and polluted water from rivers, tributaries, and neighboring countries;
- establishment of water quality management and pollution abatement programs in existing institutions in the five countries to meet regional needs; and
- groundwater protection in the basin.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 3
Project 1a: Water Quality Management:
Water Quality Assessment and Management

TERMS OF REFERENCE

I. BACKGROUND

1. Discharges of water pollutants from point sources (such as cities and industries) and nonpoint sources (such as agricultural enterprises) have contributed to economic, environmental, and human health impacts in the Aral Sea Basin. The five basin countries have agreed to work out the principles of water quality improvement, to limit discharges of pollution from all sources, and to drastically reduce the disposal of highly saline agricultural drainage waters into rivers of the basin.

2. The Water Quality Assessment and Management Component is Component 1 of two components in the Water Quality Management Project.[1]/ This project addresses Program 3 approved by the Heads of States of the five countries.

Component 1 involves the following activities:

(i) establishing water quality monitoring systems;
(ii) conducting a pollution source inventory and water quality assessment;
(iii) assessing alternative schemes for removal of highly mineralized and polluted water from rivers, tributaries, and neighboring countries;
(iv) harmonizing water quality management institutions and pollution abatement programs among the five countries; and
(v) investigating groundwater contamination and strategies for protection.

Component 1 serves as an integral part of the GEF-funded Aral Sea Basin Water Resources and Environmental Management Project. In addition, Component 1 provides the required linkage and coordination between the Regional Water Resources Management Strategy Project (Program 1) and Component 2, Agricultural Water Quality Improvement. This Terms of Reference (TOR) is for a six-month preparation period for Component 1.

II. OBJECTIVES

3. The overall objective of this Terms of Reference (TOR) is to define a

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1/ Component 2 is entitled "Agricultural Water Quality Improvement" and involves drainage improvements, increases in water use efficiency, and use of on-site best management practices focused on improving water quality from irrigated agriculture.

six-month effort to prepare the details of the project so that it can be approved by the Interstate Council and funded through the GEF. Consultations will need to be conducted among different ministry staff of the five countries, the Aral Sea Basin regional institutions, external experts, and external support agencies to design the processes and specific tasks for the three-year project. The consultations and preparatory work are to be completed during the six-month period.

4. Another general objective of this water quality component is to provide linkages and integration with the other interrelated component of the project as well as the regional water strategy development process also funded by GEF.

5. Specific objectives of this component for the three-year project include:

(i) establishing and equipping a system for monitoring water quality and ecological conditions in order to assess pollution sources and evaluate the effectiveness of abatement programs, especially for improving sampling by BVOs and Hydromet.
(ii) conducting an inventory of pollution source loadings from all significant point and nonpoint sources in the basin as part of the water resources assessment to be conducted under the GEF-funded water resources management strategy,
(iii) assessing existing and future alternative schemes of collector drainage water removal and municipal/industrial wastewater treatment, including a plan to stop or greatly reduce the discharge of highly mineralized and polluted water on rivers, tributaries, and neighboring countries;
(iv) establishing effective water quality management institutions and pollution abatement programs in each country to provide consistency in developing and enforcing regulations for water pollution abatement; and
(v) initiating investigations of groundwater to assess contamination and approaches to protection in particular the relationship between ground and surface water.

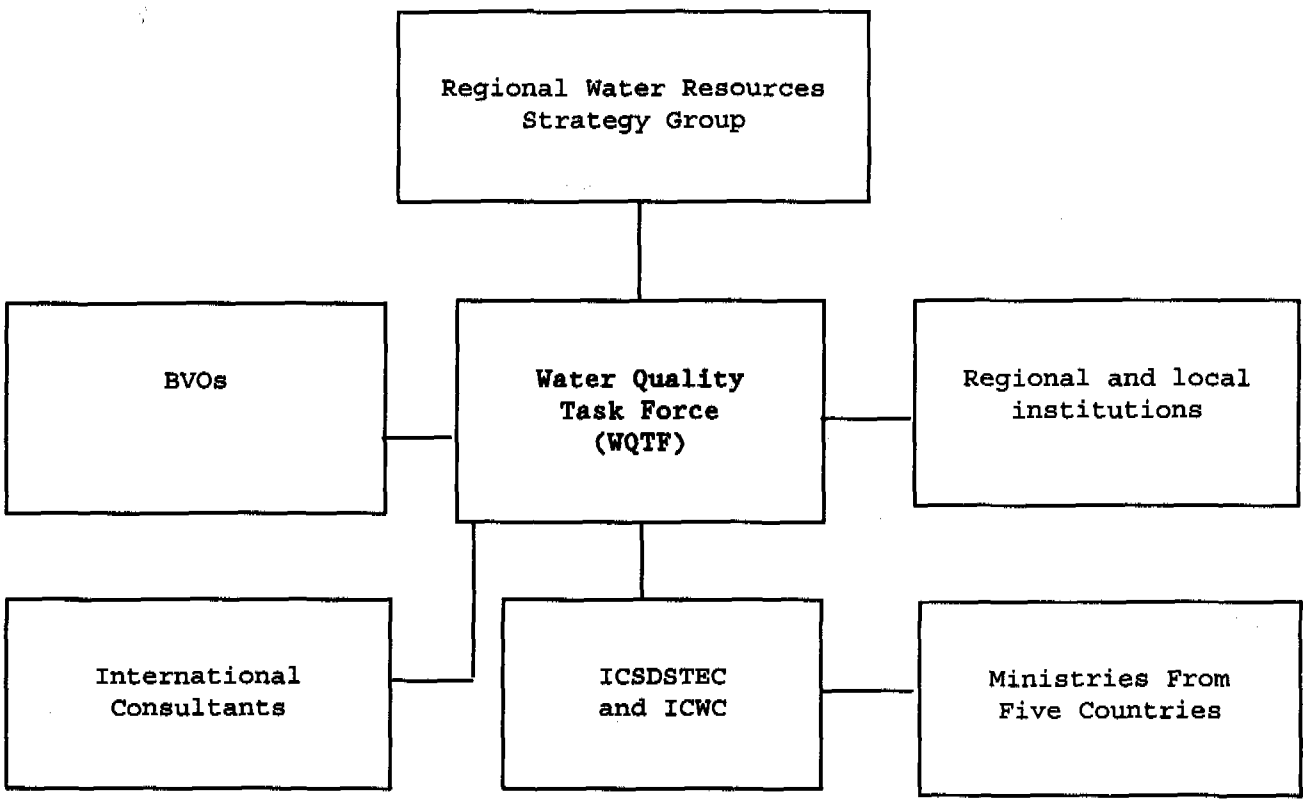
III. SCOPE OF WORK

6. A Water Quality Task Force (WQTF) will be established as a Task Force of the Regional Water Resources Strategy Group that will be charged with the responsibility for leading the regional water resources management strategy effort. The WQTF will consist of local experts responsible for water quality issues in the five countries as well as staff from the regional institutions, BVOs, local institutes, SRI, and appropriate international consultants (see schematic below). The Task Force will coordinate with the ICSDSTEC[1]/ of the

1/ Interstate Commission for Socio-economic Development and Scientific, Technical, and Ecological Cooperation

Interstate Council and with the other programs approved by the Heads of States.

7. The WQTF will also coordinate with the appropriate ministries, institutes, university staff, and other organizations of the five countries in determining the tasks, analyses, and equipment required for completing within a three-year period the activities needed to meet the specific objectives listed in part II above. In addition, the WQTF will present its analyses of the impact of alternative schemes of collector drainage water removal and municipal/industrial pollution abatement to the Regional Water Resources Strategy Group. The working body will use these analyses in its deliberations on recommended strategies for water quality improvement of rivers and tributaries, especially those flowing to neighboring countries. Of course, coordination will occur between this component and the other approved programs of the Heads of States.



IV. DESIGN OF TASKS

8. The preparation activities would be carried out in five stages as below:

STAGE 1: Appoint WQTF Members

The Regional Water Resources Strategy Group in consultation with the Executive Committee of the Interstate Council will appoint members of the WQTF from the five countries, the regional institutions, and the BVOs. The WQTF will add other members as needed (including international consultants) and will determine how it will function over the six-month period. It is expected that this group will continue to function during the three-year project.

STAGE 2: Establish Subcommittees of the WQTF

The WQTF will establish subcommittees consisting of its members and other needed experts to begin working on the preparation of a draft TOR for the three-year project that will meet the objectives outlined in part II above. The subcommittees will also prepare a TOR for integration, linkage, and coordination with the Regional Water Resources Strategy Group and the Agricultural Water Quality Improvement Component. The seven subcommittees are tentatively identified below:

Subcommittee 1.	Water Quality Monitoring System Design
Subcommittee 2.	Priority Monitoring Equipment Needs
Subcommittee 3.	Pollution Source Inventory and Water Quality Assessment
Subcommittee 4.	Assessment of Alternative Schemes for Pollution Abatement
Subcommittee 5.	Establishment of Water Quality Management Programs
Subcommittee 6.	Groundwater Contamination
Subcommittee 7.	Coordination and Integration

The above subcommittees could be modified or others added if appropriate.

STAGE 3: Workshop on Draft Approaches

The WQTF will hold a workshop for all interested parties, including invitations to UNDP, UNEP, and World Bank. The workshop will serve to present early thoughts on the seven draft TORs to be prepared by the subcommittees. The workshop will provide a forum for all participants, including NGOs, to make suggestions and to conduct consultations with the GEF lead organizations on the project.

STAGE 4: Draft TOR

The WQTF will present the findings of the workshop to the Regional Water Resources Strategy Group and the Interstate Council to obtain feedback in preparation for completing a final draft TOR for the three-year component. The final consolidated draft TOR will be prepared using the TORs prepared by each of the subcommittees and the feedback obtained during the workshop.

STAGE 5: Workshop and Final TOR

The WQTF will present the draft TOR for this component to the Interstate Council and GEF lead organizations (UNDP, UNEP, and World Bank)--perhaps in a workshop setting-- prior to a planned participative workshop on the larger GEF project related to the Regional Water Resources Management Strategy. Appropriate changes will be incorporated in the TOR and a final version will be submitted to the Interstate Council and GEF for final review for funding.

V. TIME SCHEDULE AND REPORTING

9. The entire preparation should take six months. The timetable for each stage is as follows:

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Appointment of Water Quality Task Force	—					
2	Establish Sub Committees of the Task Force	—	—				
3	Workshop on draft approaches			—			
4	Preparation Consolidated draft TORs			—	—	—	
5	Workshop Final TORs					—	—

10. There are four reports that should be prepared during the six month period. The reports and associated deadlines are described below:

	Report	Due Date (end of)
(i)	Composition of WQTF and subcommittees	Month 1
(ii)	Description of initial elements of TOR as background for workshop	Month 2
(iii)	Draft TOR	Month 5
(iv)	Final TOR	Month 6

VI. PROPOSED BUDGET

11. The proposed budget for preparation over a six month period is presented below:

Item	Estimated Cost (in US$) Local	Foreign	Total
Water Quality Assessment			
1. Local Specialists Water Pollution Control Specialists; Environmental Engineers; Chemical Engineers; Legal Experts; Procurement Specialists; Groundwater Hydrologists; Geologists; Chemists; Aquatic Biologist; Computer Specialist; Economist; Field Technicians; and Data Analyst.	20,000	--	20,000
2. International Experts Environmental Engineer; Legal Expert; Procurement Specialist; Aquatic Biologist	--	60,000	60,000
3. Travel/Accommodations	5,000	15,000	20,000
4. Training (workshops)	--	15,000	15,000
5. Communications/Printing	--	5,000	5,000
6. Goods and Materials	--	5,000	5,000
SUBTOTAL (COMPONENT 1)	25,000	100,000	125,000

Heads of States Approved Program No. 3
Project 1b: Water Quality Management:
Agricultural Water Quality Improvement

TERMS OF REFERENCE

I. BACKGROUND

1. The middle and lower reaches of the Aral Sea Basin contain a complicated network of irrigation systems with various internal drainage water collection facilities. Many facilities for collection of drainage water have been constructed but much additional subsurface drainage and surface drainage work is necessary to have a sustainable agriculture in the basin. Disposal of these drainage waters, which are salinized and carry agricultural chemicals leached from the soil profile, is often back into the river system. This is causing the degradation of water quality and results in lower crop yields and additional human health risks for the residents. Collection of these drainage waters and disposal systems that are more environmentally oriented are being proposed by the concerned governments.

2. The total area under irrigation in the Aral Sea Basin is estimated to be 7.3 million hectares of which 3.2 million (44.3 percent) are located in the Syr Darya Basin and 4.1 million (55.7 percent) are located in the Amu Darya Basin. About two million hectares of the irrigated land is considered to be seriously damaged by waterlogging and salinity. Most of this land is in the lower reaches of the Syr Darya and the Amu Darya Basins. Lesser degrees of salinization and waterlogging problems exist on about 1.7 million hectares of land which is also located primarily in Uzbekistan, Turkmenistan and Kazakhstan.

3. Most of the two million hectares of irrigated land that is now seriously damaged by waterlogging and salinity will require an intensification of the drainage system to provide the root zone drainage needed for sustained agricultural production. Water applied to the seriously salinized land for leaching presently is about 5,000 to 10,000 cubic meters per hectare per year. Experience in the region has shown that with proper drainage systems the leaching quantities can be reduced to about 2,000 cubic meters per hectare per year. Thus one side benefit to the installation of proper drainage in the seriously salinized areas would be the savings of about 6 km^3 of water per year.

4. Some degree of drainage protection for waterlogging and salinity control is already in place for over 4.2 million hectares of irrigated land in the Aral Sea Basin. Disposal and reuse conditions should be rethought to assure consideration of more environmentally sensitive solutions. This effort will require inputs from many concerned organizations and people. Many new and innovative ideas will be tested.

5. The Agriculture Water Quality Improvement component is Component 2 of the two components in the Water Quality Management Project,[1]/ which addresses Program 3 approved by the Heads of States of the Aral Sea Basin countries.

II. OBJECTIVES

6. The overall objective of this effort will be to prepare infrastructure, equipment and material investment plans as well as study plans and research plans to solve non point source water quality problems created by irrigated agricultural systems in an effort to improve water quality in the rivers of the Aral Sea basin. Pilot projects, field trials and demonstration areas will be used to the extent possible to test the extent that proper irrigation and drainage improvements can contribute to the efficient use of water due to leaching requirement reductions. The pilot projects or trial areas, as well as the new water balance stations, will also be used for on-site testing of best management practices to control pollution. Since municipal and industrial wastewaters from within or near the irrigated areas often flow into collector drains, consideration to this type of pollution will primarily be given under the companion Terms of Reference (TOR) for Component 1. The main conceptional objectives for work to be performed during the three year Phase I project which require preparation during the next six month period are to:

(i) assemble information on practical strategies for reducing water use and improving drainage water quality from irrigated agriculture;

(ii) identify best management practices for agricultural pollution control;

(iii) conduct pilot projects, field trials, and demonstration areas for practical use of these strategies and best management practices as part of sustainable agricultural systems; and

(iv) prepare priority infrastructure and equipment investment plans, investigation action plans, and research strategies to solve nonpoint source pollution problems from irrigated agriculture.

III. SCOPE OF WORK

7. The work will involve preparation of programs for the study and research components to facilitate completion as early as possible during the three-year Phase I Program. Investment plans for new infrastructure and improvements in existing infrastructure will require the preparation of feasibility reports. Investment plans for the purchase of equipment and materials such as laboratory equipment for water quality analysis will require work plans that document how the materials and equipment fit into a planned action activity

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1/ Component 1 is entitled "Water Quality Assessment and Management" and involves establishing water quality monitoring systems and associated pollution prevention and control programs.

such as the establishment of water balance stations. Methodology will involve the analysis of alternative solutions when making the investment plans, evaluations and studies noted above to facilitate decision making that will involve stakeholders.

IV. DESIGN OF TASKS

8. Preparation activities for each of three main areas of the work are described below:

A. Assessment of existing information and studies

During the preparation process, an assessment of existing information, studies and research related to the above stated objectives will be necessary. The collector drain concept to minimize return to the river of polluted waters is the central consideration for the Amu Darya River. However, opportunities to improve the quality of waters discharged from irrigation systems are available and will help reduce the problems if used with collector systems and especially when discharges are to go directly back to a water source such as the river. Existing information and studies indicate there are a number of conceptional approaches to improve water quality in the rivers. These are:

(i) off-site treatment and reuse schemes;
(ii) reuse in the vicinity degraded water was generated;
(iii) on-site treatment which would primarily apply to point source pollution from municipal and industrial sites but could apply to agricultural enterprises such as livestock feedlot operations or poultry production facilities; and
(iv) some combination of the above approaches.

The assessments need to review the environmental situation related to existing designs, information and studies to be certain the environmental, engineering and economic logic related to existing studies is applicable to the present conditions.

Existing information will be made available to the organizations doing this preparation work in a timely manner by the individual countries appropriate Ministry. Lists of available information on the subjects important to water quality improvement have already been prepared.

B. Investments in infrastructure, equipment and materials

Preparation efforts will also aim at identification and justification of needed infrastructure, equipment and materials. These needs will be specified with realistic identification descriptions and cost estimates. The needs will be cross referenced to indicate which of

the Phase I efforts they support. We anticipate the Phase I efforts related to this component could include items such as:

(i) Pilot projects and new water balance stations to demonstrate and test water quality and pollution equipment, control techniques, and new technology.
(ii) Laboratory infrastructure remodeling;
(iii) Laboratory equipment;
(iv) Facility improvements for offices where studies and research will be carried out;
(v) Computers, printers, fax and copy machines; and
(vi) Vehicles;

C. Studies and applied research

Many studies will be required during the Phase I project. The main goal during the preparation will be to package the studies required into appropriate and logical work programs or subproject activities. Some of the studies anticipated may be completed early in the Phase I process and thus ready for financing within the first year of the project. Other studies may take longer and require financing of implementation in the second phase project. It will be important to the governments and the people of the Aral Sea Basin countries to package the studies in a way that will facilitate thorough but early conclusions for solving the water quality problems. Study items requiring appropriate insertion into efficient study plans with time, manpower, facility and financial requirements are presented below for proper consideration during the project preparation period:

(i) Basin wide salt balance studies which will likely involve modeling aimed at an eventual management model for saline water management;
(ii) Diversion of drainage water and other wastewater to collector systems to allow for cleaning the water to the extent possible and feasible with ultimate disposal to the Aral Sea (study of the hydro-geological situation along proposed routes, reuse of collector flows and modeling influences of collectors of adjacent lands and aquifers all will be needed);
(iii) Diversion of collected drainage flow into local depressions and constructed flow through wetlands to determine water quality changes (study capacities of existing natural depressions, explore fisheries development potentials, wetland development plant and vegetation selection to improve evapotranspiration and water quality improvement, evaluate mineral content of drainage and wastewaters to determine if depressional storage will be hazardous due to elements that become toxic when concentrated due to evaporation);
(iv) Conduct feasibility studies for regulation of river flow and collector drainage flow to improve water quality, including use of storage facilities and regulating reservoirs as well as controlled

releases from drainage storage areas during periods of high flow and the development of basin hydrological-hydrochemical simulation models for improving water quality;

(v) Research and study efforts to minimize the amount of drainage water that requires collection and the best management practices to improve water quality and efficiency (this will involve field trials, pilot projects, demonstration areas and water balance stations to test appropriate technology and check effectiveness of approaches);

(vi) Research and studies on the reuse of mineralized drainage waters (study suitability and sustainability of agricultural systems with salt tolerant crops, hydro-geologic and lithological zones to safely promote reuse of drainage and sewage wastewater, determine economic indicators and requirements to have successful systems); and

(vii) Evaluations of desalinization and treatment facilities for municipal and industrial wastewaters collected in agricultural drainage waters (analyze existing methods and compare to contents of wastewaters in the basin).

The preparation effort will be subject to competitive selection, however, regional and local organizations will be heavily involved in the efforts with help from hired local and international experts in the individual technology or evaluation procedures necessary for each technical item or study area. Special efforts will be made to involve appropriate individuals from the Aral Sea Basin countries with interest in the particular test, study or research activity.

V. TIME SCHEDULE AND REPORTING

9. The three essential tasks, as detailed below, would be carried out during the six month period.

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Assessment of Existing Information and Studies Studies						
2	Identification of Investments in Infrastructure, Equipment and Materials						
3	Identification of required studies and applied research						

10. The critical nature of the preparation requires completion within a six month period to facilitate initiation of the Phase I project. An inception report will be required within 1 1/2 months of receipt of the assignment. A mid-term report will be required by month 4 and a final report within 6 months. All reports will be prepared in Russian and English. The payment schedule will be determined by the donor, however, it will likely be:

- Upon signing contract 20 Percent
- Inception Report submission 25 Percent
- Mid-term Report submission 25 Percent
- Final Report acceptance 30 Percent

VI. PROPOSED BUDGET

11. The proposed budget for preparation over a six month period is presented below:

Item	Estimated Cost (in US$) Local	Foreign	Total
Agricultural Water Quality			
1. Local specialists Salinity Specialists; Environmental Specialists; Hydraulic Engineer; Drainage Engineer; Ecologist; Hydrogeologist; Agriculturalist; Economist; Modelers; Irrigation Engineer; Procurement Specialist; Research Specialist; Research Assistants; Field Technicians	80,000	-	80,000
2. International Experts Salinity Control Specialists; Environmental Specialists; Drainage Engineer; Irrigation Engineer; Modeler; Procurement Specialist	-	120,000	120,000
3. Travel/Accommodations	10,000	60,000	70,000
4. Interpreter/translators	-	6,000	6,000
5. Equipment (computers, fax etc.)	-	4,000	4,000
6. Overhead and contingencies	-	10,000	10,000
SUBTOTAL (COMPONENT 2)	90,000	200,000	290,000
GRAND TOTAL FOR PROJECT	115,000	300,000	415,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 3

To take measures aimed at increasing the waterflow in the Syr Darya riverbed, and in the discharge control units at the Shardarinsk hydropower station in order to provide an adequate amount of water into the Aral Sea.

Project 2: Remodelling of Syr Darya River Bed and Shardarinsk Control Units

PROJECT BRIEF

I. BACKGROUND

1. The principal tributaries of the Syr Darya, namely Naryn, Kara and Chirchick rise in the Kyrgyz mountains and are fed mainly by snow and glaciers and run off from spring and autumn rainfall. The river takes the name Syr Darya below the confluence of Naryn Darya and Kara Darya. There are fifteen large reservoirs with a capacity exceeding 30Mm^3 in the Syr Darya basin. Chardara reservoir located in Kazakhstan is the last reservoir on the Syr Darya, below which the river flows for 1200 km until it reaches the Aral Sea. About 3.3 million hectares of land, located in the four states of Kyrgyzstan, Kazakhstan, Tajikistan and Uzbekistan, are irrigated from the flow supplies and storages on the Syr Darya.

2. The average annual flow in the Syr Darya is about 38 km^3 with another 2 km^3 being the contribution from ground water. On the other hand, the domestic, industrial and agricultural uses which are already established require about 56km^3 annually. Some of these uses are met by a turnover, or reuse of the supplies by lower riparians resulting in increased salinity and pollution. In years of poor flows e.g. 1970, no supplies reached the Aral Sea at all.

3. Reduction in the Syr Darya river flows and frequent fluctuations in available discharge have had a serious effect on the river channel, particularly below the Chardara reservoir and hydropower station. Chardara reservoir (live storage 4.3 km^3) is the uppermost impounding site in Kazakhstan. About 12 km^3 are released below the hydropower station in an average year. This is by far the largest inflow into Kazakhstan, the other two significant inflows being Kirov Canal (1 km^3) and Chirchik Canal (0.5 km^3) annually.

4. As a result of the degradation of the Syr Darya river bed, the supplies released below Chardara reservoir can no longer be passed into the river. Some of these supplies are therefore released into an adjoining depression in

the desert, known as Arnacai lake, where these are wasted as a result of evaporation and seepage. The extent of these releases is substantial, as about 18 km^3 were diverted into Lake Arnacai in 1969 and about 7 km^3 during 1993/94 with discharges varying in the intervening years.

5. While proceeding from Chardara reservoir to the Aral Sea the Syr Darya river bed has experienced accumulative degradation in its carrying capacity. The maximum release capacity below the hydropower station is about 1,300 m^3/sec, however the river bed is not capable of carrying any more than 1,100 m^3/sec. Near Kizl-Orda, the maximum discharge which can pass over the Kizl-Orda hydro station is no more than 800 m^3 /sec. Below these control units the river bifurcates into two channels, namely Zaman on the left with a capacity of 350m^3 /sec and Karaozak on the right with a capacity of only 50 m^3/sec. The Zaman branch has been further choked off by a constricted diversion weir for irrigating about 15,000 ha of land (AITEK area) located between the two branches of the river. The Karaozak branch has become extinct due to the construction of a number of bridges with inadequate waterway. An old railway bridge has further aggravated the available capacity of the river.

6. Prior to total control of the Syr Darya through construction of reservoirs in its upper reaches and the degradation of its river bed, the Syr Darya delta adjoining the Aral Sea was an agriculturally prosperous and environmentally rich area. Developments in the upper reaches of the river have caused successive reduction in the available water to the eco-systems, wildlife and agriculture in the delta. A much more drastic impact has resulted from the lowering of the Aral Sea which caused the main bed of the Syr Darya, within the delta to erode to a new and much steeper slope, causing almost all the fan-shaped channels to dry up. Obviously, almost all the ecosystems and agriculture in the delta area were badly affected. Some efforts were made to simulate the past river regime through construction of dykes (Amanatgil and Aklak). These works have demonstrated the benefits which can accrue to the environment and the economy of the area through such interventions.

7. The salinity and pollution levels of the residual water, which now flows through the delta, are extremely high, rendering it unfit for domestic or industrial use.

II. OBJECTIVES

8. The Heads of States,at the January 1994 meeting in Nukus, have approved a comprehensive program with the following objectives:

(a) Increasing the water flow in the Syr Darya river bed;

(b) Increasing the flow of the river through the control structures; and

(c) Providing adequate amounts of water into the Aral Sea area.

III. SCOPE

9 The above objectives would be met by a thorough and exhaustive study of the regime of the Syr Darya with particular emphasis on the following aspects:

(a) Design of the penstocks for the Shardarinsk hydropower station and release capacity downstream of Chardara reservoir;

(b) Capacity of the Syr Darya river bed from Chardara reservoir up to Kizl-Orda diversion dam;

(c) Capacity of the spillway at Kizl-Orda diversion dam and capacities of all upstream regulators;

(d) Existing capacity of Zaman and Karaozak branches of Syr Darya and the water way through various cross drainage structures across the river and its branches;

(e) Waterway available at the Aitek diversion weir and the capacity of the river channel downstream of the weir;

(f) Prevailing situation of Syr Darya, capacity and flows in the delta area, including quality of water, and

(g) Existing environmental and agricultural situation in the delta and the reasons for its deterioration.

10. The study of these and other allied issues is expected to result in the preparation of a detailed program of investments, which may be implemented in accordance with their priorities. In view of the interdependence of each component of this program for reversing the degradation of Syr Darya and the intricate and protracted nature of the issues, it is necessary to carry out, a prior review of the existing data and documents, and arrange extensive field visits to the various key project areas. These prior reviews and inspections would then lead to the preparation of detailed scope of work and terms of reference for preparing investment projects on the Syr Darya and its delta. The scope of work and terms of reference for this initial preparatory work are attached.

IV. OUTPUTS

11. The outputs of the project are expected to be completed in stages. The first stage would consist of the preparatory actions leading to the preparation of the initial report and terms of reference. Feasibility studies would be carried out at the second stage taking into account the requirements of remodelling, renovation,and reconstruction. A further refinement of the program would provide a prioritized list of investment projects, which would meet the technical and economic criteria acceptable to international lending agencies. The cost of implementing the total program is expected to exceed $250 million.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

12. The initial review of the seven sub-areas of study, recounted in para. 9 above, would be carried out by specialized foreign consultants, well versed in the design and implementation of hydraulic and environmental structures. These foreign consultants would be assisted by local research institutes and design bureaus. Apart from engineering and environment, the foreign consultants are expected to provide expertise on use of computers for design analysis, software for design of hydraulic structure, programs for river regulation, and economic and financial analysis up to international standards. The procurement of all goods and services would be carried out under procedures consistent with the World Bank's Procurement Guidelines. Project preparation and implementation is expected to proceed according to the following schedule.

NO	ITEMS	YEARS							
		1	2	3	4	5	6	7	8
1	Initial Review of Existing Data and Field Visits	—							
2	Preparation of Terms of Reference	—							
3	Preparation of Feasibility Studies for the Prioritized Program		—		—		—		
4	Procurement and Contract Awards			—		—		—	
5	Implementation of Priority Projects				—	—	—	—	—

VI. RESOURCES

13. Some preliminary designs were prepared for the restoration of Syr Darya river bed and increasing capacity of Shardarinsk hydropower station about 12 years ago but were never reviewed or implemented. Preliminary studies on environmental works in the Syr Darya Delta are also extant with the local design institutes. However, new designs would have to be devised which meet the changed conditions, as well as the state of the art requirements. The consultants would prepare detailed reports on the description of each component, their inter-relation, and establish a pattern of priority preparation. The cost of the feasibility studies and final design would depend on the quantity of work defined by the consultants in their review of existing data and studies, however, this is expected to be in the order of $10.00 million. The approximate cost of the first stage of the consultants' work, which would include field visits, review of existing data and documents, and preparation of detailed terms of reference, is given below:

INITIAL REVIEW OF EXISTING DOCUMENTS AND FIELD VISITS

(Estimated Cost)

	Cost in US$ million		
Item	Local	Foreign	Total
Local Consultants/Specialist	0.10	-	0.10
Foreign Consultants	-	0.30	0.30
Travel	-	0.07	0.07
Traning	-	-	-
Equipment/Goods/Materials	-	0.03	0.03
Sub-Total	**0.10**	**0.40**	**0.50**
Physical & Price Contingencies	-	0.02	0.02
Total	**0.10**	**0.42**	**0.52**

VII. JUSTIFICATION

14. The implementation of this series of projects would ensure the re-introduction of fresh water into the Syr Darya Delta. These fresh water supplies are expected to range between 7 km^3 and 18 km^3, depending on the variations in precipitation and snow melt in the catchment and would transform the environment, the eco-systems and the agriculture in the delta area. These additional supplies would also complement the efforts to stabilize the North bay of the Aral Sea. The project is highly productive and is expected to be technically and economically viable.

VIII. ISSUES

15. The following issues have surfaced, however, other principal issues are expected to be discerned after the initial review has been completed.

(a) The complexity of the program would require specialists in a large number of disciplines which may cause some administrative problems and delays.

(b) The size of the total program may be a hindrance in procuring adequate financing.

(c) The approval of the Executive Committee of the Interstate Council would be required before proceeding with project preparation.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 3
Project 2: Remodelling of Syr Darya River Bed
and Shardarinsk Control Units

TERMS OF REFERENCE

I. BACKGROUND

1 The Heads of States for Kazakhstan and the four Republics of Central Asia: Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan have agreed, in their meeting held in Nukus on January 11, 1994, to promote projects which would reverse the degradation of the Syr Darya river bed and provide adequate waterway through the river and the cross drainage structures in order to restore the ecological balance of the Aral Sea Disaster zone and promote economic activity in the Syr Darya delta.

II. OBJECTIVES

2. As a result of the degradation of the Syr Darya river bed, the supplies released below Chardara reservoir can no longer be passed into the river. Some of these supplies are therefore released into an adjoining depression in the desert, known as Arnacai lake, where these are wasted through evaporation and seepage. The extent of these releases is substantial, as about 18 km^3 were diverted into Lake Arnacai in 1969 and about 7 km^3 during 1993/94, with discharges varying in the intervening years.

3. While proceeding downstream from Chardara reservoir to the Aral Sea the Syr Darya river bed has experienced accumulative degradation in its carrying capacity. The maximum release capacity below the hydropower station is about 1,300 m^3/sec, however the river bed is not capable of carrying any more than 1,100 m^3/sec. Near Kizl-Orda, the maximum discharge which can pass over the Kizl-Orda hydro station is no more than 800 m^3 /sec. Below these control units the river bifurcates into two channels, namely Zaman on the left with a capacity of 350m^3 /sec and Karaozak on the right with a capacity of only 50 m^3/sec. The Zaman branch has been further choked off by a constricted diversion weir for irrigating about 15,000 ha of land (AITEK area) located between the two branches of the river. The Karaozak branch has become extinct due to the construction of a number of bridges with inadequate waterway. An old railway bridge has further aggravated the available capacity of the river.

4. Prior to total control of the Syr Darya through construction of reservoirs in its upper reaches and the degradation of its river bed, the Syr Darya delta adjoining the Aral Sea was an agriculturally prosperous and environmentally rich area. Developments in the upper reaches of the river have caused successive reduction in the water available for eco systems, wildlife and agriculture in the delta. A much more drastic impact has

resulted from the lowering of the Aral Sea which caused the main bed of the Syr Darya, within the delta to erode to a new and much steeper slope, causing almost all the offtaking channels and the fan-shaped delta to dry up. Obviously, almost all the ecosystems and agriculture in the delta area were adversely affected. Some efforts were made to simulate the past river regime through construction of dykes (Amanatgil and Aklak). These works have demonstrated the benefits which can accrue to the environment and the economy of the area through such interventions.

5. The salinity and pollution levels of the residual water, which now flows through the delta, are extremely high, rendering it unfit for domestic or industrial use.

6. The Heads of States, at the January 1994 meeting in Nukus, have approved a comprehensive program with the following objectives:

(a) Increasing the water flow in the Syr Darya river bed;

(b) Increasing the flow of the river through the control structures; and

(c) Providing adequate amounts of water into the Aral Sea area.

III. SCOPE OF WORK

7. The above objectives enunciated by Heads of States would be met by a thorough and exhaustive study of the regime of the Syr Darya with particular emphasis on the following aspects:

(a) Design of the penstocks for the Shardarinsk hydropower station and release capacity downstream of Chardara reservoir;

(b) Capacity of the Syr Darya river bed from Chardara reservoir up to Kizl-Orda diversion dam;

(c) Capacity of the spillway at Kizl-Orda diversion dam and capacities of all upstream regulators;

(d) Existing capacity of Zaman and Karaozak branches of Syr Darya and the water way through various cross drainage structures across the river and its branches;

(e) Waterway available at the Aitek diversion weir and the capacity of the Zaman river channel downstream of the weir;

(f) Prevailing situation in the lower reaches of Syr Darya, capacity and flows in the delta area, including quality of water, and

(g) Existing environmental and agricultural situation in the delta and the reasons for its deterioration.

8. The study of these and other allied issues is expected to result in the preparation of a detailed program of investments, which may be implemented in accordance with their technical and economic priorities. In view of the interdependence of each component of this program for reversing the degradation of Syr Darya and the intricate and protracted nature of the issues, it is necessary to carry out, a prior review of the existing data and documents, and arrange extensive field visits to the various key project areas. These prior reviews and inspections would then lead to the preparation of detailed scope of work and terms of reference for preparing investment projects on the Syr Darya and its delta. The scope of work and terms of reference for this initial preparatory work are the focus of this proposal.

9. The initial review of the seven sub-areas of study, recounted in para. 3.01 above, would be carried out by specialized foreign consultants, well versed in the design and implementation of hydraulic and environmental structures. These foreign consultants would be assisted by local research institutes and design bureaus. Apart from engineering and environment, the foreign consultants are expected to provide expertise on use of computers for design analysis, software for design of hydraulic structure, programs for river regulation, and economic and financial analysis up to international standards. The procurement of all goods and services would be carried out under procedures consistent with the World Bank's Procurement Guidelines. The term "Consultant" as used in this document refers to the specialized expatriate firms working together with the local design enterprises and research bureaus.

10. The consultants' services shall follow sound engineering and economic practices and shall comprise but not be limited to the brief description of the consultants' terms of reference given below in Chapter IV.

IV. DESIGN OF TASKS

11. The consultants' services shall be carried out in distinct steps as detailed below and in the time period shown in the implementation schedule.

Step 1: Review of all existing data and documents pertaining to the seven subprojects identified in para. 3.01 above;

Step 2: Field visits to the subproject areas so as to understand and define the issues responsible for the flow problems;

Step 3: Prepare brief reports on each on the seven subprojects, and a cover volume, defining their inter-relationship and the technical priorities for implementation; and recommend an overall program of preparation;

Step 4: Prepare detailed terms of reference for each of the seven sub-projects for preparation of feasibility studies and final designs, based on the overall program prepared under Step 3.

12. During Step 1 the consultant shall, interalia, review and evaluate the following reports, documents and data, presently existing in the archives of the employer:

(a) Design reports on Chardara reservoir, particularly those dealing with the spillway, penstocks, bottom outlet and any other features relating to releases down-stream of the reservoir;

(b) Data on discharges released into the Arnacai lake, for a period of 20 years, compared to the releases downstream of Chardara reservoir into the river;

(c) Design and data on offtakes located below the Chardara reservoir and upstream of Kizl-Orda diversion dam;

(d) Available waterway in the bridges along the Karaozak branch, including the railway bridge and the design capacity features of the Aitek diversion weir;

(e) Progressive data on erosion of Syr Darya river bed in the delta area, including present situation.

(f) Data on agricultural development and environmental features which existed in the past and which have now become extinct in the delta area;

(g) Hydraulic long section and sample cross sections of the Syr Darya river bed and;

(h) Collection of relevant maps and drawings.

13. During Step 2 the consultant shall carry out field visits along the Syr Darya, extending from the Chardara reservoir up to the North Bay of the Aral. The consultant shall maintain a record of the issues which surface as a result of the review of data and documents, followed by field visits.

14. The consultant shall commence work on Steps 3 and 4 simultaneously, preparing the report on each subproject, defining the issues and reflecting them in the terms of reference. The terms of reference shall be in sufficient detail to permit the selected subproject/subprojects to be completed up to the final design stage. The consultant shall prepare a financial budget for carrying out the preparation tasks and provide a time schedule for its completion.

15. All reports, including drawings, data, maps, charts etc. shall be prepared in the English and the Russian language. The consultant shall provide 20 sets of each report and terms of reference in Russian and English to the employer.

16. The prior review of existing documents and data, field visits and preparation of reports and terms of reference is expected to proceed according to the following schedule of implementation:

V. TIME SCHEDULE AND REPORTING

17. Project preparation in its initial phase would proceed according the following time schedule:

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Review of all existing Data & Documents						
2	Field visits to Subproject areas						
3	Reports on Subprojects and Program of Preparation						
4	Preparation of Detailed Terms of Reference in the seven components						

VI. PROPOSED BUDGET

18. The approximate budget for the initial phase of the preparation work is given below:

INITIAL REVIEW OF EXISTING DOCUMENTS AND FIELD VISITS

(Estimated Cost)

Item	Cost in US$ million		
	Local	Foreign	Total
Local Consultants/Specialist	0.10	-	0.10
Foreign Consultants	-	0.30	0.30
Travel	-	0.07	0.07
Training	-	-	-
Equipment/Goods/Materials	-	0.03	0.03
Sub-Total	**0.10**	**0.40**	**0.50**
Physical & Price Contingencies	-	0.02	0.02
Total	**0.10**	**0.42**	**0.52**

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 4

Projects:
1. Wetland Restoration
2. Restoration of Northern Part of the Aral Sea
3. Environmental Studies in the Aral Sea Basin

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 4

To undertake research work and to decide upon the existing the existing engineering options, to prepare projects and to create artificially watered landscape ecosystems in the deltas of the Amu Darya and Syr Darya Rivers and on the exposed Aral Sea beds. Furthermore to undertake the required melioration work in order to restore the original environmental situation in the above mentioned areas.

Project 1: Wetland Restoration

PROJECT BRIEF

I. BACKGROUND

1. The desiccation of the Aral Sea has, together with conversion for agriculture caused the disappearance of the wetlands in the deltas of both rivers. These deltas have historically been the riches parts of the Aral Sea ecosystem. Besides, the barren draw-down zone of the Aral Sea contributes allegedly to sand and pesticide laden salt and dust storms sweeping into the hinterland. As a result of the desiccation of the Aral Sea the following main negative environmental effects can be noted:

(i) Complete loss of fisheries in the Aral Sea;

(ii) Loss of most of the wetlands in the deltas

(iii) Loss of biodiversity, mostly in the Sea and wetlands;

(iv) Loss of the muskrat industry and grazing in wetlands and flood plain;

(v) Increase in salt and dust storms in the hinterland.

It is unrealistic to expect that the Aral Sea can be restored to life because the water resources needed are not available. However, parts of the Aral Sea ecosystem can be restored, in particular the wetlands, using water which would otherwise be lost by flowing into the Aral Sea. Most of this water would eventually flow into the Aral Sea anyway, because the wetlands would have a through-flow system to prevent salinization.

II. OBJECTIVES

2. The objectives of this project are to restore the environment in the delta of the Amu Darya to a condition close to the condition the delta was in before the start of the desiccation of the Aral Sea and to stabilize part of the draw-down zone. The project is expected to compensate and mitigate to a

large extent the detrimental environmental effects of the drying up of the Aral Sea.

III. SCOPE

3. The proposed project would, when fully implemented, create fresh and brackish water wetlands in the delta of the Amu Darya and the draw down zone of the Aral Sea. This would be achieved by constructing dykes and diverting water from the Amu river for the fresh water wetlands in the delta and by constructing dykes and collecting brackish drainage water in the draw-down zone. An overflow system between the existing and planned wetlands might also be envisaged.

IV. OUTPUTS

4. The project would:

(a) Provide an overall strategy and preliminary design and implementation schedule of a brackish and fresh water shelterbelt in the draw-down zone of the Aral Sea using water from the Amu river basin.

(b) Determine the size and location of a pilot fresh and brackish water wetland.

(c) Provide a technical feasibility study, design and cost-benefit estimate for a pilot fresh and brackish water wetland.

(d) Recommend institutional arrangements for implementing and managing the projects, including an evaluation of the socio-economic impacts of the projects on the local communities and region.

(e) Implement the pilot project(s).

V. PLAN OF IMPLEMENTATION AND SCHEDULE

5. The project would be implemented in three phases: Phase 1 which would last 8 months would produce the strategy, studies and design of the pilot project(s). Phase 2 would last 5 years, during which the pilot projects would be implemented. Phase 3 , implementation of the strategy is beyond the scope of this project. A foreign consultant firm is expected to be engaged in the design of the project. This firm should make a twinning arrangement with a consortium of local institutions headed by a leading partner.

VI. RESOURCES

6. The following resources would be required during the study and design stage:

	Unit	Quantity	Cost in US Dollars Local	Foreign	Total
Local Specialists	MM	100	40,000	-	40,000
International Consultants	MM	32	-	640,000	640,000
International Travel	TRIPS	10	-	50,000	50,000
Local Travel	LS	LS	60,000	-	60,000
Training	LS	LS	-	40,000	40,000
Equipment	LS	LS	-	85,000	85,000
Miscellaneous	LS	LS	-	30,000	30,000
Total			100,000	845,000	945,000

7. Implementation of the pilot project is expected to cost about $25 million.

VII. JUSTIFICATION

8. Many designs and plans for wetland restoration already exist and some projects have already been carried out from which valuable lessons can be learnt. These need to be reviewed, additional data gathered in the field, and (a) pilot project(s) designed and implemented.

9. The desiccation of the Aral Sea has resulted in the complete loss of fisheries, loss of most of the wetlands in the delta with consequent loss of grazing, biodiversity and muskrat exploitation while the drawdown zone contributes to the severity of salt and dust storms. Living conditions near the Aral Sea are very poor indeed. This project is designed to mitigate these detrimental effects to a large extent.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 4
Project 1: Wetland Restoration

TERMS OF REFERENCE

I. BACKGROUND

1. The shrinking and salinization of the Aral Sea as a result of the diversion of waters from the two rivers flowing into it, the Syr River in the Northern, and the Amu River in the Southern part of the Aral Sea, has together with conversion for agriculture, caused the disappearance of most of the wetlands in the deltas of both rivers. (The term wetland is here used according to the widely accepted "Ramsar" definition. This definition describes a wetland as an area of marshland permanently or temporary wet or covered with water the depth of which does not exceed 6 meters.)

2. This desiccation and conversion process has caused the complete or partial disappearance of many species of flora and fauna, several of which were of economic importance to the inhabitants of the deltas such as fish, muskrats, waterfowl and reeds. Besides, the wetlands were important for grazing.

3. The river deltas, especially the delta of the Amu River, have historically been (and still are) biologically the richest parts of the Aral Sea ecosystem. At present the water quality of the Aral Sea has deteriorated to such an extent, that higher life has practically vanished. As it is unrealistic to expect that the Aral Sea ecosystem can be restored to its original state (i.e., the state it was in before it began to shrink substantially in the early 1960s), two basic questions can be raised:

(i) Can the detrimental ecological impacts of the shrunken Aral Sea be mitigated with (ecological) countermeasures;

(ii) Can the original ecological functions of the Aral Sea be restored in selected parts of the Aral Sea basin?

The three most detrimental effects of the drying and salinization of the Aral Sea have been the disappearance of its wetland biodiversity and vegetation, the loss of its fisheries, and the alleged contribution of its barren draw-down zone to the salt- and pesticide-laden sandstorms sweeping over the delta hinterland.

I.1. Strategy for Resolving Ecological Problems

The above issues could be addressed through the creation of a wetland buffer zone between the Aral Sea and the hinterland and the closing off and restoration of the Northern part of the Aral Sea, the "Northern Bay." The latter project will be the subject of separate TOR.

The program is expected to be executed in at least three phases: The first phase will involve the development of a general strategy of water use against the objectives described hereunder and the design of (a) pilot project(s) which should provide answers to uncertainties about costs, benefits and feasibility of implementation of the goals defined in the strategy.

The second phase consists of implementing the pilot project(s) and refining the strategy on the basis of the results.

The third phase should consist of design and implementation of the projects defined by the strategy.

I.2. Phase 1.

The wetland buffer zone is envisaged to consist of five separate sub-zones, three of which already exist in the delta (wetlands fed by river water, drainage water and a mixture of both). This study however includes mainly the creation of two new wetland zones in the draw-down area of the Aral Sea, although all wetlands might eventually be connected by way of a through-flow system and have therefore to be considered in the design, which is likely to consist of:

(i) A fresh water wetland as an elongated band in the draw-down zone along the margin of the former shoreline of the Aral Sea, fed by water from the Amu river;

(ii) A brackish water wetland fed by drainage water and possibly overflow from the fresh water wetland.

To prevent salinization, both wetlands should have a through-flow system. Various designs can be considered such as:

(i) The creation of the fresh water wetland only in case enough water is available and the wetlands prove not to be economically feasible. Advantage: the fresh water wetland would have all the benefits of the brackish wetland and more while construction costs would be minimized by constructing only one wetland. Possible disadvantage: the size may not be sufficient to prevent the aerial salt transportation.

(ii) The creation of a brackish wetland only. Advantage: drainage water, unsuitable for other purposes is used. Disadvantage: less productive than the fresh water wetland and smaller in size.

(iii) In case both wetlands are created, these could be created parallel each other (the present SANIIRI proposal) with the "upper" fresh water wetland closest to the Aral Sea discharging into the "lower" brackish wetland like a cascade system or in alignment with each other. The first option would probably be cheaper for various reasons, the latter would provide a longer salt and dust buffer.

The benefits of wetland creation are:

(i) The restoration and preservation of the original biodiversity;
(ii) The restoration of fisheries;
(iii) Provision of grazing along the margins of the wetlands;
(iv) Provision of reeds and muskrats;
(v) Purification of drainage water by aquatic vegetation;
(vi) Trapping of sand and salt blown into the hinterland from the draw-down zone;
(vii) Firewood production and wind-break if the banks and dykes are planted with trees;
(viii) Soil stabilization in the draw-down zone.

II. OBJECTIVES

4. The objectives of the study are to:

(i) Provide an overall strategy and preliminary design and implementation schedule of a brackish and fresh water shelterbelt in the draw-down zone of the Aral Sea using river and drainage water from the Amu river basin;

(ii) Determine the size and location of a pilot fresh and brackish water wetland;

(iii) Provide a technical feasibility study, design and cost estimate for a pilot fresh and brackish water wetland. These designs could be closely linked;

(iv) Provide a cost - benefit analysis of the fresh and brackish wetlands;

(v) Recommend institutional arrangements for implementing and managing the projects;

(vi) Evaluate the socio-economic impacts of the projects on the local communities;

III. SCOPE OF WORK

5. Much has already been written about the creation of "polders" in the Amu River delta. The word "polder" has been used in existing documents to describe a variety of reservoir/cascade reservoir systems and is often a misnomer in the strict sense of the word. Nevertheless, several plans and designs for this system exist, and artificial wetlands have already been created in the delta, which could be considered as a part of the concept of wetland creation described above. These lakes should be studied because they already form examples of what to expect when wetlands are created under the project such as the Adjibai lake which receives drainage water, the Muinak and Rybachee lakes which receive river water and the Djilterbaz lake which receives both drainage and river water. A large wetland has been formed by

drainage water in the desert on the border between Uzbekistan and Turkmenistan: the Sary-Kamoush. However, the objectives relating to the creation of these lakes and wetlands do not seem to have been well defined and coordinated with a view to their ecological stability and an assessment of their ecological function seems to be lacking. These Terms of Reference are therefore not to be considered prescriptive, but intend to leave the Consultant(s) room for creativity. Consultant(s) are expected to review existing plans, undertake field investigations, design structures determine feasibility of the plans and formulate a strategy.

IV. DESIGN OF TASKS

6. The Consultant(s) will:

a. Assess the hydrological system of the delta and the drawdown zone, including an estimate of the volumes and locations of water (drainage as well as river water) which would be available for wetland creation. Consultants should liaise closely with the water strategy team in this respect.

b. Assess the salinity regime of the existing wetlands as a guide for the wetlands to be designed.

c. Study the water purification capacity of the existing wetlands, provided mainly the aquatic vegetation known locally as the "bioplato".

d. Provide a ground water model to forecast flow and salinity.

e. Identify flora and fauna historically present in the delta requiring conservation, their habitats and environmental requirements. Consultants should liaise closely with the Environmental Assessment team in this respect.

f. Advise on the desirability of creating fresh and brackish wetlands and on the location of these

g. Recommend an optimal size and location for the pilot wetlands, brackish as well as fresh..

h. Design an optimal fresh and brackish wetland from an ecological point of view including size, depth, hydrology etc. and suited to the preservation of the species identified under b). above.

i. Assess the ecosystem expected to develop in the wetlands based at least partly on studies of existing wetlands in the area.

j. Advise on eventual introduction of species of flora and fauna, in particular the stocking of the wetlands with fish.

k. Provide guidelines as to the management of the wetland.

l. Advise on institutional arrangements necessary for wetland management.

m. Provide an estimate of costs and benefits of the pilot project.

n. Report on expected benefits for the local population.

V. TIME SCHEDULE AND REPORTING

7. As mentioned before, many preliminary designs for polder and wetland creation exist. The following organizational arrangement is therefore envisaged: A foreign consultant firm should be engaged in the design of the project to ensure that the design is made according to international standards. The foreign consultant firm should make a twinning arrangements with a consortium of local institutions headed by a leading partner such as the Central Asian Scientific Research Institution for Irrigation SANIIRI. Other institutions which could be involved are:

- The Design and Research Institute for Irrigation "UZGIPROMELIOVODHOZ" in Tashkent, Uzbekistan.
- UZVODPROJECT
- The "Center for Ecology and Water Management" in Tashkent, Uzbekistan.
- The Desert Research Institute, Academy of Sciences in Ashkabad, Turkmenistan.

Most of the data gathering and design should be carried out by the local consultants while on-the-job training should be provided where necessary by the foreign consultants. Sending local experts abroad for additional training should also be considered.

8. The study is expected to take 8 months. An inception report should be submitted after 6 weeks, an interim report after 4 months, a draft final report after 7 months and a final report one month after comments on the draft ave been received from the client.

9. The Governments will provide all documents necessary for the work of the Consultants. It will also facilitate travel by the Consultants within and between the countries of the five Aral Sea Republics by issuing the necessary multiple entry visas and permits.

VI. PROPOSED BUDGET

10. The following composition of the Consulting Team and number of man months is anticipated:

Qualification:	Foreign Man-months	Local Man-months
Civil or drainage engineer/team leader	8	8
Wetland ecologist	3	16
Inland Fisheries specialist	2	8
Hydrologist	5	16
Saline vegetation specialist	3	8
Economist	2	8
Ground Water Modeling Expert	4	12
Hydrotechnical Engineer	3	16
Sociologist	2	8
Total	32	100

11. Based on the above analysis, the following budget requirements have been anticipated:

	Unit	Quantity	Cost in US Dollars Local	Foreign	Total
Local Specialists	MM	100	40,000	-	40,000
International Consultants	MM	32	-	640,000	640,000
International Travel	TRIPS	10	-	50,000	50,000
Local Travel	LS	LS	60,000	-	60,000
Training	LS	LS	-	40,000	40,000
Equipment	LS	LS	-	85,000	85,000
Miscellaneous	LS	LS	-	30,000	30,000
Total			100,000	845,000	945,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 4

To undertake research work and to decide upon the existing the existing engineering options, to prepare projects and to create artificially watered landscape ecosystems in the deltas of the Amu Darya and Syr Darya Rivers and on the exposed Aral Sea beds. Furthermore to undertake the required melioration work in order to restore the original environmental situation in the above mentioned areas.

Project 2: Restoration of the Northern Part of the Aral Sea (North Bay)

PROJECT BRIEF

I. BACKGROUND

1. The Aral Sea was the world's fourth largest lake in the area in 1960. However, from that time, diversion of water mainly for irrigation from the two rivers feeding into the Aral Sea, the Amu and Syr Rivers, has caused the Aral Sea to shrink. This process is continuing today and if the present trend continues, the level of the Aral Sea will be over 21 meters lower in the year 2,000 than it was in 1960 with a surface area of only 34% of what it originally was.

2. The shrinking of the Aral Sea has been accompanied by a substantial increase in salinity through evaporation of the original water body and the increased inflow of salt leached out from the irrigation areas and conveyed to the Sea via drainage channels and the rivers themselves which also receive part of the drainage. As a result, salinity levels have increased from about 8ppt in 1960 to between 30 and 40ppt at present. Of the original aquatic fauna (which has always been quite poor), practically nothing is left.

3. Under existing conditions, there is little hope, that the Aral Sea can be restored to its pre-1960 conditions. Even if its level could be stabilized at the present level or a few meters higher, the continuous inflow of large quantities of salt would eventually render the lake hypersaline and unsuitable for higher aquatic life. The forecast for the year 2000 is a salinity of 50ppt (seawater is approximately 32ppt).

4. There are, however, possibilities to restore and maintain parts of the Aral Sea close to its original state with the consequent benefits for the local population and the preservation of biodiversity. Such an opportunity exists in the Northern part of the Aral Sea, by closing off a natural bay, (hereafter referred to as the North Bay), and in the Southern part by creating endiked wetlands and "polders". This project refers only to the North Bay.

5. The North Bay lies in the Republic of Kazakhstan and has a surface area of 3120 km^2 formerly connected to the Aral Sea via a wide channel. The Syr River flows into the southern part of the bay and from there its waters flow directly south into the Aral Sea (whose level is about 2m lower) without mixing with the water in the bay. Except for the area where the river debouches into the bay, the bay is hyper saline. Aquatic and bird life is concentrated in this brackish water area.

6. The Kazakhstan Hydrological Design Institution (Kazgynprovodhoz) has produced a design to restore the ecological conditions in the North Bay in such a way as to approach the original conditions of the Aral Sea as closely as possible. Such a system can be created by constructing a dam just South of the mouth of the Syr River, closing off the Bay from the Aral Sea and a discharge canal with an intake regulation structure some 40km to the east of the dam. In this way, the discharge of the Syr Darya will fill up the Bay again at least partly, while the throughflow will prevent the buildup of salinity.

II. OBJECTIVES

7. The objectives of this project (Restoration of the North Bay) are to restore the environment of the Northern part of the Aral Sea to its original ecosystem for the benefit of the riparian population and biodiversity.

III. SCOPE

8. The proposed project would result in the filling up and restoration of the water quality of the North Bay, a part of the Aral Sea which is now hyper saline, largely dried out and biologically practically dead. Consequently, a healthy ecosystem with inherent benefits for the local population and biodiversity would be reestablished. A review of the existing literature on the project would be necessary. Additionally, field work would be required to assess the various aspects of the project and to learn from similar projects which have been carried out on a much larger scale in the delta of the Amu Darya.

IV. OUTPUTS

9. The project would include the design and construction of a dyke to close off the Northern Bay and the design and construction of a discharge sluice. Furthermore, a study should be made of the amount of water available, the kind and size of the ecosystem which can be created, a forecast of the stability of this ecosystem and measures for its enhancement and management. A cost-benefit analysis of the project should also be made.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

10. Plan of Implementation and Schedule.
A foreign consulting firm would be contracted to ensure that the designs are made according to international standards. This firm should make a formal arrangement for cooperation with a local institute. The study is expected to take seven months, some of which may be used in the foreign consultant's home office in particular where it concerns structural designs or modelling. The implementation period is expected to take 3 years.

VI. RESOURCES

11. The following resources would be required during the preparation stage:

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
Local	MM	57	22,800	-	22,800
Foreign	MM	21	-	420,000	420,000
International Travel	LS	LS	-	35,000	35,000
Local Travel	LS	LS	-	80,000	80,000
Training	LS	LS	-	40,000	40,000
Equipment	LS	LS	-	85,000	85,000
Miscellaneous	LS	LS	-	37,200	37,200
Total			22,800	845,000	720,000

12. Implementation of the project would require about $50 million.

VII. JUSTIFICATION

13. The ecological consequences of the desiccation and salinization of the Aral Sea are well known. As it is unrealistic to expect that the Aral Sea can be restored, the question can be raised whether it would be possible to restore at least a part of the Sea. This is probably well possible in this project. The benefits accruing to the local population (mainly the citizens of Aralsk) would include a.o. the physical improvement of their desert environment and possibly micro climate, provision of fishing opportunities, recreation, grazing, etc. The North Bay would also constitute an important link in the migration route of waterfowl and therefore be of international importance for biodiversity conservation.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 4
Project 2: Restoration of the Northern Part of the Aral Sea (North Bay)

TERMS OF REFERENCE

I. BACKGROUND

1. The Aral Sea was the world's fourth largest lake in area in 1960. However, from that time, diversion of water mainly for irrigation from the two rivers feeding into the Aral Sea, the Amu and Syr Rivers, has caused the Aral Sea to shrink. This process is continuing today and if the present trend continues, the level of the Aral Sea will be over 21 meters lower in the year 2000 than it was in 1960 with a surface area of only 34 % of what it originally was.

2. The shrinking of the Aral Sea has been accompanied by a substantial increase in salinity through evaporation of the original water body, and the increased inflow of salt leached out from the irrigation areas and conveyed to the lake via drainage channels and the rivers themselves which also receive part of the drainage. As a result, salinity levels have increased from about 8 ppt in 1960 to between 30 and 40 ppt at present. Of the original aquatic fauna (which has always been quite poor), practically nothing is left. Attempts have been made to introduce marine fish species into the lake, some of which have established themselves. However the lake's fish fauna is depauperate and at present a fishing village along the shores of the Aral Sea fishes in another lake 300 km away.

3. Besides, the Aral Sea acts as the ultimate sink for agrochemicals (pesticides, herbicides and fertilizers), leached from the irrigation areas.

4. Under existing conditions, there is little hope, that the Aral Sea can be restored to its pre-1960 conditions. Even if its level could be stabilized at the present level or a few meters higher, the continuous inflow of large quantities of salt would eventually render the lake hypersaline and unsuitable for higher aquatic life. The forecast for the year 2000 is a salinity of 50 ppt (seawater is approximately 32 ppt).

5. There are, however, possibilities to restore and maintain parts of the Aral Sea close to its original state with the consequent benefits for the local population and the preservation of biodiversity. Such an opportunity exists in the Northern part of the Aral Sea by the closing off a natural bay,(hereafter referred to as the North Bay), and in the Southern part by creating endiked wetlands and "polders". These TOR refer only to the North Bay, but exchange of information between the Northern and Southern projects is encouraged - in particular on biological and physical parameters.

II. OBJECTIVES

6. The objectives of the study are to undertake an in-depth review of the existing plans for the restoration of the North Bay, to advise on an optimal design of the civil engineering structures to be constructed and to make a forecast of the ecosystem which is likely to develop as a result of the hydrological changes brought about by these civil engineering structures. Advice is also required on possible measures to enhance the development of the Northern Bay ecosystem such as through replanting or introduction of species. An estimate of the costs and benefits should also be made. Apart from a review of the existing literature on this project, field work will be necessary to assess the various aspects of the project. Throughout the study, consultants should liaise closely with the team carrying out the study on the creation of wetlands in the drawdown zone in the south-western part of the Aral Sea

III. SCOPE OF WORK

7. The project area lies in the Republic of Kazakhstan and comprises the northern part of the Aral Sea. This part of the Sea consists of a bay with a surface area of 3120 km^2 formerly connected to the Aral Sea via a wide channel. The Syr River flows into the southern part of the bay and from there its waters flow directly South into the Aral Sea (whose level is about 2 m lower) without mixing with the water in the bay. At present, a small river channel is the only connection between the bay and the main body of the Sea. Except for the area where the river debouches into the bay, the bay is hyper saline. Aquatic and bird life is concentrated in this brackish water area. The most conspicuous bird species are Dalmatian Pelicans, Mute Swans, Spoonbills, Cormorants, Egrets and Ducks. Flamingoes occur in the hyper saline parts of the bay.

8. The Kazakhstan Hydrological Design Institution (Kazgynprovodhoz) has produced a design to restore the ecological conditions in the North Bay in such a way as to approach the original conditions of the Aral Sea as closely as possible. This means, in the first place, a lowering of the salinity in the Bay by providing an inflow of fresh water of reasonable quality and by providing a through flow of such waters to prevent the build-up of salinity.

9. Such a system can be created by constructing a dam just South of the mouth of the Syr River, closing off the Bay from the Aral Sea and a discharge canal with an intake regulation structure some 40 km. to the East of the dam. In this way, the whole discharge of the Syr River will flow through most of the Bay with the exception of two smaller, isolated embayments in the North. These latter bays may not be flushed and should stay more saline. However, from an ecological point of view, the presence of these salinity gradients within the Northern bay will only be beneficial in enhancing biodiversity.

10. The project is in a fairly advanced state of design. Crucial to the success of the project is an international agreement between the riparian States of the Syr River to a guarantee a minimum inflow of fresh water into the Northern Bay.

IV. DESIGN OF TASKS

11. The consultants should provide:

(a) Evaluation of the designs for the project as drafted by the Kazakhstan Hydrological Design Institute, including evaluation of the various alternatives considered by the Institute.

(b) Determination of the optimal dam height, length, alignment and construction, and a detailed design.

(c) Determination of the optimal alignment and dimensions of the discharge canal and a detailed design.

(d) Design of the discharge structure in the canal which would allow for the flushing of the bay.

(e) Provision of cost estimates for all civil engineering works.

(f) Recommendations on the realistic levels of inflow from the Syr River which would be required to maintain a relatively stable, healthy and productive ecosystem in the bay.

(g) Recommendations on the future hydrology and salinity of the bay and the best way of managing the salinity.

(h) Recommendations on whether or not the bay should be allowed to drain to a maximum extent before impoundment, to flush out as much saline water as possible.

(i) Assessment of the present ecosystem in the bay, including an inventory of flora and fauna.

(j) Forecast of the ecosystem which can be expected to develop as a result of the project.

(k) Description of the necessary research and monitoring requirements, in particular with regard to the future management of the bay.

(l) Preliminary guidelines for the future management of the bay, including required inflow, possible establishment and management of nature reserves, possible reintroduction of species indigenous in the region, fishing regulations etc.

(m) Advise on institutional arrangements necessary for the management of the North Bay, including training requirements.

12. **Organizational arrangements.** The following organizational arrangements are anticipated: A foreign consulting firm should be contracted to ensure that the designs are made according to international standards. This firm should make a formal arrangement for cooperation with a local Institute such as the Kazakhstan Hydrological Design Institute which is based in Alma Ata, and the Central Asian Scientific Research Institution for Irrigation (SPA SANIIRI) in Tashkent, which are expected to involve other local institutions and\or experts. Frequent field visits will be necessary to the project area and a field office may have to be established in Aralsk or Kazalinsk. The lease of an airplane or a helicopter may be necessary in view of the large distances involved, in particular if frequent travel between Alma Ata and the project area is foreseen.

13. **Training and Associated Activities.** Consultants are expected to provide on-the-job training to their counterpart institute(s), in particular in areas where there may be deficiencies in skills which were less emphasized in the former Soviet Union (e.g., economic analysis). Study tours or training courses abroad for local experts could also be provided under the project.

V. TIME SCHEDULE AND REPORTING

14. The study is expected to take seven months, some of which may be used in the foreign consultant's home office, in particular where it concerns structural designs. The following reports are anticipated:

(a) Inception Report An inception Report describing consultant arrangements in the field o start the study and the first activities should be ready 6 weeks after the beginning of the study.

(b) Interim Report An Interim Report, describing the results of consultant activities should be submitted four months after Consultant's arrival in Kazakhstan.

(c) Final Report The draft final report, including the detailed design of the structures and a cost estimate should be submitted six months after the start of the consultant's work in Kazakhstan and the final report one month after comments by the client.

(d) Services to be provided by the Republic of Kazakhstan

The Republic of Kazakhstan will make available free of charge all information in its possession pertinent to the consultant's work upon his request with the exception of information of a sensitive political or military nature, such at the discretion of the Government. The Government will facilitate the consultant's work by providing all necessary documents such as visas and permits to enable the consultant to carry out this study.

VI. PROPOSED BUDGET

15. The following is envisaged with regard to Consultant's qualifications and time:

Qualifications	Man-months	
	Foreign	Local
· A civil engineer with experience in the design of the structures required, who would be team leader	7	14
· A hydrologist with experience in the modelling of fresh/salt water mixing patterns	3	7
· A wetlands/aquatic ecologist	3	6
· Structural engineer experienced in hydraulic structures	1	3
· Economist	2	4
· Fisheries specialist	2	4
. Ground water specialist	1	7
· Surveyors, draughtsmen	2	12
Total	21	57

16. Based on the above manpower requirements the following budget is anticipated.

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
Local	MM	57	22,800	-	22,800
Foreign	MM	21	-	420,000	420,000
International Travel	LS	LS	-	35,000	35,000
Local Travel	LS	LS	-	80,000	80,000
Training	LS	LS	-	40,000	40,000
Equipment	LS	LS	-	85,000	85,000
Miscellaneous	LS	LS	-	37,200	37,200
Total			22,800	845,000	720,000

Heads of States Approved Program No. 4

To undertake research work and to decide upon the existing the existing engineering options, to prepare projects and to create artificially watered landscape ecosystems in the deltas of the Amu Darya and Syr Darya Rivers and on the exposed Aral Sea beds. Furthermore to undertake the required melioration work in order to restore the original environmental situation in the above mentioned areas.

Project 3: Environmental Studies in the Aral Sea Basin

PROJECT BRIEF

I. BACKGROUND

1. The Aral Sea lies in Central Asia in the former Soviet Republics of Kazakhstan and Uzbekistan. In 1960, it was the fourth largest inland lake in the world. Since then it has shrunk from 68,000 km2 to 37,000 km2, its level has dropped by 14.3 m, between 30 and 40 ppt at present. This is primarily a result of reduced river inflow by the two rivers feeding into the Aral Sea, the Syr River in the North and Amu River in the South because of withdrawals for irrigation. Besides, an increased inflow of salt and pesticides, leached from the irrigation areas has further contributed to its salinization and deterioration of its water quality. As a result, there is at present practically no more higher life in the Aral Sea.

2. The desiccation and salinization of the Aral Sea has caused a number of problems, the most serious of which are:

(i) The disappearance of its fisheries;
(ii) The disappearance of its biodiversity;
(iii) The development of a large barren draw-down zone from which the wind allegedly blows salt and pesticide laden dust into the hinterland aggravating the salinity problem of the land and causing respiratory diseases in the population.
(iv) The disappearance of the wetlands in the deltas of the Amu and Syr rivers with loss of biodiversity, fisheries, grazing and the muskrat industry; and
(v) Possible regional climate change.

II. OBJECTIVES

3. There have been proposals to carry out an overall environmental assessment of the whole of the Aral Sea basin. However, in view of the enormous area covered by this basin, the scope of the Aral Sea program and the fact that certain important aspects such as water quality and salinization are being tackled by other projects, this project is not an overall basin wide Environmental Assessment exhaustive in its coverage of environmental issues. These environmental studies are:

(a) To examine and analyze the major problems caused by the desiccation of the Aral Sea with a view to assisting the Governments in the determination of appropriate measures and policies to mitigate various detrimental effects caused by the deterioration of the Sea.

(b) To study of the hydrology and water quality of the Sea itself to provide the necessary data to develop a long term strategy about the future of the Aral Sea.

III. SCOPE

4. The scope of work for the environmental studies would include the following studies:

(a) The origin and severity of salt and dust storms.
(b) Biodiversity in the Aral Sea basin.
(c) Water quality of the Aral Sea.
(d) Limnology of the Aral Sea
(e) Climate Change as a result of the drying up of the Aral Sea.

IV. OUTPUTS

5. The outputs of the project would consist of five comprehensive studies on various aspects of the Aral Sea and its environment as summarized below:

(a) Salt and Dust Storms. There are several theories about how the salt and dust is transported and where it actually comes from. These questions would be answered through the study before cost effective measures to reduce these storms can be taken.

(b) Biodiversity in the Aral Sea Basin. The biodiversity of the Aral Sea basin has severely been depleted due to various causes, mainly wetland destruction. New wetlands have originated however where drainage water accumulates in the periphery of the agricultural lands. Other wetlands, fed by drainage and river water have deliberately been created in the delta of the Amu River. Some of these seem to have taken over at least some of the functions of the wetlands which have been lost. The biological value of these wetlands needs to be assessed in view of the overall water management of the basin so as to maintain the supply of water to the biologically valuable ones. Besides, there may be other biologically valuable areas in the basin which require management. A basin wide biodiversity inventory would constitute an important part of the study.

(c) Water quality in the Aral Sea. For the future management of the Aral Sea it is important to determine its water quality. This is information is of crucial importance to determine how much water would be needed to dilute the water to such an extent, that a

reasonably healthy ecosystem can be reestablished in the Sea and how much water would be required to maintain this quality. These questions relating to water quality and water balance would be answered by the study.

(d) Limnology of the Aral Sea. Limnological studies would be carried out to determine whether or not stratification would occur which might render restoration impossible even if enough water for dilution could be made available. Hydrological modelling of the Sea would be required to provide an answer to this question.

(e) Climate change. Regional climate modeling would be necessary to establish the effects of the desiccation of the Aral Sea. Apart from analyzing existing data, a considerable amount of field work is envisaged as the gathering of data has virtually stopped since the break-up of the Soviet Union.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

6. In view of the extensive volume of data on the Aral Sea and its basin, collected by various research institutions in the Aral Sea region, it is desirable that twinning arrangements are made between foreign consultants or a foreign consultant firm and local consultants or a local institution. In most cases, a cost effective way of carrying out the various projects would be to have longer term data gathering and field work carried out by local institutions. The study is expected to take one year.

VI. RESOURCES

7. The cost of carrying the study has been estimated as below:

	Cost in US Dollars		
	Local	Foreign	Total
Local Consultants	59,200	-	59,200
Foreign Consultants	-	760,000	760,000
International Travel	-	55,000	55,000
Local Travel	80,000	-	80,000
Training	-	30,000	30,000
Equipment	-	85,000	85,000
Miscellaneous	-	26,000	26,000
Total	149,200	956,000	1,095,200

VII. JUSTIFICATION

8. The Environmental Studies are needed to provide clear policy guidance on important environmental issues in the Aral Sea basin. At present there is a lot of confusion on major environmental issues which may result in suboptimal or ineffective resource allocation.

VIII. ISSUES

9. Before defining the scope of work, it is necessary to address some important issues which have a direct bearing on the conduct of the environmental studies. The first of these is the future water allocation to the Aral Sea. Restoration of the Aral Sea to a biologically healthy state is of course desirable, but probably it is not technically feasible, as it would require an amount of good quality water which is unlikely to become available, considering the trade-offs between alternative water uses. The second issue is the long term sustainability of agriculture in the basin which depends on implementation of an adequate drainage system to halt and reverse the ongoing salinization of cropland. There may be no other option than to discharge this saline drainage water into the Aral Sea, in which case its quality will deteriorate even further. These issues have been further elaborated below.

10. Restoration of the Aral Sea

(a) Restoration of the Aral Sea quantitatively and qualitatively would have the following benefits:

- Increase in fish production.
- Improvement of the biodiversity of the region.
- Reduction in severity of salt and dust storms through reflooding of the draw-down zone.
- Beneficial influence on the local climate.
- Improvement of living conditions of the population close to the Sea in particular in the villages of Muynak and Aralsk.

(b) The trade-offs would be:

- Drastic reduction or complete cessation of irrigated agriculture in the basin.
- Providing water from other sources than the Amu and Syr rivers at great financial and possibly environmental costs.
- Loss of a "sink" for future drainage water.

(c) Mitigatory measures which would cost less water than restoration of the Aral Sea would be:

- Fish production in fish farms.
- Creation of wetlands in the perimeter of the Aral Sea.
- Stabilization of the drawdown zone.

- Creation of a vegetation belt between the drawdown zone and the hinterland.
- Rehabilitation of the "North Bay" of the Aral Sea near Aralsk.

11. Salt and Dust Storms. There are several theories about how the salt and dust is transported and where it actually comes from. Some sources say that the salt-dust is blown high into the sky and precipitates far inland. Others say the salt, sand and dust travel as a sheetflow just above the ground. As to the origin of the salt and dust, the drawdown zone of the Aral Sea may not be the only or even not be the major source. The irrigation areas along both rivers are flanked by salt flats caused by the evaporation of saline drainage water which is discharged into the desert flanking the irrigation belt along the river. This salt is also likely to be blown into the hinterland, together with dust from the irrigated lands which lay plowed and barren for a large part of the year. An eight year study in the eighties collecting salt-dust all over the Amu delta did not find a correlation between precipitation of salt-dust and the desiccation of the Aral Sea. There are several questions which need to be answered before measures to mitigate this phenomenon can be taken. Measures which have been proposed include:

(a) The creation of a vegetative shelterbelt between the drawdown zone and the hinterland in case the sand and salt travel as a sheetflow. This function can most probably best be performed by the proposed construction of wetlands in the drawdown zone of the Aral Sea.

(b) Soil stabilization of the drawn-down zone itself, also best implemented by wetland creation, because the salinity of the soil and the extreme aridity of the region preclude revegetation.

(c) A change in agricultural practices if salt and dust comes from agricultural land.

(d) A change in the drainage system if (much of the) salt comes from the evaporation ponds in the desert.

12. Biodiversity in the Aral Sea Basin. The biodiversity of the Aral Sea basin has severely been depleted due to various causes. Much of the original habitats has been converted or degraded, in particular, the original forests and wetlands along the rivers, while the desiccation and salinization of the Aral Sea itself has caused the disappearance of a large area of suitable aquatic habitat and the biologically diverse deltaic wetlands. New wetlands have originated however where drainage however where drainage water accumulates in the periphery of the agricultural lands. Other wetlands, fed by drainage and river water have deliberately been created in the delta of the Amu River. Some of these seem to have taken over at least some of the functions of the wetlands needs to be assessed in view of the overall water management of the basin so as to maintain the supply of water to the biologically valuable ones. Besides, there may be other biologically valuable areas in the basin which require management. A basin wide biodiversity inventory is therefore required.

13. Water Quality in the Aral Sea. The salinity of the Aral Sea has increased dramatically since the early sixties and now about equals that of sea water. This does not mean however that the Aral Sea contains sea water. The ion balance seems to be very different from that of sea water, to the extent that despite the introduction of sea fish in the past, higher life is now all but absent from the Aral Sea. Besides, there are reports of heavy pesticide and other contamination in the Aral Sea. For the future management of the Aral Sea, it is important to determine its water quality.

14. Limnology of the Aral Sea. Limnological studies would be required to determine whether or not stratification would occur which might render restoration impossible even if enough water for dilution could be made available. Hydrological modelling of the Sea might be required to provide an answer to this question.

15. Climate Change. Concern has been voiced about the possible effects on the local climate by the desiccation of the Aral Sea. Regional climate modelling might be necessary to establish these effects. Apart from gathering new and analyzing existing data, consultants will also evaluate the policy of the Governments and reasonable alternatives proposed and recommended by international and national agencies, NGO's, local communities and peoples directly and indirectly affected by the policy and projects emanating from the Environmental Studies. A considerable amount of field work is envisaged as the gathering of data has virtually stopped since the break-up of the Soviet Union.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 4
Project 3: Environmental Studies in the Aral Sea Basin

TERMS OF REFERENCE

I. BACKGROUND

1. The Aral Sea lies in Central Asia in the former Soviet Republics of Kazakhstan and Uzbekistan. In 1960, it was the fourth largest inland lake in the world. Since then it has shrunk from 68,000 km2 to 37,000 km2, its level has dropped by 14.3 m, and salinity levels have increased from about 8 ppt in 1960 to between 30 and 40 ppt. at present. This is primarily a result of reduced river inflow by the two rivers feeding into the Aral Sea, the Syr River in the North and Amu River in the South because of withdrawals for irrigation. Besides, an increased inflow of salt and pesticides, leached from the irrigation areas has further contributed to its salinization and deterioration of its water quality. As a result, there is at present practically no more higher life in the Aral Sea.

2. The desiccation and salinization of the Aral Sea has caused a number of problems the most serious of which are:

(i) The disappearance of its fisheries;
(ii) The disappearance of its biodiversity;
(iii) The development of a large barren draw-down zone from which the wind allegedly blows salt and pesticide laden dust into the hinterland aggravating the salinity problem of the land and causing respiratory diseases in the population;
(iv) The disappearance of the wetlands in the deltas of the Amu and Syr river with loss of biodiversity, fisheries, grazing and the muskrat industry;
(v) Possibly regional climate change;

With the breakup of the Soviet Union in 1991, the five Republics acted to establish the basis for cooperation. An agreement was signed in February 1992 for the joint management of the two rivers. A further agreement was reached in March 1993 on joint activities for addressing the Aral Sea crisis, improving the environment and ensuring the social and economic development of the Aral Sea Region. In parallel, an Aral Sea Fund has been set up to finance approved programs and projects. Finally, the general strategy for tackling the problems of the Aral Sea and the Aral Sea Region has been set out in a draft "Concept Paper" which has been approved by the Heads of State of he Aral Sea Republics.

II. OBJECTIVES

3. There have been proposals to carry out an overall environmental assessment of the whole of the Aral Sea basin. However, in view of the

enormous area covered by this basin, the scope of the Aral Sea program and the fact that certain important aspects such as water quality and salinization are being tackled by other projects, this project is not an overall basin wide Environmental Assessment exhaustive in its coverage of environmental issues. It focuses on:

(a) The major problems caused by the desiccation of the Aral Sea, with a view to assist the Governments in the determination of appropriate measures and policies to mitigate detrimental effects caused by the deterioration of the Sea;

(b) A study of the hydrology and water quality of the Sea to provide the data necessary to develop a long term view about the future of the Aral Sea itself.

III. SCOPE OF WORK

The Aral Sea Dilemma

4. An important question to be answered in view of future water allocation is the question of the future of the Aral Sea itself. Restoration of the Aral Sea to a biologically healthy state is of course desirable, but is probably not be technically feasible, requires an amount of good quality water which is unlikely to become available, or could be undesirable or unaffordable given the trade-offs between alternative water uses. Besides, the long term sustainability of agriculture in the basin depends on the implementation of an adequate drainage system to halt and reverse the ongoing salinization of cropland. There may not be another option than to discharge this saline drainage water into the Aral Sea, in which case its water quality will deteriorate even further.

5. Restoration of the Aral Sea quantitatively and qualitatively would have the following benefits:

- Increase in fish production;
- Improvement of the biodiversity of the region;
- Reduction in severity of salt and dust storms through reflooding of the draw-down zone;
- Beneficial influence on the local climate;
- Improvement of living conditions of the population close to the Aral Sea, in particular in the villages of Muynak and Aralsk.
- Possible reduction in severity of climate close to the Sea;

The trade-offs would be:

- Drastic reduction or complete cessation of irrigated agriculture in the basin;

- Providing water from other sources than the Amu and Syr rivers at great financial and possibly environmental costs;
- Loss of a "sink" for future drainage water;

Mitigatory measures which would cost less water than restoration of the Aral Sea would be:

- Fish production in fish farms;
- Creation of wetlands in the perimeter of the Aral Sea;
- Stabilization of the drawdown zone;
- Creation of a vegetation belt between the drawdown zone and the hinterland;
- Rehabilitation of the "North Bay" of the Aral Sea near Aralsk;

In order to be able to make sound decisions on the future of the Aral Sea basin and the Aral Sea itself, it is necessary to have sound data on a number of issues which are detailed below.

Salt and Dust Storms

6. There are several theories about how the salt and dust is transported and where it actually comes from. Some sources say that the saltdust is blown high into the sky and precipitates far inland. Others say the salt, sand and dust travel as a sheetflow just above the ground.

7. As to the origin of the salt and dust, the drawdown zone of the Aral Sea may not be the only or even not be the major source. The irrigation areas along both rivers are flanked by salt flats caused by the evaporation of saline drainage water which is discharged into the desert flanking the irrigation belt along the river. This salt is also likely to be blown into the hinterland, together with dust from the irrigated lands which lay plowed and barren for a large part of the year. An eight year study covering a large part of the Amu river delta did not find a correlation between the precipitation of salt-dust and the desiccation of the Aral Sea.

8. There are several questions which need to be answered before measures to mitigate this phenomenon can be taken. Measures which have been proposed include:

(a) The creation of a vegetative shelterbelt between the drawdown zone and the hinterland in case the sand and salt travel as a sheetflow. This function can most probably best be performed by the proposed construction of wetlands in the draw-down zone of the Aral Sea.

(b) Soil stabilization of the draw-down zone itself, also best implemented by wetland creation, because the salinity of the soil and the extreme aridity of the region preclude revegetation.

(c) A change in agricultural practices if salt and dust comes from agricultural land.

(d) A change in the drainage system if (much of the) salt comes from the evaporation ponds in the desert.

Biodiversity in the Aral Sea Basin

9. The biodiversity of the Aral Sea basin has severely been depleted due to various causes. Much of the original habitats has been converted or degraded, in particular the original forests and wetlands along the rivers, while the desiccation and salinization of the Aral Sea itself has caused the disappearance of a large area of suitable aquatic habitat and the biologically diverse deltaic wetlands.

10. New wetlands have originated however where drainage water accumulates in the periphery of the agricultural lands. Other wetlands, fed by drainage and river water have deliberately been created in the delta of the Amu River. Some of these seem to have taken over at least some of the functions of the wetlands which have been lost. The biological value of these wetlands needs to be assessed in view of the overall water management of the basin so as to maintain the supply of water to the biologically valuable ones.

11. Besides, there may be other biologically valuable areas in the basin which require management. A basin wide biodiversity inventory is therefore required.

Water Quality in the Aral Sea

12. The salinity of the Aral Sea has increased dramatically since the early sixties and now about equals that of sea water. This does not mean however that the Aral Sea contains sea water. The ion balance seems to be very different from that of sea water, to the extent that despite the introduction of sea fish in the past, higher life is now all but absent from the Aral Sea. Besides, there are reports of heavy pesticide and other contamination in the Aral Sea.

13. For the future management of the Aral Sea it is important to determine its water quality. This is information is of crucial importance to determine how much water would be needed to dilute the water to such an extent, that a reasonably healthy ecosystem can be reestablished in the Sea and how much water would be required to maintain this quality.

Limnology of the Aral Sea

14. Limnological studies would be required to determine whether or not stratification would occur which might render restoration impossible even if enough water for dilution could be made available. Hydrological modelling of the Sea might be required to provide an answer to this question.

Climate Change

15. Concern has been voiced about the possible effects on the local climate by the desiccation of the Aral Sea. Regional climate modelling might be necessary to establish these effects.

16. Apart from gathering new and analyzing existing data, Consultants will also evaluate the policy of the Governments and reasonable alternatives proposed and recommended by international and national agencies, NGO's, local communities and peoples directly and indirectly affected by the policy and projects emanating from the Environmental Studies. A considerable amount of field work is envisaged as the gathering of data has virtually stopped since 1991.

IV. DESIGN OF TASKS

17. Consultants will:

Salt and Dust Storms

(a) Determine the adequacy of the existing data;

(b) Design, and start implementation if necessary, of a research and\or monitoring program to provide additional data;

(c) Determine, the relative contribution of the Aral Sea drawdown zone to the airborne salt and dust problem;

(d) Determine possible other sources of salt and dust and their relative contribution to the problem;

(e) Advise on the extent and severity of the problems;

(f) Advise on possible measures to counteract the problems.

Biodiversity Assessment

(a) Prepare, on the basis of existing information and field work an inventory of flora and fauna in the Aral Sea basin. The inventory should concentrate on the Aral Sea itself, on the flood plains and deltas of the Amu and Syr rivers and on

wetlands whether natural or created by drainage water from agricultural lands. Much of the data should be depicted on maps. The fauna inventory should focus on mammals, birds and fish but include available data on other taxa. The flora inventory should focus on vegetation types with a description of the composing species. Satellite imagery may be required for this task;

(b) Assess the national and international importance of the flora and fauna of the Aral Sea basin on the basis of uniqueness, level of endemism etc;

(c) Assess the international importance of habitats for migratory species, paying particular attention to flyways of migratory birds;

(d) Advise on the management and protection of important habitats and species;

Water Quality of the Aral Sea

(a) Collect available data on the water quality of the Aral Sea, in particular salts, heavy metals, agrochemicals and pollutants;

(b) Carry out additional water quality analyses of these parameters by collecting samples in the field;

(c) Investigate the possible dumping of chemicals by Soviet factories in the Aral Sea and eventually carry out targeted analyses to determine the concentrations of these chemicals;

(d) Advise on the requirements and possible methods for improving the water quality to such an extent that a reasonably healthy and productive ecosystem can be restored in the Aral Sea;

Limnology of the Aral Sea

(a) Assess mixing patterns and stratification of the different water masses in the Aral Sea;

(b) Build, if necessary, a hydrological model of the Sea and collect data for this purpose;

(c) Assess the feasibility of restoration of the water quality of the Aral Sea in case sufficient fresh water becomes available;

Climate Change

(a) Advise on the extent and probability of climate change caused by the desiccation of the Aral Sea. This may require development of a climate model;

V. TIME SCHEDULE AND REPORTING

18. In view of the extensive volume of data on the Aral Sea and its basin, collected by various research institutions in the Aral Sea region, it is desirable that twinning arrangements are made between foreign consultants or a foreign consultant firm and local consultants or a local institution. In most cases, a cost effective way of carrying out the various projects would be to have longer term data gathering and field work carried out by local institutions.

19. The Environmental Studies are expected to take one year.

VI. PROPOSED BUDGET

20. The manpower requirements for the preparatory phase have been estimated below:

		Manmonths	
Item	Qualifications	Foreign	Local
Salt and Dust Storms	Wind Erosion Expert	5	24
Biodiversity Assessment	Zoologist	4	12
	Ornithologist	6	24
	Ichthyologist	2	12
	Botanist	4	24
Water Quality	Water Quality Expert	4	12
	Chemical Analyst	4	12
Limnology	Limnologist	3	8
	Hydrological Modeler	2	8
Climate	Climatic Modeler\ Meteorologist	4	12
	Total	**38**	**148**

21. Based on the above manpower requirements the following budget is anticipated.

	Cost in US Dollars		
	Local	Foreign	Total
Local Consultants	59,200	-	59,200
Foreign Consultants	-	760,000	760,000
International Travel	-	55,000	55,000
Local Travel	80,000	-	80,000
Training	-	30,000	30,000
Equipment	-	85,000	85,000
Miscellaneous	-	26,000	26,000
Total	149,200	956,000	1,095,200

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 5

Projects:

1. Clean Water, Sanitation and Health - Uzbekistan (short-term)
2. Clean Water, Sanitation and Health - Turkmenistan (short-term)
3. Clean Water, Sanitation and Health - Kazakhstan (short-term)
4. Clean Water, Sanitation and Health (medium-term)
5. Long-term Water Supply and Wastewater Management

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5

To prepare and implement intergovernmental programs "Clean Water and Health," which provide for supplying the affected population in the Central Asian countries with good quality drinking water and improving the sanitary and epidemiological situation in the country.

Project 1: Clean Water, Sanitation and Health - Uzbekistan (short-term)

PROJECT BRIEF

I. BACKGROUND

1. This project is a part of the operations program approved by the Heads of State for the Phase 1 Aral Sea Program. It is one of several responses to the unsatisfactory living conditions in the disaster zone, which are characterized in part by lack of potable water, inadequate sanitation, and high rates of waterborne diseases. It focuses upon smaller communities in Uzbekistan; other projects will address similar water supply and sanitation needs in Kazakhstan and Turkmenistan, and similar needs of urban areas in the region. These are described in separate project briefs within Program 5.

2. People residing in the Amu Darya Delta have historically drawn their water from rivers and canals, which until the 1960's was of satisfactory quality. As the surface water quality deteriorated due to upstream agricultural, industrial and community activities, community water supplies became increasingly polluted with mineral, bacterial, and chemical constituents. Communities turned to ground water sources but eventually found that ground water also was contaminated because of hydraulic links to surface water.

3. The use of contaminated water had profound health effects as evidenced by the high rates of typhoid, paratyphoid, viral hepatitis and dysentery in the target area. Infant mortality is a universally accepted indicator of community health: while declining nationwide to about 24.2 per thousand live births, it is increasing in the target area and at present stands at about 50 per thousand.

4. Authorities have taken measures to correct the situation. These included the drilling of deeper wells, using groundwater recharge systems for storing surface water in the four month period when its quality is satisfactory, and treating mineralized water with desalination devices. These measures met with mixed success in part because of operational difficulties and the novel nature of the technologies applied. At present half of the people are served by these systems.

II. OBJECTIVES

5. The objectives of the project are to urgently stabilize and improve the water-related health situation of the population in the disaster zone through:

(i) the rapid provision of safe water for drinking and household use;

(ii) the rapid provision of appropriate sanitation facilities; and

(iii) raising the population's awareness to the role that water and sanitation play in improving health, thereby promoting proper use of facilities and insuring long-term sustainability.

III. SCOPE

6. The project consists of physical works for water supply and sanitation, and water-related institutional development, health education and applied research, as follows:

(i) Activities related to water supply including:
- rehabilitation and expansion of existing ground water supply systems;
- construction of new ground water supply systems;
- ground water exploration as necessary for the above activities;
- water treatment and distribution.

(ii) Activities related to sanitation including the upgrading of existing and construction of new sanitation facilities.

(iii) Institutional development to assure sustainability of the above facilities through community involvement, organizational strengthening and training for operation and maintenance.

(iv) Health and hygiene education to maximize health benefits.

(v) Applied research related to artificial recharge, including contaminate degradation during storage; treatment technology; the feasibility of metering and billing on the basis of volumetric consumption; and the sustainable delivery of water supply service.

(vi) Equipment for monitoring and analysis.

IV. OUTPUTS

7. The project would produce physical works for water supply and sanitation and would develop water-related institutions. Health and hygiene education would be provided to maximize health benefits.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

8. The feasibility study for the program is expected to be carried out by the local design and research centers, in joint venture with foreign consultants. the completion of the feasibility study and designs to permit appraisal would take about nine months. Implementation of the physical works would take about three years.

9. There are several activities by others which have elements similar to those of this project. They offer learning and cooperation opportunities but they do not solve the water supply problem on a large scale. They are:

(i) The European Community proposal for a study of the willingness to pay for water to provide a better understanding of the social and economic aspects of water supply. The study would take four months and involve 15 local and 4 foreign staff months.

(ii) The German Red Cross has provided a reverse osmosis treatment plant for the town of Tukhtakupur which has been operating for about one year. Performance results are not available at this time.

(iii) GTZ of Germany has an ongoing study on the status of the potable water supply sector in Uzbekistan which would be completed by January 1995. It also proposes a pilot project for a new water supply system, including water treatment and consumer metering, for an unspecified town of about 5,000 people.

(iv) Uzbekgidrogeologia has submitted a request for Japanese funds for a US$ 20 million project which would benefit 400,000 people in Kavakalpakia through the installation of 100 desalinization devices on 50 existing wells and 50 new wells, and the installation of three new artificial recharge facilities.

VI. RESOURCES

10. Preparation Costs

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	100,000	-	100,000
Foreign Personnel (Incl. travel)	-	625,000	625,000
Training Personnel	-	70,000	70,000
Equipment, Materials	-	30,000	30,000
Total	10,000	725,000	825,000

11. The cost of implementing the project would be about US$ 18 million.

VII. JUSTIFICATION

12. The precarious health of the 3.5-4 million inhabitants of the Aral Sea disaster zone is a major concern of their national governments, international organizations and of course, the people in the disaster zone. Therefore, of utmost urgency is the rapid implementation of the potable water and sanitation/sewerage program components, which will improve the health situation in the disaster zone over the short to long term.

VIII. ISSUES

13. Technology. At the reconnaissance level it appears that the present technologies, i.e., the use of naturally or artificially recharged ground water with desalination treatment and chlorination, are the most cost-effective means for providing safe drinking water. During the project preparation phase these technologies would be analyzed and compared with alternative possibilities including but not limited to:

(i) The use of groundwater which meets drinking water standards without treatment (other than disinfection) through the sustainable exploitation of high quality ground water lenses should they exist. Accordingly there would be a review of ground water data to investigate the possible presence of high quality lenses and ascertain their sustainable yields.

(ii) The choice of alternative desalination technologies, include, but are not limited to, reverse osmosis and ion exchange. Desalinization technologies would be compared on the basis of performance, initial and recurrent costs, ease of operation (including pretreatment if necessary), availability of electricity, chemicals and spare parts, and reliability. A further consideration regarding treatment choice is the ability of the process to remove agrochemical and industrial waste constituents should they be in the raw water.

(iii) The extent to which synthetic organic compounds and other contaminants are degraded or removed when stored in artificially recharged ground water reservoirs. The subsequent treatment system would have to adequately treat the retrieved water if and as necessary, hence this question is relevant to the design of the treatment system.

(iv) The level of service and the means of delivery. The choice of technology is influenced by the desired quantity of potable water to be supplied. One option is to provide 50 - 90 liters per capita per day of water which meets the standard in every respect. Another

option is to provide 5 lpcd at the standard for drinking and cooking, and the balance at less than standard for bathing, laundry and household purposes. (Under this option existing systems which supply unsafe water could be retained for non-potable purposes). Under either option water could be made available through house connections, yard taps, standposts or, for the 5 lpcd option, plastic containers. These (and other potentially viable) alternatives would be analyzed in terms of feasibility, cost, sustainability, and, through consultation with prospective consumers, acceptability to users.

(v) The choice of pipe material. In the past transmission and distribution pipe has been made of steel. Alternative materials will be investigated and compared in terms of cost, reliability and expected life.

(vi) Water metering. Water is used wastefully at present because consumer are not attuned to the fact that water is an economic good. Charging for water based upon the metered volume consumed is universally accepted as the best means for promoting conservation, but a successful metering program requires a sound institutional structure and is costly to implement. There are other ways of promoting conservation, and alternatives would be examined.

14. Sustainability. The history of foreign assisted water supply and sanitation projects is replete with failures because once in place, the systems were not sustained. Failures occur for a variety of reasons including consumer indifference, institutional weakness, lack of managerial and technical skills, and inadequate funds for operation and maintenance. Successful, sustainable projects are characterized by consumers who have participated in the planning process and who can afford and are willing to pay for the service, and by delivery institutions which are at the community level where consumers can influence performance. Therefore it is imperative that the consumers participate in the design of the project, that there be a mechanism for the recovery of at least a part of costs based upon ability to pay (see above discussion on metering and paragraph 9 (i) regarding proposed EC study on willingness to pay), and that supplemental funds, if needed, come from an assured and sustained source. The possible use of community-based or privatized delivery organizations would be investigated and, if appropriate, encouraged.

15. Coordination. The Government and its agencies have been discussing and implementing various projects and technical assistance activities with several external donors, and there appears to be overlaps among the various activities. This project must be prepared with complete knowledge of and in harmony with the programs of others. Ultimate responsibility for this rests with the government counterparts who are responsible for the preparation of this project.

16. After consideration of the above issues and alternatives a final project would be selected and designed. The project would have the following characteristics: (i) reliable and consistent delivery of potable water; (ii) cost-effectiveness, in that it maximizes the numbers of communities and people served within the budget (the amount of which would be determined upon completion of the preparation study); (iii) is accepted and engenders a sense of ownership by the community; (iv) is readily operated and maintained at the local level; and (v) would not be pre-empted by other near-term water improvements under the Aral Sea or other programs.

Heads of States Approved Program No. 5
Project 1: Clean Water, Sanitation and Health - Uzbekistan (short-term)

TERMS OF REFERENCE

I. BACKGROUND

1. These Terms of Reference are to prepare an investment project whose objectives are to urgently stabilize and improve the unsatisfactory water-related health situation of the population in the Uzbekistan portion of the disaster zone through:

a. the rapid provision of safe water for drinking and household use;
b. the rapid provision of appropriate sanitation facilities; and
c. raising the population's awareness to the role water and sanitation plays in improving health, thereby promoting proper use of the facilities and ensuring long-term sustainability.

II. OBJECTIVES

2. The objectives of the work covered by these Terms of Reference are to:

a. identify, plan and design a program of water supply rehabilitation and expansion;
b. identify, plan and design a program for the provision of appropriate sanitation, including environmentally sound removal of wastewater;
c. design a program for health and hygiene education to maximize the benefits of the above investments;
d. design an institutional development program which would help to ensure the long-term sustainability of the investments and maximize the expected health benefits; and
e. design an applied research program which addresses areas of technical and institutional uncertainty.

III. SCOPE OF WORK

Note: The scope of work described below is indicative of the work required to fulfill the objectives of this undertaking. It is possible that, during the course of the work, new or supplemental information will become available to require modification of the work program in order to fulfill the objectives.

3. To accomplish objective 2(a):

- compile and evaluate information on the existing water supply situation with regards to source, treatment and distribution facilities including capacities, performance, state of repair and operational difficulties, the ability to meet consumer needs and their suitability for expansion;

- estimate the demand for water supply and the willingness to pay for alternative levels and quality of service (note that the European Community may undertake a "willingness to pay" study which may provide useful information in this regard, see the Project Brief);

- use the above information to plan, in consultation with community groups, a program of water supply improvements;

- prepare cost estimates, designs, specifications and contract documents for the proposed facilities and related equipment.

4. To accomplish objective 2(b):

- compile and evaluate information about present facilities used for sanitation and wastewater management including their level of use, acceptance by consumers, and their suitability for community health and environmental protection;

- use the above information to plan, in consultation with community groups, a program of sanitation and wastewater management improvements;

- prepare cost estimates, designs, specifications and contract documents for the proposed facilities and related equipment.

5. To accomplish objective 2(c): design a program for health and hygiene education which would maximize the use of existing health education institutional and physical infrastructure, and be coordinated with similar programs of other assistance agencies.

6. To accomplish objective 2(d):

- analyze present institutional arrangements, with particular regard to the responsibilities, coordination, staffing, management and effectiveness of the various agencies involved in planning, construction and operation of water supply, sanitation, health and community development in the region;

- in consultation with the Steering Committee for this study, design an institutional arrangement for the implementation of

the project and for subsequent operation and maintenance. O and M in particular should be done at the lowest appropriate level, possibly employing user groups or the private sector. Special attention should be given to the long-term sustainability of the systems, hence the institutional arrangement should provide a sense of ownership on the part of the consumer and provide reliable sources of funds for O and M.

- design a program for capacity building, addressed in particular to the institutions and staff responsible for O and M.

7. Outline a program of applied research which addresses questions that are particular to the water supply, sanitation and health sectors of the region and which are of near-term concern to the sectoral agencies.

8. Describe the positive and negative environmental impacts of the project. Prepare monitoring program and a plan for mitigation of residual impacts.

9. In carrying out the above work, address as appropriate the issues described in the Issues section of the Project Brief.

IV. DESIGN OF TASKS

10. Outputs will include:

a. an inception report which presents a work plan and schedule, the relative roles of local and foreign staff, the process of consultation with concerned institutions, and comments on (and, if appropriate, recommended changes to) these Terms of Reference.

b. Special reports on, for example, health education and institutional development. These would be presented in workshops to engender discussion, participation and feedback.

c. Training sessions as agreed with the client in subjects such as demand analysis and willingness to pay, economic analysis and financial sustainability.

d. Feasibility report for the full project including technical, financial, institutional, economic, social and environmental analysis. (This need not duplicate information in special reports).

e. Preliminary and final designs, specifications, and contract documents.

V. TIME SCHEDULE AND REPORTING

11. The contract period would be nine months. At month six there should be sufficient information to permit appraisal of the project. This would include the feasibility report in draft as well as well as designs to permit the preparation of costs estimates to +- 15%.

12. To fulfill these Terms of Reference would require an estimated 250 staff months of local and 25 staff months of foreign personnel. In addition to engineers and technicians, the staffing list would expertise in economics, hygiene education, sanitation planning community development, and institutional analysis.

VI. PROPOSED BUDGET

13. Preparation cost.

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	100,000	-	100,000
Foreign Personnel (Incl. travel)	-	625,000	625,000
Training Personnel	-	70,000	70,000
Equipment, Materials	-	30,000	30,000
Total	10,000	725,000	825,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5

To prepare and implement intergovernmental programs "Clean Water and Health" which provides for supplying the affected population in the Central Asian countries with good quality drinking water and improving the sanitary and epidemiological situation in the country.

Project 2: Clean Water, Sanitation and Health - Turkmenistan (short-term)

PROJECT BRIEF

I. BACKGROUND

1. This project is a part of the operations program approved by the Heads of State for the Phase I Aral Sea Program. It is one of several responses to the unsatisfactory living conditions in the disaster zone, which are characterized in part by lack of potable water, inadequate sanitation, and high rates of waterborne diseases. It focuses upon smaller communities in the Tashauz (Khorezm Region) of Turkmenistan; other projects will address similar water supply and sanitation needs in Kazakhstan and Uzbekistan, and similar needs of urban areas in the region. These are described in separate Project Briefs within Program 5.

2. People residing in the Amu Darya Delta have historically drawn their water from rivers and canals, which until the 1960's was of satisfactory quality. As the surface water quality deteriorated due to upstream agricultural, industrial and community activities, community water supplies became increasingly polluted with mineral, bacterial, and chemical constituents. Communities turned to ground water sources but eventually found that ground water also was contaminated because of hydraulic links to surface water.

3. The use of contaminated water had profound health effects as evidenced by the high rates of typhoid, paratyphoid, viral hepatitis and dysentery in the target area. Infant mortality is a universally accepted indicator of community health: it is 56.4 per 1000 live births in all Turkmenistan and 75.2 in Tashauz.

4. Authorities have taken measures to correct the situation. These included the drilling of deeper wells, using groundwater recharge systems for storing surface water in the four month period when its quality is satisfactory, and treating mineralized water with desalination devices. These measures met with mixed success in part because of operational difficulties and the novel nature of the technologies applied. At present half of the people are served by these systems.

II. OBJECTIVES

5. The objectives of the project are to urgently stabilize and improve the water-related health situation of the population in the disaster zone through:

(i) the rapid provision of safe water for drinking and household use;

(ii) the rapid provision of appropriate sanitation facilities; and

(iii) raising the population's awareness to the role water and sanitation play in improving health, thereby promoting proper use of facilities and ensuring long-term sustainability.

III. SCOPE

6. The project consists of physical works for water supply and sanitation, and water-related institutional development, health education and applied research, as follows:

(i) Activities related to water supply including:

- rehabilitation and expansion of existing ground water supply systems;
- construction of new ground water supply systems;
- ground water exploration as necessary for the above activities;
- water treatment and distribution.

(ii) Activities related to sanitation including the upgrading of existing and construction of new sanitation facilities.

(iii) Institutional development to assure sustainability of the above facilities through community involvement, organizational strengthening and training for operation and maintenance.

(iv) Health and hygiene education to maximize health benefits.

(v) Applied research related to artificial recharge, including contaminate degradation during storage; treatment technology; the feasibility of metering and billing on the basis of volumetric consumption; and the sustainable delivery of water supply service.

(vi) Equipment for monitoring and analysis.

IV. OUTPUTS

7. The project would produce physical works for water supply and sanitation and would develop water-related institutions. Health and hygiene education would be provided to maximize health benefits.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

8. The feasibility study for the program is expected to be carried out by the local design and research centers, in joint venture with foreign consultants. The completion of the feasibility study and designs to permit appraisal would take about nine months. Implementation of the physical works would take about three years.

9. There are several activities by others which have elements similar to those of this project. They offer learning and cooperation opportunities but they do not solve the water supply problem on a large scale. They are:

(i) The European Community proposal for a study of the willingness to pay for water to provide a better understanding of the social and economic aspects of water supply. The study would take four months and involve 15 local and 4 foreign staff months.

(ii) The German Red Cross has provided a reverse osmosis treatment plant for the town of Tukhtakupur which has been operating for about one year. Performance results are not available at this time.

(iii) GTZ of Germany has an ongoing study on the status of the potable water supply sector in Uzbekistan which would be completed by January 1995. It also proposes a pilot project for a new water supply system, including water treatment and consumer metering, for an unspecified town of about 5000 people.

(iv) Uzbekgidrogeologia has submitted a request for Japanese funds for a US$ 20 m project which would benefit 400,000 people in Karakalpakia through the installation of 100 desalinization devices on 50 existing wells and 50 new wells, and the installation of three new artificial recharge facilities.

VI. RESOURCES

10. Preparation Costs

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	100,000	-	100,000
Foreign Personnel (Incl. travel)	-	625,000	625,000
Training Personnel	-	70,000	70,000
Equipment, Materials	-	30,000	30,000
Total	10,000	725,000	825,000

11. The cost of implementing the project would be about US$18 million.

VII. JUSTIFICATION

12. The precarious health of the 3.5-4 million inhabitants of the Aral Sea disaster zone is a major concern of their national governments, international organizations and of course, the people in the disaster zone. Therefore, of utmost urgency is the rapid implementation of the potable water and sanitation/sewerage program components, which will improve the health situation in the disaster zone over the short to long term.

VIII. ISSUES

13. Technology. At the reconnaissance level it appears that the present technologies, i.e., the use of naturally or artificially recharged ground water with desalination treatment and chlorination, are the most cost-effective means for providing safe drinking water. During the project preparation phase these technologies would be analyzed and compared with alternative possibilities including but not limited to:

(i) The use of groundwater which meets drinking water standards without treatment (other than disinfection) through the sustainable exploitation of high quality ground water lenses should they exist. Accordingly there would be a review of ground water data to investigate the possible presence high quality lenses and ascertain their sustainable yields.

(ii) The choice of alternative desalination technologies, which include but are not limited to reverse osmosis and ion exchange. Desalinization technologies would be compared on the basis of performance, initial and recurrent costs, ease of operation (including pretreatment if necessary), availability of electricity, chemicals and spare parts, and reliability. A further consideration regarding treatment choice is the ability of the process to remove agrochemical and industrial waste constituents should they be in the raw water.

(iii) The extent to which synthetic organic compounds and other contaminants are degraded or removed when stored in artificially recharged ground water reservoirs. The subsequent treatment system would have to adequately treat the retrieved water if and as necessary, hence this question is relevant to the design of the treatment system.

(iv) The level of service and the means of delivery. The choice of technology is influenced by the desired quantity of potable water to be supplied. One option is to provide 50 - 90 liters per capita per day of water which meets the standard in every respect.

Another option is to provide 5 lpcd at the standard for drinking and cooking, and the balance at less than standard for bathing, laundry and household purposes. (Under this option existing systems which supply unsafe water could be retained for non-potable purposes). Under either option water could be made available through house connections, yard taps, standposts or, for the 5 lpcd option, plastic containers. These (and other potentially viable) alternatives would be analyzed in terms of feasibility, cost, sustainability, and, through consultation with prospective consumers, acceptability to users.

(v) The choice of pipe material. In the past transmission and distribution pipe has been made of steel. Alternative materials will be investigated and compared in terms of cost, reliability and expected life.

(vi) Water metering. Water is used wastefully at present because consumers are not attuned to the fact that water is an economic good. Charging for water based upon the metered volume consumed is universally accepted as the best means for promoting conservation, but a successful metering program requires a sound institutional structure and is costly to implement. There are other ways of promoting conservation, and alternatives would be examined.

14. Sustainability. The history of foreign assisted water supply and sanitation projects is replete with failures because once in place, the systems were not sustained. Failures occur for a variety of reasons including consumer indifference, institutional weakness, lack of managerial and technical skills, and inadequate funds for operation and maintenance. Successful, sustainable projects are characterized by consumers who have participated in the planning process and who can afford and are willing to pay for the service, and by delivery institutions which are at the community level where consumers can influence performance. Therefore it is imperative that the consumers participate in the design of the project, that there be a mechanism for the recovery of at least a part of costs based upon ability to pay (see above discussion on metering and paragraph 9 (i) regarding proposed EC study on willingness to pay), and that supplemental funds, if needed, come from an assured and sustained source. The possible use of community-based or privatized delivery organizations would be investigated and, if appropriate, encouraged.

15. Coordination. The government and its agencies have been discussing and implementing various projects and technical assistance activities with several external donors, and there appear to be overlaps among the various activities. This project must be prepared with complete knowledge of and in harmony with the programs of others. Ultimate responsibility for this rests with the

government counterparts who are responsible for the preparation of this project.

16. After consideration of the above issues and alternatives a final project would be selected and designed. The project would have the following characteristics: (i) reliable and consistent delivery of potable water; (ii) cost-effectiveness, in that it maximizes the numbers of communities and people served within the budget (the amount of which would be determined upon completion of the preparation study); (iii) is accepted and engenders a sense of ownership by the community; (iv) is readily operated and maintained at the local level; and (v) would not be pre-empted by other near-term water improvements under the Aral Sea or other programs.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5
Project 2: Clean Water, Sanitation and Health - Turkmenistan (short-term)

TERMS OF REFERENCE

I. BACKGROUND

1. These Terms of Reference are to prepare an investment project whose objectives are to urgently stabilize and improve the unsatisfactory water-related health situation of the population in the Turkmenistan portion of the disaster zone through:

a. the rapid provision of safe water for drinking and household use;

b. the rapid provision of appropriate sanitation facilities; and

c. raising the population's awareness to the role water and sanitation plays in improving health, thereby promoting proper use of the facilities and ensuring long-term sustainability.

II. OBJECTIVES

2. The objectives of the work covered by these Terms of Reference are to:

a. identify, plan and design a program of water supply rehabilitation and expansion;

b. identify, plan and design a program for the provision of appropriate sanitation, including environmentally sound removal of wastewater;

c. design a program for health and hygiene education to maximize the benefits of the above investments;

d. design an institutional development program which would help to ensure the long-term sustainability of the investments and maximize the expected health benefits; and

e. design an applied research program which addresses areas of technical and institutional uncertainty.

III. SCOPE OF WORK

Notice: The scope of work described below is indicative of the work required to fulfill the objectives of this undertaking. It is possible that, during the course of the work, new or supplemental information will become available to require modification of the work program in order to fulfill the objectives.

3. To accomplish objective 2 (a):

- compile and evaluate information on the existing water supply situation with regards to source, treatment and distribution facilities including capacities, performance, state of repair and operational difficulties, the ability to meet consumer needs and their suitability for expansion;

- estimate the demand for water supply and the willingness to pay for alternative levels and quality of service (note that the European Community may undertake a "willingness to pay" study which may provide useful information in this regard, see the Project Brief);

- use the above information to plan, in consultation with community groups, a program of water supply improvements;

- prepare cost estimates, designs, specifications and contract documents for the proposed facilities and related equipment.

4. To accomplish objective 2 (b):

- compile and evaluate information about present facilities used for sanitation and wastewater management including their level of use, acceptance by consumers, and their suitability for community health and environmental protection;

- use the above information to plan, in consultation with community groups, a program of sanitation and wastewater management improvements;

- prepare cost estimates, designs, specifications and contract documents for the proposed facilities and related equipment.

5. To accomplish objective 2 (c) design a program for health and hygiene education which would maximize the use of existing health education institutional and physical infrastructure, and be coordinated with similar programs of other assistance agencies.

6. To accomplish objective 2 (d):

- analyze present institutional arrangements, with particular regard to the responsibilities, coordination, staffing, management and effectiveness of the various agencies involved in planning, construction and operation of water supply, sanitation, health and community development in the region;

- in consultation with the Steering Committee for this study, design an institutional arrangement for the implementation of the project and for subsequent operation and maintenance. O and M in particular should be done at the lowest appropriate level, possibly employing user groups or the private sector. Special attention should be given to the long-term sustainability of the systems, hence the institutional arrangement should provide a sense of ownership on the part of the consumer and provide reliable sources of funds for O and M.

- design a program for capacity building, addressed in particular to the institutions and staff responsible for O and M.

7. Outline a program of applied research which addresses questions that are particular to the water supply, sanitation and health sectors of the region and which are of near-term concern to the sectoral agencies.

8. Describe the positive and negative environmental impacts of the project. Prepare monitoring program and a plan for mitigation of residual impacts.

9. In carrying out the above work, address as appropriate the issues described in the Issues section of the Project Brief.

IV. DESIGN OF TASKS

10. Outputs will include:

a. an inception report which presents a work plan and schedule, the relative roles of local and foreign staff, the process of consultation with concerned institutions, and comments on (and, if appropriate, recommended changes to) these Terms of Reference.

b. Special reports on, for example, health education and institutional development. These would be presented in workshops to engender discussion, participation and feedback.

c. Training sessions as agreed with the client in subjects such as demand analysis and willingness to pay, economic analysis and financial sustainability.

d. Feasibility report for the full project including technical, financial, institutional, economic, social and environmental analysis. (This need not duplicate information in special reports).

e. Preliminary and final designs, specifications, and contract documents.

V. TIME SCHEDULE AND REPORTING

11. The contract period would be nine months. At month six there should be sufficient information to permit appraisal of the project. This would include the feasibility report in draft as well as well as designs to permit the preparation of costs estimates to +- 15%.

VI. PROPOSED BUDGET

12. To fulfill these Terms of Reference would require an estimated 250 staff months of local and 25 staff months of foreign personnel. In addition to engineers and technicians, the staffing list would expertise in economics, hygiene education, sanitation planning community development, and institutional analysis. The budget has been estimated at:

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	100,000	-	100,000
Foreign Personnel (Incl. travel)	-	625,000	625,000
Training Personnel	-	70,000	70,000
Equipment, Materials	-	30,000	30,000
Total	10,000	725,000	825,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5

To prepare and implement intergovernmental programs "Clean Water and Health" which provides for supplying the affected population in the Central Asian countries with good quality drinking water and improving the sanitary and epidemiological situation in the country.

Project 3: Clean Water, Sanitation and Health - Kazakhstan (short-term)

PROJECT BRIEF

I. BACKGROUND

1. This project is a part of the operations program approved by the Heads of State for the Phase I Aral Sea Program. It is one of several responses to the unsatisfactory living conditions in the disaster zone, which are characterized in part by lack of potable water, inadequate sanitation, and high rates of waterborne diseases. It focuses upon the districts of Aralsk and Kazalinsk in the Kzylorda region of Kazakhstan; other projects will address similar water supply and sanitation needs in disaster zones of Uzbekistan and Turkmenistan. These are described in separate Project Briefs within Program 5.

2. There are 150,000 people living in the districts of Aralsk and Kazalinsk. Historically drinking water was drawn from rivers and canals, which until the 1960's was of satisfactory quality. As the surface water quality deteriorated due to upstream agricultural, industrial and community activities, water supplies became increasingly polluted with mineral, bacterial, and chemical constituents and communities subsequently turned to ground water sources.

3. The use of contaminated water had profound health effects as evidenced by the high rates of typhoid, paratyphoid, viral hepatitis and dysentery in the region. Infant mortality is a universally accepted indicator of community health, and the rate is considerably higher in the disaster zone than nation-wide.

4. Fortunately there is an alternative to traditional water sources. There is a large reserve of fresh ground water at Sarybulak, 90 km north west of Aralsk, and some 11 wells have been developed to depths of 250 m - 260 m with a combined yield of 20,000 cu m/d (1993 data). Aralsk is served by this source through a 90 km 1000 mm pipeline and an additional line is proposed for service to Kazalinsk.

5. Neither Aralsk or Kazalinsk have wastewater systems. A means of managing the wastewater created by the introduction of additional piped water supply must be found and developed.

II. OBJECTIVES

6. The objectives of the project are to urgently stabilize and improve the water-related health situation of the population in the target area through:

(i) the provision of safe water for drinking and household use;
(ii) the provision of appropriate sanitation or wastewater facilities; and
(iii) raising the population's awareness to the role that water and sanitation play in improving health, thereby promoting proper use of facilities and ensuring long-term sustainability.

III. SCOPE

7. The project consists of studies and works for water supply and sanitation, water-related institutional development and health education, as follows:

(i) Activities related to water supply including:

- demand and willingness to pay analysis;
- assessment of present source and distribution facilities;
- review of ground water data and further investigations as may be necessary to establish sustainable yields in terms of quantity and quality;
- rehabilitation and expansion of existing and construction of new ground water source and transmission systems;
- water treatment as necessary;
- distribution system expansion.

(Notice: the US Government may fund water supply facilities in this area and coordination is required).

(ii) Activities related to sanitation include a review of the present sanitation situation, analysis of need and willingness to pay for sanitation and sewerage, and the upgrading of existing and construction of new sanitation facilities.

(iii) Institutional development to assure sustainability of water supply and sanitation/sewerage facilities through community involvement, organizational strengthening and capacity building for operation and maintenance.

(iv) Health and hygiene education to maximize health benefits. (Notice: the US Government may fund a health program in this area and coordination is required).

(v) Applied research on selected subjects including the protection of aquifers from contamination and the feasibility of metering and billing on the basis of volumetric consumption.

(vi) Equipment for monitoring and analysis.

8. The final project as selected and designed would have the following characteristics: (i) reliable and consistent delivery of potable water from a sustainable source; (ii) cost-effectiveness, in that it maximizes the numbers of communities and people served within the budget (the amount of which would be determined upon completion of the preparation study); (iii) is accepted and engenders a sense of ownership by the community; (iv) is readily operated and maintained at the local level; and (v) would not be pre-empted by other near-term water improvements under the Aral Sea or other programs.

IV. OUTPUTS

9. The project would study and produce works for water supply and sanitation and would develop water-related institutions. Health and hygiene education would be provided to maximize health benefits.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

10. The feasibility study for the project is expected to be carried out by the local design and research centers, in joint venture with foreign consultants. The contract duration would be about 15 months, with the draft feasibility study and designs to permit appraisal available at the twelfth month. Implementation of the physical works would take about three years.

11. There are several activities by others which have elements similar to those of this project which offer learning and cooperation opportunities. They are:

(i) The European Community proposal for a study of the willingness to pay for water to provide a better understanding of the social and economic aspects of water supply. The study would take four months and involve 15 local and 4 foreign staff months.

(ii) The US government plans to implement a potable water and public health project in 1994-1995. Among other things, it would construct 100 km of distribution pipe in the cities of Aralsk and Kazalinsk.

VI. RESOURCES

12. Preparation Costs

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	160,000	-	160,000
Foreign Personnel (Incl. travel)	-	1,025,000	1,025,000
Training Personnel	-	30,000	30,000
Equipment, Materials	-	40,000	40,000
Total	160,000	1,095,000	1,255,000

13. The cost of implementing the project would be about US$25 million.

VII. JUSTIFICATION

14. The precarious health of the 3.5-4 million inhabitants of the Aral Sea disaster zone is a major concern of their national governments, international organizations and of course, the people in the disaster zone. Therefore, of utmost urgency is the rapid implementation of the potable water and sanitation/sewerage program components, which will improve the health situation in the disaster zone over the short to long-term.

VIII. ISSUES

15. Technology:

(i) Water may be supplied through house connections, yard taps, standposts or standpipes. Alternative means of service would be analyzed in terms of feasibility, cost, sustainability, and, through consultation with prospective consumers, acceptability and willingness to pay.

(ii) The choice of pipe material. In the past transmission and distribution pipe has been made of steel. Alternative materials will be investigated and compared in terms of cost, reliability and expected life.

(iii) Metering. Water is used wastefully at present because consumers are not attuned to the fact that water is an economic good. Charging for water based upon the metered volume consumed is universally accepted as the best means for promoting conservation, but a successful metering program requires a sound institutional structure and is costly to implement. There are other ways of promoting conservation, and alternatives would be examined.

16. Groundwater Resources. Data on ground water availability is limited. There is some uncertainty on the location, quality and sustainability of ground water resources, hence it will be necessary to explore and analyze prevailing conditions.

17. Sustainability. The history of foreign assisted water supply and sanitation projects is replete with failures because once in place, the systems were not sustained. Failures occur for a variety of reasons including consumer indifference, institutional weakness, lack of managerial and technical skills, and inadequate funds for operation and maintenance. Successful, sustainable projects are characterized by consumers who have participated in the planning process and who can afford and are willing to pay for the service, and by delivery institutions which are at the community level where consumers can influence performance. Therefore it is imperative that the consumers participate in the design of the project, that there be a mechanism for the recovery of at least a part of costs based upon ability to pay and that supplemental funds, if needed, come from an assured and sustained source. The possible use of community-based or privatized delivery organizations would be investigated and, if appropriate, encouraged.

18. Coordination. The government and its agencies have been discussing and implementing various project and technical assistance activities with several external donors, and there appear to be overlaps among the various activities. This project must be prepared with complete knowledge of and in harmony with the programs of others. Ultimate responsibility for this rests with the government counterparts who are responsible for the preparation of this project.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5
Project 3: Clean Water, Sanitation and Health - Kazakhstan (short-term)

TERMS OF REFERENCE

I. BACKGROUND

1. The poor drinking water quality in the districts of Aralsk and Kazalinsk of the Kzylorda region of Kazakhstan has been a significant cause of the high rates of disease there. In response authorities have found and developed a fresh ground water source at Sarybulak, some 90 km north west of Aralsk. Aralsk is now served in part by this well field, and an additional pipeline is proposed for service to Kazalinsk.

2. Neither Aralsk or Kazalinsk have wastewater systems. A means of managing wastewater there must be found and developed.

3. These Terms of Reference are to prepare an investment project whose objectives are to urgently stabilize and improve the unsatisfactory water-related health situation of the target population through:

a. the augmentation of safe water supply;

b. the provision of appropriate sanitation facilities; and

c. raising the population's awareness to the role water and sanitation plays in improving health, thereby promoting proper use of the facilities and ensuring long-term sustainability.

II. OBJECTIVES

4. The objectives of the work covered by these Terms of Reference are to:

a. identify, plan and design a program of water supply rehabilitation, augmentation and development including:

- the development of the Sarybulak well field, trunk and feeder mains to Aralsk and Kazalinsk together with feeders and distribution systems farms and small rural townships;

- the rehabilitation and expansion of the distribution systems in Aralsk and Kazalinsk;

- proposals for water supply to the rural townships and farms between Kazalinsk and Kyzl-Orda;

- analyze other potential sources (including the development of a well field to the North of Kyzl-Orda) and the water distribution systems in the town itself;

- analyze the feasibility of service to small townships and farms to the Southeast of Kyzl-Orda, but within the rayon of Kyzl-Orda;

- regarding the distribution system in Kyzl-Orda, the work is confined to an overview and identification of dominant problems and issues and the preparation of reconnaissance-level cost estimates.

b. identify, plan and design a program for the provision of appropriate sanitation, including environmentally sound removal of wastewater;

c. design a program for health and hygiene education to maximize the benefits of the above investments; and

d. design an institutional development program which would help to ensure the long-term sustainability of the investments and maximize the expected health benefits.

III. SCOPE OF WORK

Notice: The scope of work described below is indicative of the work required to fulfill the objectives of this undertaking. It is possible that, during the course of the work, new or supplemental information will become available to require modification of the work program in order to fulfill the objectives.

5. To accomplish objective 4 (a):

a. compile and evaluate information on the existing water supply situation with regards to source, treatment and distribution facilities including capacities, performance, state of repair and operational difficulties, the ability to meet consumer needs and their suitability for expansion. This work would include:

(i) review of investigations which have been carried out to determine the locations, size, quantity and quality of the ground water aquifers;

(ii) review the operating experiences with the well fields already commissioned;

(iii) determine the need for additional testing to determine the size and quality of the ground water aquifers in the Syr Darya delta from East of Kyzl Orda to Northwest of Aralsk. Comment on the possibility of artificial recharge. In the event of additional work being needed, the consultant will detail the requirement and supervise the drilling and testing program.

b. estimate the demand for water supply and the willingness to pay for alternative levels and quality of service (note that the European Community may undertake a "willingness to pay" study which may provide useful information in this regard, see the Project Brief);

c. Prepare an array of alternative water supply development possibilities including ground water from Sarybulak as currently being undertaken by government, local ground water (with or without treatment), surface water with treatment, localized vs. regional schemes, dual water supply systems (one supplying drinking water the other supplying lower quality water) etc. and evaluate them at reconnaissance level of detail for technical and economic viability and sustainability. Select and confirm a preferred alternative.

Should this review indicate the need to alter the proposed program of work the consultant should propose and discuss viable alternatives with the government and adjust the scope of work accordingly.

d. prepare cost-effective projects and subprojects which fulfill the objectives of paragraphs 3 and 4 and report on their feasibility in technical, economic, financial and institutional terms;

e. prepare cost estimates for investments, operations and maintenance;

f. prepare designs, specifications and contract documents for the proposed facilities and related equipment.

6. To accomplish objective 4 (b):

a. compile and evaluate information about present facilities used for sanitation and wastewater management including their level of use, acceptance by consumers, and their suitability for community health and environmental protection;

b. use the above information to plan, in consultation with community groups, a program and project for sanitation and wastewater management improvements and report on their feasibility in technical, economic, financial and institutional terms;

c. prepare cost estimates investments and operations and maintenance;

d. prepare designs, specifications and contract documents for the proposed facilities and related equipment.

7. To accomplish objective 4 (c) design a program for health and hygiene education which would maximize the use of existing health education institutional and physical infrastructure, and be coordinated with similar programs of other assistance agencies.

8. To accomplish objective 4 (d):

a. analyze present institutional arrangements, with particular regard to the responsibilities, coordination, staffing, management, costs and effectiveness of the various agencies involved in planning, construction and operation of water supply, sanitation, health and community development in the region;

b. in consultation with local governing bodies and other concerned agencies, propose institutional arrangements for water supply, sanitation and sewerage for the implementation of the project and for subsequent operation and maintenance. O and M in particular should be done at the lowest appropriate level, possibly employing user groups or the private sector. Special attention should be given to the long-term sustainability of the systems, hence the institutional arrangement should provide a sense of ownership on the part of the consumer and provide reliable sources of funds for O and M.

c. design a program for capacity building, addressed in particular to the institutions and staff responsible for O and M.

9. Describe the positive and negative environmental impacts of the project. Prepare an environmental monitoring program and a plan for mitigation of residual impacts.

10. In carrying out the above work, address as appropriate the issues described in the Issues section of the Project Brief. In addition consider:

a. the effects of realistic pricing on water demand;

b. the risks of depleting the ground water aquifers and their contamination with brackish water;

c. the possible need for and costs of water treatment to meet water quality standards.

d. the extent and quality of the construction work already undertaken and in progress;

e. the extent to which production and retail metering has been considered, and the feasibility of introducing metering; and

f. the extent to which urban and rural communities and the private sector can be mobilized (and are prepared to be involved) in the provision and operation of urban and rural water distribution systems and sanitation facilities together with potential for moving from community participation to community management of water distribution and sanitation systems.

g. In regard to operation and maintenance, the consultants should describe the resources needed, e.g. in terms of offices, depots, human resources development, staff, labor, laboratories, meters, equipment (vehicle, ect.), spares, material and finance.

IV. DESIGN OF TASKS

11. Outputs will include:

a. an inception report which presents a work plan and schedule, the relative roles of local and foreign staff, the process of consultation with concerned institutions, and comments on (and, if appropriate, recommended changes to) these Terms of Reference and scope of work.

b. Special reports on, for example, groundwater development, health education and institutional arrangements and development. Drafts of these would be presented in workshops to engender discussion, participation and feedback and they would be revised based upon this process.

c. Training sessions as agreed with the client in subjects such as geohydrology, ground water development, demand analysis/ willingness

to pay, economic and institutional analysis and financial sustainability.

d. Separate feasibility reports for water supply and sanitation/sewerage projects or subprojects covering technical, financial (including the potential for cost recovery), institutional, economic, social and environmental analysis. (This need not duplicate information in special reports).

e. Preliminary and final designs, specifications, and contract documents.

V. TIME SCHEDULE AND REPORTING

12. The contract period would be 15 months. At month 12 there should be sufficient information to permit appraisal of the project. This would include the feasibility reports in draft as well as well as designs to permit the preparation of costs estimates to +- 15%.

VI. RESOURCES

13. To fulfil these Terms of Reference would require an estimated 400 staff months of local and 41 staff months of foreign personnel. In addition to engineers and technicians, the staffing list would include expertise in economics, hygiene education, sanitation planning, community development, and institutional analysis.

14. Preparation Costs

	Cost in US Dollars		
	Local	Foreign	Total
Local Personnel	160,000	-	160,000
Foreign Personnel (Incl. travel)	-	1,025,000	1,025,000
Training Personnel	-	30,000	30,000
Equipment, Materials	-	40,000	40,000
Total	160,000	1,095,000	1,255,000

References

1. Aral Sea Program (Phase I), Informal Field Notes, World Bank/UNEP/UNDP, May - June 1993 Clean Water and Health - Kazakhstan

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5

To prepare and implement intergovernmental programs "Clean Water and Health" which provides for supplying the affected population in the Central Asian countries with good quality drinking water and improving the sanitary and epidemiological situation in the country.

Project 4: Medium Term Provision of Water Supply

PROJECT BRIEF

I. BACKGROUND

1. This project is prepared in accordance with the program approved by the Heads of States of the Aral Sea Basin Phase 1. It is one of the several responses to the unsatisfactory living conditions in the Disaster Zone located in the delta areas of the Amu Darya and the Syr Darya rivers. These areas are characterized in part by lack of potable water, inadequate sanitation, and high rates of waterborne diseases. It focuses upon populations in and around regional centers, towns and rural communities along the Amu Darya in the Aral Sea Disaster Zone. It addresses water supply and sanitation needs of Urgench region in Republic of Uzbekistan, Nukus region in Karakalpakia and Tashauz region in the Republic of Turkmenistan.

2. Approximately 2.3 million people, about 50:50 split between urban and rural, live on the Uzbekistan side and 1.2 million on the Turkmenistan side of the Disaster Zone in the Amu Darya river delta. People there historically draw their drinking water supply requirements from the river and its canals, which until the 1960's, was of satisfactory quality. Due to upstream agricultural, industrial and community activities, water supplies became increasingly polluted with mineral, bacterial and chemical substances. This is true of both surface and ground water sources because of the hydraulic link between them. The discharge into the river of highly-mineralized, pesticide containing drainage waters from agricultural lands, significant reduction in run-off volume through excessive withdrawals for irrigation, compounded by steadily increasing municipal and industrial effluents, are the main reasons for the deterioration of water quality.

3. The use of contaminated water had profound health effects as evidenced by the unusually high rates of typhoid, paratyphoid, viral hepatitis and dysentery in the target areas. Infant mortality rate, a universally accepted indicator of community health, is 59.9 in Karakalpakia, 39 in Khorezm region (capital Urgench city) and 72.2 per 1,000 live births in Tashauz region.

4. Despite the serious financial limitations, the republics of Uzbekistan, Turkmenistan and Karakalpakstan are undertaking a number of water supply and sanitation projects based on the Tuyumuyun/Kapras reservoir source, as follows:

WS Systems Components: Republic of Uzbekistan (Target population 2.3 million)

a) Kaparas Reservoir: Storage to be added to existing capacity from 550 to 900 million cum.
b) Proposed pumping chamber: To fill Kaparas Reservoir to higher TWL of 130m.
c) Pumping Chamber: To flush Kaparas Reservoir to prevent salinity build-up at its bed.
d) Water Treatment Plants: Existing capacity being extended from 370,000 to 1.14 million cum/day.
e) Water Transmission Lines: Existing and Proposed (for Khorezm region and Karakalpakstan).

Water Treatment Plant (cu/day)							Water Transmission Lines
WTP	Existing plant capacity from canal d/s hydrodam	Plant expansions based on Kaparas Reservoir				Proposed pipe linking plant with reservoir	
		Phase 1 Work in progress		Phase 2 Proposed			
		Add	Total	Add	Total		
Right Bank	170,000	170,000	340,000	200,000	540,000	Dual main 10 km, 1400 mm dia.	-Tuy-Nuk: 240 km, 1400 mm dia. -Nuk-Kun: 105 km, 1000 mm dia, river crossing at Nukus not yet built. -Kun-Muy: 70 km, 500 mm dia. -Muy-Tok: 110 km, 1020 to 500 mm dia.
Left Bank	200,000	200,000	400,000	200,000	600,000	Dual main 15 km, 1400 mm dia.	-Tuy-Urg: 2 lines each 72 km, 1200 dia. -Tuy-Khi: 65 km, 1000 dia. -Khi-Urg: 27 km, 800 to 500 mm dia. -Urg-Gur: 36.8 km, 1200 mm dia. -Gur-Man: 51 km, 800 mm dia. West and North of Urgench: 65 km (proposed)
Total	370,000	370,000	740,000	200,000	1,140,000		

Tuy: Tuyumuyun, Nuk: Nukus, Kun: Kungrad, Muy: Muynnak, Urg: Urgench, Khi: Khiva, Gur: Gurlin, Man: Mangit.

WS System Components: Republic of Turkmenistan (Target Population 1.2 million)

Water Treatment Plant			Water Transmission Line
Left Bank	Initial Phase	Second stage proposed	Length of Tuyunuyun-Tashauz water transmission line 180 km. 150 km completed as of 1993.
	109,000 cum/day 40% of work completed	118,000 cum/day	

5. Due to financial constraints, inflation and the non-availability of supplies and equipment, it has not been possible to fulfill the planned work in an organized manner. Civil and mechanical works are carried as and when finances become available. This has left some works unfinished and others proceeding slowly. At the current rate of construction, it is unlikely that the population in the Disaster Zone can be provided with potable water in the foreseeable future.

6. Water-borne sewerage is available in several towns, including the regional capitals of Nukus, Urgench and Tashauz. Approximately 300,000 people are served. The remaining urban population are served by septic tanks or pit latnies. For the medium term, it may be appropriate to confine work in the sanitation sector to optimizing systems which already exist; this and other options would be reviewed as part of the project preparation study.

II. OBJECTIVES

7. The objectives of the medium term program are to stabilize and improve water related health situation of population in the Disaster Zone through the following activities:

i) Develop community water supply and sanitation sewerage facilities in the urban and rural areas of the Amu Darya river delta to optimize sunk costs and ongoing programs.

ii) Raise the population's awareness to the role water and sanitation play in improving health, thereby promoting proper use of facilities and ensuring long-term sustainability.

iii) Identify a follow-up seven year program of development for water supply and sanitation for the period 1998 to 2005.

III. SCOPE

8. The project would consist of physical works for water supply and sanitation, and water related institutional development, health education, and applied research, as follow:

(i) Activities related to water supply including

Construction/completion of the water supply works indicated in the fore-mentioned table. In this regard the following studies are required:

(a) Analysis of source works at Tuyumuyun i.e., the pumping chamber and raw water mains to the downstream water treatment plants;

(b) The need for and timing of the proposed "flushing" and reservoir filling, pumping chamber at Kaparas reservoir;

(c) The need for a separate intake and pumping chamber to serve Tashauz feeder in Turkmenistan or whether a common intake pumping station may be built to serve the two republics.

(d) Review of the design of the existing treatment plants, operational aspects, and design of proposed extensions.

(e) Review of the design and suitability of the Nukus feeder main and booster pumping.

(f) Review of the proposal to continue the Nukus feeder to Muynak. The proposal to construct a 110 km, 500 mm diameter pipeline for a population less than 30,000 should be examined further in comparison to provision of a package desalination plant similar to one built at Tokhatakupyr by German Red Cross, of a capacity of 2,400 cu m/day.

(g) The design of 1,000 mm diameter river crossing west of Nukus and link-up with Kungrad main.

(h) As an alternative to development of source works in the form of Kaparas reservoir, a proposal to bring relatively more pure water from the upper reaches in basin (e.g. canal starting from Vaksh river intake at the main hydropower station casting Rubles 3.6 billion 1984 prices, or canal starting from Amu Darya river in the Uzbekistan Pogranichny range costing Rubles 2.5 billion 1984 prices, should be studied and evaluated in terms of the overall needs.

(ii) Activities related to sanitation/sewerage facilities for the rehabilitation, expansion and optimization of existing facilities in the three regional centers Nukus, Urgench and Tashauz. The oxidation ponds system nearing completion in Nukus for sewage treatment and disposal may be examined from the point of view of its applicability to other urban centers.

(iii) Institutional development to assure stainability of the above facilities through community involvement, organizational strengthening, and training for operation and maintenance.

(iv) Health and hygiene education to maximize health benefits.

(v) Applied research related to treatment technology and the feasibility of metering and billing on the basis of volumetric consumption.

IV. OUTPUTS

9. The project would produce studies and physical works related to water supply and sanitation and would build the capacity of water-related institutions. Health and hygiene education would be provided to maximize health benefits.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

10. The project would be prepared over a two year period from 1994 to 1996, and implemented over a four year period from 1997 to 2001. The preparation would possibly include assistance from Ministry of Communal Services, Ministry of Agriculture, Ministry of Water Management, Uzbekgidrogeologia Corporation, Priaralskaja Hydrogeological Enterprise, Uzbek Scientific Research Institute for Sanitation, Hygiene and Occupational Diseases and others.

VI. RESOURCES

11. Man Month Requirements

	Local experts MM	Foreign Experts MM
Manager, Water/ San. Engineer	240	21
Water Chemist	80	4
Water Treatment Specialist	80	6
Water Pipe Line Specialist	200	6
Pumping Specialist	200	6
Water Planning Specialist (Demand Analysis)	120	6
Water Resource Engineer	120	9
Economist	120	6
Financial Analyst	290	6
Quantity Surveyor(Final Design/Estimator)	800	16
Institutional Expert	290	16
Sub-total	2,240	105
Sewerage and Sewage Disposal		
Sewerage Engineer	484	16
Sewage Treatment Specialist	484	16
Sanitation Planner	243	15
Hygienist	123	8
Social Scientist	123	5
Quantity Surveyor (Final Design)	803	9
Sub-total	2,260	78
Grand Total	5,000	182

Preparation Cost

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
Local Experts	MM	5,000	2,000,000	-	2,000,000
Foreign Experts	MM	182	-	4,550,000	4,450,000
Training	LS	LS	-	400,000	400,000
Equipment	LS	LS	-	500,000	500,000
Studies	LS	LS	-	800,000	800,000
Total			2,000,000	6,250,000	8,250,000

12. Implementation Cost

A) Water Supply

		US $ million	
(a)	Pumping chamber at eastern end of Kaparas reservoir including associated works;	8.0	
(b)	Completion of pumping chamber at the western end of Kaparas reservoir and pipe works (4 pipes 1400 mm diameter) to downstream water treatment plants;	10.0	
(c)	Pumping chamber, completion of (i) treatment plant and (ii) feeder main to Tashauz and Kunia Urgench;	20.0	
(d)	Completion of the treatment plant extensions on the east and west banks of the river;		20.0
(e)	Three booster pumping stations on the east bank;	6.0	
(f)	River crossing near Nukus, associated pipe lines, pumping stations and other works to transport water to Kungrad;	10.0	
(g)	Potable water to Muynak either by pipe line, or package plant.	5.0	
	Sub-total	79.0	

B) Sanitation and sewerage

(h)	Optimization and improvement of sewerage and sewage disposal in three regional centers Nukus, Urgench and Tashauz;	15.0
(i)	Contingencies	6.0
	Sub-total	21.0

Medium term provision of water supply sanitation and sewerage in the Disaster Zone of the Amu Darya river delta. Total US $ 100 million

VII. JUSTIFICATION

13. The precarious health of the 3.5-4 million inhabitants of the Aral Sea disaster zone is a major concern of their national governments, international organizations and of course, the people in the disaster zone. Therefore, of utmost urgency is the rapid implementation of the potable water and sanitation in the disaster zone over the short to long term.

VIII. ISSUES

14. (i) With reference to data available on water quality monitoring in the Kaparas reservoir showing presence of pesticides and phenols, opinions have been expressed about the desirability of relying on this source in the medium term program. The project description above therefore includes a study proposing to bring relatively more pure water from the upper reaches in the basin. Additionally mitigation methodology of chemicals in the water may be investigated.

(ii) The extensive use of welded, unlined mild steel pipes reportedly provided with cathodic protection, in a hostile saline environment needs to be looked into for alternative and more suitable pipe materials.

(iii) Proposal to extend the Nukus feeder main to Muynak must be compared with other alternatives like desalinization package plant similar to the one installed in Tokhtakupyr.

(iv) It is reported that Kaparas reservoir generates its own salinity from the reservoir bed. This needs to be investigated more carefully so as to determine its severity. To overcome this problem flushing arrangements through dilution or gravity are proposed. It is necessary to ascertain the effectiveness of the flushing arrangements.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5
Project 4: Medium Term Provision of Water Supply

TERMS OF REFERENCE

I. BACKGROUND

1. This project is one of the several responses to the unsatisfactory living conditions in the Disaster Zone located in the delta areas of Amu Darya river. These areas are characterized in part by lack of potable water, inadequate sanitation, and high rates of water-borne diseases. The two republics of Uzbekistan and Turkmenistan state that water supply is the main problem of the communities (urban and rural). The World Bank Preparation Mission has agreed that the issues in the delivery of potable water should be reviewed and analyzed in depth. As a result of the Mission's findings, these terms of reference have been written. The consultants should carry out their investigations and enquiries and justify and be responsible for any interpretation of the information available.

II. OBJECTIVES

Water Supply

2. The objectives of the water supply component of the project are to:

(a) Review and comment upon the existing short and long term proposals for the development of water supply in the urban and rural areas of the Amu-Darya river delta;

(b) Identify, establish, prepare and design an agreed action program of works which can be carried out in the period 1996 to 2000 and which aims to optimize sunk costs and programs;

(c) Identify a follow-up seven year development program for the years 2000-2007;

(d) Make recommendation for any financial and institutional changes which are necessary to carry out the programs and to operate and maintain the assets;

Sanitation and Sewerage

3. The objectives of the sanitation and sewerage component of the project are to:

(a) Carry out an overview of the urban sanitation section and assess the likely impact of the proposed water supply programs;

(b) Assess the feasibility and prepare preliminary and detailed engineering for sanitation and sewerage to be carried out during the period 1996-2000 in Nukus, Urgench and Tashauz;

(c) Carry out a financial and institutional analysis of the proposals in the three cities selected in (b) above for Phase 1 of the Program, giving particular attention to the operation and maintenance of assets and make recommendations for change.

III. SCOPE OF WORK

A. Water Supply

4. The consultants will undertake field visits, hold discussion and review and comment upon the feasibility studies, designs, calculations, construction work (undertaken in the last ten years or so), and the proposed program and phasing of work for:

(a) The feeder or trunk mains on the east and west banks of the Amu-Darya from the Tuyamuyun reservoir complex (and the Takatakupur, Muynak, Kungrad, Kulsura (near the Caspian Sea), Mangit, Tashauz and Kunia Urgench; together with:

(i) all related source works, pumping stations, etc.

(ii) urban and rural water supply distribution systems; and

(iii) the institutional and organizational set up for designing, financing, constructing, operating and maintaining the system;

5. It is understood that approximately 60 percent of the urban distribution networks are in place with the remaining areas obtaining water from stand posts or hand pumps. At this stage an overview is required, but the overview should include a review of water source development and distribution, in the rural areas also.

IV. DESIGN OF TASKS

6. In particular the consultant will review and analyze:

(a) the extent to which ground water: (i) is currently used for urban and rural communities; (ii) has been considered as a possible source of water; and (iii) is a possible source for future needs; In regard to (iii) some pilot work or artificial recharge is already underway to test the feasibility of recharging the ground water aquifers with less saline water in the June to September period. The extent to which ground water could be exploited, particularly in the rural areas, and could affect the phased development of the feeder mains, should be analyzed;

(b) the rural water development program as it is currently formulated by the Ministry of Agriculture, and whether there are any feasible

alternatives to the proposal to lay thousands of km of pipelines in the rural areas.

(c) the design response to the expected water demands with special reference made to; (i) the source works at the Kaparas reservoir (Tuyamuyun); (ii) the treatment plants; (iii) the booster pumping along the east bank feeder main; (iv) the river crossing west of Nukus; (v) the proposed primary main to Muynak and (vi) the pros and cons of combining the Tashauz source pumping with the source pumping for the east and west bank feeder mains.

(d) the extent and quality of the construction work already undertaken;

(e) the sunk costs of the work undertaken so far, providing estimates of cost to complete the system as currently designed;

(f) the likelihood of current program targets being met and possible operation and maintenance costs of the system at various stages of the development program;

(g) the extent to which production, bulk, and retail metering has been considered and allowed for;

(h) the quantity and quality of the water available at the Kaparas reservoir and the opportunity and costs of improving water quality by flushing and/or obtaining water from a source further upstream;

(i) the extent to which the urban and rural communities can be mobilized (or are willing to be involved) in the provision of urban and rural distribution systems; together with the potential for moving from 'community participation' to community management of water distribution systems.

7. As an alternative to development of source works in the form of Kaparas reservoir, a proposal to bring relatively more pure water from upper reaches in the basin (e.g. canal starting from Vaksh river intake at main hydropower station costing rubles 3.6 billion in 1984 prices, or canal starting form Amu Darya in the Uzbekistan Pogranichny range costing rubles 2.5 billion in 1984 prices) should be studied and evaluation report prepared in terms of overall needs.

Institutional Analysis

8. The consultant shall review present institutional arrangements for project implementation and recommend modification as necessary for implementation under international practice including competitive bidding for civil works and equipment.

9. The consultant shall review present institutional arrangements for operations and maintenance and ascertain their suitability under the expanded project. The institutional design criteria shall include efficient, cost-effective organization and management of the facilities and their operating staff; incentives which promote high performance; cost recovery from consumers to the fullest extent feasible (time-phased as necessary) thereby promoting institutional and financial autonomy; delegation including the possibility of water user groups and sanitation cooperatives employed to operate tertiary facilities and to collect user fees; and the possible involvement of the private sector for selected operations, maintenance, billing and collecting activities. A program for capacity building at management, staff and operating levels shall be designed and costed.

Reporting Requirements

10. The consultants will prepare: (i) brief inception report written 3 months after mobilization; (ii) an interim report; and (iii) a final report/studies incorporating the findings, analyses, proposals, cost estimates, action programs, and detailed engineering, bidding documents and technical support during supervision covering the period 1996-2000, which inter alia incorporate:

(a) a feasibility report containing analysis of the alternatives considered, evaluated on the basis of technical, economic, financial, institutional, social, environmental and risk criteria, thereby justifying the selected alternative;

(b) for the selected alternative: a phased program to complete the physical work;

(c) preliminary engineering, detailed engineering and a detailed financing plan for Phase I (1996-2000) indicating sources and applications of funds;

(d) proposals for obtaining full or partial cost recovery, indicating the likely range of tariffs, fees and charges which would be required together with the associated methods of charging for the water used (meters, assessments, other);

(e) recommended billing and collection procedures in outline terms;

(f) forecast cash flow statements and balance sheets for the period 1996-2000 (assuming that the systems are self-contained entity for the purpose of this exercise);

(g) prepare detailed engineering and designs and drawings, civil and equipment bidding packages, classified under ICB and LCB headings, for the phase I program;

(h) a recommended follow up development program covering the seven year period 2000-2007, i.e. one which can be realistically carried out in seven years.

Environmental Assessment

(i) The Phase 1 investment programs for water supply and sewerage will be subjected to a full environmental assessment equivalent to the requirements of World Bank Operational Directive 4.01. This will include an analysis of potential impacts upon the population, infrastructure, flora and fauna. Impacts would in the first instance be avoided or minimized by appropriate project design. Residual impacts would be mitigated by actions incorporated int he project. Environmental management and monitoring plan would be prepared, with cost estimate and responsibilities assigned. The environmental assessment process would be in full consultation with affected people and their views would be taken into account.

(j) The design of projects under the program shall seek to avoid involuntary resettlement. If this is not possible, affected people will be cared for in a manner that leaves them no worse off than prior to the project. This means both resettlement, adequate compensation, and a restoration of economic and social welfare to pre-project conditions. World Bank Operational Directive 4.30 and Technical Paper 70 provide guidance in this regard.

Financial Analysis

(k) The consultant shall prepare a financial analysis for the construction of the project and for its subsequent operation and maintenance. For the construction phase this would include a statement of sources and applications of funds. For the operations phase this would include a time-phased program of cost recovery from consumers, possibly based volumetric metering and/or flat rate fees, and if necessary, subsidies from government on a declining basis;

Demand Analysis and Willingness to Pay

(l) At present consumers pay little or nothing for water supply, and there is little regard for water as an economic good. The consultant shall undertake an analysis of demand and willingness to pay for water supply, for governmental, industrial, commercial and household users, and for municipal irrigation of parks and green spaces. This analysis would then be used to reveal for each consumer category: the revenue potential from water sales and sewerage services, an approximate price elasticity of demand, and the merits of introducing volumetric metering. The information

shall be used to recommend a phased program of cost recovery, by consumer category, and the institutional framework necessary to implement it. It shall also be used to design a public information program to raise awareness to the economic value of water and the cost of wasteful use.

Special Reports

(m) Special reports on, for example, groundwater development, health education and institutional arrangements and development. Drafts of these would be presented in workshops to engender discussion, participation and feedback and they would be revised based upon this process.

Training Sessions

(n) Training sessions including overseas study tours as agreed with client in subjects such as geo-hydrology, ground water development, demand analysis/willingness to pay, economic and institutional analysis and financial sustainability.

B. Sanitation and Sewerage

11. The consultant would:

(a) undertake site visits, hold discussions review drawings and literature and ascertain the extent to which human body wastes and household sullage are currently dealt with in the urban areas. This task which should be regarded as an overview assignment may involve a review of surface water drainage system;

(b) assess the impacts that the proposed water supply system will have on the existing urban sanitation and drainage system: and prepare an 'overview assessment' of the issue involved, together with proposals and ideas incorporating estimates for change and improvement;

(c) comment on the need for, opportunities and costs of providing for sewage/sullage treatment;

(d) review a typical organization (including operation and maintenance) which is responsible for sanitation, sewerage and drainage systems and management; include a discussion of the resources available to the various institutions (see above discussion on institutional analysis);

(e) consider the extent to which the communities can be involved (or are willing to be involved) in the provision of tertiary distribution sewerage or drainage networks, and consider the opportunity for moving from community participation to 'community managed' programs;

(f) prepare and design costed first phase action program for the period 1996-2000 including preliminary and detailed engineering for rehabilitation, completion or expansion of affordable and appropriate sanitation/sewerage in Nukus, Urgench and Tashauz. The programs should be confined to what can be realistically achieved in four years, justify the proposals in economic, financial, social and environmental terms, indicating whether and how costs can be recovered;

(g) prepared detailed engineering designs and drawings for the three towns;

(h) prepare civil and equipment bidding packages, classified under ICB and LCB headings;

12. Reports concerning sanitation and sewerage would be incorporated under separate headings along with the reports prepared for water supply. The interim report should cover items 6 (a) to (e) and make a reference to the towns and likely activities to be included in the phase I action program.

13. The consultant should undertake the following tasks which are common to both water supply and sanitation and include their findings in the reports previously referred to:

(a) consider the need for hygiene education or any other relevant program to be undertaken along with the physical work programs and, if necessary, prepare costed proposals for such programs; and

(b) consider the need for, and role (if required) of, nongovernmental organizations (NGOs) in the proposed water supply and sanitation programs.

14. In carrying out the above work, address as appropriate the issues described in the Issues section of the Project Brief.

V. TIME SCHEDULE AND REPORTING

15. The period of consultancy assignment is expected to be two years from 1994 to 1996. A total of 182 man-months for expatriate and 5,000 man-months of local experts are envisaged. The expertise required includes water supply and sewerage engineers, sewage disposal expert, and specialists in water chemistry, water demand analysis, water resource planning, hygiene, pumping equipment specialists, economists, and social scientists.

VI. PROPOSED BUDGET

16. Preparation Cost

			Cost in US Dollars		
	Unit	Qty	Local	Foreign	Total
Local Experts	MM	5,000	2,000,000	-	2,000,000
Foreign Experts	MM	182	-	4,550,000	4,450,000
Training	LS	LS	-	400,000	400,000
Equipment	LS	LS	-	500,000	500,000
Studies	LS	LS	-	800,000	800,000
Total			2,000,000	6,250,000	8,250,000

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5

To prepare and implement intergovernmental programs "Clean Water and Health" which provides for supplying the affected population in the Central Asian countries with good quality drinking water and improving the sanitary and epidemiological situation in the country.

Project 5: Long-Term Water Supply and Wastewater Management

PROJECT BRIEF

I. BACKGROUND

1. Over the past three decades the Aral Sea has shrunk considerably as expanding irrigation in its basin reduced river flow into it. At the same time increasing quantities of minerals, pesticides, fertilizers and human wastes contaminate river flows especially in the lower reaches of the Amu and Syr rivers. As a consequence, there have been serious human health impacts, including high rates of typhoid, paratyphoid, viral hepatitis and dysentery. (See Annex 1 for a more detailed description of the current health situation.) Most severely affected are the regions of Kzyl-Orda in Kazakhstan, Karakalpakstan and Khorezm Uzbekistan, and Tashauz Turkmenistan, however the area of impact has been expanding easterly (upstream) and may now even include Bokhara and beyond.

2. The community water supplies in the Aral Sea basin are based on both groundwater and surface waters, which due to the hydraulic linkage between them are both equally affected by the environmental pollution. Centralized water supply systems in urban centers based on surface waters, rivers and canals, using treatment facilities of settling, coagulation, filtration and chlorination are, in need of improvement and expansion to insure supply of drinking water meets the requirements of safety. Ground water quality varies over the area; fresh water lenses meeting requisite standards for drinking purposes are also available and well fields (for example in Kazakhstan), are developed to provide centralized water supplies. In other areas, particularly small scattered settlements, the water is brackish and desalination devices are required to make it fit for drinking. the urban and rural sewerage and sanitation systems in the region are inadequate in terms of coverage and level of service and need improvement, expansion and optimization.

II. OBJECTIVES

3. In the interim, the current strategy -- it is a short to medium term strategy -- is to address the most critical problems in terms of human health and welfare. That is to provide safe drinking water and adequate sanitation to those who are suffering most, some four million people living in the Karakalpakstan, Urgench (Khorezm region) in Uzbekistan, Tashauz region in Turkmenistan and Aralsk, Kazalinsk (Kzyl-Orda region) in Kazakhstan. Projects 5(a), 5(b), 5(c) and 5(d) of the Heads of States Approved Program 5 - Clean

Water and Health, fulfill this strategy. These programs consists of the following works:

(i) Installation of desalination devices on existing and new wells in scattered rural populations of Karakalpakstan (Program 5a);

(ii) Water treatment followed by desalination systems for Urgench and Tashauz regions (Program 5b);

(iii) Expansion of Sarybulak well fields for water supply to urban and rural areas of Aralsk and Kazalinsk including provision of water supply and sewerage networks (Program 5c);

(iv) Improvement and expansion of centralized water supply and sewerage systems to regional centers Nukus, Urgench and Tashauz as well as rural communities of these regions based on development and expansion of Kaparas reservoir, water treatment plants and wastewater treatment plant (Program 5d).

4. This approach of expanding, improving and optimizing the existing facilities is appropriate for the short- to medium-term. Also required is a strategy for the long-term, comprehensive development of the sector which takes into account physical, human and economic resources; demands for services and institutional arrangements which are best suited for its implementation.

III. SCOPE

5. The scope of this activity would be to prepare terms of reference for the preparation of long-term technical, policy and institutional strategies for: (a) the augmentation and development of water supply for urban, (b) the management of municipal and industrial wastewater, with the goals of improving public health and quality of life, promoting economic development.

6. This activity has two steps. The first step would be to prepare a terms of reference for the preparation of the long-term strategy. The second step would be to prepare the strategy itself. The attached terms of reference are for step 1. Step 1 would take about six months and would cost about US$0.4 million; step 2 would cost in the range of US$4-7 million. The scope of step 1 would be to prepare terms of reference for the preparation of a long-term technical, policy and institutional strategies. The terms of reference would cover water supply, sanitation, and wastewater management with respect to physical resources, infrastructure systems, demands, and institutional arrangements, including those which concern planning and implementation of projects and those which concern operation and maintenance. Step 1 will determine the boundary conditions for development of the long-term strategy, that is, the geographical regions and sub-basins to be covered and the institutional issues and options to be addressed. Details on the Scope of Work for Step 1 are given in para. 7 of the attached terms of reference.

7. This activity would have as a central feature a participatory and consultative process that would involve service providers, service users and other stakeholders. The draft TOR would be presented in a workshop formulated to obtain feedback, and the final TOR would reflect consensus views.

IV. OUTPUTS

8. On the basis if the studies prepared under this project, a long-term strategy for development of domestic, agricultural and industrial uses would be produced. The study would also establish the priorities of investment, their costs and economic benefits. An immediate task would be to identify those investments which must be taken up immediately after the resources developed under the short and medium-term projects.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

9. Output reports would consist of an inception report in month 3 which would describe the proposed organizational arrangements and program of work; a draft outline terms of reference in month 4; a draft reference in month 5; and the final product in month 6.

VI. RESOURCES

10. This project would require an input of about 200 staff months of local and 10 staff months of foreign expertise.

VII. JUSTIFICATION

11. There is at present no agreed long-term strategy for urban, rural and industrial water supply nor for wastewater management. There have been several studies prepared over time (see the attached list of references) and these provide valuable information, analysis and alternatives for development, but because of poor data, inadequate analysis and changed conditions, none have the complete backing of the major stakeholders.

REFERENCES

1. Aral Sea Basin Program Phase 1, Approved Program No. 1: Regional Water Resources Management Strategy.

2. Aral Sea Basin Program Phase 1, Approved Program No. 3: Water Quality Management.

3. Aral Sea Basin Program Phase 1, Approved Program No. 5: Clean Water and Health.

4. Problem of Sources of Household Drinking Water Supply for the Population of the Republic of Uzbekistan for the period up to the year 2010. Feasibility Report (21 volumes). Ministry of Land Reclamation and Water Management, Republic of Uzbekistan, Tashkent 1992.

5. Diagnostic Study for the Development of an Action Plan for the Conservation of the Aral Sea. UNEP Expert Working Group, 1991.

6. The Aral Sea Problem. Philip P. Micklin, Ph.D. Professor of Geography, Department of Geography, Western Michigan University, Kalamazoo, Michigan 49008, U.S.A. May 10, 1993 (to be published in Civil Engineering: Proceedings of the Institution of civil Engineers, London, U.K.)

Attachments

HUMAN HEALTH AND POTABLE WATER SUPPLY AND SANITATION IN THE DISASTER ZONE

Over the past about three decades the Aral Sea has shrunk considerably as expanding irrigation in its basin reduced river flow into it. At the same time increasing quantities of pesticides, defoliants, fertilizers and pathogens started building up with the returning drainage flow especially in the lower reaches of the two tributaries Amu and Syr Darya rivers. The resulting serious disturbance of human environment characterized by polluted and salinized drinking water, only one of the indices of the many adverse environmental factors, is implicated in high rates of typhoid, paratyphoid, viral hepatitis and dysentery, the incidence of which has been growing since the 1970s. On the basis of current health services data 400,000 km^2 around the sea has become "a region of ecological calamity". Mainly located in the regions of Kyzl Orda (population 600,000) republic of Kazakhstan, Karakalpakstan and Khorezm (population 2.3 million) in Republic of Uzbekistan, and Tashauz (population 1.2 million) in republic of Turkmenistan, it has come to be know as "Disaster Zone".

Between 1974 to 1989 the rate of illness from typhoid in the Kzyl Orda area increased as much as 29-fold, viral hepatitis increased as much as seven-fold, and paratyphoid increased fourfold. During these same years, more than 60,000 in the region had viral hepatitis, 70,000 had acute intestinal diseases. Almost every year, waterborne outbreaks of typhus, paratyphoid and viral hepatitis have been registered in thirty settlements in the area. Tens of thousands of people were affected by water-related outbreaks of viral hepatitis between 1978 and 1986. The Kzyl Orda region had 40% of the total incidences of viral hepatitis, and 45% of typhoid cases registered in Kazakhstan. Further, between 1976 to 1980, the annual typhoid morbidity index increased by 20%. It has been noted that approximately 75% of those suffering from acute intestinal infectious were children. Thirty percent of infantile mortality could be attributed to intestinal infections.

Karakalpakia statistics for intestinal infections also were significant. Typhoid and viral hepatitis morbidity indices exceeded the mean FSU (Former Soviet Union) levels by a factor of 2.5 during some years. The mean typhoid morbidity index for 1977 to 1986 in Karakalpakia exceeded the Uzbekistan' s morbidity level for the same period by a factor of 1.5, and that of FSU by fivefold. Typhoid morbidity was high in Karakalpakia every year, and exhibited no definite trends in its dynamics. Dysentery morbidity levels were much lower in Karakalpakia than in the Uzbek republic or the FSU. However, beginning in 1982, a steady increase in the number of disease cases was observed. By 1987, the relative index reached the mean level of the republic. Morbidity attributable to viral hepatitis in Karakalpakia always exceeded the mean FSU. On some occasions (e.g. 1982), the morbidity level was twice that

of FSU level. Infantile morbidity attributable to viral hepatitis in Karakalpakia doubled (from 5.7 to 12.1%) for seven to ten years. Medical service reports from Uzbek republic indicated 8.9% of the total population of children was at risk of infection. The group of sick children represented 1.2% of the total population of children.

The same acute situation was observed in Tashauz region of Turkmenistan republic. For the decade of 1980's population morbidity from acute intestinal infections remained at a high level (355 to 525% per 1000 people). In 1988, the viral hepatitis morbidity in the Tashauz region exceeded the Turkmenistan republic level by a factor of two (597.8%, compared to 264.3% per 1000 people), and was one-third greater than the FSU index (305.4% per 1000 people). Similarly throughout the past decade, the absolute figure and the morbidity index exhibited a constant increasing trend. These rates increased from 378.5% in 1980 to 706.6% per 1000 people in 1989. Peaks of morbidity were manifested during certain years in the decade. The infant mortality rate is 59.9% in Karakalpakia, 56.4% in all Turkmenistan and 75.2% in the Tashauz region.

The harmful effects of the biological and agrochemical substances found in the environment require consideration of the connection between population morbidity and the state of environment. Research in Karakalpakia has confirmed the role of water as a factor in the propagation of viral hepatitis, typhoid and dysentery among the population. The discharge into water environment of highly-mineralized, pesticide-containing reverse drainage waters from agricultural lands, along with a significant reduction in runoff volume because of excessive effluents, are the main reasons for the essential deterioration of water quality. Data from water agencies delineate the process that has occurred over the past 10 to 15 years. The mineral content of the water, reaching 2 to 3 g/l or more in the lower reaches comprising the delta area has sharply increased in surface waters. The pervasive high levels of salinity having spread to ground water aquifers also prevent their direct use for domestic water supplies. In order to give immediate relief to the populations of the Disaster Zone, there is need to undertake projects in water supply, sanitation and hygiene education in response to the serious concern voiced equally by the people and government officials met during visits by the Identification Mission in 1993.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 5
Project 5: Long-Term Water Supply and Wastewater Management

TERMS OF REFERENCE

I. BACKGROUND

1. This document is a terms of reference to prepare a terms of reference. The ultimate output will be a long-term strategy for urban, rural and industrial water supply in the lower Amu Darya and Syr Darya basins, defined as the disaster zone of the Aral Sea. These terms of reference envisage an input of about 200 staff months of local and 10 staff months of foreign expertise. The duration of the effort would be about six months. The output would be a consensus-derived terms of reference for the development of the long-term strategy.

2. Over the past three decades the Aral Sea has shrunk considerably as expanding irrigation in its basin reduced river flow into it. At the same time increasing quantities of minerals, pesticides, fertilizers and human wastes contaminate river flows, especially in the lower reaches of the Amu and Syr rivers. As a consequence there have been serious human health impacts, including high rates of typhoid, paratyphoid, viral hepatitis and dysentery. Most severely affected are the regions of Kyzl-Orda in Kazakhstan, Karakalpakstan and Khorezm Uzbekistan, and Tashauz Turkmenistan however, the area of impact has been expanding easterly (upstream) and may now even include Bakhara and beyond.

3. The community water supplies in the Aral Sea basin are based on both groundwater and surface waters, which due to the hydraulic linkage between them are both equally affected by the environmental pollution. Centralized water supply systems in urban centers based on surface waters, rivers and canals, using treatment facilities of settling, coagulation, filtration and chlorination are in need of improvement and expansion to insure supply of drinking water meets the requirements of safety. Ground water quality varies over the area; fresh water lenses meeting requisite standards for drinking purposes are also available and well fields (for example in Kazakhstan) are developed to provide centralized water supplies. In other areas, particularly small scattered settlements, the water is brackish and desalination devices are required to make it fit for drinking. the urban and rural sewerage and sanitation systems in the region are inadequate in terms of coverage and level of service and need improvement, expansion and optimization.

4. There is at present no agreed long-term strategy for urban, rural and industrial water supply nor for wastewater management. There have been several studies prepared over time (see the list of references) and these provide valuable information, analysis and alternatives for development, but because of poor data, inadequate analysis and changed conditions, none have the complete backing of the major stakeholders.

5. In the interim, the current strategy -- it is a short to medium term strategy -- is to address the most critical problems in terms of human health and welfare. That is to provide safe drinking water and adequate sanitation to those who are suffering most, those in the Karakalpakstan, Urgench (Khorezm region) in Uzbekistan, Tashauz region in Turkmenistan and Aralsk, Kazalinsk (Kzyl-Orda region) in Kazakhstan. Projects 5 (a), 5 (b), 5 (c) and 5 (d) of the Heads of States Approved Program 5 - Clean Water and Health, fulfill this strategy.

II. OBJECTIVES

6. The objectives of these terms of reference are to prepare terms of reference for the preparation of long-term technical, policy and institutional strategies for (a) the augmentation and development of water supply for urban, rural and industrial use for the lower Amu Darya and Syr Darya river basins and (b) the management of municipal and industrial wastewater, with the goals of reducing environmental impacts and promoting conservation through reuse.

III. SCOPE OF WORK

7. The consultant will do whatever work is required to meet the objectives of these terms of reference. The following is an indicative work program but it may be modified as appropriate:

- obtain relevant information and documents, and interview experts, to develop an understanding of the current water supply and sanitation/sewerage situation. (Note: the foreign expert team may elect to send a one or two person reconnaissance mission to collect reports and data (which is in the Russian language) so work on translation may begin at the onset of this assignment);

- similarly develop an understanding of the various investment strategies which have been put forward by institutions and individuals. These include but are not limited to (a) reliance on the yields of the Kaparas reservoir (although there is uncertainty about the long-term sustainability of water quality from the reservoir); (b) the construction of one or more pipelines or canals from upstream high-quality water sources; (c) the construction of one or more desalinization plants; (d) the use of dual distribution systems to deliver drinking and non-potable water; and (e) the construction of one or more drinking water bottling plants.

- develop an understanding of the institutional arrangements, international agreements, laws and policies which are relevant to the water supply and wastewater sector of the region, including those which concern planning and implementation projects and those which concern operation and maintenance. (In this connection the consultant should refer to the organizational arrangements employed under Aral Sea Program 1, Regional Water Resources Management

Strategy. That program provides for a Strategy Group and Specialized Task forces);

- develop an understanding of the processes used to analyze water supply problems, prepare alternative solutions and select and decide a development option;

- determine and agree on the boundary conditions for strategy development, that is, what regions and what river basins would be covered by the strategy;

- prepare a draft outline terms of reference and present it in workshop format to concerned stakeholders and obtain feedback;

- prepare a draft full terms of reference and again consult with concerned stakeholders;

- finalize the terms of reference and submit it to the Interstate Council for approval.

IV. DESIGN OF TASKS

8. The final output would be a Terms of Reference acceptable to the Interstate Council for the development of interstate, long term, technical, policy and institutional strategies for water supply and wastewater management. It would also prescribe the methods for developing the strategies; the institutions to be involved to ensure broad, interstate participation (refer to the organizational arrangements for Aral Sea Program 1 for guidance); the organizational arrangements and the process to be employed for stakeholder consultation and for ensuring environmental sustainability. In addition it would contain a time-phased work program, a list of local and foreign expertise required, a list of office and transport equipment needs, and an itemized estimate of costs. Finally, it would contain a capacity building program to train local experts in strategy development and implementation. This may include local training and overseas study tours.

V. TIME SCHEDULE AND REPORTING

9. Output reports would consist of an inception report in month 3 which describes the proposed organizational arrangements and program of work; a draft outline terms of reference in month 4; a draft terms of reference in month 5; and the final product in month 6.

VI. PROPOSED BUDGET

10. Estimated preparation costs are expected to be about US$7.00 million of which US$6.30 would be in foreign exchange.

VII. CONSIDERATION IN FORMULATING STRATEGIES

11. There are certain internationally-accepted principles which should be incorporated in water and wastewater strategies. These are given in Attachment 2 to serve as a guide.

REFERENCES

1. Aral Sea Basin Program Phase 1, Approved Program No. 1: Regional Water Resources Management Strategy.

2. Aral Sea Basin Program Phase 1, Approved Program No. 3: Water Quality Management.

3. Aral Sea Basin Program Phase 1, Approved Program No. 5: Clean Water and Health.

4 Problem of Sources of Household Drinking Water Supply for the Population of the Republic of Uzbekistan for the period up to the year 2010. Feasibility Report (21 volumes). Ministry of Land Reclamation and Water Management, Republic of Uzbekistan, Tashkent 1992.

5. Diagnostic Study for the Development of an Action Plan for the Conservation of the Aral Sea. UNEP Expert Working Group, 1991.

BRIEF DESCRIPTION OF SOME LONG-RANGE ALTERNATIVES
WHICH HAVE BEEN PROPOSED

1. The strategy would consider alternative solutions and select and decide on a development option consisting of a single component or a combination of components; for example Kaparas reservoir long-term development, pipelines or canals conveying relatively more pure water from upstream in the Aral Sea basin, large scale desalination systems, and bottling plants. Discussions with local officials concerned with water supply in Amu Darya and Syr Darya basins have indicated a number of alternative solutions briefly described below.

2. Reference 4 (1992) is a feasibility study of the sources of potable water in the republic of Uzbekistan. It has proposed and evaluated eight alternatives to develop long-term strategy for the populations of the Amu Darya basin. In economic analysis of these alternatives, the officials stated, that due account has been taken of the river crossings, railway/road bridges and drainage and protection works. The salient features of these alternatives are briefly given below:

(i) Source of Water: Amu Darya River Water at site. Salient Features of the Scheme: Conventional and 'deep' treatment of water followed by desalination using electrodialysis or reverse osmosis; complete evaporation of 'reject' water to salts to be disposed of by burial in the ground. This alternative envisages installation of large scale desalination plants on location to benefit populations in Disaster Zone, Bukhara (Uzbekistan) and Charjou (Turkmenistan). Energy requirements to be met by construction of thermal or nuclear power plants;

(ii) Amu Darya river water at site. Salient features same as (i) above except 'reject' concentrated water will be disposed of in natural depressions instead of complete evaporation;

(iii) Groundwater and collector drainage water at site. Conventional and 'deep treatment followed by desalination as in (i) above;

(iv) Groundwater of Zarafashan River basin. Pumping of ground water and its transmission by 700 km of feeder mains to Disaster Zone, Bukhara (Uzbekistan) and Charjou (Turkmenistan);

(v) Groundwater of Zarafashan River Basin. Same a in (iv) above but dual distribution system; one system supplying water which meets the standards for drinking/cooking and the other system based on local source of lesser quality than the standard, for bathing, laundry and household non-potable purposes;

(vi) Combination of groundwater and surface water sources at site. Conventional including 'deep' treatment on location followed by desalination. Dual distribution system as in (v) above;

(vii) Amu Darya river water at site after "Zero discharge of pollutants goal" has been achieved to ensure Clean Water in the river. Conventional treatment on location. The Economic analysis shows this option to be the costliest;

(viii) Talimardjan Reservoir number 2 to be build at Karshi steppe. Amu Darya river water at Karshi Steppe in May-July having salinity of 0.5 - 0.7 gram per liter will be pumped 150 meters above the river bed for storage in the reservoir, and then conveyed by means of a 850 km canal of 70 cu.m per second capacity all along by gravity to Tuyumuyun for treatment, transmission and distribution in disaster zone on both sides of the international border;

(ix) Amu Darya river intake in Pogranichny range located inside Uzbek territory with pumping required for storage in the reservoir to be built 80 meters above river bed, OR Baksh river intake and reservoir in Tajik territory. The canal with a carrying capacity of 74 cu.m per second will be 980 km long in case of Amu Darya intake and 1200 km long in case of Vaksh river intake. It will convey water from the reservoir in the mountains to Tuyumuyun by gravity alone. The water, after chlorination only, meets the standards. This alternative had been found most economical of all the eight options.

3. The Syr Darya delta discussions with Kazakhstan officials (Project Institute Kazgiprovodkhoz, Almaty) indicated that groundwater exploration in the disaster zone had resulted in the development of well fields of acceptable quality at Sarybulak and Octyubinsk. The Sarybulak well field is located at two adjacent sites, namely, Kasamansakya (20 wells with only 25 in use, 185-250 meter depth, 19-20 liters per second discharge per well) and Berdekulskaya (10 wells, 200 meter depth, total discharge 240 liters per second). The well field supplies water to Aralsk and Kazalinks. The consumption of water is estimated at an average of groundwater reserve near border with Octyubinks region of Kazakhstan has been found with salinity level below 1 gram per liter; it is not, however, being exploited. The officials stated that exploitation of well fields is proceeding in a sustainable manner, with the fields estimated to be sufficient for the needs of the population for the next 25 years. Also Ministry of Hydrogeology had been conducting groundwater investigations in the past. They possess excellent expertise and equipment in this field. Their data could prove useful in the preparation of a long-term strategy relating to groundwater in the Syr Darya delta. Unlike feasibility

studies completed in the Amu Darya delta, no work has been done for a long-term strategy on water supply in respect of Syr Darya delta. However, the following alternatives indicated by Kazakh officials could constitute basis for further work on development of a long-term strategy.

(i) Compilation and review of available hydrogeological information on groundwater deposits, depths, quality and hydrogeological maps should become part of preparation of a feasibility study for groundwater resources;

(ii) Feasibility study of Bugansky reservoir as a source of potable water by using water transmission mains and water treatment plants in the Aral Sea Basin;

(iii) Ugams water diversion to the Bugansky reservoir (or Charvansky reservoir, with possible compensation) for purposes of potable water supply, with possibilities of different options for the Aral Sea Basin;

(iv) Water diversion from Ele-Balkhash basin (Kapchagai reservoir) to Aral Sea Basin by means of pumping stations, tunnels, and by-pass channels; canal and pipeline options.

(v) Ob-Irtish diversion from Siberia exclusively for drinking water supply in the Aral Sea Basin in Kazakhstan and Uzbekistan;

(vi) Transfer of water of Volga river through the mountains to Aral Sea Basin for drinking water supply;

(vii) Construction of water treatment plants followed by desalination plants using Syr Darya water at site Kzylorda region.

Issues Concerning Alternatives

4. Kaparas reservoir offers one of the alternatives in the long-term strategy for water supply sector. This is based on discussions which were held with officials of Scientific and Technical River Center of SANIIRI in the last week of March, 1994. Scientific data compiled by them with respect to water quality monitoring in Kaparas reservoir have established that contribution of salinity by the bed of Kaparas reservoir to the water stored in the reservoir is negligible (0.1 gram per liter). In fact, it is likely to decrease with time as the reservoir is brought into operation on an engineering basis in future. Additionally, during the period 1989-1993 the salinity levels of Kaparas reservoir has rarely exceeded 1 gram per liter during May-July, the period set apart for collection and storage of Amu Darya river water. Also pesticides content in the Kaparas water has been recorded

to be consistently below the safe level (standard 0.02 mg/l) during the five years of monitoring. The phenols content is 2 to 3 times higher than the normal (standard 0001 mg/l). This, the local officials stated, can be brought within limits with chlorine-ammonia treatment. However, literature indicates use of activated carbon (granular GAC, or powder PAC) as means of phenol removal. These officials (on the basis of monitoring data) are of the firm view that Kaparas itself acts as a natural and highly significant water treatment device reducing concentrations of substances as they exist in the river water or the water in the main reservoir at Tuyumuyun. They have further expressed the opinion that the need to flush the reservoir of its

sediment can be efficiently met by natural means. An answer to this problem could be found in the construction of appropriate engineering structures to be incorporated in Dam No. 3 of the reservoir complex instead of installation of large capacity pumps. The officials of the Vodoprojekt Association of the Ministry of Water Management, on the other hand, are of the view that the high salinity and pesticide/phenol pollution of Kaparas reservoir make it unfit as a water source for developing a medium- or long-term strategy; their assertion, however, is not supported by any scientific data. The present consultant activity will therefore review the relevant information and data for appropriate recommendations.

CONSIDERATIONS IN FORMULATING WATER SUPPLY AND WASTEWATER STRATEGIES

The following are internationally accepted principles for consideration in formulating water supply and wastewater strategies. These are offered as a guide to those who will prepare the strategies. This is an indicative list which is subject to modification to match prevailing conditions.

The strategy should:

- recognize that water is an economic good, that economic, social and environmental costs are incurred in its use, and that beneficiaries should bear those costs;

- recognize that appropriate institutional arrangements are necessary for sustainability, in particular for efficient management and operations, and that these are best based at the lowest appropriate level where accountability and incentives may stimulate good performance;

- involve stakeholders in its formulation to promote a sense of ownership and a commitment to its success. Stakeholders may include urban, rural and industrial users, agencies which plan and design water systems, local governments, financial institutions and groups which may be effected favorably or adversely by the strategy;

- be environmentally sound, protecting and improving public health and the environment;

- be least cost and time-phased to provide flexibility and allow for sequential development which matches needs and resource availability. In this context the strategy should identify high priority investments and other activities which should be subjected to feasibility study;

- incorporate demand management as a major element, recognizing the role of price in promoting efficient water use and conservation, and in promoting the reduction of pollution;

- in addition, the strategy should be affordable to society and should provide safety nets to ensure that basic needs are met; use existing facilities to the fullest feasible extent; promote wastewater reuse; and promote reduction in industrial waste;

- finally, the strategy must be fully coordinated with other programs for the Aral Sea, in particular with Program 1, Regional Water Strategy; and with Program 2, Water Quality Management.

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 6

Projects: 1. Integrated Land and Water Management of the Upper Watersheds

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 6

To undertake the required water and environmental work, and on the basis of such work to take specific measures to improve the environmental situation in the zones of water flow formation.

Project 1: Integrated Land and Water Management in Upper Watersheds

PROJECT BRIEF

I. BACKGROUND

1. Very complex land and water management problems exist in upper watersheds that characterize mountain and headwater areas of the Aral Sea Basin. While the Aral Sea region is often referred to as a "disaster zone", these upstream areas appear to include significant environmental, economic, and health disasters and consequences for the millions of people living there. Waterlogging, salinization, contamination of groundwater, flooding, and excessive water use adversely affect irrigation and reduce agricultural yields in these zones of flow formation, which include the Fergana Valley. Erosion problems are particularly severe in the region as a result of deforestation and overgrazing of farmland. Pollution from coal, uranium, tin, and other mining activities contaminate drinking water supplies, cause erosion problems and slides, and degrade environmental quality. Sewage releases, from seven million people in the Fergana Valley alone, pollute surface water and groundwater and pose serious human health risks.

2. This complex problem is being experienced in the Kyrgyz Republic, Tajikistan, and the upper basins of Uzbekistan. The water pollution is international because of the complexity of the borders and the solutions must also come from a multinational, more regionalized approach. The solutions are also difficult because of the small fields that are irrigated, common-property grazing lands, dense populations in the mountain valleys, industrialization, steep terrain, and poverty. Also, information covering the anthropogenic land and water problems in the upper watersheds is incomplete and not organized in a useful way.

3. The Aral Sea Basin salinity and other water quality problems originate in the upper watersheds, thus solutions to these problems begin here. For example, in the last 20 years pollution of the Amu Darya is no longer limited to the delta area and now is present in the city of Termez, some 2,000 km upstream. In addition, ecologically vulnerable areas that still have a suitable level of quality should be protected from further degradation.

II. OBJECTIVES

4. The main purpose of the project would be to prepare an assessment of the environmental problems in these upper watersheds caused by natural and anthropogenic sources as the basis for the identification of alternative measures to improve overall economic and social conditions, and environmental quality.

5. The project has three specific objectives:

(1) Assess existing conditions. To collect information and assess conditions of land and water management activities (such as mining, agriculture, forestry, livestock management, and municipal discharges) on surface waters, groundwaters, soils, and the local economy.

(2) Conduct investigations. To investigate and assess methods of land and water resources management in the upper watersheds that address the adverse conditions identified in (1) above.

(3) Identify possible improvements. To estimate the likely improvements in environmental quality, health, the economy, and other benefits that may result from implementation of remedial action plans.

III. SCOPE

6. The sustainability of social, economic, and environmental conditions enjoyed by populations in upper basins draining to the Aral Sea is at risk. The following practices must be re-evaluated:

(i) current methods of mining, agriculture, forestry, and livestock management must be reviewed and changed in some cases to minimize future surface and groundwater quality degradation and ecological damage;
(ii) existing discharges of pollution must be reduced greatly;
(iii) vegetation of affected mining areas, gullies, and mudslides must be initiated; and
(iv) newer, more sustainable systems for agriculture must be developed, demonstrated, implemented; and
(v) undamaged drainage areas, ecologically important lands, and dangerously steep and unstable lands must be protected from anthropogenic impacts until new systems are developed.

The project would require the assessment of previously-reported scientific studies, research, and field tests. It also would require the performance of new laboratory studies and field tests. The work required to meet each of the objectives stated in Section II is outlined below:

OBJECTIVE 1: Assess Existing Conditions

(i) Effects of slides, erosion, and floods on waterbodies and related civil works.
(ii) Effects of deforestation and inadequate pasture management on flow formation, erosion, and slide formation processes.
(iii) Impacts of municipal, industrial, and mining activities on surface and groundwater quality.
(iv) Ecological effects of reservoirs constructed in the upper watersheds.
(v) Impacts of irrigation practices in upper watersheds on soil erosion, water quality, and downstream flooding.
(vi) Ecological changes that have occurred in the land and water environment as the result of anthropogenic activities mentioned above.

OBJECTIVE 2: Conduct Investigations

(i) Study improved methods of irrigation in upper watersheds.
(ii) Determine the most sustainable crops for agriculture in upper watersheds.
(iii) Identify needs for treatment of wastewater discharges from cities and industries in the upper watersheds.
(iv) Develop maps and inventories of groundwater characteristics.
(v) Determine the nature of toxic pollutants in surface water, groundwater, and soils.

OBJECTIVE 3: Identify Possible Improvements

(i) Prepare maps showing ecologically vulnerable areas.
(ii) Predict water balance related to irrigation withdrawals and returns.
(iii) Predict changes in quality of surface and groundwaters, including salinization.
(iv) Determine assimilative capacity of rivers and soils.
(v) Predict benefits downstream as a result of environmental improvements in upper watersheds.
(vi) Identify solutions and recommend specific improvement measures in upper watersheds.

The mapping, inventories, research and demonstration projects would be conducted in the Kyrgyz Republic, Tajikistan, and the upper watersheds of Uzbekistan. Because land management is linked so closely with surface and groundwater quality, integrated management of both land and water within small drainage basins is being stressed in the project.

IV. OUTPUTS

7. The outputs for the project are expected to be as follows:

(i) assessment of existing conditions and impacts of land and water management activities on surface waters, groundwaters, and soils;
(ii) information on more appropriate methods of land and water resources management in upper watersheds; and
(iii) description of possible improvements in environmental quality that may result from implementation of recommended remedial action programs.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

8. During the six-month project preparation period, preparatory work would include a series of planning workshops that would be carried out to detail specific elements of the project. The work would also involve visits to selected upper watersheds in the three countries of interest, the Kyrgyz Republic, Tajikistan, and Uzbekistan. The project would then be performed over 1 1/2 years and would be undertaken as a special Task Force under the Regional Water Resources Strategy Group.

Preliminary plans and schedule for the project are as follows:

Objective	Activities	Year 1	Year 2
1. Assess existing conditions	Collect needed information and assess conditions of land and water management activities	XXXXXXXXXXXX	
2. Conduct investigations	Investigate and assess more appropriate methods of land and water resources management	XXXXXXXXXXXXXXXXXX	
3. Identify possible improvements	Estimate the likely improvements that may result from implementation of remedial actions		XXXXXXXXXX

VI. RESOURCES

9. The project is estimated to cost US$2 million over a 1 1/2 year period. The proposed budget for preparation of the project over the six-month period are presented below:

Item	Estimated Cost (in US$) Local	Foreign	Total
1. Local Specialists Water Pollution Control Specialists; Environmental Engineers; Chemical Engineers; Legal Experts; Procurement Specialists; Hydraulic Engineer; Drainage Engineer; Ecologist; Hydrogeologist; Agriculturalist; Forester; Economist; Modelers; Irrigation Engineer; Geologists; Chemists; Aquatic Biologist; Computer Specialist; Field Technicians, and Data Analyst.	32,000	-	32,000
2. International Experts Environmental Scientist; Legal Expert; Procurement Specialist; Agricultural Engineer; Forester; Drainage Engineer	-	75,000	75,000
3. Travel/Accommodations	8,000	50,000	58,000
4. Training (workshops)	-	20,000	20,000
5. Interpreter/translators	-	5,000	5,000
6. Equipment (computers, fax etc.)	-	10,000	10,000
TOTAL FOR PROJECT	40,000	160,000	200,000

VII. JUSTIFICATION

10. Although there appears to be some data available on land and water problems in the upper watersheds of the Aral Sea Basin, very little information has been synthesized into a useful format and there are known gaps in the information database.

11. A coordinated program is needed to assess existing data; conduct investigations; and identify possible improvements so that plans can be implemented to correct environmental, economic, and health problems and consequences for the millions of people living in these upper watersheds. These measures will ultimately benefit the environment and people in the entire Aral Sea Basin.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 6
Project 1: Integrated Land and Water Management in Upper Watersheds

TERMS OF REFERENCE

I. BACKGROUND

1. Very complex land and water management problems exist in upper watersheds that characterize mountain and headwater areas of the Aral Sea Basin. While the Aral Sea region is often referred to as a "disaster zone", these upstream areas appear to include significant environmental, economic, and health disasters and consequences for the millions of people living there. Waterlogging, salinization, contamination of groundwater, flooding, and excessive water use adversely affect irrigation and reduce agricultural yields in these zones of flow formation, which include the Fergana Valley. Erosion problems are particularly severe in the region as a result of deforestation and overgrazing of farmland. Pollution from coal, uranium, tin, and other mining activities contaminate drinking water supplies, cause erosion problems and slides, and degrade environmental quality. Sewage releases, from seven million people in the Fergana Valley alone, pollute surface water and groundwater and pose serious human health risks.

2. This complex problem is being experienced in the Kyrgyz Republic, Tajikistan, and the upper basins of Uzbekistan. The water pollution is international because of the complexity of the borders and the solutions must also come from a multinational, more regionalized approach. The solutions are also difficult because of the small fields that are irrigated, common-property grazing lands, dense populations in the mountain valleys, industrialization, steep terrain, and poverty. Also, information covering the anthropogenic land and water problems in the upper watersheds is incomplete and not organized in a useful way.

3. The Aral Sea Basin salinity and other water quality problems originate in the upper watersheds, thus solutions to these problems begin here. For example, in the last 20 years pollution of the Amu Darya is no longer limited to the delta area and now is present in the city of Termez, some 2,000 km upstream. In addition, ecologically vulnerable areas that still have a suitable level of quality should be protected from further degradation.

II. OBJECTIVES

4. The overall objective of this Terms of Reference (TOR) is to define a six-month effort to prepare the details of the project so that it can be

approved by the Interstate Council. Consultations will need to be conducted among different ministry staff of the countries in the upper watersheds of the Aral Sea Basin, the Aral Sea Basin regional institutions, external experts, and external support agencies to design the processes and specific tasks for the full project. The consultations and preparatory work are to be completed during the six-month period.

III. SCOPE OF WORK

5. A Watershed Task Force (WTF) will be established as a Task Force of the Regional Water Resources Strategy Group that will be charged with responsibility for leading the regional water resources management strategy effort. The WTF will consist of local experts responsible for water and land issues in the three countries as well as staff from the regional institutions, BVOs, local institutes, SRI, and appropriate international consultants. The Task Force will coordinate with the ICSDSTEC[1]/ of the Interstate Council and with the other programs approved by the Heads of States.

6. The WTF will also coordinate with the appropriate ministries, institutes, university staff, and other organizations of the three countries in determining the tasks, analyses, and equipment required for completing within a one and a half year period the activities needed to meet project objectives.

IV. DESIGN OF TASKS

7. The preparation would extend over five stages as given below:

STAGE 1: Appoint WTF Members

The Interstate Council's Executive Committee, in connection with the Regional Water Resources Strategy Group, will appoint members of the WTF from the three countries, the regional institutions, and the BVOs. The WTF will add other members as needed (including international consultants) and will determine how it will function over the six-month period. It is expected that this group will continue to function during the 1 1/2 year project.

STAGE 2: Establish Subcommittees of the WTF

The WTF will establish subcommittees consisting of its members and other needed experts to begin working on the preparation of a draft TOR for the 1 1/2 year project that will meet the objectives outlined in part II above. The subcommittees will also prepare a TOR for integration, linkage, and coordination with the Regional Water Resources Strategy Group.

1/ Interstate Commission for Socio-economic Development and Scientific, Technical, and Ecological Cooperation.

STAGE 3: Workshop on Draft Approaches

The WTF will hold a workshop for all interested parties, including international and donor agencies. The workshop will serve to present early thoughts on the individual draft TORs to be prepared by the subcommittees. The workshop will provide a forum for all participants, including NGOs, to make suggestions.

STAGE 4: Draft TOR

The WTF will present the findings of the workshop to the Regional Water Resources Strategy Group and the Interstate Council's Executive Committee to obtain feedback in preparation for completing a final draft TOR for the full project. The final consolidated draft TOR will be prepared using the TORs prepared by each of the subcommittees and the feedback obtained during the workshop.

STAGE 5: Workshop and Final TOR

The WTF will present the draft TOR for this component to the Interstate Council's Executive Committee -- perhaps in a workshop setting -- prior to a planned participative workshop on the larger project related to the Regional Water Resources Management Strategy. Appropriate changes will be incorporated in the TOR and a final version will be submitted to the Interstate Council for final review for funding.

V. PLAN OF IMPLEMENTATION OF SCHEDULE

8. The entire preparation should take six months. The timetable for stages is as follows:

Stage	Brief Description	MONTHS					
		1	2	3	4	5	6
1	Appoint WTF	—					
2	Establish subcommittees	—	—				
3	Workshop			—			
4	Prepare draft equipment needs			—	—		
5	Draft TOR			—	—	—	
6	Workshop and Final TOR						—

9. Four reports would be prepared during the six month period. The reports and associated deadlines are described below:

Report	Due Date (end of)
1. Composition of WTF and subcommittees	Month 1
2. Description of initial elements of TOR as background for workshop	Month 2
3. Draft TOR	Month 5
4. Final TOR	Month 6

ARAL SEA PROGRAM - PHASE 1

Project Briefs and Terms of Reference

PROGRAM 7

Projects:
1. Automatic Control Systems and Civil Works for the Amu Darya Basin
2. Automatic Control Systems and Civil Works for the Syr Darya Basin

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 7

To provide Amu Darya and Syr Darya BVOs with the necessary technological equipment. To install at the abovementioned BVOs automated systems for managing information and forecasting centers there. Implementation of the second stage of the ASUB Syr Darya Project and of the first stage of the ASUB Amu Darya Project.

Project 1: Automatic Control Systems for Water Regulation and Civil Works in the Amu Darya Basin

PROJECT BRIEF

I. BACKGROUND

1. The Heads of States of Kazakhstan and the four republics of Central Asia have decided to provide its Basin Water Management Associations (BVO) for the Amu Darya with engineering means and information and forecasting centers necessary to introduce automated control systems for water resources management in this basin. Furthermore, the Heads of the States decided to support a capacity building program for the BVO providing it with adequate office technology, and other necessary facilities, transport and training.

II. OBJECTIVES

2. The objectives of this program are to ensure timely and adequate water supply to various users and consumers within the river basin, to stimulate economic development, and to convey water to the Amu Darya delta and the Aral Sea with minimum losses. The program is also expected to increase efficiencies of water use and when operated in conjunction with other programs approved by the Heads of States, it is expected to reduce salinity and pollution and halt environmental degradation. Another allied objective is to build the capacity at all levels of the regional organization (BVO) responsible for water distribution to a level that it can discharge its functions with optimum efficiency.

III. SCOPE

3. The proposed program would when fully implemented, provide real time data from the reorganized information and forecasting centers, to the automated control systems for water management through a series of advanced generation computers located in the precincts of the BVO and its branch and field centers. The total program is expected to cover about 42 water intake structures along Amu Darya and its tributaries. After the completion of the feasibility study, the project is expected to be divided into four independent, technically and economically viable tranches. The scope of the

first tranche is expected to be limited to about one quarter of the total program and would form the proposed project for the Aral Sea Program in Phase 1 or Phase 2.

IV. OUTPUTS

4. The project would consist of a computerized automated regulation program for the water intake structures on the Amu Darya. The hardware and the software for the program would be provided for only about one quarter of the total requirement, to cover a discreet and technically viable time slice of the program. Similarly about one quarter of the information collection and forecasting centers would be renovated and modernized. The project would also include repairs to any off-taking structures located within the selected tranche. (However, the capacity building of the BVO would be attended to in its entirety).

V. PLAN OF IMPLEMENTATION AND SCHEDULE

5. The feasibility study for the program is expected to be carried out by local design and research centers and bureaus, in joint venture with foreign consultants, particularly in the fields of Computer Systems Analysis, software for the programs of regulation, and economic and financial analysis. The same team/teams are expected to continue with the final design and implementation, after the technical and economic feasibility has been established and financing assured. Project preparation and implementation is expected to proceed according to the following schedule:

SCHEDULE OF PROJECT PREPARATION AND IMPLEMENTATION

No	ITEMS	YEARS					
		1994	1995	1996	1997	1998	1999
1	Preparation of feasibility study	—					
2	Preparation of final design for first time slice		—				
3	Procurement and contract awards			—			
4	Implementation of first time slice				—	—	—

6. The total project program is expected to cost about US$158 million including physical contingencies (20%) and price contingencies (international). The local cost of the project is expected to be about 10%.

VI. RESOURCES

7. Some preliminary designs for the Amu Darya basin were prepared in 1989. However, these efforts do not account for the advances which have been made in computer technology and automated systems dependent thereon, since that time. New designs would have to be devised which meet the state of the art requirements. The cost of the feasibility study has been estimated at $0.75 million. Preparation of the final design and implementation drawings, for the first time slice, is expected to cost approximately another US$1.25 million. Details for the approximate cost of the feasibility study are given below:

Feasibility Study for Automated Control Systems

Cost in US$ million

Items	Local cost	Foreign cost	Total amount
Local Consultants/specialists	0.13	-	0.13
Foreign Consultants	-	0.37	0.37
Travel	-	0.10	0.10
Training	-	0.05	0.05
Equipment/Goods/Materials	-	0.05	0.05
	0.13	0.57	0.70
Physical and Price Contingency	-	0.05	0.05
	0.13	0.62	0.75

8. Procurement of all goods and services would be carried under procedures consistent with the World Bank's Guidelines for procurement.

VII. JUSTIFICATION

9. The introduction of automation is expected to save about 2 cubic.km of water, after the entire program has been implemented. The program is expected to be economically viable, however, this can only be established firmly after the feasibility study has been completed and the technical and economic analysis completed for the total program and the selected time slice.

VIII. ISSUES

10. During the identification/preparation of the project, the following issues have surfaced:

a. The BVO' does not have access to all the off-take structures from the river. Any regulatory changes at such sites require the permission of the oblasts and territorial administrations.

b. An acute shortage of electric power has adversely affected the regulation regime, as only 70% has been available on the local grids and transformers.

c. The approach channels from the rivers, particularly on main stem of the Amu Darya are subject to progressive loss of capacity and are re-excavated every year. The impact of reduction in discharge in the approach channels would have to be incorporated in the program.

d. The first phase of the program which was completed on the Syr Darya in 1984 is already obsolete and according to some sources "ancient". New automation technology would have to be devised to meet the charging conditions.

11. The above issues have already been incorporated in the terms of reference of the Consultants, who are expected to investigate, analyze and recommend their resolution.

12. The project, Amu Darya is expected to be technically and economically viable. Subject to confirmation by the findings of the feasibility study, it is recommended that the first tranche of the project should be included in the first or the second phase of the Aral Sea Program, for financing.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 7
Project 1: Automatic Control Systems for Water Regulation and Civil Works in the Amu Darya Basin

TERMS OF REFERENCE

I. BACKGROUND

1. The Heads of States for Kazakhstan and the four Republics of Central Asia: Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan have agreed to provide the BVO Amu Darya, which is a regional basin Water Management Associations, with engineering means to introduce automated control systems for water resources in these basins and organize information and forecasting centers. Furthermore, the Heads of States have decided to support capacity building for this regional organization and to modernize office and computer facilities.

II. OBJECTIVES

2. The responsibilities of the BVO are to deliver water resources to various users and consumers within the river basins, to serve the populations and the economic development of the states, and also to convey water to Amu Darya river delta and to the Aral Sea. The BVO is also entrusted to operate the jointly used water supply structures, hydraulic systems and reservoirs, canals and other facilities under the charge of the ICWC. The BVO accounts for the disposition of all waters, this is also termed "Water-Balance" and is built-up from actual stream flows, diversions and measured return flows and estimates of unmeasured losses and gains in each reach of either river. The facilities operated by the BVO are essentially the diversion structures and headworks to the canals together with the measurement facilities entrusted to the BVO for data and information transmission. The BVO operates the telephone and radio networks. Automation has been introduced in varying degrees. Much of it goes little beyond the level of remote but local operation of gates from central control rooms situated at the headworks and linked to water-level sensors. In some cases it is understood that gates are remotely controlled over great distances; instructions to gate operators are given by radio or telephone links.

3. The objectives of decisions taken by the Heads of States are to provide the BVO with the means of water measurement forecasting and regulation and to exercise control over the Amu Darya river system in real time; a study has therefore been proposed to achieve these objectives. The proposed study would concentrate on the technical, financial and economical issues, attendant on the strategies to be adopted and should provide the Interstate State Committee of the Heads of States with an economically sound investment program.

4. The preparation of the feasibility study is expected to be carried out by local design and research enterprises and bureaus located in the five republics. However, outside assistance from individuals and specialized firms

would be necessary in the fields of designing computer systems analysis, software for the programs and carrying out financial and economic analysis acceptable to international lending donor agencies. The local enterprises and bureaus together with specialized expatriate firms are, hereinafter, termed as the Consultant.

III. SCOPE OF WORK

5. The scope of the Consultant's services shall cover the following assignments:

a) Examination and Analysis of existing facilities and those needed to enable the collection of data on flow formations of the Amu Darya in upper reaches, mainly in Tajikistan including surface stream flow of the river and all its tributaries through an analysis of the following:

   (i) surface flows in rivers and their tributary streams;

   (ii) releases from reservoirs;

   (iii) additions to surface flows from ground water and other return flows.

b) Assessment of the losses and gains in the rivers in the reach below the formation zones, resulting from evaporation, deep infiltration and other surface losses.

c) Determination of the water uses in the Amu Darya basin, for irrigation, domestic water supply, industry, etc. by using standard time periods.

d) Examination of the existing information collection and forecasting stations, to establish their shortcomings, if any, and to prepare a program for modernizing the same. These stations would be expected to collect and transmit information on quantity of water, quality of water, water losses, silt charge, meteorological data, etc.

e) Collection of information on other specialized organizations, who transmit data on hydro-meteorology and water pollution, for determining the water quality patterns.

f) Designing a computerized automatic regulation systems program for about 42 water intake structures along the Amu Darya, and its tributaries. The automatic regulations systems program will

include the design of all computer hardware, software, systems analysis programs, and any other ancillary facilities.

g) Establishing the costs, including O & M costs and replacement costs, and benefits of the program and carrying out a financial and economic analysis using methodology acceptable to international lending/donor organizations.

h) Submitting periodic progress reports and final reports on all aspects of the program as set out in detail in the terms of reference.

i) Carrying out an assessment of the existing staff and equipment available to the BVO's, including their suboffices, with a view to building their capacity for discharging their responsibilities as a regional organization. Establishing the requirements of capacity building for the staff of the BVO's at their headquarters, and suboffices, and to provide them with necessary computers, office facilities, training, transport, etc.

6. The Consultant's services as stipulated in the implementation schedule shall be carried out in three distinct phases as enumerated below:

Phase A: Feasibility Study. Review of the existing automation facilities for the Syr Darya and review of all existing documents and data; preparation of preliminary design of an automated, computerized regulation system; and preliminary estimation of benefits and carrying out financial and economic analysis, for the Syr Darya. The analysis and finalizing of capacity building aspects for the BVO would be presented in a separate volume.

Phase B: Final Design and Implementation Drawings and Details. The consultant shall review the total program on each river and based on technical and financial constraints divide it into packages which can be implemented one after the other. The final design would be prepared only for that package which is ready for implementation and for which financing has been secured.

Phase C: Implementation of the Program, Operation and Maintenance and Training. This phase would succeed the final design for each selected package in succession.

7. The services of the Consultant shall be self terminating at the end of each phase; the Consultant shall not proceed with any subsequent phase until and unless authorized in writing by the employer.

8. The Consultant's services shall follow sound engineering and economic practices and shall comprise of but not be limited to the brief description of the Consultant's Terms of Reference given hereunder for each phase.

IV. DESIGN OF TASKS

Consultant's Work under Phase A.

9. The Consultant's Services during Phase A, which is expected to cover a period of approximately 7 months, shall be directed to the preparation of the technical and economical feasibility reports, including any field work, which is required to achieve these objectives.

10. The Scope of Consultant's Services, in Phase A shall be regulated by and not limited to the technical and economical considerations, narrated in paragraphs 2.07 to 2.27 below, in so far as may be necessary.

11. The Consultant shall review and evaluate the following reports, documents and data presently existing in the archives of the employer.

Amu Darya

(i) Design of the Automated Management Water Regulation System for the Amu Darya Basin. 1989, 15 volumes.

(ii) Annual Reports on Hydrology. 1984-1994.

(iii) Annual Reports of BVO "Amu Darya"

(iv) Annual Reports on Regime of Work on Tuya-Muyun Reservoir.

(v) Various Reports in the archives of SANIIRI and BVO Amu Darya.

(vi) Report by SANIIRI on Water Control System of Amu Darya.

(vii) Project for Construction of Gauging Stations on the Amu Darya.

(viii) Data collected from Hydrometeorological and other services.

12. The Consultant shall examine all available data on flow formations in the Amu Darya Basin. These data shall cover surface flows, releases from reservoirs, and additions of ground water. The Consultant shall further study: the methods for collecting these data and the analytical methods, used for processing them. He will also identify and recommend any improvements to these hydrological and hydrogeological programs. The Consultant's analysis is expected to establish the total availability of flows at various river profiles where offtakes are located.

13. The Consultant shall also prepare an inventory of water users for irrigation, domestic water supply and industry. While establishing these uses, the Consultant shall take into account the time-lags that are expected to occur in transferring the water resources from the formative regions to regions of consumptive uses. The Consultant shall analyze the demand pattern and relate the same to the water availability in average year. The period of excesses and shortages should be computed and furthermore this analyses should be expanded to include inflows from the reservoirs and groundwater.

14. The Consultant shall collect data on the existing instrumentation and equipment available at the Information Collection and forecasting stations and analyze the effectiveness of their operation. In particular, the Consultant shall recommend any additional equipment and/or improvement of existing equipment. The quality and the extent of the equipment of these stations should be such as to meet the technical requirements of the projected automated stations. The Consultant shall also prepare an inventory of all the specialized equipment for the transmission of these automatic data from the Information Collection and forecasting stations to the control stations, located in the subunits and the headquarters of the BVO's.

15. The Consultant shall proceed to prepare a computerized automated regulation program for about 42 water intake structures along the Amu Darya. This program must be responsive to the following information modules:

(a) Water Resources of the System

- Information about surface water inflows in main river stem
- Information about local water resources
- Information about drainage effluent
- Information about water intakes of surface water
- Information about water storage in reservoirs
- Information on water flow to the Aral Sea zone and to the Aral Sea
- Inflow forecasts in main stem
- Side inflow forecasts
- Local sources effluent forecasts
- Bed erosion forecasts
- Backwater forecasts
- Subsurface supply forecast
- Total available water resources forecasts.

(b) Water Demands in all Sectors

- Water Demand estimate for irrigation
- Analysis and assessment of applications in water demand for irrigation
- Water demand estimate for industry and communal necessities at consumptive use centers
- Consolidated water demand estimate at Management Control Station, Regional Management and Water Resources Complex

- Water demand estimate for ecological needs
- Recreation requirements
- Water demand estimate at Water Resources Complex, Regional Management and the Basin according to uncontrolled sources

(c) Planning for Sub-systems in the Water Resources Complex

- Estimate of water resources deficiency levels
- Estimate of reservoirs carryover regulation capacity
- Elaboration of yearly plan (Water Resources Complex level)
- Elaboration of yearly plan (Regional Management level)
- Estimate of water deficiency in agriculture
- Estimate of hydro power indices
- Estimate of social hardship due to water shortage
- Estimate of optimal subsurface water use regime
- Estimate of water deficiency level for current term
- Elaboration of current water distribution plan.

(d) Automatic Systems Control for the Basin
On-line Control

- Estimate of current water supply plan
- Registration of water resources dynamics in zone of runoff regulation
- Control of management operational command
- Information about Management Control Station operation schedule
- Assessment of Management Control Station actual state
- Correction of Management Control Station operation schedule
- Estimate of changing process for Management Control Station
- Estimate of Management Control Station operation schedule with pumping stations

(e) Automatic Systems Control for the Basin
Registration and Management

- Registration and management of water supply plan for execution
- Registration and management of water supply in a basin
- Registration and management of reservoirs operations
- Registration of directives, instructions and execution
- Control of water demand execution in Regional Management Stations
- Control of water demands execution in the basin.

(f) Composition of Input Data on Water Quality

- Information on surface inflows to the main streams
- Information on water quality in tributary streams (local sources)

- Information on water quality in collectors
- Information on water quality in reservoirs
- Information on water quality - underground water
- Forecast of surface water quality in the main river
- Forecast of water quality in the main streams
- Forecast of water quality in tributary streams
- Forecast of water quality of return flow water
- Forecast of water quality of bed inflow
- Forecast of water quality of underground water
- Forecast/Balance of quality of total water resources available
- Control of water volume and quality in sections under control

16. Design an automatic system of regulation, responsive to the above packages of inputs, and capable of adjusting the discharges in the off-takes, to meet the revised demands, in real time.

17. Prepare a detailed list of all computer equipment, software and other related equipment and provide a cost estimate both for imported equipment (in foreign exchange) and local equipment, if any.

18. The Consultant shall also calculate the cost of operation and maintenance and the cost of periodic replacement

19. During the course of his analysis the Consultant shall pay particular attention to the following issues and provide specific recommendations thereto:

(a) Assess the restrictions on the BVOs, to operate in different oblasts and territorial administrations, and its impact on the proposed automated system;

(b) Examine and report on the possibility that the BVOs should control only the rim stations, with responsibility limited to transfers of water from one republic to the other. In this alternative the Republic Ministries of Water Economy would be responsible for the remaining off-takes, located within their republics;

(c) An acute shortage of electrical power has been affecting the operation of the canal systems. The Consultant shall prepare a preliminary study on the requirements of power and suggest ways to meet this additional demand on the local grids;

(d) The Consultant shall analyze the cost of installations for stations that are located at great distances and make recommendations on the advisability of excluding them from the program.

20. A number of hydraulic structures have deteriorated because of lack of maintenance and repairs. Among them are key water intakes and regulation structures. The Consultant shall prepare an inventory of their requirements of repairs and also recommend a phased program of their implementation. Preferably the phasing shall be such that those structures which are included in the ongoing phase of automation are repaired on a priority basis.

21. The head-reaches of the off-take channels constitute an open cut from the river, especially in the case of the Amu Darya. These open cut channels have to be cleaned (dredged and excavated) every year and require about 50 million cubic meters of earthwork excavation on the Amu Darya alone. The Consultant shall examine the impact of the variable discharge in the approach channel on the design of the automatic system.

22. The Consultant shall prepare, based on his preliminary design, preliminary cost estimates and investment schedules. Furthermore, he shall prepare a phased program of completing the entire automation on both the rivers and their tributaries. The priorities in this program would be based on economic and technical parameters and would be presented in such a manner that time slices of the program can be implemented in successive installments.

23. The Consultant shall calculate the direct and the indirect benefits from the automation of the system. The benefits ascribed to savings in water shall be supported by analytical calculations based on acceptable methodology.

24. The Consultant shall carry out an economic and financial analysis of the automation system for each of the rivers separately. Sensitivity analysis of the economic viability of the selected alternatives would also be carried out by considering changes in key factors affecting costs and benefits. The Consultant shall take into account the shadow price of foreign exchange in performing the economic analysis. The economic and financial analysis shall be carried out in a manner acceptable to international financing/donor agencies, and in sufficient detail to allow judgment on the advisability of the investment.

25. The Consultant shall calculate the annual operation, maintenance and repair charges for the proposed automation system and shall carry out a study on the cost recovery of these charges as well as the capital investment.

26. The Consultant shall prepare a brief report on the environmental impact of the proposed automation system on the regime of the two rivers and the service area supplied by them.

Capacity Building of BVO's

27. BVO Syr Darya consists of seven sub-units with their headquarters in: Uch-Curgan, Gulistan, Chirchik, Tohta-Gul, Charvak, Andijan and Leninabad, employing a total staff of about 1,000 persons. About 60 persons are also employed at the Headquarters in Tashkent. BVO Amu-Darya employees about ___

persons in its subunits Kurgan-Tube, Charjou, Urgench, Nukus, and another ___ persons at its headquarters at Urgench. The BVOs have evolved a strong conceptual approach to water-management. Financial constrains, however, and interruption of their development programs following the break-up of the USSR have left them vulnerable and ill-equipped. The Consultant shall propose a program to modernize the in house office and computer facilities and to support the development of modelling and management capabilities. The Consultant shall further provide a program of study tours, training and overseas fellowships with emphasis on water management. He shall explore the possibilities of information exchange with other agencies abroad, in such areas as software, and analytical approach to water management. The Consultant shall also assess the requirements for transport, machinery and equipment, that are necessary for successful operation of these regional organizations and make recommendations. The findings of the Consultant shall be presented in separate reports for BVO "Amu Darya" and BVO "Syr Darya".

V. TIME SCHEDULE AND REPORTING

28. The Consultant shall submit his findings in the form of reports as designated below:

(i) Summary Report and Executive Summary;

(ii) Technical report on the design of the system;

(iii) Cost estimates and analysis of rates, including bills of quantities and technical specifications;

(iv) Benefits and justification, including financial and economic analysis and sensitivity analysis and cost recovery;

(v) Drawings, data, charts and maps.

29. All reports, including drawings, data, charts and maps shall be prepared in Russian and in English. The Consultant shall provide 40 sets of each feasibility study in Russian and in English to the Employer.

30. Separate feasibility studies, shall be prepared for the Amu-Darya Automated System and that on the Syr-Darya.

31. The Consultant shall provide special on-the-job training, particularly applicable to the review and design of the automated system and its operation.

32. The initial phase of the consultants tasks would be carried out in about seven months, as detailed below:

NO	Item	MONTHS						
		1	2	3	4	5	6	7
1	Mobilization							
	Phase A							
2	Study of Existing Documents							
3	Collection of Information on Hydrology							
4	Collection of Information from Outside Sources							
5	Analysis of Existing Staff of BVO's							
6	Analysis of Existing Information Collection Centers							
7	Preparation of Computer Program for Six Modules and Design for Information Collection Centers							
8	Preparation of List of Computer and Other Equipment and Information Collection Centers							
9	Calculations of Costs and Benefits							
10	Computation of Financial and Economic Analysis, Sensitivity Analysis and Cost Recovery							
11	Submission of Reports							

VI. PROPOSED BUDGET

33. The first phase of the feasibility would be carried out at a cost of $0.75 million, as detailed below:

Feasibility Study for Automated Control Systems

Cost in US$ million

Items	Local cost	Foreign cost	Total amount
Local Consultants/specialists	0.13	-	0.13
Foreign Consultants	-	0.37	0.37
Travel	-	0.10	0.10
Training	-	0.05	0.05
Equipment/Goods/Materials	-	0.05	0.05
	0.13	0.57	0.70
Physical and Price Contingency	-	0.05	0.05
	0.13	0.62	0.75

34. Preparation of the final design and drawings for the first time slice would require an additional cost of $ 1.25 million.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 7

To provide Amu Darya and Syr Darya BVOs with the necessary technological equipment. To install at the above mentioned BVOs automated systems for managing information and forecasting centers there. Implementation of the second stage of the ASUB Syr Darya Project and of the first stage of the ASUB Amu Darya Project.

Project 2: Automatic Control Systems for Water Regulation and Civil Works in the Syr Darya Basin

PROJECT BRIEF

I. BACKGROUND

1. The Heads of States of Kazakhstan and the four republics of Central Asia have decided to provide its Basin Water Management Association (BVO) for the Syr Darya with engineering means and information and forecasting centers necessary to introduce automated control systems for water resources management in this basin. Furthermore, the Heads of the States decided to support a capacity building program for the BVO providing it with adequate office technology, and other necessary facilities, transport and training.

II. OBJECTIVES

2. The objectives of this program are to ensure timely and adequate water supply to various users and consumers within the river basin, to stimulate economic development, and to convey water to the Syr Darya delta and the Aral Sea with minimum losses. The program is also expected to increase efficiencies of water use and when operated in conjunction with other programs approved by the Heads of States, it is expected to reduce salinity and pollution and halt environmental degradation. Another allied objective is to build the capacity at all levels of the regional organization (BVO) responsible for water distribution to a level that it can discharge its functions with optimum efficiency.

III. SCOPE

3. The proposed program would when fully implemented, provide real time data from the reorganized information and forecasting centers, to the automated control systems for water management through a series of advanced generation computers located in the precincts of the BVO and its branch and field centers. The total program is expected to cover about 42 water intake structures along Syr Darya and its tributaries. After the completion of the feasibility study, the project is expected to be divided into four independent, technically and economically viable tranches. The scope of the first tranche is expected to be limited to about one quarter of the total program and would form the proposed project for the Aral Sea Program in Phase 1 or Phase 2.

IV. OUTPUTS

4. The project would consist of a computerized automated regulation program for the water intake structures on the Syr Darya. The hardware and the software for the program would be provided for only about one quarter of the total requirement, to cover a discreet and technically viable time slice of the program. Similarly about one quarter of the information collection and forecasting centers would be renovated and modernized. The project would also include repairs to any off-taking structures located within the selected tranche. However, the capacity building of the BVO would be attended to in its entirety.

V. PLAN OF IMPLEMENTATION AND SCHEDULE

5. The feasibility study for the program is expected to be carried out by local design and research centers and bureaus, in joint venture with foreign consultants, particularly in the fields of Computer Systems Analysis, software for the programs of regulation, and economic and financial analysis. The same team/teams are expected to continue with the final design and implementation, after the technical and economic feasibility has been established and financing assured. Project preparation and implementation is expected to proceed the following schedule:

SCHEDULE OF PROJECT PREPARATION AND IMPLEMENTATION

No	ITEMS	YEARS				
		1994	1995	1996	1997	1998
1	Preparation of feasibility study	—				
2	Preparation of final design for first time slice		—			
3	Procurement and contract awards			—		
4	Implementation of first time slice				—	—

6. The total project program is expected to cost about US$158 million including physical contingencies (20%) and price contingencies (international). The local cost of the project is expected to be about 10%.

VI. RESOURCES

7. Final designs and implementation drawing for the Syr Darya basin were prepared in 1974-78 and partly implemented, under direction from Moscow. However, these efforts do not account for the advances which have been made in computer technology and automated systems dependent thereon, since that time. New designs would have to be devised which meet the state of the art requirements. The cost of the feasibility study has been approximately computed and is expected to be in the region of $0.75 million. Preparation of the final design and implementation drawings, for the first time slice, is

expected to cost approximately another US$1.25 million. Details for the approximate cost of the feasibility study are given below:

Feasibility Study for Automated Control Systems

	Cost in US$ million		
Items	Local cost	Foreign cost	Total amount
Local Consultants/specialists	0.13	-	0.13
Foreign Consultants	-	0.37	0.37
Travel	-	0.10	0.10
Training	-	0.05	0.05
Equipment/Goods/Materials	-	0.05	0.05
	0.13	0.57	0.70
Physical and Price Contingency	-	0.05	0.05
	0.13	0.62	0.75

8. Procurement of all goods and services would be carried under procedures consistent with the World Bank's Guidelines for procurement.

VII. JUSTIFICATION

9. The introduction of automation is expected to save about 1 cubic.km of water, after the entire program has been implemented. The program is expected to be economically viable, however, this can only be established firmly after the feasibility study has been completed and the technical and economic analysis completed for the total program and the selected time slice.

VIII. ISSUES

10. During the identification/preparation of the project, the following issues have surfaced:

a. The BVO does not have access to all the off-take structures from the river. Any regulatory changes at such sites require the permission of the oblasts and territorial administrations.

b. An acute shortage of electric power has adversely affected the regulation regime, as only 70% has been available on the local grids and transformers.

c. The approach channels from the rivers, particularly on main stem of the Amu Darya are subject to progressive loss of capacity and are re-excavated every year. The impact of reduction in discharge in the approach channels would have to be incorporated in the program.

d. The first phase of the program which was completed on the Syr Darya in 1984 is already obsolete and according to some sources "ancient". New automation technology would have to be devised to meet the charging conditions.

11. The above issues have already been incorporated in the terms of reference of the Consultants, who are expected to investigate, analyze and recommend their resolution.

12. The project, Amu Darya is expected to be technically and economically viable. Subject to confirmation by the findings of the feasibility study, it is recommended that the first tranche of the project should be included in the first or the second phase of the Aral Sea Program, for financing.

ARAL SEA PROGRAM - PHASE I

Heads of States Approved Program No. 7
Project 2: Automatic Control Systems for Water Regulation and Civil Works in the Syr Darya Basin

TERMS OF REFERENCE

I. BACKGROUND

1. The Heads of States for Kazakhstan and the four Republics of Central Asia: Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan have agreed to provide the BVO Syr Darya, which is a regional basin Water Management Associations, with engineering means to introduce automated control systems for water resources in this basins and organize information and forecasting centers. Furthermore, the Heads of States have decided to support capacity building for this regional organization and to modernize office and computer facilities.

II. OBJECTIVES

2. The responsibilities of the BVO are to deliver water resources to various users and consumers within the river basin, to serve the populations and the economic development of the states, and also to convey water to Syr Darya river delta and to the Aral Sea. The BVO is also entrusted to operate the jointly used water supply structures, hydraulic systems and reservoirs, canals and other facilities under the charge of the ICWC. The BVO accounts for the disposition of all waters, this is also termed "Water-Balance" and is built-up from actual stream flows, diversions and measured return flows and estimates of unmeasured losses and gains in each reach of either river. The facilities operated by the BVO are essentially the diversion structures and headworks to the canals together with the measurement facilities entrusted to the BVO for data and information transmission. The BVO operates the telephone and radio networks. Automation has been introduced in varying degrees. Much of it goes little beyond the level of remote but local operation of gates from central control rooms situated at the headworks and linked to water-level sensors. In some cases it is understood that gates are remotely controlled over great distances; instructions to gate operators are given by radio or telephone links.

3. The objectives of decisions taken by the Heads of States are to provide the BVO with the means of water measurement forecasting and regulation and to exercise control over the Syr Darya river system in real time; a study has therefore been proposed to achieve these objectives. The proposed study would concentrate on the technical, financial and economical issues, attendant on the strategies to be adopted and should provide the Interstate State Committee of the Heads of States with an economically sound investment program.

4. The preparation of the feasibility study is expected to be carried out by local design and research enterprises and bureaus located in the five

republics. However, outside assistance from individuals and specialized firms would be necessary in the fields of designing computer systems analysis, software for the programs and carrying out financial and economic analysis acceptable to international lending donor agencies. The local enterprises and bureaus together with specialized expatriate firms are, hereinafter, termed as the Consultant.

III. SCOPE OF WORK

5. The scope of the Consultant's services shall cover the following assignments:

a) Examination and Analysis of existing facilities and those needed to enable the collection of data on flow formations along the Syr Darya through an analysis of the following:

   (i) surface flows in rivers and their tributary streams;

   (ii) releases from reservoirs;

   (iii) additions to surface flows from ground water and other return flows.

b) Assessment of the losses and gains in the rivers in the reach below the formation zones, resulting from evaporation, deep infiltration and other surface losses.

c) Determination of the water uses in the Syr Darya basin, for irrigation, domestic water supply, industry, etc. by using standard time periods.

d) Examination of the existing information collection and forecasting stations, to establish their shortcomings, if any, and to prepare a program for modernizing the same. These stations would be expected to collect and transmit information on quantity of water, quality of water, water losses, silt charge, meteorological data, etc.

e) Collection of information on other specialized organizations, who transmit data on hydro-meteorology and water pollution, for determining the water quality patterns.

f) Designing a computerized automatic regulation systems program for about 250 water intake structures on the Syr Darya, and its tributaries. The automatic regulations systems program will include the design of all computer hardware, software, systems analysis programs, and any other ancillary facilities.

g) Establishing the costs, including O & M costs and replacement costs, and benefits of the program and carrying out a financial and economic analysis using methodology acceptable to international lending/donor organizations.

h) Submitting periodic progress reports and final reports on all aspects of the program as set out in detail in the terms of reference.

i) Carrying out an assessment of the existing staff and equipment available to the BVO's, including their suboffices, with a view to building their capacity for discharging their responsibilities as a regional organization. Establishing the requirements of capacity building for the staff of the BVO's at their headquarters, and suboffices, and to provide them with necessary computers, office facilities, training, transport, etc.

6. The Consultant's services as stipulated in the implementation schedule shall be carried out in three distinct phases as enumerated below:

Phase A: Feasibility Study. Review of the existing automation facilities for the Syr Darya and review of all existing documents and data; preparation of preliminary design of an automated, computerized regulation system; and preliminary estimation of benefits and carrying out financial and economic analysis for the Syr Darya. The analysis and finalizing of capacity building aspects for the BVO would be presented in a separate volume.

Phase B: Final Design and Implementation Drawings and Details. The consultant shall review the total program on each river and based on technical and financial constraints divide it into packages which can be implemented one after the other. The final design would be prepared only for that package which is ready for implementation and for which financing has been secured.

Phase C: Implementation of the Program, Operation and Maintenance and Training. This phase would succeed the final design for each selected package in succession.

7. The services of the Consultant shall be self terminating at the end of each phase; the Consultant shall not proceed with any subsequent phase until and unless authorized in writing by the employer.

8. The Consultant's services shall follow sound engineering and economic practices and shall comprise of but not be limited to the brief description of the Consultant's Terms of Reference given hereunder for each phase.

IV. DESIGN OF TASKS

Consultant's Work under Phase A.

9. The Consultant's Services during Phase A, which is expected to cover a period of approximately 7 months, shall be directed to the preparation of the technical and economical feasibility reports, including any field work, which is required to achieve these objectives.

10. The Scope of Consultant's Services, in Phase A shall be regulated by and not limited to the technical and economical considerations, narrated in paragraphs 2.07 to 2.27 below, in so far as may be necessary.

11. The Consultant shall review and evaluate the following reports, documents and data presently existing in the archives of the employer.

Syr-Darya

1. Technical Project of Automated Systems of Management on the Syr Darya river (1974-1978); 64 volumes.

2. Working Documents (1981-1993); 150 volumes.

3. Annual Data on hydrometeorology (1984-1994); 10 volumes:

   (a) surface flow;
   (b) Operation of reservoirs;
   (c) Return flows;
   (d) Ground water.

12. The Consultant shall examine all available data on flow formations in the Syr Darya Basin. These data shall cover surface flows, releases from reservoirs, and additions of ground water. The Consultant shall further study: the methods for collecting these data and the analytical methods, used for processing them. He will also identify and recommend any improvements to these hydrological and hydrogeological programs. The Consultant's analysis is expected to establish the total availability of flows at various river profiles where offtakes are located.

13. The Consultant shall also prepare an inventory of water users for irrigation, domestic water supply and industry. While establishing these uses, the Consultant shall take into account the time-lags that are expected to occur in transferring the water resources from the formative regions to regions of consumptive uses. The Consultant shall analyze the demand pattern and relate the same to the water availability in average year. The period of excesses and shortages should be computed and furthermore this analyses should be expanded to include inflows from the reservoirs and groundwater.

14. The Consultant shall collect data on the existing instrumentation and equipment available at the Information Collection and forecasting stations and analyze the effectiveness of their operation. In particular, the Consultant shall recommend any additional equipment and/or improvement of existing equipment. The quality and the extent of the equipment of these stations should be such as to meet the technical requirements of the projected automated stations. The Consultant shall also prepare an inventory of all the specialized equipment for the transmission of these automatic data from the Information Collection and forecasting stations to the control stations, located in the subunits and the headquarters of the BVO's.

15. The Consultant shall proceed to prepare a computerized automated regulation program for about 250 structures on the Syr Darya and its tributaries. This program must be responsive to the following information modules:

(a) Water Resources of the System

- Information about surface water inflows in main river stem
- Information about local water resources
- Information about drainage effluent
- Information about water intakes of surface water
- Information about water storage in reservoirs
- Information water flow to the Aral Sea zone and to the Aral Sea
- Inflow forecasts in main stem
- Side inflow forecasts
- Local sources effluent forecasts
- Bed erosion forecasts
- Backwater forecasts
- Subsurface supply forecast
- Total available water resources forecasts.

(b) Water Demands in all Sectors

- Water Demand estimate for irrigation
- Analysis and assessment of applications in water demand for irrigation
- Water demand estimate for industry and communal necessities at consumptive use centers

- Consolidated water demand estimate at Management Control Station, Regional Management and Water Resources Complex
- Water demand estimate for ecological needs
- Recreation requirements
- Water demand estimate at Water Resources Complex, Regional Management and the Basin according to uncontrolled sources

(c) Planning for Sub-systems in the Water Resources Complex

- Estimate of water resources deficiency levels
- Estimate of reservoirs carryover regulation capacity
- Elaboration of yearly plan (Water Resources Complex level)
- Elaboration of yearly plan (Regional Management level)
- Estimate of water deficiency in agriculture
- Estimate of hydro power indices
- Estimate of social hardship due to water shortage
- Estimate of optimal subsurface water use regime
- Estimate of water deficiency level for current term
- Elaboration of current water distribution plan.

(d) Automatic Systems Control for the Basin
On-line Control

- Estimate of current water supply plan
- Registration of water resources dynamics in zone of runoff regulation
- Control of management operational command
- Information about Management Control Station operation schedule
- Assessment of Management Control Station actual state
- Correction of Management Control Station operation schedule
- Estimate of changing process for Management Control Station
- Estimate of Management Control Station operation schedule with pumping stations

(e) Automatic Systems Control for the Basin
Registration and Management

- Registration and management of water supply plan for execution
- Registration and management of water supply in a basin
- Registration and management of reservoirs operations
- Registration of directives, instructions and execution
- Control of water demand execution in Regional Management Stations
- Control of water demands execution in the basin.

(f) Composition of Input Data on Water Quality

- Information on surface inflows to the main streams
- Information on water quality in tributary streams (local sources)
- Information on water quality in collectors
- Information on water quality in reservoirs
- Information on water quality - underground water
- Forecast of surface water quality in the main river
- Forecast of water quality in the main streams
- Forecast of water quality in tributary streams
- Forecast of water quality of return flow water
- Forecast of water quality of bed inflow
- Forecast of water quality of underground water
- Forecast/Balance of quality of total water resources available
- Control of water volume and quality in sections under control

16. Design an automatic system of regulation, responsive to the above packages of inputs, and capable of adjusting the discharges in the off-takes, to meet the revised demands, in real time.

17. Prepare a detailed list of all computer equipment, software and other related equipment and provide a cost estimate both for imported equipment (in foreign exchange) and local equipment, if any.

18. The Consultant shall also calculate the cost of operation and maintenance and the cost of periodic replacement

19. During the course of his analysis the Consultant shall pay particular attention to the following issues and provide specific recommendations thereto:

(a) Assess the restrictions on the BVOs, to operate in different oblasts and territorial administrations, and its impact on the proposed automated system;

(b) Examine and report on the possibility that the BVOs should control only the rim stations, with responsibility limited to transfers of water from one republic to the other. In this alternative the Republic Ministries of Water Economy would be responsible for the remaining off-takes, located within their republics;

(c) An acute shortage of electrical power has been affecting the operation of the canal systems. The Consultant shall prepare a preliminary study on the requirements of power and suggest ways to meet this additional demand on the local grids;

(d) The Consultant shall analyze the cost of installations for stations that are located at great distances and make recommendations on the advisability of excluding them from the program.

20. A number of hydraulic structures have deteriorated because of lack of maintenance and repairs. Among them are key water intakes and regulation structures. The Consultant shall prepare an inventory of their requirements of repairs and also recommend a phased program of their implementation. Preferably the phasing shall be such that those structures which are included in the ongoing phase of automation are repaired on a priority basis.

21. The head-reaches of the off-take channels constitute an open cut from the river, especially in the case of the Amu Darya. These open cut channels have to be cleaned (dredged and excavated) every year and require about 50 million cubic meters of earthwork excavation on the Amu Darya alone. This type of offtake is also used for the Kirov Canal from the Syr Darya. The Consultant shall examine the impact of the variable discharge in the approach channel on the design of the automatic system.

22. The Consultant shall prepare, based on his preliminary design, preliminary cost estimates and investment schedules. Furthermore, he shall prepare a phased program of completing the entire automation on both the rivers and their tributaries. The priorities in this program would be based on economic and technical parameters and would be presented in such a manner that time slices of the program can be implemented in successive installments.

23. The Consultant shall calculate the direct and the indirect benefits from the automation of the system. The benefits ascribed to savings in water shall be supported by analytical calculations based on acceptable methodology.

24. The Consultant shall carry out an economic and financial analysis of the automation system for each of the rivers separately. Sensitivity analysis of the economic viability of the selected alternatives would also be carried out by considering changes in key factors affecting costs and benefits. The Consultant shall take into account the shadow price of foreign exchange in performing the economic analysis. The economic and financial analysis shall be carried out in a manner acceptable to international financing/donor agencies, and in sufficient detail to allow judgment on the advisability of the investment.

25. The Consultant shall calculate the annual operation, maintenance and repair charges for the proposed automation system and shall carry out a study on the cost recovery of these charges as well as the capital investment.

26. The Consultant shall prepare a brief report on the environmental impact of the proposed automation system on the regime of the two rivers and the service area supplied by them.

Capacity Building of BVO's

27. BVO Syr Darya consists of seven sub-units with their headquarters in: Uch-Curgan, Gulistan, Chirchik, Tohta-Gul, Charvak, Andijan and Leninabad, employing a total staff of about 1,000 persons. About 60 persons are also employed at the Headquarters in Tashkent. The BVOs have evolved a strong conceptual approach to water-management. Financial constrains, however, and interruption of their development programs following the break-up of the USSR have left them vulnerable and ill-equipped. The Consultant shall propose a program to modernize the in house office and computer facilities and to support the development of modelling and management capabilities. The Consultant shall further provide a program of study tours, training and overseas fellowships with emphasis on water management. He shall explore the possibilities of information exchange with other agencies abroad, in such areas as software, and analytical approach to water management. The Consultant shall also assess the requirements for transport, machinery and equipment, that are necessary for successful operation of these regional organizations and make recommendations. The findings of the Consultant shall be presented in separate reports for BVO "Amu Darya" and BVO "Syr Darya".

V. TIME SCHEDULE AND REPORTING

28. The Consultant shall submit his findings in the form of reports as designated below:

(i) Summary Report and Executive Summary;

(ii) Technical report on the design of the system;

(iii) Cost estimates and analysis of rates, including bills of quantities and technical specifications;

(iv) Benefits and justification, including financial and economic analysis and sensitivity analysis and cost recovery;

(v) Drawings, data, charts and maps.

29. All reports, including drawings, data, charts and maps shall be prepared in Russian and in English. The Consultant shall provide 40 sets of each feasibility study in Russian and in English to the Employer.

30. The Consultant shall provide special on-the-job training, particularly applicable to the review and design of the automated system and its operation.

31. The initial phase of the consultants tasks would be carried out in about seven months as detailed below:

NO	Item	MONTHS						
		1	2	3	4	5	6	7
1	Mobilization							
	Phase A							
2	Study of Existing Documents							
3	Collection of Information on Hydrology							
4	Collection of Information from Outside Sources							
5	Analysis of Existing Staff of BVO's							
6	Analysis of Existing Information Collection Centers							
7	Preparation of Computer Program for Six Modules and Design for Information Collection Centers							
8	Preparation of List of Computer and Other Equipment and Information Collection Centers							
9	Calculations of Costs and Benefits							
10	Computation of Financial and Economic Analysis, Sensitivity Analysis and Cost Recovery							
11	Submission of Reports							

VI. PROPOSED BUDGET

32. The furst phase of the feasibility would be carried out at a cost of $0.75 million, as detailed below:

Feasibility Study for Automated Control Systems

Items	Cost in US$ million		
	Local cost	Foreign cost	Total amount
Local Consultants/specialists	0.13	-	0.13
Foreign Consultants	-	0.37	0.37
Travel	-	0.10	0.10
Training	-	0.05	0.05
Equipment/Goods/Materials	-	0.05	0.05
	0.13	0.57	0.70
Physical and Price Contingency	-	0.05	0.05
	0.13	0.62	0.75

33. Preparation of the final design and drawings for the first time slice would require an additional cost of $1.25 million.

ARAL SEA PROGRAM - PHASE 1

Project Brief and Terms of Reference

Supplementary Program

Project: 1. Capacity Building for Executive Committee for the ICAS and for the International Fund for the Aral Sea

ARAL SEA PROGRAM - PHASE I

Supplementary Program
Capacity Building Project

PROJECT BRIEF AND TERMS OF REFERENCE

I. BACKGROUND

1. The Aral Sea was the fourth largest inland lake in the world. However, due to extensive diversions from the Amu and Syr rivers for irrigation, the sea has shrunk to less than half its original size. Saline drainage from irrigated lands, excessive use of agrochemicals and industrial waste have polluted the lower reaches of the rivers. The destruction of the ecosystem of the sea, the blowing of salts from the exposed seabed and the polluted surface and groundwater have created serious health hazards and depressed the economy of a wide zone around the sea.

2. Numerous reports have been written by experts and international organizations to address the crisis but effective solutions have remained elusive. In response to the requests from the five Aral Sea Basin States, a Bank mission visited the region in September 1992 and recommended a program framework for stabilizing the environment of the sea and river deltas, rehabilitating the disaster zone around the sea and comprehensive management of the international Amu and Syr rivers. At an international seminar held in Washington on April 26, 1993, representatives of the five States, donor countries and international agencies approved the approach proposed by the Bank for addressing the Aral Sea crisis. A joint Bank-UNEP-UNDP mission visited the region in May 1993 and identified 19 projects for consideration in the first phase of the Program.

3. On January 11, 1994, the five heads of States approved the concepts, programs and regional institutions for addressing the Aral Sea crisis. The decisions of the Heads of States were consistent with the Bank-UNEP-UNDP mission's suggestions.

The Regional Institutions

4. The regional institutions approved by the Heads of States include the following:

(a) The Interstate Council for Aral Sea (ICAS) which is responsible for formulating the policies and preparing and implementing the programs for addressing the crisis. ICAS has 25 ministers and high-level members, 5 from each State. It meets at least twice a year for approving and coordinating the policies and programs recommended by the Executive Committee (EC) which is the operational organ of the ICAS.

(b) The International Fund for Aral Sea (IFAS) mobilizes the funds contributed by the five states, donor countries and international agencies for financing the projects approved by the ICAS. It has an Executive Board headed by An Executive Director which is the operational organ of the IFAS.

(c) The Chairman of the Executive Committee of ICAS and the Executive Director of the Executive Board of the IFAS are the top operations managers of the ICAS and the IFAS. Their responsibilities and functions are defined in the statutes approved by the Heads of States. Their objectives are the same. Their functions are different but complementary.

Aral Sea Program - Phase 1

5. A follow-up Bank mission visited the region in February/March 1994 to assist the EC in identifying projects for implementing the programs approved by the Heads of States. These projects are of multi-sector nature and include comprehensive water resources management, potable water supply, sanitation, health, watershed management, pilot projects for wetlands development, soil stabilization, improving of water regulation and distribution, environment assessment, hydro-meteorological services and other reviews and research studies. The EC uses the services of the Interstate Commission for Water Coordination (ICWC) and its organizations for four programs approved by the Heads of States relating to water resources management and the services of the Interstate Commission for Socio-Economic Development and Scientific, Technical, and Ecological Cooperation (ICSDSTEC) for the remaining three programs relating to social services and environment.

II. OBJECTIVES

6. The main objectives of the proposed capacity building project are to build and strengthen the organizations of the EC and the IFAS to carry out the responsibilities defined in their respective statutes approved by the Heads of States and to coordinate their activities effectively to ensure the efficiency and success of the Aral Sea Program. The other regional organizations of the ICWC and ICSDSTEC which prepare and implement projects under the directions and supervision of the EC also need assistance to improve their capacity but the required technical and financial assistance is provided separately as components of the specific projects assigned to them. The proposed Capacity Building Project is designed solely for improving the abilities of the apex institutions of the EC and IFAS to manage a large and complex multi-sectoral program for addressing the Aral Sea crisis.

III. SCOPE

7. The proposed project would provide technical and financial assistance to the apex institutions of the EC and IFAS for managing the initial stages of

the Aral Sea Program - Phase 1 when these new institutions need guidance and support on virtually every aspect of their activities. Specifically, the Project would provide:

(a) a consultancy fund to engage short-term advisors and experts to establish procedures and practices for managing various activities and providing hands-on training in such activities as supervision; quality control of implementing agencies' outputs' procurement of works, goods and services; budgeting; accounting and audits; cash forecasts and disbursement applications; compliance with the requirement of financing agencies; preparing progress reports; and monitoring evaluating performance of the Program;

(b) office technology and communications equipment;

(c) training, both on-the-job training and study tours, workshops, and training of trainers;

(d) foreign travel (for meetings organized by financing agencies)

8. Short-term rather than full time advisors and experts are proposed in order to provide flexibility for engaging the necessary expertise at the required time and the period needed. Given the conditions in the Basin, experienced and competent advisors are likely to prefer short-term rather than long-term assignments. Moreover, the overhead cost of housing, settlement and resettlement of long-term consultants would be high. Office technology and communications equipment and material include computers, printing equipment, faxing, telex and copying equipment, telephones and office stationary. Training includes hands-on training of both professional and support-staff, workshops organized by the Bank's Economic Development Institute (EDI) on project management, supervision, procurement, disbursements and other requirements of the financing agencies. Short study tours of managers and key staff to organizations in foreign countries where similar work is done would be useful.

IV. OUTPUTS

9. This project will provide the regional organizations with the capacity to carry out the responsibilities defined in their respective statutes and to coordinate and manage their activities effectively to ensure efficiency and success of the overall Aral Sea Basin Program. These outputs are quantified in Annexes 1 and 3 for the EC and Annexes 2 and 4 for the IFAS.

V. RESOURCES AND PLAN OF IMPLEMENTATION

10. The project is expected to take three years. An estimate of the foreign exchange and local resources required for the project are as follows:

	Estimated Cost (in US$ million)		
	EC	IFAS	TOTAL
International Consultants	2.10	1.40	3.50
Equipment	1.05	1.05	2.10
Training	.80	.60	1.40
Local Cost of Operations	1.10	1.00	2.10
TOTAL	5.05	4.05	9.10

Financing

11. The Europe and Central Asia Department (ECA) of the Bank requested and has been granted $2 million from the Special Grants Program (SGP) of the Bank to provide financing for building the capacity of the apex institutions of EC and IFAS during the crucial initial period of the first 12 months with effect from July 1, 1994. SGP has agreed to provide the funds on certain conditions with have been met. The EC and the IFAS require continuing assistance throughout the Phase 1 period of 5 years, but the commitment of the SGP is limited only for FY95. However, it is extremely important for the initial stage of the first 12 months. Other sources of financing have to be mobilized for FY96 and beyond.

Bank Special Grant Financing

12. The project components relating to the EC and IFAS will be implemented separately by these organizations in accordance the estimates given in paragraph 10 and Annexes 1 through 6. ECA will administer the approved SGP funds and supervise the project following the Bank's normal procedures. In the case of procurement of advisors and experts for technical assistance to the EC and IFAS, ECA will play a proactive role of preparing a list of experts (at least two experts for each position) to enable EC and IFAS to exercise their choice in selection. This is necessary because the EC and IFAS do not know the sources and availability of the needed experts. An effort will be made to select Russian speaking experts who are competent and have also the experience in Bank procedures. The cost of management and supervision of the project will be met from ECA's administrative budget. The supervision during the first few years will be intensive. The supervision budget in the first year will be particularly high.

13. Annexes 1 through 4 give the details of the estimated cost of advisors, office technology and communications equipment, training and foreign travel for both the EC and the Executive Directorate of IFAS. The local currency

costs, detailed in annexes 5 and 6, include staff salaries, office space and furniture and maintenance of these facilities (including water supply and electricity) which will be financed by the IFAS. During the first year, however, the local costs of the EC will be financed by the Government of Uzbekistan as a part of its share of contributions to the IFAS. A similar arrangement is made for the local costs of the Executive Directorate of IFAS. This is a temporary arrangement.

14. According to the resolutions approved by the Heads of States on January 11, 1994, imported materials and equipment for the Aral Sea Program will be given free and unimpeded access (without taxes) through the Aral Sea Basin States. The staff of the regional institutions will enjoy diplomatic status and will be given unimpeded travel facilities in all the States in connection with the planning and implementation of the Aral Sea Program.

VI. JUSTIFICATION AND ISSUES

15. Both the EC and the IFAS are new institutions. Their top managers and heads of departments have been appointed by the Heads of States only recently and their staff positions have not been fully established yet. Although their functions have been defined in the statutes they have yet to establish working procedures and coordination arrangements to implement their responsibilities. They seem to be looking to the Bank for guidance.

16. The Central Asian States are used to management methods which were established by the Former Soviet Union (FSU). Moscow decided what should be done and all the managers down the line had to follow those commands. The freedom of the managers and staff to innovate or to act differently was limited. The experiences of the managers of IFAS and EC are deeply rooted in the past management practices. It would take time and a great deal of effort and training to change their traditional practices.

17. The success of the program depends on procedures for procurement of works, goods and services that ensure efficiency and economy. Competition is an effective instrument to achieve this goal. However, there are no private contractors and consultants in the countries. Civil works are still handled by construction trusts/bureaus and engineering designs by design institutes attached to various ministries and government organizations. Works are assigned without competition and contract prices are negotiated, fixed and sometimes enforced.

18. The Aral Sea Basin countries are land-locked and isolated. Until recently, Russia was the only route for land and air transportation. Airline services between the central Asian countries and with the rest of the world are still limited. Russia remains the only route for land transportation.

19. Working conditions for foreign contractors and consultants are difficult especially in the rural areas and the disaster zone around the Aral Sea where most works of the Program are located. Aside from transportation difficulties, the conditions of water supply, sanitation and health in these areas are hazardous.

20. Although the education levels of the people are generally high and technical staff are experienced and competent, communications with Bank staff and foreign experts who do not know the Russian language is difficult and time-consuming. Interpreters are needed at every step, even to make a telephone call to arrange a meeting with the officials. Because the reports and data are written in Russian, they have to be translated into english or the language of the concerned financing agency.

21. The statutes of the EC and the IFAS define their respective responsibilities, but the EC is required to select and prepare projects and programs jointly with the Executive Directorate of the IFAS. Unless the joint working arrangements are clearly defined and coordinated, there is a danger of jurisdictional disputes. Further, both EC and the IFAS are involved in coordination of international relations and participation of international agencies and donors for addressing the Aral Sea crisis. The need for establishing procedures for cooperation between the EC and IFAS is important and urgent.

22. The EC and IFAS are not national organizations of any one State. They are regional organizations of the five states whose cooperation and consensus on every issue concerning their respective interests is essential. The statutes of the ICAS define consensus on any issue as agreement of all states and that a single vote of dissent is enough to disapprove the recommendations of the EC or the IFAS. Because the issues involved in the management of international rivers are highly sensitive and addressing the Aral Sea crisis requires huge investments extending over a long period of two to three decades, the potential for disagreements and the danger of the collapse of the cooperative effort exist at every step.

23. The technical solutions of the Aral Sea Program are formidable enough. Addressing the above issues, managing a complex multi-sectoral program involving many implementing agencies, meeting the demands and interests of all the five states and satisfying the conditions of the international financing agencies and donors will impose an extraordinary burden on the infant institutions of the EC and IFAS. They need support and assistance from the international community to succeed. The support and assistance required would be extraordinary given the complexity of the program, the inexperience of the EC and IFAS, and the need to sustain the cooperation of the five states to address the Aral Sea crisis.

Annex 1

Executive Committee
Office Technology/Communications Equipment and Vehicles
FY95

No.	ITEM	UNITS	TOTAL COST (US$)
1.	Computers: PC 486, HDD 120 MB RAM 8 MultiSYNC-Monitor., 2 port, 1 serial 1 parallel. Software: Windows, MS-Word, Word Perfect, Excel, MS-Project: Terminal Procom-Plus	15	45,000
2.	Fileserver: MicroVAX 4000, DEC Server and Ethernet exten. for 16 ports, communication card, modem x.25 and dial-modem	1	30,000
3.	Laser Jet Printers	5	12,000
4.	Copier: 50 c per 1 min (two sided, sorter 20 p.) Canon 4050 or equivalent	2	30,000
5.	Computer work-stations, etc.	15	15,000
6.	FAX (auto answer)	2	3,000
7.	Typewriters	6	5,000
8.	Vehicles (7-8 seater Landcruiser/mini-van)	2	50,000
9.	Miscellaneous: Computer supplies(paper,ink cartridges for printers, diskettes, disk organizers, etc); Fax paper, Toner for Copiers,		10,000
	Total		200,000

Annex 2

International Fund for Aral Sea
Office Technology/Communications Equipment and Vehicles
FY95

No.	ITEM	UNITS	TOTAL COST (US$)
1.	Computers: PC 486, HDD 120 MB RAM 8 MultiSYNC-Monitor., 2 port, 1 serial 1 parallel. Software: Windows, MS-Word, Word Perfect, Excel, MS-Project: Terminal Procom-Plus	15	45,000
2.	Fileserver: MicroVAX 4000, DEC Server and Ethernet exten. for 16 ports, communication card, modem x.25 and dial-modem	1	30,000
3.	Laser Jet Printers	5	12,000
4.	Copier: 50 c per 1 min (two sided, sorter 20 p.) Canon 4050 or equivalent	2	30,000
5.	Computer work-stations, etc.	15	15,000
6.	FAX (auto answer)	2	3,000
7.	Typewriters	6	5,000
8.	Vehicles (7-8 seater Landcruiser/mini-van)	2	50,000
9.	Miscellaneous: Computer supplies(paper,ink catrides for printers, diskettes, disk organizers, etc); Fax paper, Toner for Copiers,		10,000
	Total		200,000

Annex 3

Capacity Building Project
Technical Assistance and Training
Executive Committee
FY 95

Technical Assistance:
Short-Term Expatriate Consultants: Legal Expert, Financial Specialists, Institutional/Management Specialist, Information Technology Specialists, Procurement Specialist, Economist, Ecologist, Sociologist,

Total Man-months: 24

Estimated Costs: US$ 600,000 (24 person-months @ USD 25,000 per person-month inclusive of travel and subsistence)

Training:
Overseas Training: Environment, Water Resources Management, Procurement, Contract Administration, International Law

Estimated Costs: US$ 300,000 (15 person-months @ USD 20,000 per person-month)

Foreign Travel:
US$ 50,000 (Travel costs for EC Management/Staff for participation in International Conferences/Seminars on the Aral Sea, meeting with donor agencies, and Donor's Meeting on the Aral Sea Program.

Annex 4

Capacity Building Project
Technical Assistance and Training
International Fund for Aral Sea
FY 95

Technical Assistance:
Short-Term Expatriate Consultants: Legal Expert, Financial Specialists, Institutional/Management Specialist, Information Technology Specialists, Economist, Accounting/Auditing Specialists

Total Man-months: 16

Estimated Costs: US$ 400,000 (16 man-months @ USD 25,000 per man-month inclusive of travel and subsistence)

Training:
Overseas Training: Financial/Human Resources Management, Accounting and Auditing, International Law, Banking, Information Technology

Estimated Costs: US$ 200,000 (10 person-months @ USD 20,000 per person-month)

Foreign Travel:
US$ 50,000 (Travel costs for EC Management/Staff for participation in International Conferences/Seminars on the Aral Sea, meeting with donor agencies, and Donor's Meeting on the Aral Sea Program).

Annex 5

ANNUAL BUDGET: LOCAL COSTS
Executive Committee of the Interstate Council
(in US$)

STAFF	
High level (30 @ $500/month)	180,000
Lower level (10 @ $200/month)	24,000
Total Staff	204,000
OFFICE EXPENDITURES	
Rent (@ $6,000/month)	72,000
Utilities	8,000
Furniture	40,000
Supplies	8,000
Printing	5,000
Total Office Expenditure	133,000
TRANSPORTATION	
Vehicles (Local purchase)	14,000
Local Transportation (operation costs)	10,000
Total Transportation	24,000
TOTAL ANNUAL LOCAL COSTS	361,000

Annex 6

ANNUAL BUDGET: LOCAL COSTS
International Fund for Aral Sea
(in US$)

STAFF	
High level (25 @ $500/month)	150,000
Lower level (10 @ $200/month)	24,000
Total Staff	174,000
OFFICE EXPENDITURES	
Rent (@ $6,000/month)	72,000
Utilities	8,000
Furniture	40,000
Supplies	8,000
Printing	5,000
Total Office Expenditures	133,000
TRANSPORTATION	
Vehicles (Local purchase)	14,000
Local Transportation (operation costs)	10,000
Total Transportation	24,000
TOTAL ANNUAL LOCAL COSTS	331,000