UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

FINAL EVALUATION REPORT

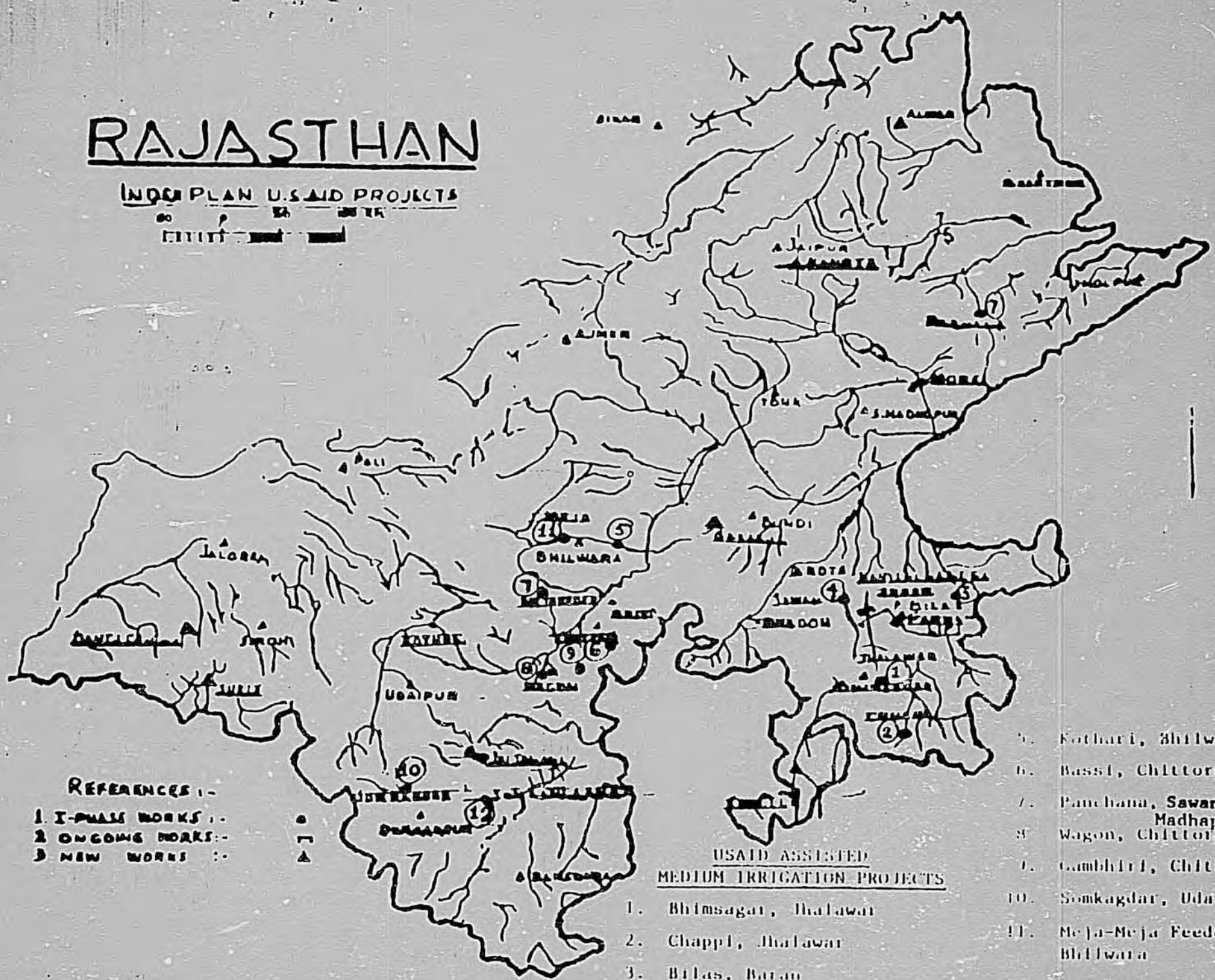
OF THE

RAJASTHAN MEDIUM IRRIGATION PROJECT
(PROJECT NO: 386-0467)

NEW DELHI
JUNE 1986

RAJASTHAN

INDO PLAN U.S.AID PROJECTS



REFERENCES :-

1. I-PHASE WORKS :-
2. ONGOING WORKS :-
3. NEW WORKS :-

USAID ASSISTED
MEDIUM IRRIGATION PROJECTS

1. Bhimsagar, Jhalawar
2. Chappi, Jhalawar
3. Bilas, Baran
4. Sawan Bhadon, Kota
5. Kothari, Bhilwara
6. Bassi, Chittorgarh
7. Panchana, Sawan Madhapur
8. Wagon, Chittorgarh
9. Gambhiri, Chittorgarh
10. Somkagdar, Udaipur
11. Meja-Meja Feeder Bhilwara
12. Som Kamla Amba, Dungarpur

EXECTIVE SUMMARY

FOREWORD

After the renewal of bilateral assistance to India in 1978 the Missions investments in Irrigation were initiated based on the Lindblom Report of June 1978 in which a high-level U.S. Strategy Team stated that "investments in the GOI Irrigation sector are sound and crucial to the development needs of India." This is the first irrigation project fully designed by USAID for assistance after the Agency resumed activities in 1978. Earlier in 1978 USAID collaborated with the World Bank in the Gujarat Medium Irrigation Project. Deficiencies and drawbacks have been observed in the planning, design and implementation of this Rajasthan Medium Project. There are, however, useful lessons to be learned. Judged by most projects in India, this project as a whole may be considered fairly good. Below is an extract from "The World Food Situation and Irrigation Programmes" in the ICID bulletin, 1976 by A. Wiener, President, Tahal Water Planning for Israel Ltd., Israel. This provides a perspective for this evaluation:

> "A few irrigation projects implemented in the less developed countries since World War II have been eminently successful in all aspects, inclusive of the agricultural production aspect. However, the performance of irrigation projects in less developed countries has, by and large, been rather disappointing. Some of the major agricultural production successes in the few notable exceptions can be attributed to the initiative and entrepreneurship of medium and large-scale farmers, who were capable of applying the agricultural production transformation process in all its various facets, once the irrigation facilities had been put at their disposal. However, most of the projects designed to benefit the small farmer in the less developed countries have been less successful and in many cases have failed completely in all but the engineering features of the project. Curiously enough, the repeated failures have not deterred government agencies from continuing to pursue some policies proven by the lack of results to be ineffective. In many cases, 20 to 30 years have elapsed before projects have reached fruition and even after this lapse of time, productivity has fallen short of the target."

As shown in Annex III, a summary of 26 World Bank Irrigation Projects world-wide reflect these problems pointed out in the statement by Wiener above. The Rajasthan Medium Irrigation Project (RMIP) compares well when judged by these projects. The World Bank data also confirm Wiener's view that the conventional way of doing irrigation business must change. Lessons learned from the RMIP should be used to improve the design and implementation of other USAID projects. Experiences with the construction of new projects in Rajasthan raise some important questions about AID's comparative advantage in irrigation. For example, several GOR officials told the evaluation team that the best use of future USAID assistance would probably be in the modernization of existing projects versus the construction of new projects.

BASIC PROJECT IDENTIFICATION DATA

1.	Country	:	India
2.	Project Title	:	Rajasthan Medium Irrigation Project
3.	Project Number	:	386-0467 (Loan and Grant)
4.	Project Dates:		
	a) Project Agreement	:	June 30, 1980
	b) Project Amendment	:	July 30, 1983 (Grant)
	c) Obligation		
	i) Initial — Loan	:	$15 million June 30, 1980
	Grant	:	$0.5 million Aug. 30, 1980
	ii) Final — Loan	:	$20.0 million Dec.15, 1980
	Grant	:	$0.75 million July30, 1983
	d) Original PACD	:	June 30, 1985
	e) Revised PACD	:	June 30, 1986
5.	Project Funding:		
	a) AID Bilateral Funding		
	(Loan)	:	$35 million
	(Grant)	:	$1.25 million
	b) Other Major Donors	:	None
	c) Host Country Counterpart Funds	:	$22.50 million
6.	Mode of Implementation	:	Grant and Loan agreement with the Government of India.
7.	Project Design	:	Government of India
		:	USAID/New Delhi
8.	Responsible Mission Officials		
	a) Mission Director:		Prisilla M. Boughton, 1979 - 1983
	b) Project Officers:		Edwin Stains, 1980 - 1983
			N. A. Dimick, 1983 - 1984
			J. S. Bakshi, 1985 - 1986
			J. R. Khanna, 1986 - present
9.	Previous Evaluation	:	None but a Brief Mid Term USAID Internal Review was conducted in 1983.
		:	
10.	Cost of Present Evaluation	:	a) Direct Hire: One
		:	b) Contract : $ 8,700 -

EXECUTIVE SUMMARY

This is a brief summary of the results of the evaluation of the Rajasthan Medium Irrigation Project (386-0467) in the Indian state of Rajasthan. This was a six year project (1980-86) with a total projected cost of $58.75 million. USAID assistance included a grant of $1.25 million and a loan of $ 35 million or a total contribution of $ 36.25 million. The present evaluation was carried out in May-June, 1986 by a four person team of professionals over a 30 day period.

The stated project objectives were to increase agricultural production and the income of the rural poor, to increase rural employment, and to reduce the impact of drought in the project areas.

PROJECT CONCEPT

The project emphasized improving the design and construction standards of a selected new, on going and to be modernized medium irrigation projects which, upon completion, could provide additional irrigation to an area of 65,000 hectares. After appraisals, twelve medium irrigation projects became eligible for AID assistance. As of the end of June 1986, these projects were still in various stages of construction/implementation. Actual potential for irrigation was achieved on 15,610 hectares of which actual utilization or area irrigated to date is only 7195 hectares. When finally completed, the 12 medium projects will provide additional irrigation for an estimated 81,544 hectares. This is 16,500 more hectares than the initial targeted area. The project has met it's targets for participant training and the socio-economic baseline studies. The project has been only partially successful in providing the in-country training planned. Grant Fund disbursements lagged behind targets and $200,000 of these funds were deobligated. The entire loan amount of $35 million has been utilized.

The major inputs for this project were $35 million primarily for the construction costs of civil works, $352,000 for training equipment and $430,000 for training. Technical assistance was budgeted at $210,000, and $218,000 was planned for special studies. The Government of Rajasthan's contribution was $22.5 million which was primarily for construction works.

PROJECT OUTCOME

The major findings and conclusions emerging from the evaluation are:

Overall:

- Deficiencies and drawbacks have been observed in the planning, design and implementation of the Project from which there are important lessons to be learned by the GOR and USAID. Judged, however, by other medium projects in India, this project as a whole is considered satisfactory or fairly good.

POLICY RELATED

- The Government of Rajasthan (Irrigation Department) is now convinced that all existing medium irrigation projects in the State will need to be completed and modernized with below the outlet infrastructure designed as an integral part of each project. This is a new development which will have a significant impact for future medium projects.

- The project has stimulated and raised farmer involvement to a priority policy decision making level.

- The project has created serious policy level thinking about the need for strengthening the GOR Irrigation Department's units for survey and investigations, design and research capabilities. It has also raised the need for a separate Irrigation Water Management cadre for medium irrigation projects to top decision making levels in the Department.

- The Government of Rajasthan Irrigation Department has learned that it must rely more on other agencies and mechanisms including private sector firms to accomplish good Irrigation Water Management.

- The project has also given more focus on medium versus major irrigation project implementation and did shift staff and resources more than expected to these medium projects despite great financial and staffing constraints throughout the states irrigation sector.

TECHNOLOGIES

- New technologies such as new reservoir operations, crop water requirements, Adjustable Proportional Modules (APMs), pucca naccas, broad crested weirs, rotational water supply system (RWSS) and farmer involvement (FI) were successfully introduced at two projects (Wagon and Gambhiri). These technologies are being transferred to other projects in Rajasthan.

- The need is now felt for much more emphasis on special studies as well as the diagnosis and testing of new technologies which had not been emphasised prior to this USAID-assisted project.

TRAINING

- The training efforts have introduced network planning, diagnostic analysis (DA), and farmer involvement which are now institutionalized in the Department's Irrigation Management & Training Institute's (IMTI) regular courses. Three of the project staff trained overseas are now staff members of the IMTI. The project has built up strong linkages with both the IMTI and one state University.

- Seventy-five percent of the professionals who participated in overseas training returned to work on USAID-assisted projects.

- The need has now been broadly recognized in the Irrigation Department for more and better quality training.

DIRECT BENEFITS ON RURAL PEOPLE

- Where water has been made available and facilities provided, farm families have benefited from higher production due to yield and cropping intensity increases resulting in higher levels of living.

- About 60 percent of total project costs was used for providing labour to rural people. This labour component amounts to Rs. 38 crores. Tribals, small holders, and tenants probably made up about 80 percent of the total labor force.

- Rural women received about Rs. 20 crores (19 million women days) in wages or a little over 50 percent of the total labor payments.

- At two projects (Wagon and Gambhiri) farmers have gained confidence from participation in activities and now have a greater voice in planning and implementing the on-farm works as well as in the decision-making of the Water Distribution Committees.

- The building up of the ground water potential has occured in several project areas where dams have been completed and farmers are sinking more wells for better water control. In three projects, the rural electrification program is active having anticipated this increased demand for pump sets to exploit groundwater created by the sub-projects.

OTHER ASPECTS

- USAID has established substantial credibility with the Government of Rajasthan (Irrigation Department). The environment is quite positive for possible new future activities. Preliminary discussions have taken place related to the possibilities for organizing a special cadre for operations and management of systems in the GOR/ID.

- GOR/ID officials contacted think that USAID's likely comparative advantage is in assisting modernization of existing projects, promotion of irrigation water management software activities and training versus constructing new projects.

- The Wagon Medium Project assisted by USAID has made much progress. This could become a model project if the present pace and quality of work is maintained over the next year or two.

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ACRONYMS AND GLOSSARY

APM	-	Adjustable Proportional Modules for fixing the discharge of water from public outlets.
BLOCK/KHAND PANCHAS	-	Leader of block level farmers committee.
CWC	-	Central Water Commission.
CHAK	-	The area irrigated from the public outlet.
CUSEC	-	Cubit feet per second.
CHAK SARPUNCH	-	Leader of chak level farmers committee.
CM	-	Centimetres.
CUMEC	-	Cubit meter per second.
CRORES	-	Rs 100 million
DA	-	Diagnostic analysis.
EL	-	Elevation
FI	-	Farmer Involvement
GOI	-	Government of India
GOR/ID	-	Government of Rajasthan Irrigation Department
GOR/AD	-	Government of Rajasthan Agricultural Department
HA	-	Hectares
HYV	-	High Yielding Varieties
HA/MT	-	Hectare Meters - one meter of water depth on one hectare of land
IWM	-	Irrigation Water Management
IM & T	-	Irrigation Management and Training Project
IMTI	-	Irrigation Managment Training Institute
JALVITRAN COMMITTEE	-	Farmer Committee for Better Water Distribution and Management
KHARIF	-	Rainy Cropping Season
KATCHA	-	The opposite of PACCA, such as unlined earthen channels

LOK SABHA	-	Indian Parliament
LOP	-	Life of Project
LAKH	-	Rs. 100,000
LMC	-	Left Main Canal
MIP	-	Medium Irrigated Project
MSFT	-	Million Square Feet
MAF	-	Million Acre Feet
MCM	-	Million Cubit Meters
O & M	-	Operation and Maintenance
PACD	-	Project Activity Completion Date
PID	-	Project Identification Document
PIL	-	Project Implementation Letter
PMF	-	Probable Maximum Flood
PILLAI PROMUKH	-	Leader of Canal Level Farmers Committee
PILLAI PRADHAN	-	Leader of Distributary Level Farmers Committee
PANCHAYAT	-	Local Organization of Leading Farmers in Villages
RMIP	-	Rajasthan Medium Irrigation Project
ROZEWARI	-	A Modification of WARABUNDI
RABI	-	Winter Cropping Season
RMC	-	Right Main Canal
RIPROP	-	Stones and material used along canal channels for protection from erosion and cuts by water flows
SUB-PROJECTS	-	One of the 12 projects under the Rajasthan medium irrigation project
WMSP	-	Water Management Synthesis Project
WARABANDI	-	An Indian rotation water supply system

THE EVALUATION REPORT

SUMMARY OF CONCLUSION AND RECOMMENDATIONS

A. General

1. Overall Assessment of the Project

Though many assumptions made in the design and execution of the Rajasthan Medium Irrigation Project did not prove valid, there are important lessons to be learned. By comparison with standards observed for medium projects in India, the Project as a whole is evaluated as fairly good to satisfactory with a few highly successful activities.

- The 10 medium construction and two modernization sub-projects could not be completed due to lack of realism in project design, plus serious physical, management and financial constraints. Several innovations however, have been transferred and adopted. These includes;
  - Medium projects in Rajasthan are adopting new design approaches up to the micro system
  - On-farm network planning and design for completed projects is now accepted for RMIP's
  - Farmer involvement activities have resulted in high level policy dialogue and a GOR committee to revise the 1978 Irrigation Act to provide more incentives for farmer to organize and become more involved.
  - New technical innovations such as regulated outlets, control structures, pucca naccas and measuring devices at demonstration sites are or will be installed on other projects
  - Where irrigation potential is created and utilized, cropping intensities, yields and incomes have increased
- Tribal and marginal farmers along with landless labor to date have received an estimated Rs.20 million in wages for construction labor with women receiving about 50 to 60 percent of the total
- Seventy five percent of the participant trainees returned to work on the project
- The in-country training was evaluated as good and the two courses carried out by the A.I.D. Water Management Synthesis II Project as excellent. Three project short courses are now institutionalized at the GOR Training Institute at Kota (diagnostic analysis, network planning and design and farmer involvement)

- One medium project has performed well and is becoming a model for other medium projects in Rajasthan providing full irrigation using new management technologies

2. The Project Strategy and Components

The Project's strategy was not appropriate for meeting project goals within the life-of-project time frame. The project paper provided only $500,000 grant funds which were amended to $1,250,000 in 1983. Efforts were made to change the project strategy at this time through several PILs and a brief mid-project internal review, but software components were not adequately integrated into the Project. The major ways the evolved strategy differs from the Project Paper strategy and those of Project amendments are:

- Long time lag of two years before significant implementation began.

- Sub-projects were brought into RMIP late in LOP, i.e. two in 1984 and three in 1985.

- Over emphasis on construction of dams and canals and little emphasis on completing minor works and software activities.

- Lack of an effective monitoring cell and no clear project monitoring methodology plan.

- Special field studies at sub-projects to provide empirical data for critical design criteria were not done.

The Overall Result

The Project has brought more attention to medium projects in Rajasthan and has been a major factor in the GOR/ID realizing the need for completed projects to the farm level with more farmer involvement and technologies not previously implemented.

One of the most important results of this project is probably the change in attitudes of officials at top policy levels related to farmer involvement. This achievement is primarily that of two committed senior engineers who gained new attitudes and knowledge from an oversea training programme and returned to initiate a series of activities eventually involving the Ministers of Agriculture and Irrigation as well as the Rajasthan Chief Minister. Probably of about equal importance is that three major IWM courses introduced are now provided on a regular basis at the GOR/ID Irrigation Management and Training Institute. USAID has introduced some new IWM concepts and technologies which will likely have a continuing impact. Though the Project did not and could not meet many unrealistic goals in a brief six year period, the Project has created much ferment in the GOR/ID thinking about ways and means to create new approaches for the micro-system, operation and management, involvement of beneficiaries and the need for using outside firms and consultants.

3. **Drought Crises**

Severe droughts occured in each year of the LOP which adversely impacted implementation. These droughts drew finances, staff, and attention to drought relief and other activities. The full compliment of staff divisions assigned to RMIPs were inadequate. Staff at RMIPs at the assistant engineer levels up had responsibilities other than RMIPs in their circles.

B. Findings Conclusions and Recommendations

Findings and conclusions drawn from the evaluation with recommendations are presented under the headings: 1) physical and technical, 2) software grant-funded activities, 3) planning and management and socio-economic aspects of the Project.

1. PHYSICAL AND TECHNICAL

a) TECHNICAL DESIGN ELEMENTS OF PROJECTS

1. FINDINGS:

- Design of dams and canals generally conform to current specifications and codes. Finalization of designs in consultation with CWC took too much time especially in regard to hydrology and soil aspects of projects.

- Assumptions made for hydrology, conveyance efficiencies, field application efficiencies, sedimentation, and drainage were not tested for validity. No studies were carried-out as planned and recommendations in CWC appraisal reports were not followed.

- Probable maximum flood (PMF) estimates computed by CWC Hydrology Directorate are generally excessive, therefore, costs of dam spillways increased.

- Water budgeting, intensity of irrigation and cropping patterns suggested are generally un-realistic and based on rough rules of thumb and not empirical field data.

- Drainage and field channel networks planned have not been introduced on most sub-projects.

2. RECOMMENDATIONS:

- The investigation and design wing of the ID in Rajasthan needs considerable strengthening with an interdisciplinary staff.

- Contracts with consultancy firms and other organizations for assistance in obtaining the specific data needed for investigations, surveys, designs and sub-project preparation are needed.

- Research on lining required for selection of lining materials and types of lining with hard economic analysis to evolve rational criteria are needed before lining is undertaken.

- Special studies such as conveyance efficiencies are typically beyond the capability of junior project site staff. Therefore, these should be entrusted to an improved design and research wing of GOR/ID or to private firms.

- USAID should make the implementation of critical special studies a condition precedent before releasing instalments for loan reimbursements for construction.

- Detailed soil surveys of commands, collection of relevant data of existing irrigation, views of farmers about possible returns from each crop are needed before intensities and cropping patterns are planned. Farmer participation is needed at the sub-project formulation stage especially regarding micro-system activities.

- Sedimentation studies should be conducted on existing reservoirs early in LOP to check the validity of assumptions made in the design of new projects.

- Active farmer involvement and on-farm development is needed on all medium projects. A special cell or separate organizational unit is needed to help farmers organize and play a large role in IWM improvement.

- Computation of probable maximum flood (PMF) requires serious review at the appropriate levels.

b) TECHNICAL IMPLEMENTATION

1. FINDINGS:

- Over-all performance of the Project has been satisfactory. The Rajasthan ID generally possesses adequate expertise for the construction of earthen dams masonary structures and canals. The quality of construction is evaluated as good however, all the works scheduled or planned for LOP could not be completed. The earthen dam construction at Panchana, Bassi, Wagan and Kothari projects compare favourably with similar medium projects in India.

- Major delays in completions of sub-project technical components resulted from:

  - Inadequate funding by GOR.
  - Inadequate personnel placement and rapid transfers.
  - Delays in finalising designs i.e. hydrology, spillway capacities, etc. due to lack of data.
  - Unrealistic planning and staff with responsibilities other than project implementation.
  - Construction of canal systems not synchronized with dam and stored water supplies.
  - Long lag in on-farm distribution system planning, design and implementation (40 to 8 ha units). (To date on-farm works are insignificant.)
  - CWC Appriasal Report recommendations for drainage networks, special studies, GW observations, installation of rainguages and guage recorders, extension support services, and technical staff have not been given adequate attention by GOR/ID.

- Fixing of APMS and introduction of warabandi with farmer involvement was slow with two exceptions. (Wagan and Gambhiri projects.)

2. RECOMMENDATIONS:

- Sub-projects should begin only after careful preparation, detailed investigations, collection of reliable data, positioning of adequate staff and likely assurance of funds provided as scheduled.

- Fewer projects should be selected with a higher probability of completion within LOP. Subject Loan disbursements precedent should be linked to TA as well as adequate staffing and software activities.

- Rehabilitation and modernisation projects should be given priority over new projects.

- Regular and close monitoring mechanisms need to be designed into future projects.

- Available private firms should be selected to provide TA and serve as a liason between state projects and USAID. Design such mechanisms into the PP and have conditions precedent to assure this is done.

- Project specific monitoring plans (physical and financial) need to be developed to insure timely completion of all activities.

- More realism is needed in project design, appraisal and scheduling on implementation plans.

c) OTHER ISSUES

1. FINDINGS:

- Aside from the considerable employment benefits, the economic impact of dam and canal construction is lessened due to long time overruns.

- Questions are being asked in GOR/ID about separation of construction and operation maintenance personnel into separate cadres.

- Better studies are needed on environmental impact of projects with a focus on watershed factors, catchment areas and ground water problems with action recommendations.

2. RECOMMENDATIONS:

- Should ensure that to the extent possible grant activities be lied to the execution of specific sub-projects

- Funding of rehabilitation and modernization of projects should be given priority over funding new projects.

- An indepth special study is needed now to determine how the creation of a separate operations and management cadre might be done and at what cost to the GOR and to staff.

- Provision of more funding in projects for performance management of main system and activities below public outlets should be built in each sub-project with a definite operational and staff training program to operate and monitor the system.

- Provide for beautification of dam and reservoir areas other facilities for local people. Extensive tree plantation around dams and along canals should be encouraged and treated as a part of development.

- Soil conservation measures with programs of afforestation should be made a part of an overall GOR policy especially in catchment areas of irrigation projects.

2. GRANT FUNDED SOFTWARE DIMENSIONS

a) FINDINGS:

1. Training:

- The training needed to be integrated into the project and linked with loan disbursements to assure that it was done in a timely manner.

- There was a need for an assessment of training needs for the RMIP and a training plan should have been developed from it.

- Too much of the participant training was adhoc with late participant selection and the criteria for selection were not strictly followed throughout LOP.

- Over 90 percent of overseas training and about 80 percent of the in-country training was for staff of the Irrigation Department. Agriculture Department staff received little training. This is possibly one reason why the AD did not cooperate as expected in this Project.

- The training provided in-country was late and inadequate but 5 training activities evaluated by USAID staff were judged as good. A small contribution of TA by USAID several local action training activities triggered a high level policy debate and actions in the GOR for finding ways to provide more incentives for farmer involvement. Very useful in-country training was that which utilized USA TA for the DA and Measurement Based Workshops respectively in 1982 and 1983.

2. Special Studies:

- Only one study socio-economic benchmark survey of six projects was conducted. This should provide base line data for a future impact evaluation.

- The GOR/ID was reluctant to contract special studies. Only after PACD and deobligation of substantial grant funds was it realized that non-ID organizational actors are needed for many of the new IWM-type activities.

- Due to studies not being implemented, many rule-of-thumb decisions were made which may have proved costly i.e. the lack of physical and economic data for lining criteria, water budgets and water requirements of crops.

- A careful plan did not exist for identifying the priority studies needed or the TA for the design of these studies. A mechanism to assume that critical studies are executed early versus late or never in LOP plus a method to review and monitor of studies was needed.

- The special expatriate and local technical assistance designed into the project needed for helping ID staff to do certain IWM studies for which there was no prior ID capability or experience was not utilized.

3. Technical Assistance

- Technical assistance was never integrated into the project. Careful advance plans were needed to assure that TA was made available early in LOP.

- More outside technical assistance than planned or utilized was needed early in LOP to provide assistance, guidance and training for most of the new IWM software activities planned. The 9.5 person months of TA provided during LOP produced significant impacts.

- A mechanism for linking TA to loan disbursements for certain priority activities would probably have resulted in acquiring more TA as and when required.

RECOMMENDATIONS AND ACTION IMPLICATIONS

- Software activities need to be carefully assessed at the project design stage and built into projects as integrated components and not left fuzzy or marginal. A mechanism like tying loan disbursements to specific grant funded activities needs to be developed in future projects.

- Development of suitable and need based training programs require careful manpower and institutional assessments. A definite plan including the performance tasks for which training is required with capable training institutions is needed.

- As USAID continues it's irrigated agriculture and IWM emphasis, more TA for projects with large software components will be needed especially for appropriate periods early in LOPs to train and demonstrate to staff the new methodologies and technologies.

- Long delays in getting the training, special studies and tehchnical assistance required for a project are a perennial problem. Some possible ways to resolve this might include: One, preparation of the environment before and during project design to build up adequate understanding and committment for new IWM software activities. Two, advance planning to target key activities early versus late in the project can and should be done. Three, mechanisms such as local contractors and/or expatriate TA must be arranged for early in the LOP. Four, few irrigation departments presently have staff with the inclination or capabilities for many IWM software activities. These activities will need to be contracted to existing and emerging private firms or institutes which have or can develop capabilities.

- Participants for overseas and local training must be carefully selected using specific criteria to ensure their personal success and to maximize their impact on irrigation development. Adhoc and last minute selections should not be allowed. Also State and GOI clearances for participants should be done much in advance of expected departure dates.

- More and better quality in-country training is needed, therefore, State should build-up local training institutions.

- In future projects, building and providing the means for strong functional linkages between organizations is a critical need. Software activities of training, research, special studies and TA need to be carefully planned and closely linked to provide complimentarity to assure greater impacts. Too much is usually assumed at the project design stage about the coordination of organizations and the integration of project activities with old line institutions practicing separation. To avoid this in future projects, some possible ways might be: One, at the project design stage all parties to be involved in the proposed project be given ownership through active participation in the project design process. Two, funds stipulated for particular activities to be implemented by each organizational actor should be specified and budgeted in the State budget. Three, in the project planning, reviews and meetings all organizational actors should play an active role.

- Future project papers should stipulate that local private firms will play a part in specific software activities. Private firms have a positive role to play but they are seldom supported enough in irrigation projects. Some possible means to facilitate this are: One, to build into the project design specific software activities to be done by private firms. Two, find a mechanism where USAID with concurance of the State involved handle the contract directly versus using a mode similar to host country contracting. Three, USAID should continue to stimulate, motivate and assist private firms in IWM and help them improve their capabilities.

- The policy of promoting more farmer involvement in projects should not be left to chance. This can be built-into and specified in the design of projects with mechanisms to assure its implementation. For example, the mobilization of farmers' resources is often left completely out of projects due to vague assumption about what farmers will or will not do.

- Project success is enhanced by more flexible design, implementation and operations. There is a critical need for well planned process-type versus blue print-type approaches.

- Irrigation projects are seldom viewed as one aspect of total farming systems. The focus in new projects should be more on irrigated agriculture than simply on irrigation projects. This will require actors other than engineers, much more action research, pilot demonstration, special studies, and testing built into projects as critical learning mechanisms.

- In most new projects, design and construction completely dominate and often mitigate software emphases. USAID likely has a comparative advantage in IWM software but not in the design and construction of dams and canals. This suggests a complete departure from new medium projects and more focus on such projects as rehabilitation and modernization with definite stress on IWM software.

- Irrigation Departments tend to act as caretakers of projects rather than managers who are actively involved in problem solving. Projects need to build-in ways to improve their capacity for collecting and analyzing information, learning from experience and careful analysis which helps in the management and monitoring of projects. One approach is to build in a

top local consultant supported by grant funds who serves as a laison to the departments concerned and USAID.

- Redesign of projects is often needed. A mid-project evaluation therefore, is a must. Mid-term project reviews do not suffice for evaluations. USAID must assure that adequate evaluations are built-into each project and not allow priority evaluation schedules to slip. Many problem projects can be redesigned given data and useful recommendations from intensive objective evaluation.

- The problem of staff transfers in irrigation departments is exceedingly complex, and a very political issue. This issue however sensitive, should be faced at the project design phase and monitored throughout the LOP. Good IWM requires staff at a project site over relatively long periods of time to build-up creditability with users.

- Training requires top-level committment, otherwise those sent for in-country training are sometimes the less able staff. USAID should probably not support substantial training activities in a State until a comprehensive manpower and institutional analysis has been done and a policy clearly articulated which provides the required committment.

- Once USAID has been involved in a project in a given state such as Rajasthan, creditability is development which provides a good basis for future assistance. To achieve lasting and significant impacts in most irrigated agricultural projects the "real" time horizon is more like 10 to 15 years versus the usual five or six years of LOP.

MANAGEMENT AND PLANNING DIMENSIONS OF RMIP

A) Findings:

1) Planning

- Project implementation planning and management was inadequate and one of several factors causing cost overruns on most sub-projects.

- RMIP authorities could have more accurately assessed project time schedules by using a more systematic planning/management approach.

- Co-ordination and integration of the various elements of the Project were weak.

- Benefits in irrigation from RMIP's will come much later than planned or expected and some of the delay has resulted from poor planning.

B) Contract Planning and Execution :

- A number of contractual problems were encountered at Panchana, Som Kagdar, Bassi, Bhimsagar, Bilas and Sawan Bhadon sub-projects.

C) Project Implementation and Monitoring:

- The lack of an effective monitoring and progress reporting system is identified as one of the factors responsible for many shortcomings in the slow implementation of RMIPs.

D) Organization and Personnel:

- During LOP there were many unanticipated institutional constraints. Some of these could not have been anticipated by Project designers. Some might have been eliminated if a more careful institutional analysis had been made at pre-project and design stages. A good mid-project evaluation with sound recommendations probably could have helped resolve some of these problems.

- Rajasthan Irrigation Department did not have adequate staff strength for the Project and there were too many staff transfers.

- Major progress was made at a sub-project where staff were on the job over continuous periods of three to four years.

2. Recommendations:

a) Planning

- More detailed planning for Project implementation and construction should receive closer attention.

b) Contract Planning and Execution

- Selection of the most suitable contractor should not be based on price alone.

- There is need for prior development of a schedule which specifies the timing of works required by each contractor.

- It is necessary to record the performance of contractors on a systematic basis in order to provide data and information for evaluating capabilities of various tenderers during tender scrutiny of future projects for justifying possible

rejections of low bidders. Systematic documentation of information of this type will help eliminate unsuitable contractors who do not have demonstrated capabilities.

c) Project Implementation and Monitoring:

- There is need for more effective monitoring of projects.

- One method of improving the accuracy of the budget monitoring is the establishment of progress payments as milestones in contract schedules. Another approach may be a regulation that potential contractors provide a schedule of estimates with the tendering doucments.

d) Organization and Personnel:

- A laison person is needed to provide better monitoring, oversight, and guidance of the routine project activities both for the GOR and USAID.

- The degree of coordination and team work demonstrated at Wagon project is needed at other project sites. Such co-ordination and team work definitely produces results.

e) Evaluation:

- Objective mid-term project evaluations can help resolve some implementation issues and change directions of projects not performing well.

- Final project evaluations require considerably more time and staff than often allocated.

3. Social and Economic

a) Findings and Lessons Learned

- The economic analysis for the design of this Project was quite good considering data available. But the assumptions made about project completion dates by project designers were highly unrealistic. The designed estimated costs per hectare for completed sub-projects will probably doubled due to long delays.

- Detailed criteria and guidelines for approving the RMIPs were finalized one year after PA. Appraisal and approval of five sub-projects lagged to 1984 and 1985 but two sub-projects were accepted into the RMIP in 1985, the original PACD year. These plus severe constraints in implementation have resulted in large magnitudes of benefits foregone to beneficiaries and society as well as changing the cost-benefit ratios estimated at Project design.

- Cost estimates for nine of twelve sub-projects were continually revised due to inflationary pressures and modifications in designs and scopes. The total revised cost of the twelve sub-projects is estimated at Rs. 2487 million versus Rs. 2264 million. This Rs. 223 million difference is equivalent to the total costs of a project about the size of two Wagon type sub-projects or a potential irrigated area of over 11,000 hectares.

- The planned irrigation potential for all RMIPs is 81,500 hectares compared with the 65,000 hectares estimated in the Project Paper. When completed and full utilization takes place, these 12 projects will directly benefit 8,250 more families than the PP estimate of 32,000 families.

- More than 50 percent of the households with land on RMIP's have land holding of 4 hectares or less. The average holding is about 2.5 hectares. Therefore, the small farmer criteria on the PP is or will be fulfilled.

- USAID assistance, even within the context of constraints on total State resources, probably did help to accelerate medium projects. The GOR received 70 percent assistance for medium projects from AID loan and grant funds from the GOI.If USAID assistance had not been available, it is not known what the GOI assistance to the GOR for medium projects might have been. The GOR/ID over the LOP gave more attention to the RMIPs and slowed work on other medium projects as reported by officials. USAID loan funds of $ 35 million were fully utilized as a result of several adjustments made in financing sub projects late in LOP.

- The irrigation potential created by PACD was only 15,700 hectares against a design of 65,000 of which only 7195 hectares are utilized or receiving water.

- Since all sub-projects are still incomplete the validity and appropriateness of the PP assumptions made for the economic analysis such as benefits/cost ratios using estimated parameters as irrigated area, cropping pattern, yields, 1979 prices and farm income cannot be verified.

- At the two projects where irrigation is now available, yields and per hectare net incomes have doubled and tripled for wheat over non irrigated conditions and land values have risen significantly due to irrigation though this dimension of land values was not estimated in the PP design. Some land values as a result of irrigation have doubled and tripled especially at locations along canals where there are wells. The PP estimates used Rs. 1600 net gain per irrigated hectare at 1979-80 prices. This seems appropriate or perhaps a little conservative.

- **Not included in the Project design was the value added from creation of more stable ground water and more GW potential. This additional GW potential has stimulated new private wells and electrifications at four project command areas.**

- Project constructions to date has generated about Rs. 18 to 20 crores of wages for unskilled labor. By the completion of these 12 subprojects up to 1990 or so this amount will likely reach Rs. 38 to 40 crores with 50 to 60 percent accruing to women. Unskilled labor at RMIP's primarily constitute poverty level tribal people, landless, marginal and small land holder classes.

b) Recommendations:

- Economic and financial analyses of projects need to be supported by good institutional analysis. Otherwise vague assumptions about organizational capabilities will invalidate the best of economical and financial analyses.

- Economic and financial analysis at the design stage should estimate several alternative completion target dates to provide a clear picture of benefits foregone when projects are not completed as schedule.

- More time and better data bases are required for designing complex irrigation projects. Time is also required to build the committment for projects prior to, during and after project design. For example, for many proposed projects where there is a limited data base, and a pre-design mechanism for critical special studies might help to minimize costly design errors.

- There is a need to examine the value added from irrigation from recharge of ground water (GW) and the increased potential of ground water providing farmers with more water control. Also estimates of increased values of land resulting from new irrigation should form part of the general economic analyses.

- An intensive impact evaluation is needed for the RMIP about 1990-1991 in which the assumptions for the project design is economic analysis can be tested. Substantial lessons may be learned to inform future project design at a very low cost.

- Experiences in India indicate that the factors limiting rates of returns to medium as well as other irrigation investments are planning, design, implementation and management of projects. If the management of surface systems can be improved with more farmer involvement, including mobilization of labor for below the outlet works, the rates of return can be greatly increased.

Chapter I

GENERAL

A. PROJECT DESCRIPTION

The Rajasthan Medium Irrigation Project was originally designed as a five year irrigation sector support project. The project agreement was signed on June 30,1980 and envisaged an original Project Assistance Completion Date (PACD) of June 30,1985. Subsequently, the PACED was extended to June 30,1986. The project was designed to assist the Government of Rajasthan (GOR) by providing financial support for new and on-going project and the modernization and improvement of Medium Irrigation Projects (MIP) in the State. The original project agreement provided financial assistance of $35 million (loan) for the construction of 15 to 20 medium irrigation projects for the creation of an additional irrigation potential of about 65,000 hectares. Also $0.5 million was provided as grant financing for training and special studies. The grant agreement for $0.5 million was amended on July 30, 1983 and grant financing was increased to $1.:5 million. The GOR contribution was $22.5 million and the total project cost was estimated at $58.75 million.

The main objectives of the project were:

- To increase agricultural production and income of the rural poor,
- To increase rural employment, and
- To reduce the impact of drought in the project areas,

The following broad criteria were embodied in the Project Agreement for approval of the medium sub-projects for USAID financing:

- Rural poor are the target population (i.e. 50 percent of the farms in the Cultivable Command Area are less than four hectares in size);
- Sub-projects have a direct rate of return of 9 percent or more;
- Soils and other physical conditions are appropriate to medium irrigation as planned;
- Improved canals and water courses are provided to approximately the 8 hectare level and selected reaches of water courses are to be lined as necessary;
- Appropriate water budgets are to be prepared;
- Adequate provision is to be made for system drainage;
- All works are to meet recognised GOI engineering design standards;
- Qualified personnel will be available for all project associated activities;

- Adequate agricultural support services are to be made available; and
- Construction of individual MIPs will be completed within five years of initiation.

These criteria were supplemented later with detailed guidelines for formulating the sub-projects. Based on these criteria and guidelines, the following 12 sub-projects were ultimately approved on the dates indicated for AID financing under the Project.

• Bhimsagar, Jhalawar	(April 1982)
• Chappi, Jhalawar	(August 1982)
• Bilas, Baran	(August 1982)
• Sawan Bhadon, Kota	(August 1982)
• Kothari, Bhilwara	(October 1982)
• Bassi, Chittorgarh	(October 1982)
• Panchana, Sawan Madhopar	(December 1983)
• Wagan, Chittorgarh	(January 1984)
• Gambhiri, Chittorgarh	(July 1984)
• SomKogdar, Udaipur	(June 1985)
• Meja-Meja Feeder, Bhilwara	(June 1985)
• Som Kamla Amba, Dungarpur	(November 1985)

These sub-projects are currently in various stages of implementation and five are providing limited irrigation facilities to agricultural land under their commands. When completed, these projects are expected to provide an ultimate irrigation potential of 81,544 ha, compared with the original target of 65,000 hectares.

The implementation schedule outlined in the USAID Project Paper (PP) requires an end-of-project evaluation for (i) determining the extent to which project design elements, implementation performance and project outputs originally envisioned have been accomplished with special emphasis on institutional, socio-economic and implementation issues, and (ii) arriving at some general conclusions which can help guide and strengthen future USAID programming and design for future irrigation projects in India.

B. EVALUATION PLAN

As the PACD was set for June 30, 1986, a six week end-of-project evaluation for May and June 1986 was planned to ascertain (i) the current status of the project in attaining the original and revised objectives (ii) the problem areas or constraints experienced in implementation, (iii) the lessons to be learnt and, (iv) to the degree possible, identify the overall development impact on the areas served by the projects.

Accordingly, an Evaluation Team consisting of the following professionals was constituted by USAID:

(i)	**C.S. Parthasarathy** **Management Consultant**	**Leader**
(ii)	**Manohar Lal Mathur** **Irrigation Engineer**	**Member**
(iii)	**S.N. Gupta** **Economist**	**Member**
(iv)	Dr. Max K. Lowdermilk Deputy Chief, Office of Irrigated Agriculture, USAID	Member

All but the USAID Direct hire professional were contracted for this evaluation. The scope of work for the evaluation is provided in Annex VII. The evaluation was conducted during the period of May 19-June 28, 1986 in collaboration with the concerned officers of the Government of Rajasthan, Government of India, Ministry of Water Resources's, Central Water Commission (CWC) and USAID.

EVALUATION METHODOLOGY

The team reviewed all project documents available with USAID and developed a program of action and methodologies for the evaluation. The first week (May 19 - 24, 1986) was devoted to a detailed background review of the project and sub-projects and indepth discussions with USAID project officers associated with the project. An evaluation design was then developed for visits to sub-project sites which included, field observations and interviews, discussions with relevant staff during May 26 to June 3,1986. Survey forms were also designed for specific project technical data and for the training component. The time available to the evaluation team was short; however, of the 12 sub-projects financed by USAID, seven were selected for field visits. These sub projects were:

- Wagan
- Gambhiri (Modernization)
- Bassi
- Kothari
- Somkagdar
- Panchana
- Bhimsagar

The evaluation design and related questionnaires developed by the team were discussed with various officials concerned with the projects, revised as needed, and sent to informants for specific information. During June 4-7, 1986, the team studied and analysed the data and information acquired during the project field visits and prepared for the second phase of field visits to other sub-projects which began on June 9,1986.

During the following four days the team concentrated on field visits and also visited the Water Management Training Institute at Kota, (a USAID assisted project). This Institute provided some of the short-term training for the RMIP. Annex VI shows the projects, staff and farmers visited, in the field. The remaining period was utilized in drafting, reviewing and finalising the team's report.

Sources of Data and Information

The following sources of data and information were utilised for the evaluation:

- Project Identification Document (PID)
- Project Paper (PP)
- Project Agreement
- Project Appraisal Reports of Central Water Commission (CWC)
- Project Implementation Letters (PIL)
- Annual Implementation/Status Reports
- Quarterly Progress/Status Reports
- Interviews with
  - Senior officials of State Irrigation, Agriculture and other Departments
  - Sub-projects staff
  - CWC staff
  - Farmers
  - Trainees
  - USAID staff
- Field Observations
- Questionnaire Information
- Diagnostic Analysis studies
- Various documents - reports, USAID files, etc.

C. BACKGROUND

1. The Present Project

Table I summarizes the funding history of the RMIP.

TABLE 1
SUMMARY FUNDING HISTORY
$ (000)

Item	Original PP	Grant Amendment (Additional)	Current Estimate
AID Grant	500	750	1,250
AID Loan	35,000	-	35,000
Sub Total AID	35,500	750	36,250
Host Country	22,500	-	22,500
Grand Total	58,000	750	58,750

The contribution of the Government of Rajasthan was 38 percent of total project planned costs and USAID grant funded software activities constituted about two percent of the total planned cost. Grant funds were not fully utilized due to inadequate planning and other problems; thus $200,000 or more of the grant contribution will be deobligated.

2. The Original Project Design

This was the irrigation project fully designed by USAID upon resumption of activities in the Country in 1978. USAID had earlier jointly funded the Gujarat Medium Project in 1978 with the World Bank. Several advisors to the Mission identified irrigation as an important sector for investments and based on this and World Bank experiences the Mission accepted a request from the GOI for assistance to priority State for medium irrigation which was Rajasthan. Though the mission in 1979 had no technical professional direct hire staff, limited technical assistance from an irrigation engineer and a rural sociologist for one month each was utilized in the project design. USAID/PD with help from an Agricultural Officer, two short-term consultants, Central Water Commission (CWC) and the Government of Rajasthan Irrigation Department (GOR/ID) designed the project. The original project identification document was cleared by Mission Director John L. Withers May 24,1978 and approved by AID, Washington shortly thereafter.

The original PP lacked technical input at some points and in retrospect adequate time was probably not allowed for design of the project or to prepare the environment better in Rajasthan. Several assumptions were made at the design stage which have not proven valid as is often the case in new project environments. For example, the original estimates that the new medium irrigation

projects could be completed in a 5 year period was wide of the mark.

Medium projects in India typically take from 10 to 15 years for completion and since 1947, in fact as a high-level GOI Planning Commission Report (1983) states, " not a single project in the irrigation, power, or flood control section (since Independence) has been completed within the time schedule and within the cost estimates". It was also stated in the PP that "fifteen to twenty subprojects are expected to be financed, half new and on-going and half modernized". Instead, it required a long period to get the 12 sub-projects finally appraised and cleared by the GOI and the GOR. These included 10 new and on-going and two modernization projects. Other assumptions made which proved incorrect are related to: 1) the availability of irrigation staff, 2) the provision of agricultural support services, 3) qualified personnel to undertake special studies and other software components, 4) the existence of farmer committees for allocation of water, 5) the capabilities of the training and visitation extension staff, 6) the ID design and enforcement of a formal warabundi water supply system, 7) chak development, 8) economic analysis of lining channels, 9) studies of the value of water lost, and 10) mission staff adequate for regular close project monitoring. In addition the design team used questionable data about ground water potential and cropping intensities as well as cost per hectare which were too low. There were many factors which resulted in the project not producing the benefits estimated in the PP which are discussed in this Report. The major lesson was that given the best conditions, such projects in India or elsewhere cannot be completed in such a short period of five years except under unusual emergency-type situations. Table 2 provides some of the data which compares selected PP estimates with actual performance.

TABLE 2
ORIGINAL PP ESTIMATES AND ACTUAL PERFORMANCE

Item	Original PP and Grant Fund Amendment (Planned)	Actual
- Number of sub-projects	15 to 20	12
- New projects	7 to 10	10
- Modernization projects	8 to 10	2
- Irrigation potential created	65,000 ha	81,554 ha
- Irrigation utilization	65,000 ha	7,195 ha
- Dams completed	all	5
- Canals completed	all	2
- Project with 50 percent of households with under 4 ha. of land	all projects	achieved
- Employment Generation from construction	50,000 person years	achieved

Item	Original PP and Grant Fund Amendment (Planned)	Actual
*-Distribution network to 40 or 8 ha. level completed	all	none
- Sets of special studies completed	3	1
- Incountry training (number)	430	550
- Participant training	$313,249	$416,192
- Mid project evaluation	1	None

It was of critical importance to have had an intensive external mid-project evaluation as called for in the PP about 30 months of the project agreement. USAID was aware that about 24 months elapsed before actual implementation activities began. There was an opportunity in 1983 to make significant changes in the Project. Instead of the mid-term external evaluation, a mid-term USAID Mission Review was done.

3. The Grant Fund Amendment

The grant fund amendment of July 30, 1983 introduced the following minor changes in the project.

- Assurance that staff trained overseas under the new grant contribution would be assigned to the USAID assisted sub-projects except for compelling administrative circumstances.

- Inservice training for project design officers, development of training modules, and special courses and training activities in water management for both the GOR/ID and GOR/AD staff.

- Special studies including baseline socio-economic surveys, water management studies, organizational studies and evaluations.

- USAID short term technical assistance (14 work months)

- Establishment of a Water Management Training Cell.

- Equipment for training and design.

Grant funds of $750,000 were added to the original $500,000 in the project agreement for these activities.

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* At three sub-projects two, twenty-three, and thirty four percent of the distribution networks are completed.

4. Serious Drought Crises in Rajasthan

Each year of the LOP there were severe droughts due to the highly variable monsoon rains. The most severe crisis-type droughts were in 1982 and 1984. These emergencies slowed down implementation schedules of existing state irrigation projects including the RMIP in three major ways:

1) Total resources of the State are reduced due to reductions in revenues. Budget allocations reflect the total funds which are available to the State at a given time. The RMIP was affected by GOR annual budget allocations. Adjustments were made by USAID several times during the LOP to overcome this constraint.

2) Existing staff assigned to USAID to the RMIPs and other projects during severe drought periods are assigned to supervise drought relief works, draw-up drought relief plans, acquire labor, supervise and make payments in cash and grain, to labor on drought relief works. For example, the Superintending Engineers, Executive Engineers and staff in Bhilwara, Dungapur, Udaipur, Jaipur, and Sawaimadhopur areas, supervised seven USAID-assisted projects but during drought periods their attention was primarily given to the implementation of Non-USAID assisted drought relief works and projects.

3) Existing staff on irrigation projects with water available are often called upon to provide extra water for drinking purposes and fodder for cattle because during drought periods in the Kharif season there are often total fodder crop losses. Whatever stored water is available is used to provide some irrigation for Kharif crops. Normally most medium and small irrigation projects store water only for the Rabi (winter) season.

This drought phenomonon was examined in discussions with GOR officials.

Other USAID Projects in Rajasthan State

The USAID - assisted Irrigation Management and Training Project (IM & TP) signed in July, 1983 provides support activities for USAID assisted and other projects in five Indian states. In Rajasthan, the IM & TP assists a state training institute, an action research program, and an agricultural university. The training institute established at Kota provided some of the in-country training for staff assigned to the RMIP.

6. Annual Implementation Review (1981) and Mission Internal Review (1983)

The mission was aware of serious implementation problems early in the LOP. The recommendations of the November 1981 review and a GOI Central Water Commission review were transmitted to the GOI and GOR on December 17, 1981. This review recommended to the GOR the following:

- Immediate steps are needed for sanctioning the required subdivisions and staffing.

- Existing budget allocations of the GOR for the sub-projects need to be substantially increased to complete the project by June 1985.

- Special studies need to be expedited.

- GOI/ID efforts need improvement to ensure CWC appraisal and approval of sub-projects by March 1982.

- To expedite project design and the approval process it is recomended that the GOR establish a design unit at the state level.

The April 1983 mid-term project report made the following recommendations as summarized below:

- Budget allocations for 1983-84 for Bassi, Kothari, Chhapi and Bilas projects must be increased.

- Modification of present scope of the project by integrating on-farm development activities with the remaining construction activities.

- Two network planning cells for planning - design and for distribution network at chak level need to be established.

- Need to step up appraisal and approval process for remaining projects by September 30, 1983.

- Need to submit reimbursement claims to USAID expeditiously.

- Field officials trained in specialized disciplines should not be transferred for at least three years in the interest of project implementation.

Due to various reasons, most of these recommendations were not implemented. Major reasons were GOR constraints and the absence of any tie between loan disbursements and grant funded software activities. Also, there were no conditions precedents, or covenants in the project agreement other than the standard ones which apply to all AID financial projects.

A study of review documents, CWC appraisal reports, trip reports and other project documents provide ample evidence that USAID staff tried throughout the LOP to speed-up and improve the quality of the project and its implementation.

7. Mission Staffing Problems

As stated, this project was designed when the mission had no direct hire technical professional in Irrigation or with much previous experience in irrigation projects similar to the RMIP. Shortly after the project was signed, a technical professional was contracted to work for the Mission. Throughout the LOP, five different project officers were assigned to this project for periods of roughly one year each. Therefore, continuity was not maintained. Between late 1982 through 1984 the Mission's new Irrigation Division added several direct hire and FSN professional staff but the major focus was on designing five new irrigation projects. The work load on existing staff was unusually heavy during that period. Finally in April 1986 the final year of the RMIP, one FSN Project Officer died suddenly. This and other factors should be kept in mind when examining the findings of the Evaluation Report.

Chapter II

PHYSICAL AND TECHNICAL ASPECTS

This section of the Evaluation Report examines the design aspects of the sub-projects, the status of implementation and the physical infrastructural components. Annex I provides a more detailed description of each of the 12 sub-projects.

TECHNICAL DESIGN OF SUB-PROJECTS

The design of the various components of the sub-projects were done by the Irrigation Department (ID) of Rajasthan. The head works, canals and distribution systems were initially designed by the ID and then reviewed by the CWC especially in reference to the hydrology and flood discharge elements. Sufficient expertise exists in Rajasthan ID for the design and construction of earthen dams, masonery dams, concrete dams, canals and most of the control and safety structures. The parameters for designing various structures in accordance to the Indian Safety Codes are generally applied. The level of design and construction of the medium projects examined is considered to be of a high level.

In the absence of reliable data, however, for some aspects of design, assumptions were made which require investigation. Seven projects were investigated during the evaluation and various documents including project reports, technical estimates and the results of studies carried out were examined. Discussions were held with project officers from the Chief Engineer level to the Assistant Engineers at project sites. Since the designs of dams, canals and other structures generally conform to practices followed in India using the latest methodologies, all aspects were not fully evaluated due to the short time allocated for the Team. We did, however, deal with these aspects in our discussions with engineers. The items which required major attention are discussed in this section of the report.

It is important to note that most of the 12 sub-projects are still in the construction stage. Also certain assumptions were made for design without adequate studies. It was found that the Design and Research Wing of the ID lacks adequate staff and facilities. The major technical design components of these projects are examined. (The reader is requested to consult annex I for specific details for each project.)

HYDROLOGY

A. RESERVOIR YIELDS

In the absence of flow data, reservoir yields have been computed on the basis of annual run off and rainfall correlations using the Long Bein log deviation method. This takes into account the flow data of nearby gauge discharge sites and rainfall data of nearby rain guage stations. Dependabilility of yield was worked out and storage capacity of reservoirs fixed accordingly. Only a few dams out of the twelve projects have been completed and regular gauging of run off received at dam sites has been started only recently.

It has, therefore not been possible to test the validity of the original assumptions made for computing reservoir yields. The data available indicates that the yields worked out for different dependabilities may be in order. In any case, after working out the crop water requirements all the projects are expected to have about 75 percent water supply dependability. For the arid and semi arid areas of Rajasthan even a lower dependability of 50 percent is considered satisfactory.

B. FLOODS

Again, in the absence of observed flow data on the dam sites, probable maximum floods were computed by Snyder's method of synthetic unit. This is done by hydrograph and transposing observed storms of peak intensity and duration over the catchment area. But no consideration was given to interception of the catchment areas, however small or large this may be. It is assumed though that a probable storm of the severest intensity may occur over the whole of the catchment area when upstream reservoirs, are full and spilling. Spill way capacities on the projects under review have been provided to handle the probable maximum flood (PMF) and route this through the reservoir The PMF for which the spillways were designed for the projects are shown in table 3

TABLE 3 DATA ON TECHNICAL ASPECTS OF SUB-PROJECT FLOOD DESIGNS

NAME OF PROJECT	TOTAL CATCHMENT AREA SQ.KM	INTERCEPTED CATCHMENT AREA SQ.KM	FREE CATCHMENT SQ. KM	PMF CUSECS	ROUTED FLOOD CUSECS
1. Bhimsagar	335	6.7	335	2011	2011
2. Sawam Bhadon	146	-	146	1346	1346
3. Bilas	233	-	233	1812	1812
4. Chapi	800	-	800	5125	5125
5. Panchana	621.60	-	621.60	3795	3795
6. Som Kagdar	748	184	564	5334	3259
7. Som Kamla Amba	5376	4134	1242	30083	29950
8. Meja Moderni-zation	1651	603	1048	6915	6788
9. Kothari Stage II	2176	1800	376	6005	6005
10. Gambhiri Modernization	1036	103.6	932.4	8779	8779
11. Wagon	307	51	256	3025	2427
12. Bassi	453.20	331.5	121.7	2401	2401

The methodology adopted for computing the maximum probable flood is in order when the most severe storm recorded is considered to occur over the whole catchment. Recorded storms occuring at Bamanwas, for example, are said to be of about 1:250 frequency while others are of longer frequency. It remains an open question as to whether storms of such long frequencies should be considered for computing maximum probable floods.

In the same areas of the new projects under construction, spillways provided on dams were designed after computation of maximum floods on the basis of the normally adopted methodology. These dams have withstood such floods. Only in exceptional cases, has there been a dam failure due to inadequate spillway capacity. It is observed that there is a great difference in the spillway capacity provided for the USAID assisted RMPIs as compared to these provided on adjacent projects with similar catchment characteristics. This is one of the factors which has increased project costs considerably.

No consideration for moderation by interception of catchments has been provided in the projects. It is assumed that existing reservoirs are spilling when a severe storm is occuring in the whole catchment area and when the MPF reaches the reservoir below. But spillways of existing reservoirs are not designed on the USAID-RMIP criteria. Given the circumstance of the severest storm due to inadequate spill capacity, these existing reservoirs in all probability likely will not hold. Therefore, the additional design capacity of the USAID assisted projects have built in more safety factors.

A typical example is the catchment area of 453 sq. km at the Bassi project. This project is intercepted by 331.5 sq. km of existing reservoirs at ORAI, Shadi and Modia Mahadev. The Orai Dam is in close proximity to Bassi Dam which is now under construction. The spillway capacity of Orai has been designed to handle floods computed on the basis of a coefficient of discharge and is probably inadequate to handle floods computed on the basis of Unit Hydrograph for a storm of severest intensity as is being adopted for Bassi Project. If a severe storm occurs as envisaged in computing the PMF for Bassi, Orai Dam will probably not hold resulting in a heavy rush of stored water towards Bassi.

Another technical design consideration worth notice is that the channel capacity above or below the proposed dams is inadequate to accomodate the floods computed to pass over the spillways. The capacity of Berach River near Chittorgarh or Gambhiri River below Panchana are examples as well as Orai river below the Bassi Dam. In case the type of flood now computed for Gambhiri occurs, the whole of Chittorgarh town may be submerged.

Since the cost of great capacity spillways now provided using different criteria are high, it is found that the costs of spillways at Panchana, Bhimsagar, Son Kamla Amba make up a high proportion of the cost of headworks on these USAID assisted projects. It may be worthwhile to review the methodology to compute the PMF adopted for designing such spillways. In the case of Son Kamla Amba, the floods as computed cannot be accomodated in the river section below the dam; therefore, the costs of the spillway including a proposed breaching section also increases the total cost of headworks in that project.

While it may be desirable to construct so called fool-proof spillways as precautions against possible failures due to high floods, it is of critical importance to keep in view the overall economy and especially damage to agricultural lands and human lives. This matter of flood estimates and design of dams and spillways needs constant review at the highest levels of the GOR, CWC and the GOI.

CONVEYANCE EFFICIENCY

A conveyance efficiency of 75% has been adopted in all the USAID assisted projects. It was envisioned that all the main canals, branches, distributaries and minors up to the 40 hectare level would be fully lined and the channels from the 40 to 5 or 8 hectare units would be partly lined on a selective basis. Conveyance losses in the lined channels have been assumed to be 2 cusecs/million square feet of wetted perimeter in project estimates. It was also planned in the project that special studies would be carried out to determine the most suitable and economical lining. In the projects where canal lining has been done or is in process, plain cement concrete is used. The field channels from the 40 to 5 and 8 hectare units are being lined with concrete beds and stone masonary for the side walls with cement plaster on the inner sides of walls.

The project authorities stated that detailed studies have not been carried out to ascertain the most suitable and economical types of lining. Also no studies, as called for in the project paper, have been undertaken to determine the actual losses where the canal lining has been completed and the system is running. The discharge measuring devices to determine the flow in all reaches of the canal as planned have also not been installed though this is a requirement stated in the project paper and in the CWC appraisal reports. In the absence of discharge measuring devices on the channels and studies to determine actual losses, it has not been possible to test the validity of the assumptions made about conveyance losses and efficiencies. Studies, however, made on other projects show that with a lined canal system the conveyance efficiencies are about 75 percent.

The cost of lining the canals and channels up to the 5 and 8 hectare unit is considerable. Research on water losses is needed to determine the most suitable and economical types of lining. The stone slab lining observed on some canals at the Gambiri project have two shortcomings. One, the slabs get disturbed due to unequal settlement in the subgrade resulting in opening of joints and consequent leakage. Two, the slabs are sometimes stolen by local villagers. In any case, the coefficient of rugosity with stone slab facing may not be in the range of 0.018 as adopted for the lined canals or the USAID assisted RMIPs. In the case of stone masonery side walls with plaster on the inner face, it is doubtful if the reduction in seepage losses will be as much as assumed.

The construction of water courses from the 40 to the 8 hectare level is being done or is planned on all USAID assisted RMIPs. Without appropriate data from water loss studies and economic analyses of these, the benefits are not yet known. Project authorities, however, without studies have assumed that actual conveyance losses in the lined canals may exceed the assumed scale of 2 cusecs per million square feet of wetted perimeter.

In conclusion, the team finds the following short comings in relationship to what was planned:

- No measuring devices provided for measuring flows in all reaches of canals.

- **Studies not yet carried out to test the validity of assumptions regarding conveyance losses in canals and water courses**

- **Economic analyses to select the most effective and economical type of lining not done.**

SEDIMENTATION OF RESERVOIRS

In the absence of any previous studies or data, siltation rates were assumed as 0.048 ham/sq.km./year (1 Acre ft./Sq. mile/year) at Somkamla Amba, Bassi, Som Kagdar and other RMIPs. The assumption was slightly lower 0.036 ham/sq. km/year (0.75 Acre ft./Sq.mile/year) at Kothari stage II, Wagon and Som Kagdar projects. There seems to be no technical basis for adopting two different rates of siltation. While there is considerable interception in the catchment areas of the Som Kamla Amba, Wagon, and Bassi, the interception in the catchment of Som Kagdar is not significant.

No sedimentation studies have been carried out in any of the projects as requested by CWC to test the validity of the above assumptions made for siltation rate and consequent reduction of the live storage of the reservoirs. The CWC had recommended that sediment bench marks along the reservoir be established to observe the actual sediment loads and rates of siltation.

On Gambhiri Project, for example, which is an old project being modernized with USAID assistance, the local authorities conducted a reservoir capacity survey in 1984. The siltation rate of 1.15 acre ft./sq. mile/year was observed which is slightly higher than the assumed rate of 1 acre ft./sq. mtr/year. The data from this single source suggest that the estimates of sedimentation for the new projects are low.

Considering the rate of deforestation taking place every where in Rajasthan particularly in the hilly sectors of catchment areas, it is probable that sedimentation rates at all USAID assisted new projects are higher than assumed. In a recent study made on some non-USAID assisted projects it was found that some reservoirs were loosing their live storage capacity at the rate of about 0.5 to 1.2% each year. For example, the loss of capacity at the Bhakra project is said to be 0.35 per cent. The siltation rate adopted in RMIPs is estimated at only between 0.36 to 0.4 percent. This may prove to be satisfactory but regular observations as suggested in the appraisal reports and afforestation programs in the catchments are necessary. The evaluation team did not find that necessary studies recommended in the project appraisal reports are being done.

DRAINAGE ASPECTS

Semi-detailed soil surveys have been conducted in the command of projects and irrigability classifications have been completed. Ground water table observations were recommended by CWC but have not been made on any of the USAID assisted projects. Soils in most of the commands are stated to be shallow to deep, fine textured and with moderate to poor internal drainage characteristics. Accordingly, it was recommended in the CWC appraisal reports that simultaneous construction of drainage networks in projects be done.

Substantial provision for this has been made in the project estimates. These estimates range from Rs.1.00 million to 2.6 million for each project. Therefore, finances are not holding up this work.

Laying out and construction of drainage systems requires detailed topographical surveys of command areas and studies of soil characteristics. These surveys have not been conducted on any of the USAID assisted projects. Interviews with farmers in the commands of Wagon and Gambhiri projects revealed that there has been a perceptible rise in the levels of water in existing open wells. Though there is no observed evidence of water logging in the commands of Gambhiri Project where irrigation was introduced in 1957, it is important that groundwater levels be monitored.

Drainage and micro channel networks were planned for all the USAID assisted RMIPs. It is necessary that an overall on-farm-development (OFD) approach be considered at the planning and construction stage rather than later. Considerable savings in cost could result by taking up the work of water courses, farm drains, laterals and other drains, and land shaping at the planning stage. This is needed especially at the USAID assisted projects in the Kota-Jhalawar region where the predominate black cotton soils have poor drainage characteristics.

Project officials contacted during the field visits, stated that pilot projects for on-farm-development have been prepared for the USAID assisted projects at Bhimsagar and Panchana. The team found that USAID has stimulated activities and interest in on-farm-development for medium projects for the first time in Rajasthan. Mechanisms such as a modified command area development program for medium irrigation projects are now being explored.

In conclusion the team found the following related to the drainage aspects of the projects:

- Drainage network planning and construction not done with the construction of projects.
- Observations of water table in wells in the commands yet to be commenced.
- OFD concept needs to be introduced on all Medium Irrigation Projects.

INTENSITY OF IRRIGATION AND CROPPING PATTERN

On all USAID assisted projects, the Rabi and Kharif season crops have been proposed with varying percentages of irrigation. But in some projects such as Panchana and Som Kagdar, Kharif season irrigation has been proposed only as a protective measure for crops or at times when rains fail when Kharif crops are maturing during the months of September and October. On other projects such as Chapi, Bilas, Bhimsagar, definite Kharif crops such as Paddy have been proposed. The intensity of Kharif as adopted is as high as 35% with 10% of this allocated for Paddy. Crop water requirements have been worked out on this basis and reservoir operation tables have been prepared.

Rajasthan's agricultural areas are typically arid or semi-arid, therefore, extensive rather than intensive irrigation should probably be advocated in contrast to that planned on the USAID assisted RMIP. Field studies are needed to investigate this issue as to whether extensive irrigation during one season may result in higher total crop production and provide more benefits to farmers than intensive cultivation. Paddy or sugar cane cultivation might be confined to well irrigated areas thereby saving valuable water supplies.

The subject of cropping patterns is complex and needs more analyses. The cropping patterns adopted by farmers typically take into account several factors such as expected returns or prevailing market prices, cost of inputs such as fertilizers, seeds, pesticides and their perceived availability of labour and water. Also the size of farm operating units is an important factor. For example, the team found that about 70 to 80 percent of the land holdings on all the USAID-assisted projects were only two to four hectares in size. It is often difficult for small farmers to adopt the designed intensities of irrigation or prescribed cropping patterns. It is also virtually impossible to influence them to do so because of many constraints they face. For example, at the Wagon Project, where water has been provided to farmers for the third year, it was observed that almost 80% of the area irrigated was under wheat contrasted with the planned 27% for wheat in a Rabi intensity of 45 percent. The small land holders at this site actually had almost 100% of their land area under wheat during the 1985-86 Rabi season. This shows how invalid most planned intensities work out in practice.

Based on the evaluation teams field observations of actual versus assumed practices it seems that a higher percentage of crops for the Rabi season would be preferable to crops in the Kharif season. Cropping patterns and intensities not only have direct implications for design but also in estimating costs and benefits. Therefore, these need to be based more on actual practice versus rough estimates or assumptions of planners.

Field Application and Irrigation Efficiencies

Field application efficiencies in the USAID-assisted sub-projects was assumed as 75% and with conveyance efficiencies adopted at 75%. Therefore, the overall irrigation efficiency (0.75 x 0.75) was estimated at 56 percent. Unfortunately, the studies planned to determined actual conveyance and field application efficiencies have not been done. This is another striking case where important decisions were made without empirical field data. Without such data, decisions are made about design factors such as when, where and how much to line channels and what flow rates to adopt. Such a practice may prove to be costly over time.

DESIGN OF OUTLETS, FIXING OF ADJUSTABLE PROPORTIONAL MODULES, WARABANDI AND FARMER INVOLVEMENT

The design criteria for outlets was followed carefully. An outlet for each chak is located with levels to command the whole area of a chak. A working head of 15 cm has been used which is designed to deliver 28 litres/sec at the farm gate. The Full Supply Level (FSL) in the parent channel is maintained by suitable control structures which are adequately provided. The design and construction of canals including control and safety structures has been done with precision and expertise.

Adjustable Proportional Modules (APMs) have not been fixed on all the outlets where irrigation has begun though these are planned for all USAID-assisted projects. The modules fixed at Wagan for example, including nakka control structures fabricated locally have been adopted as a model for other medium projects in Rajasthan. The gated structures for nakkas, which have a locking arrangement are also suitable. The GOR/ID could make a detailed study and standardize these structures for uniform adoption on all new projects. A contribution of this project resulting from USA Technical Assistance has been the introduction of these structures which were originally developed at a USAID project in Pakistan.

The Warabandi or Rotation and Water Supply System, has not yet been introduced where irrigation has begun. A creditable attempt has been made on the Wagon project with a modified warabandi or Rozwari system introduced in the 1985-86 irrigation season with much success. Below each nakka point a token which is a brass medal piece is transfered from one farmer to the other after each irrigation turn throughout the chak area being irrigated. This token is a symbol that the farmer has ownership of the water for his stipulated turn which is on a time basis per unit of land to be irrigated.

At the Wagon project, a serious attempt has also been made to involve farmers and organize water users associations. This organization now being established is based on four tiers related to canal distributary chak and block levels. The approach is as below:

(i) Pillai Pramukh	-	Canal level
(ii) Pillai Pradhan	-	Distributary level
(iii) Chak Sarpanch	-	Chak level
(iv) Block/Khand Panchas	-	Block level

This organization is similar to what is known in Rajasthan as the "Jalvitran Committee" which stands for water distribution for better water management or in local terminology, "Pillai Panchayat". For each Nakka outlet representing a block of 8 hectares of land and about 15 to 20 farmers, the land holders, appoint a block panch for each block. For each chak of 40 or 20 hectares, there is a Chak Sarpanch at the outlet level elected by block panches. At the minor or distributary level, there is a "Pillai Pradhan" who again is elected from among the Chak Sarpanches.

The organizational link between the three tiers from the canal to the nakka point level is established. This panchayat-type organization is headed by the "Pillai Pramukh" for the whole canal system.

These farmer organizations recently introduced are involved in settling disputes among farmer, assisting the ID in enforcing the rules, overseeing the maintenance of watercourses and field channels and the equitable supply of water to each farmer. This arrangement is still experimental. Time is required to adequately evaluate its effectiveness. Modifications will need to be made as lessons are learned. A major impact of the USAID project has been the creation of a special high-level GOR/ID committee which is now examining ways to revise or supplement the 1978 Irrigation and Drainage Act of Rajasthan to provide more incentives for farmer involvement and farmer organizations.

ENVIRONMENTAL ASPECTS

Most of the projects are still in construction stages and only five reservoirs on new projects have been created. Studies on impact on environment due to Irrigation projects have therefore not been carried out. A few points, however, need to be mentioned:

1. As stated in the section on project technical design elements, the siltation of reservoirs is most likely to be much faster than anticipated. This is due in part to indiscriminate felling of trees, grazing of watershed areas, deforestation, and cultivation of lands in parts of catchment areas which result in the formation of gullies and soil erosion. Soil erosion, for example, is acute in the catchments of Panchana, Bilas, Bhimsagar, Chapi and other projects. While detailed studies related to sedimentation are critically needed on these new projects, estimates on the quantum of sedimentation and its rate can be estimated from other reservoirs in the area. The GOR should formulate policies about treatment of these fragile catchments especially with regard to planning and management of forests, grazing of animals, soil conservation and afforestation.

2. Extensive tree plantations are needed along the major canals. Provision for this could be made in consultation with the State Forestry Department. Such cooperation at the present time is not evident.

3. The reservoirs created by Irrigation Projects should afford opportunities to local people for recreational activities such as boating, swimming, fishing etc. The dam and reservoir areas could be developed into picnic spots and as centres for social gatherings. More attention to the beautification of areas around dams such as providing small parks and other facilities would also help to improve the environment surrounding project areas. A beginning in this direction has been made at USAID-assisted Bhimsagar, Panchana, Kothari and Meja Projects. Tree plantation completed at Kothari project is exemplary.

TECHNICAL IMPLEMENTATION STATUS

This section provides the key findings related to the evaluation of the physical and technical aspects of the 12 sub-projects. Annex I provides a detailed analysis of each project.

As stipulated in the project agreement, the GOR/ID prepared project reports using the criteria established. These projects were then cleared by the Central Water Commission's Project Appraisal Committee. Six of the sub-projects were appraised and cleared by 1982. One in 1983, two in 1984 and the remaining three in 1985. Two or more years were usually taken in getting the subprojects appraised once the process was initiated. The criteria laid down in the project agreement and those used by the Appraisal Committee required the collection of considerable data normally not utilized or available with the GOR/ID. Considerable effort and time were, therefore, used to get the designs and other components of the sub-projects finalised. As a result progress on construction of the subprojects was extremely slow.

Finally, after all the subprojects were appraised and cleared, the works progressed satisfactorily. Inspite of many constraints, the GOR/ID was able to accomplish the completion of a substantial portion of the civil works on the sub-projects. (See Annex 1)

While some sub-projects were initiated long before being included in the RMIP, still some of these are not completed; good progress has been made on several of them. Partial storage and hence partial irrigation has been accomplished on five projects. The irrigation potential created against the designed irrigation potential is shown in Table 4 along with accomplishment made in physical progress of the sub-projects. This shows that the head works of seven subprojects and about 50 percent of the canals up to the 40 hectares blocks have been completed. Excluding Chapi and Bilas projects, for other new projects the headworks have not progressed adequately but progress on the canal systems upto the 40 hectares blocks is evaluated as good. At Chapi and Bilas sub-projects, canals have been completed for utilizing available stored water supplies. At Bassi, the first storage of water will take place in the 1986 Monsoon season. The first Rabi irrigation season will start in October and November 1986. However, at this project it is necessary that extra efforts be made to plan and implement distribution network from the 40 to 8 ha units without delay.

The following summarizes the progress of implementation:

(1) Greater attention has been given to the construction of headworks than the canal systems. Both should be done simultaneously so that water stored is timely utilised. In the cases of Bassi, Som Kagdar, Bhimsagar and Panchana sub-projects, the canal system has lagged behind dam construction considerably .

TABLE 4 SUMMARY OF DETAILS RELATED TO IMPLEMENTATION STATUS OF SUBPROJECTS

1 PROJECT	2 YEAR OF APPRAISAL	3 COST AS APPRAISED MILLION RS.	4 ANTICIPATED EXPENDITURE June 30,1986 MILLION RS.	5 ANTICIPATED REVISED COST MILLION RS.	6 YEAR OF COMPLETION AS PER APPRAISAL REPORT	7 ANTICIPATED YEAR OF COMPLETION
1. Bhimsagar	1982	141.78	113.08	160.00	1985-86	1989-90
2. Chappi	1982	182.22	22.00	240.00	1986-87	1994-95
3. Bilas	1982	62.90	23.00	80.00	1986-87	1991-92
4. Sawan Bhadon	1982	85.59	29.25	113.00	1986-87	1991-92
5. Kothari	1982	74.42	86.47	97.95	1985-86	1987-88
6. Bassi	1982	60.33	58.73	85.94	1984-85	1988-89
7. Panchana	1980	210.49	104.50	242.40	1984-85	1991-92
8. Wagan	1984	110.60	84.30	110.60	1986-87	1988-89
9. Gambhiri Mod.	1984	148.58	26.40	148.50	1991-92	1993-94
10. Som Kagdar	1985	196.88	135.15	196.88	1989-90	1989-90
11. Meja Mod. Meja Feeder	1985	62.48 198.89	13.14 182.85	72.00 209.94	1990-91 1986-87	1992-93 1988-89
12. Som Kamla Amba	1985	728.78	168.00	729.86	1991-92	1995-96
TOTAL:		2263.94	1046.88	2487.16		

Contd. on next page

TABLE 4 SUMMARY OF DETAILS RELATED TO IMPLEMENTATION STATUS OF SUBPROJECTS

8 DESIGNED IRRIGATION POTENTIAL AS APPRAISED (HA)	9 IRRG. POTENTIAL CREATED	9 IRRG. POTENTIAL UTILIZED	10 PHYSICAL PROGRESS DAM	10 PHYSICAL PROGRESS CANALS UP TO 40 HA	11 % TO DESIGNED DISTRIBUTION 40 - 8 HA	12 REMARKS
1) 9986	1600	1200	30	40	-	Dam upto crest level ready. Gates to be erected.
2) 7000	-	-	-	-	-	
3) 2700	-	-	34	20	-	
4) 3200	-	-	15	35	-	
5) 3075	3075	610	100	100 RMC 60 LMC	-	
6) 3170	-	-	100	40	-	Irrg. will be done first time in Oct. 1986.
7) 8787	1500	-	100 Except Spillway	59 Eearth work- 11 Lining		
8) 5706	5541	4048	100	-	34	
9) 4773	572	572	100	20	2	
10) 4935	4935	765	100	78	23	
11) 9424	- -	- -	- 90	52 Lining 100	-	Gates to be erected on Diversion weir
12) 18788	-	-	30	25	-	
81554 TOTAL	17223	7195				

(2) Due to complex contractual problems, work on the completion of the spillway at Panchana sub-project, the installation of gates on Bhimsagar, and the excavation of headreaches of the Panchana Feeder canal, have been held up for long periods. Timely action and resolution of procedural delays could have accelerated the completion of these works. At Som Kamala Amba project for example, contracts for spillway gates were entered into for fabrication, supply and installation much before the foundations of the spillway weir were ready. Even now, while embedded parts of the gates have been supplied with huge sums paid to contractors as price escalation continues, the completion of the weir will probably take several years. The planning and synchronization of various components of the dam are inadequate. Considerable delay has also occurred in the contracting of the crest gates for the Meja Feeder Headworks. At Somkagdar, the construction of one river crossing alone is holding up the use of a major part of the water stored.

(3) Proper service roads have not yet been provided along all the canals.

(4) While huge outlays have been made and heavy expenditurse incurred for canal lining, little has been done by way of research to identify the most suitable lining material, the types of lining and the criteria of when and where to do lining. Fifty percent of the distribution system below an outlet was to be lined on a selective basis. But the selection of lengths of water courses to be lined are left to the junior most ID staff. No adequate guidelines for decisions on the major sections of watercourses requiring lining exist. Watercourses have primarily been lined along farm borders, thereby considerable increase in their length and costs. If the on-farm development concept is adopted on these projects as planned, these water courses would need to be aligned along ridges to save scarce resources and provide more efficient irrigation.

Chapter III

SOFTWARE GRANT FUNDED ACTIVITIES: TRAINING, SPECIAL STUDIES AND TECHNICAL ASSISTANCE

The total amount allocated for software activities was $1,250,000. Table 5 shows the total disbursements to June 15, 1986 together with the anticipated expenditure by PACD. Initially only $ 500,000 was allocated for software activities. In July 1983, the grant fund component of the project was increased by an additional $ 750,000. By June 15, 1986, however, only $ 535,203 of the grant funds had been disbursed. This was due to lack of planning, delayed submission of reimbursement claims and other factors discussed below under the headings of Training, Special Studies and Technical Assistance.

TABLE: 5

SOFTWARE GRANT FUND UTILIZATION STATUS
(JUNE 15,1986)

(DOLLARS)

ACTIVITIES	ALLOCATIONS	DISBURSEMENT (JUNE 15,1986)	ANTICIPATED BY PACD
1. Training of Engineers in Water Management Overseas	360,000	313,249	416,192
2. Water Management Studies	190,000	-	30,000
3. Socio-economic Baseline Studies	28,000	22,715	25,500
4. Training Workshops In-country	70,000	7,271	50,000
5. Technical Assistance	210,000	174,000	174,050
6. Dev. of Handbooks and Manuals etc.	30,000	13,115	25,000
7. Establishment of WM Training Cell for DA	10,000	-	5,000
8. Project Equipment for Training etc.	352,000	4,803	175,000
TOTAL:	1,250,000	535,203	900,742

A. Local and Overseas Training

1. Training in the Project Paper:

The original design of the project provided no training plan but referred to training in only general terms. The following references are taken from the Project Paper.

- "Training programs will be setup and training modules prepared by GOR's Irrigation and Agricultural Departments for training of department personnel, community level and water user organizations in applied water management principles and techniques". (page 30)

- "Short term training will be provided for engineers responsible for design, construction, evaluation and/or operations and for GOR/DOA officers responsible for economic analysis, to review and study practices and participate in special courses in the USA. Inservice training will be provided for project officers" (Annex. L. p.2)

- "Development of training modules and special courses and training activities in water management for use by GOR Irrigation and Agricultural Departments will be supported." (Annex. L, p.2)

- "Professionals of the Department of Agriculture will be trained in water utilization and in economic analysis." (p.29)

Training was not integrated into the project and there was no tie of grant funds to other disbursements. Rather, throughout the LOP there were problems in getting the training implemented.

2. Amendatory Agreement to the Limited Scope Grant Project Agreement (July 30, 1983)

Actual project implementation was started in 1982. Shortly after several days of discussions with the GOR/ID in 1983, a mid-term project report was prepared in April, 1983. In the month July 1983, $750,000 was added to the original $500,000 grant component of the project. In this new agreement more emphasis was given to training. A covenant was also made in the amended agreement that "staff trained on the project would be assigned to USAID supported projects for at least two years except under compelling administrative circumstances." Also there was a new provision that the GOR/ID would "provide a semi-annual placement report* on staff trained under the project." This covenant was adhered to upto the end of 1984. The evaluation team studied the semi-annual placement reports available from 1981 to 1984. Based on the staff assignments through 1984, the record of assigning participant trainees back to projects has been very good under the RMIP.

*The GOR/ID provided these reports to USAID as agreed only through December 1984. A study of these reports indicate that of 38 participants trained through 1984, 10 were transferred immediately after the training due to promotions and in the interest of the GOR; 9 returned to their posts; 4 were transferred to other USAID assisted projects; 3 were transferred to the USAID IM&T Institute at Rota, and 2 were shifted to the main office to handle USAID assigned sub projects under the RMIP.

In other words, up to December 1984, 74 percent of the participant trainees were assigned to USAID projects after training. Most participants interviewed agree that the training was useful. The new amendment also spelled out the types of training more than was done in the Project Paper. For example, it called for the in-country training of ID and AD field staff in ten network planning and design workshops (200 persons); ten construction quality control workshops for 200 field staff; three workshops for 30 personnel on management and operations; development of handbooks and field guides; establishment of a training cell, and provided for training equipment.

Still there was no training plan based on an assessment of who would do the training or a means evolved to assure that it would be done. Several key components of the training are discussed below.

The evaluation of this training was done by a structured interview schedule, discussions with participants, discussions with USAID and GOR staff and a study of three evaluation reports of major training activities. Evaluation forms were sent to all participant trainees now scattered throughout Rajasthan. Also forms were sent to a sample of those trained for the RMIP by the USAID assisted Training Institute at Kota. This Institute is funded under the Irrigation Management and Training Project. Only 20 survey forms were returned to the evaluation team. Therefore, the sample is too small to draw hard conclusions.

Due to the lack of a training plan and long delays in implementing training, some of the funds could not be used by PACD. Annex. II provides a summary of the findings obtained from the structured training evaluation survey.

B. Incountry Training

1. Diagnostic Analysis Workshop:

Probably the training which had the greatest impact in Rajasthan was the Diagnostic Analysis (DA) Workshop in 1982 arranged by USAID and the GOR/ID. This was planned and implemented by the GOR/ID and the AID centrally funded Water Management Synthesis Project (WMSP) which brought a three-person team of trainers to Rajasthan's Gambhiri Project for six weeks. This was the first time an interdisciplinary DA process was introduced in Rajasthan. Five Rajasthani trainers were used as assistant trainers who had participated earlier in the USAID/WMSP assisted 1981 Gujarat DA Workshop. Twenty trainers from Irrigation and Agricultural Departments were intensively trained in the processes, procedures and methods of DA on a live irrigation system. USAID and the GOR evaluated this training activity as a success. Though a proposed DA training cell was never established, there were several positive spin offs from this single training activity. These were: follow-up pilot of improving one minor on the Gambhiri system; three participants became trainers in the USAID assisted Irrigation Management and Training Institute established at Kota (Rajasthan) in 1984; the building of DA training into the Institutes' training program on a regular basis; one USA Graduate student's Ph.D thesis was on the Gambhiri project; greater awareness about the productive end of the system by irrigation engineers; the first major realization of the importance

of farmer involvement in system improvements and operations, and two other farmer involvement workshops held at Gambheri and Wagon projects in 1984 and 1985. Five participants were also sent to Colorado State University upon completion of this training to analize and synthesize the data collected and to prepare a professional team report. About 200 copies of this first DA study report in Rajasthan were distributed in the State and throughout India. This innovation has certainly been instrumental in promoting this new DA systems team approach concept for identifying and solving complex irrigation problems.

Participant Training

Excluding the five participants who went overseas to analize the data and complete the DA workshops report, 49 other professionals were sent to US universities* for sponsored short courses of about 5 to 6 weeks duration. All of these courses were related to Irrigation Water Management (IWM) and included the following aspects: economic analysis of irrigation projects; system and project evaluation; irrigation problems and practices; study tour of irrigation systems; social, technical operations and management; on-farm system design and evaluation; water logging and salinity and policy.

The break down of those who attended US training courses: 12 senior level officials (Secretary 1; Chief Engineer 1, Additional Chief Engineers 2, and 8 Superintending Engineers and Directors; 19 Executive Engineers and 17 Asst. Engineers. Three professionals each from the CWC and the Rajasthan Department of Agriculture also attended plus one Command Area Development official. It is not clear how the 3 CWC officials trained actually benefited the project. It should be noted that only 3 or 6% of the 49 participants were selected from the Department of Agriculture.

The overseas economic analysis training was planned for 6 professionals from the Water Utilization Cell of the Department of Agriculture and the Irrigation Department at an estimated cost of $ 70,000. Actually only three professionals received this special overseas training. The evaluation team had discussions with Dr. A. R. Mehta who had participated in this activity. He found the training at Kansas State University highly useful. After returning to Rajasthan he wrote a manual on "Economic Analysis for Irrigation Projects" which is now being used in the state. He also participated in the 1982 DA workshop as a trainer for the Economics discipline. He and one other professional trained in the USA are still working in the Water Utilization Cell of the Department of Agriculture.

While the participants interviewed evaluated the training as fair to very good, it is not clear that all the training was relevant. Though there are typically rapid transfers of engineers in Rajasthan, about 75 percent of the participant trainees returned to USAID assisted projects. There was some tendency to send senior engineers early in the Project but 17 assistant engineers or 31 percent of the total participated.

*All the courses but two were conducted by Colorado and Utah State Universities which are centers of excellence in IWM.

The evaluation forms completed indicate the following benefits described by a sample of the participants:

New Skills: Interdisciplinary team work, application of water for crops, economic analysis and irrigation scheduling.

New Knowledge: About IWM and technologies, role of agriculture in irrigation, and importance of farmer involvement.

New Attitudes: Positive view of farmers, role of IWM for India, role of assumption and attitudes in design, importance of professionals, and the need for continuous professional development. Also other intangibles such as the perceived need for more training in IWM areas were listed.

As an example of the effectiveness of one course on "Socio-economic and Management Aspects of Irrigation", two senior professionals returned to Rajasthan and began to initiate activities for training engineers about the importance of farmer involvement. One participant implemented the findings of the 1982 DA study on the Gambhiri Project. Another become the first Director of the USAID assisted Irrigation Management and Training Institute at Kota, Rajasthan. He has now been promoted to Chief Engineer of Rajasthan and is a strong supporter of training and farmer involvement.

Jointly, these two senior officials have raised farmer involvement (FI) to a high level policy dialogue. This is a direct result of their efforts in working with farmers, conducting tours, and holding training workshops. At a high level workshop in Jaipur in 1985 with the Chief Minister, Ministers of Agriculture and Irrigation farmers and officials recommended revisions in the 1974 Irrigation and Drainage Act of the State to provide incentives for FI in irrigation projects. A high level committee is now working on this critical issue. (see press reviews in Annex. V)

It is not clear that the covenant to send only participants from USAID assisted projects was adhered to strictly. Also with staff promotions and transfers every 2 to 3 years, it was difficult to assure that staff would return to their original posts. Of the small sample interviewed, only 50 percent reported that they actually used the training on USAID projects. Other estimates by GOR/ID staff provided in discussions during the evaluation reported substantially the same judgement.

In summation, the project most likely could have benefited more professionals if the training had been integrated into the overall project plan. More training could have been done earlier in the LOP and targeted better to meet early project needs. Based on the small sample of evaluation forms returned in all but a few cases, the stated benefits for the most part are intangible. Participants did report that they gained some new skills, new knowledge and some reported they had acquired new professional attitudes. Without hard data, the benefits remain somewhat intangible. All participants reported increased knowledge of IWM, which is important for Rajasthan's irrigation for the future. Nevertheless, the cost of this overseas training was justified on the grounds that three participants are now trainers; two were instrumental in bringing the importance of FI to top level decision makers and planners of the

State, and other participants are now seeking and gaining more in-country training related to IWM. In evaluating training, it must be remembered that human resource development is a long-term process and impacts are neither direct nor immediate. It usually takes several learning experiences to achieve significant impacts. It is a fact that those who were participants in overseas training courses have helped to focus more attention on IWM problems in Rajasthan. Many continue to create ferment for a more flexible IWM approach versus a traditional focus on design and construction of dams and canals. It must also be realized that there were only three of the 12 USAID assisted projects where most of this training could be utilized immediately because the systems had not been completed for delivery of water to farms.

C. Local Training

1. Network Planning Workshop

Ten workshops on network planning and design were slated for 200 professionals. However, only three workshops could be conducted and only irrigation a total of 75 professionals have been trained. These short six-to ten-day workshops were designed to help project engineers to plan and design the micro level conveyance and drainage facilities required. The majority of these trainees were from USAID assisted projects and most were involved or will be involved in these activities. Due to the two-to-three year staff transfer policy of the GOR/ID there is always the liklihood that many will soon be shifted to other projects. Our evaluation of this training is that it has been useful but more workshops should have been held to reach more operational staff. The evaluation team did observe one workshop in progress on June 12, 1986 at the USAID assisted Bhimsagar project.

The course was well designed and delivered primarily by staff from the USAID assisted IM&T Institute at Kota. Though all the training planned was not fully implemented, this type of training will continue on a regular basis under the Institute and will be of increasing importance as new projects begin to deliver water to farms. USAID staff and professionals of the Sakadia University at Udaipur, Rajasthan jointly developed a training guide for these network planning and design courses which is being used not only in Rajasthan but on other USAID projects in India. Copies have also been requested and sent to other Bureau Missions and to the World Bank. A significant impact of this training is that this is the first time in Rajasthan that Irrigation engineers have become seriously involved in planning, design and implementation of the infrastructure below the public outlet for medium projects. This is a solid accomplishment of this project. At two USAID assisted sub-projects, network development is being done (Wagon and Kothari). Network planning is also underway at Panchana and Bhimsagar sub-projects. The engineers who have taken this training report that they have learned new skills in planning and design of the facilities below the public outlet and have become more aware of the importance of active participation of farmers in is crucial activity. This too is a significant accomplishment of the RMIP.

2. Quality Construction Control Workshop

Ten of these four-to-eight day workshops were planned for 200 engineers but only two were held-for 59 participants. This training provided in 1984 and 1985 has been useful but was too little and too late in the LOP to significantly impact construction quality and management on many of the the projects. Quality control of construction on large canals is a critical problem representing high financial losses in Rajasthan and many other states of India. It should not be neglected. Only due to the USAID Project Officer who intervened strongly were these two workshops held. He also developed, on his own initiative. a "Training Manual for Construction Quality Control" which is now used in Rajasthan and other Indian states. It is not certain that this training will continue after this project though it is needed for all projects. The IM&T Institute at Kota is not offering this type of training and to date it has not been institutionalized in the Irrigation Department. Such a course should have been started much earlier in the LOP and integrated into the project with disbursements for construction costs of projects linked to this training.

3. Management and Operations Workshops

The project grant amendment stated that 30 personnel would be trained in management and operations of irrigation systems. Actually 112 professionals and farmers received training in several training activities related to management and operations. Several significant workshops were held under the project related to management and operations. These include: a measurement based workshop at Bundi for 27 professionals; two farmer involvement workshops at Gambhiri and Wagon projects for 60 professionals and farmers; a workshop on conveyance losses of channels for 21 assistants and Junior Engineers, and several workshops jointly held with the IM&T Institute on rotation water supply systems and farmer involvement. Sixty four professionals and farmers attended these last two workshops mentioned.

A review of the evaluations done by USAID on the measurement based workshop conducted by two US specialists showed that it was highly successful. Dr. John Replogle of the Phoenix Water Conservation Lab and Dr. John Mohammed of Colorado State University provided the technical assistance. As a result of this workshop, engineers have adopted the new broad crested weir designed by Replogle for measurement of flows on small channels in several projects of Rajasthan. The evaluation team saw these devices in place at two projects (Gambhiri and Wagon). Others are installed at a project at Bundi, Rajasthan. The measurement of water in small channels is relatively new to irrigation Engineers who before this project worked mostly on large canals structures.

The Farmer Involvement Action Workshop held at the Gambhiri Project was the first action workshop of its type held in Rajasthan and perhaps in India*.

*A brief write-up appearing in newspaper about this workshop is provided in Annex. V. The high-level policy workshop mentioned stimulated by this project was funded by the USAID IM&T Project.

The initiative for this innovation come from a Chief Engineer and a Superintending Engineer who gained the idea and inspiration from an overseas training program held at Colorado State University. This workshop also stimulated other farmer involvement activities and led to policy level awareness of the role of farmers in Rajasthan's Irrigation sector. USAID evaluated this workshop in 1984 and the evaluation team studied the report and also discussed the workshop with participants. It was evaluated as highly successful and along with other activities has had far reaching impacts. Thirty-two professionals and 4 farmers participated in the workshop. About 50 farmers from the Gambhiri project were involved in the field activities with professionals in this activity.

The follow-up workshops to the first Farmer Involvement Action Workshop were on rotational water supply systems plus a farmers tour to an area of Rajasthan where the warabandi system of water distribution is well established. These also proved useful. The Project Officer and another USAID professional attended these and felt that they were highly significant because they further highlighted farmer participation. These workshops are judged as highly successful. As a result, farmer involvement training for professionals and farmers is now continued in the regular courses conducted at the USAID Institute at Kota.

Though the purpose of this evaluation is not to assess the training at the Kota IM&T Institute, the IWM training there is also designed to support both USAID assisted and other projects in the State. The team feels that most of the training started under the RMIP is now institutionalized at Kota and will continue. During the LOP of the RMIP, this Institute conducted 19 courses for about 450 medium project staff throughout the State. The Institute staff who were interviewed estimate that from 25 to 30 percent of the professionals trained at the Institute were selected from the twelve USAID assisted medium projects.

4. Training activities not Implemented

The project grant amendment of July 30, 1980 allocated $200,000 for a Water Management Training Cell for undertaking diagnostic analysis and action programs. This activity was never implemented and PIL No:4, December 9, 1985 revised the budget to an amount of only $10,000. This amount was used instead to establish a temporary cell for project monitoring. The original objective was not achieved and the temporary cell has had no impact on training. Based on the success of the first DA workshop and the need for more focus on diagnostic systems approaches on all projects in Rajasthan, the team's judgement is that the original DA cell concept was an excellent opportunity foregone.

The development of handbooks, field guides, references materials and technical books was included in the 1983 amended grant budget as a line item of $ 20,000. By December 9, 1985 in PIL No: 4 that amount had been increased to $ 30,000. No handbooks nor field guides were developed to support training or field activities. Instead the GOR/ID spent $13,115 on the purchase of technical books and reference materials up to June 15, 1986. Unfortunately, the mechanism to develop useful training materials and operational guides was never found.

The amended grant for the RMIP also called for project equipment for training analysis of design and data, water management techniques etc. at a cost of $ 352,000. Under this budget item lab equipment, drilling rigs and soil scrapers estimated at $175,000 had been purchased up to June 15, 1986. However, only $4,803 had been disbursed by June 30, 1986. While this equipment is being used by the GOR/ID, the evaluation team was not convinced of its direct value to training with possibly one exception. At the Wagon project visited during the evaluation, the soil scraper purchased from grant funds is being used for training and field demonstrations in precision land levelling. One USAID professional now retired, with long experience in precision land levelling provided this initial and most useful training. Though the impact of this effort is impossible to judge at this time, it may eventually yield some benefits. Precision land leveling is a requisite for good IWM but it was not included in the project design or subsequent amendments to the project.

D. Special Studies

The project paper called for a number of special studies to be conducted. These include: technical assistance for stream gauging and seepage measurements; water management studies; and socio-economic baseline studies (Annex. K)

The water management studies at the 40 ha. level were never implemented. Also these were to be done as needed with expert assistance. These studies were to include local level organization and management.

Both the WM studies and a good mid project evaluations were opportunities missed. The Water Management studies for example, were to include crop water requirements, water course conveyance losses, field application studies, and economic analysis of the alternative costs and benefits of unimproved, improved and lined water course (p.33). The PID also suggested that such studies be made to determine the most cost effective improvements and criteria for designing water courses channels (Annex. F) Studies were also suggested for stream gauging to improve hydrographic data needed for planning and design of projects, and special water balance and operations studies to provide needed data for planning an adequate water supply (Annex. B).

The budget figures for these studies are provided in table 3 to show how changes were made overtime in the project grant funded studies.

Table 6: GRANT FUNDING FOR SPECIAL STUDIES

Type Study	Project paper 1980	Amended grant 1983	PIL No.4 1985	Disbursements Actuals to June 15,1986	Anticipated by PACD
Stream gauging and seepage	$10,000	$10,000	NIL	NIL	NIL
Water Management Studies	110,000	190,000	190,000	NIL	30,000
Socio-Economic Baselines	35,000	65,000	28,000	22,715	25,500

The Central Water Commission appraisal reports also stressed that the first two sets of studies be done. The GOR/ID started the stream gauging and seepage studies but the quality was poor and USAID rightly did not approve the investment. The water management studies, however, could have been implemented because some engineers had been trained for such studies. The mid-term project report of 1983 recommended again that the water loss measurement studies be expedited along with the socio-economic baseline studies.

The socio-economic baseline studies were contracted by the GOR to the National Council of Applied Economics and research. The team reviewed these studies and considered the work as fair. The USAID agricultural economist who supervised these studies also evaluated them as only fair. Some of the data are not useful for an impact evaluation. There are also some questions about the quality of some data and the methodologies used in these studies. Some of the data, however, can be used as a bench mark for a future project impact evaluation which is recommended.

Again, as was the case with training, it is obvious that there was inadequate planning for these studies. They, therefore, lagged and remained marginal to the project. The data from such studies early in the LOP could have been used for improved planning and implementation. Instead, rules of thumb were typically used in making judgements about seepage losses, crop water requirements, conveyance losses in small channels, field application efficiencies and field discussions on where and when to line field channels. No specific criteria were ever evolved for these decisions based on empirical field data.

There was, for example, no data base to ascertain the economics of lining upto the 5 to 8 ha. level though this has critical policy and economic implications for irrigation development in Rajasthan. For example, no data yet exist to show that the 5-8 ha. unit is more economical nor is it known how much and what sections of water courses need lining. Many such assumptions should have been tested with empirical field data.

C. Technical Assistance

No technical assistance was planned in the PP except for the $10,000 for local TA to be used for the proposed stream gauging and seepage measurements. (Annex. K). In the grant amendment (1983), $200,000 was budgeted for 14 months of technical assistance by US specialists but the type was not specified. This amount was increased to $210,000 in December, 1985 in PIL No. 4 but was not fully utilized.

The actual technical assistance expenditure through June 15, 1986 was $ 174,000. The TA was utilized for the following five activities:

		Person Months
1.	D.A. workshop by WMSP staff (3 persons)	5.5
2.	Design of small structure and testing (1 person)	1.0
3.	Measurement based workshop (2 persons)	1.0
4.	Modernization of a minor at Gambhiri sub-project and planning for precision land levelling (1 person)	1.5
5.	Farmer organization (1 person)	0.5
	Total persons months	9.5

Only about 70 percent of the 14 person months were utilized or 83 percent of the allocated TA funds.

About 7.5 months of the total TA were utilized for the 1982 DA workshop and the 1983 measurement based workshops. Both of these activities were highly successful. Also the TA for the design, fabrication, and testing of small structures was useful. These technologies were transferred from a USAID project in Pakistan to India through this project. As a result these pucca nakas are now being used at Gambhiri, Wagon and other Rajasthan projects and in Madhya Pradesh on a World Bank Project. After three years, these structures are still in good condition at the Gambhiri project and farmers now realize that they save time and help reduce losses on small channels below the public outlet. Likewise, the broad crested weirs introduced at the measurement based workshop are now being used at Gambhiri and other projects in Rajasthan.

More TA certainly could have been utilized. USAID requested the GOR to utilize more TA on numerous occasions but this did not materialize due to slow decision making and clearance problems. Also, as with special studies, there was a tendency for the GOR/ID to think that they could implement all or most of the Project software activities. With little previous experience in IWM below the public outlet, it is now realized by the GOR/ID that more TA was needed. There were also problems of planning and monitoring of these activities. The TA was never integrated into the project nor tied to loan disbursements. Therefore, it was left as somewhat marginal to the total project implementation process.

Chapter IV

PLANNING AND MANAGEMENT

This chapter reports the findings related to project planning and scheduling systems, contract planning and execution, project monitoring and project completion reports and procedures. Some of the information provided overlaps and compliments findings reported in chapter two on the physical and technical aspects of the Rajasthan Medium Irrigation Project. This information was obtained by a careful review of all USAID project documents available, documents with the GOR, Irrigation Department, the Central Water Commission (CWC) appraisal reports and indepth interviews with USAID, CWC and Rajasthan officials involved in the Project. Also interviews were held with a member of the Planning Commission and the Ministry of Finance officials about certain policy and procedures related issues.

The discussion is provided under the following headings:

- Project Planning and Time Scheduling
- Contract Planning and Execution
- Project Implementation and Monitoring
- Progress Reporting
- Monitoring Cell
- Organization and Personnel
- Mid Term Evaluation

A. Project Planning and Time Schedules

The primary conclusion drawn from the evaluation is that a more systematic approach to planning and scheduling activities was necessary.This conclusion is drawn from the following observations made during an analysis of the existing project schedules used for planning and implementing the project.

(i) It was not possible for the RMIP authorities to accurately assess the schedule position for project activities. Some rough bar charts were used which showed only the percentage of work planned and completed. One could not evaluate from these charts what the impact of any delay on other elements in the project were or the impact on the project as a whole. The method used appeared rather vague and too general. More specificity in such progress reporting was needed. For example, apart from giving the schedule completion date for the total project, scheduled dates for intermediate milestones in a particular project such as the completion of the dam, canals, erection of crest gates on spillways and other project components did not appear to be available for the RMIP's. The scheduling system used for the RMIP authorities did not provide a realistic outlook for the date of completion of the project or specific elements.

(ii) **There was a definite lack of effective co-ordination and integration of the various elements of the project. For instance, during the team's visit to Bassi irrigation project, it was observed that the water distribution system from the watercourses onwards was not in step with the construction of the main canal system and the minors. Neither was planning and implementation of the micro network in evidence.**

On the other hand, discussions with the farmers revealed that they were keen to undertake the digging of their own field channels once the work on the construction of the water courses and the installation of the outlets on the minors was completed. Similarly, the team's visit to SomKagdar irrigation project (which has some unusual problems due to undulating terrain through which the canal system runs) highlighted a similar situation of poor planning and implementation. For example, on the eve of the monsoons rains, the dam held considerable storage of scarce water that could not be conveyed to farmers due to incompleted canals.

At Som Kagdar Project there was adequate flow in the canals at head reaches but lower down much work remained to be done. Such situations have resulted in costly time lags between the creation of irrigation potential and it's utilisation on farms.

(iii) The benefits of irrigation from all the RMIP's except Panchana, Chappi and Sawan Bhadan projects will be realized much later than originally planned or expected. For example, against the original overall target of irrigation potential of 23,480 hectares to the end of June 1986, actual achievement is anticipated to be 15,610 hactares. Project-wise details are provided in Table 4 of the chapter two. It is clear from these data that achievement has fallen short of the target in respect of Panchana by 7,000 hectares, at Chappi project by 2,500 hectares and at Sawan Bhadan sub-project by 1,600 hectares. This was due to delays in the creation of storage capacity at Chappi and Sawan Bhadan projects and delays on the construction of the canal and distribution system at Panchana sub-project. These examples indicate poor planning and sequencing of project components.

An evaluation of the various processes involved in construction point to the fact that project implementation planning was inadequate. As a consequence, there have been large overruns in time and cost for most sub-projects. It appears that serious pre-construction planning for assuring the timing and quality of construction was not done.

Due to the lack of detailed planning and other problems, changes in the phasing of the project work took place regularly throughout the LOP resulting in increased costs. For example, at the Bhimsagar sub-project, there were serious contractual problems. It was found that the spillway gates were ordered in early 1981 and delivered in 1982.

But these gates which we saw in June, 1986 had not been installed. There were also delays in civil construction works at this project which was only completed in 1984-85 up to the spillway crest level. The gate manufacturer and supplier is now reluctant to erect the gates after the civil works are completed unless increased charges are paid. Better sychronization of activities might have saved about 24 months of valuable time. Order for the supply of gates could have been placed later so that delivery of these would have taken place just prior to the completion of the civil works. This example suggests that there is a connection between the quality of planning of a particular project and implementation.This case is now in a protracted arbitration process in a civil court.

For example, the project completion schedule slippages were from 2 years for Kothari II, Wagan, Gambhiri and Meja & Meja Feeder projects, to 8 years for Chappi project. There has been no change in the completion schedule of Som Kagdar to date which was appraised only in 1985-86. None of the 12 USAID projects has been completed. Though not planned, in reality, USAID invested in "a time slice of projects" all of which will be completed several years from now.

The principal reasons for slippages in schedules were found to be a combination of factors including poor planning, paucity of funds, inadequate staff and contractual problems. Overruns in total costs of the 12 projects vary from Rs. 1.1 million for Som Kamla Amba project to Rs. 67.9 million for the Panchana project. Three projects (Wagan, Gambhiri, and Som Kagdar) do not reveal cost overruns to date. The 12 USAID projects taken together have a total cost overrun Rs. 259.2 million which is about 12 percent. Reasons given for cost overruns are price escalation, changes in scope of work and delays in construction. The spill-over as of July 1, 1986 is estimated at Rs. 1440.3. An analysis of available data related to total project costs and the overall project completion schedules is provided in Table 8

Table 8

OVERRUNS IN TIME AND COST FOR SUB-PROJECTS

USAID Assisted Project	Overruns In		
	Rs.(million)	Cost (%)	Time (Years)
1.Panchana	67.9	39%	7
2.Chappi	57.8	32%	8
3.Sawan Bhadon	27.4	32%	5
4.Bilas	17.1	27%	5
5.Bassi	25.6	42%	4
6.Bhimsagar	18.2	13%	4
7.Som Kamla Amba	1.1	0.1%	4
8.Kothari II	23.5	31%	2
9.(a) Meja Feeder	9.5	0.6%	2
- (b) Meja	11.1	15.2%	2
10.Wagan	NIL	NIL	2
11.Gambhiri	NIL	NIL	2
12.Som Kagdar	NIL	NIL	NIL

Panchana and Chappi show considerable cost and time overruns. The Bassi project has a cost overrun of 42% and a time overrun of four years. Som Kagdar, appraised only in 1985-86, to date shows no overruns in either cost or time. Such cost overruns are not exceptional in India for major and medium irrigation projects. For example, the GOR Public Accounts Committee and the Ministry of Planning issued a report on the Planning Process and Monitoring Mechanism with Reference to Irrigation Projects in 1983 which was presented to the Lok Sabha. This high level report states that of 205 major irrigation projects taken-up since 1947, only 29 had been completed by 1979-80. Of 916 medium projects taken up during this period, only 469 had been completed. The report further states (p.48) that "not a single project in the irrigation, power or flood sector has been completed within the time schedule and within the cost estimates. Reasons cited for this state of affairs are: limitation of resources, inadequate project preparation, lack of effective mechanisms, for appraisal of investment proposals, lack of decentralized planning and managerial deficiencies" (p.11-12). Seen in this perspective, these 12 USAID assisted projects are about average in terms of cost and time overruns when compared to other medium projects in India.

Based on the data available and the experience of the evaluation team members our best judgement is that the increases in cost of these Rajasthan Medium projects could have been reduced if better planning and management had been used in spite of severe physical, financial and other constraints already discussed. To date, little training in planning and management of projects is provided in Rajasthan.

The evaluation team did evaluate the training for the projects organized by the Irrigation Management Training Institute at Kota but virtually no focus on project planning, management or monitoring for new projects. It is recommended that USAID take more initiative through its assisted IM&T Project to assess training needs and help to design and organize such planning courses for selected Irrigation Department staff. We were told that this young Institute started in 1984 plans to conduct a manpower assessment study in 1987. Such a study should be comprehensive enough to identify not only training needs but the organizational capabilities related to planning, design, management and monitoring of new and old projects.

B. Contract Planning and Execution

There were some serious problems with construction contracts for several of the projects. During the team's visit to seven sub-projects and discussions with the various project officers, we identified a number of contractual problems especially at Panchana, Som Kagdar, Bassi, Bhimsagar, Bilas and Sawan Bhadon projects. We, therefore, provide some information on specific contract planning and execution problems.

In the case of Som Kagdar project, it was learned that some contracts relating to the canal system resulted in protracted controversial issues regarding local labour charges to be paid by the contractor. As a result, the construction, according to local staff was held-up for nearly four years (1981 to 1984) An analysis of this particular case indicated that the lowest tender was accepted by project authorities.

Often tenders are deliberately underquoted as a means of obtaining contracts as is often the case. Serious contractual difficulties were also experienced in the construction of the dam at Bassi project. At Bassi, as well as other projects mentioned above, existing contracts had to be terminated due to labor and price problems and fresh tenders invited. Selection of the most suitable contractor was typically made under GOR rules based on only the criterion of price. The first indication that a careful investigation and analysis of tenders was necessary could have been seen at Bassi from the initial comparison of the prices quoted by the tenderers. In this case though a significantly lower bid was made, but all the bidders had not allowed for the same quantum of work. This was also the case at the Som Kagdar sub-project. We, therefore, conclude that significant deviations in the bids did not result in a detailed analysis of all the tenders. Discussions with staff also disclosed that no adequate investigation had been made of the capabilities of tenderers other than on the criterion of lowest cost. Normally, even under the GOR/ID rules, project authorities could propose the rejection of the lowest bidder on other grounds such as the contractors' lack of capability to perform the work. Such documentation, unfortunately, was not done. Therefore, after the fact much time was lost and a possible reduction in the quality of work.

The team could not find evidence from GOR project records that a systematic analysis was made on the capabilities of contractors during the time of reviewing tenders for the 12 sub-projects. The evaluation team questions why no serious efforts was made by the GOR/ID to reject low bidders on the basis of lack of capability or on other grounds. More systematic documentation of such information for future construction projects might have resulted in fewer problems.

C. Project Implementation and Monitoring

There were serious implementation problems for most projects. The Team's study of project records and field observations indicated several factors responsible for these delays in project implementation. These are summarized below:

- Resources were not forthcoming as originally envisaged owing to budgetary contraints and changes in scope of some projects primarily due to more rigourous USAID criteria for project appraisal and clearance.

- Contractual problems (terminating a contract midstream and doing the tendering, contract evaluation etc. all over again) as at Panchana, Meja Feeder Canal and Bhimsagar.

- Inadequate staff and frequent transfers of officers on a number of sub-projects, namely, Chappi, Bilas, Gambhiri, Sawan Bhadon and Meja.

- Inadequate delegation of powers and authorities, and

- **Frequent occurrence in the LOP of droughts and famine conditions in the RMIP areas.**

For example, taking two specific projects, the factors which created substantial delays are provided below.

Som Kamla Amba (New Project)

- Decision-making delays
- Inadequate delegation of powers
- Too much centralisation
- Procedural delays
- Delivery delays
- Contractual difficulties
- Changes in scope of project such as increase in gross storage, change in design flood (maximum),increase in CCA, change in canal alignment
- Inadequate provision/allocation of funds
- Delays in land acquisition

Gambhiri (Modernisation of old Project)

- Working days on a completed project in a year are limited to only 2 to 3 months (April, May, June) when canals are closed.
- Frequent transfers
- Inadequate allocation of funds
- Labour problems

D. Progress Reporting

The evaluation team examined the regular progress reports prepared by the RMIP authorities for use by the State Irrigation Department, Government of India and USAID. In evaluating the monitoring and reporting system used for the RMIP's, it was observed that the information required by users for project monitoring was inadequate. The lack of an effective monitoring system both by USAID and the GOR/ID has been identified as one of several factors responsible for some delays in project implementation.

> There was an inadequate project monitoring system which included the ability to identify the more critical areas of the work effort and bring them directly to the attention of the officials at various levels. Also, due to centralization in decision making there were long hold-ups for project site staff to make timely decisions. Somkamla Amba is a good example where such delays have postponed project completion by four or more years.

Timeliness was not given careful attention in progress reports. For example, it was found that a monthly progress report for March 1986 was submitted several months late.

The GOR did not have an adequate scheduling system to facilitate comparison of the actual performance with targets in these reports.

The analysis of these progress reports submitted for the RMIP's showed that they typically did not pinpoint deviations from the plan or possible future impacts on costs. These reports also did not answer the critical question of "what is the outlook for completion of the total sub-project or specific its components such as dam, distribution system, and other works. More specifically, the final completion dates for Panchana and Wagon projects were couched in fuzzy and 'may be' terms . For example, the revised project completion date for Panchana Project was indicated in the report as 1991-92 but field site staff stated that the real completion date would be 1992-93 or later! In the case of the Wagan project the report stated that it was "likely" to be completed during 1988-89 but project staff reported to the Evaluation Team that this was optimistic.

The monitoring system lacked trouble-shooting capacity to highlight problem areas calling for corrective actions.

In summary, an examination of progress reports showed that information flowing to top decision making levels was not condensed or summarised well for management decision making. The overall quality of most reports reviewed was quite poor.

Total Project Cost

An analysis of the RMIP expenditure statements in the office of the GOR Chief Engineer (Irrigation) indicated little idea of the real cost of specific medium projects to completion.

Based simply on a study of available reports, there seemed to be inadequate attention to mobilising resources on time for specific projects or components of projects. Use of project staff was not properly scheduled when funds were available. This may have been due to state budget problems at times due to several severe droughts or other factors.

1) Estimating the Final Cost of the Project

The estimate of the final project cost in regular reports was essential information to be furnished by project authorities but it was missing. Such data were needed to make revisions when changes in the sub-project indicated that current estimates were no longer valid. Adjustments for many cost overruns might have been made based on estimates of the works to be completed.

2) Provision of Escalation in Basic Project Cost Estimates

It was pointed out by GOR/ID project authorities that the basic estimates of cost included in the project feasibility studies and project reports did not provide for cost escalation. This practice is in conformity with Government of India policy. It is feared by the GOI that providing for cost escalation might amount to issuing a blank cheque to project implementation authorities. In contrast, realism suggests that escalations do take place due of factors such as increase in wages and materials changes in exchange rates, Government policies and other factors.

E. Monitoring Cell

There exists a temporary grant-funded RMIP Monitoring Cell in the office of the Chief Engineer (Irrigation), Jaipur, headed by an Executive Engineer with a small cadre of support staff. This Executive Engineer, is heavily burdened with many other responsibilities and duties in addition to those of the RMIPs. Such added responsibilities and duties have decreased the flexibility and effectiveness of this Cell. A well-staffed monitoring cell is necessary for a project of this magnitude which requires careful and close day to day monitoring. The present Cell should not be charged with extra responsibilities and functions. Perhaps the absence of a monitoring cell for most of the LOP with no one to spend full time at this task is one reason why improved techniques of project planning, monitoring and evaluation were not adopted.

F. Organization and Personnel

During the life of this project there were organizational and personnel constraints. Some of these could not have been anticipated by project designers. Others might have been resolved if a more careful institutional analysis had been made at project design stage and followed later by a good mid-project evaluation.

G. Staffing

There were staffing problems due to many staff transfers through the LOP. For example, over a five year period in Rajasthan there were four different Secretaries of Irrigation, six different Chief Engineers, and frequent staff changes at all other levels. An example of the rapid turn-over of staff is seen in the Additional Chief Engineer's position in the Udaipur Zone where four USAID assisted projects are located. From June 28, 1979 to March 28,1986, there were 6 professionals posted to this position for periods of 7, 10, 19, 4 months, 23 days respectively and another for 16 months. Superintending and Executive Engineers during the LOP typically averaged about 2.5 years at their posts, while lower staff averaged 2 to 3 years.

USAID, over the LOP also had five different professionals and project officers involved. This was primarily due to the rapid build-up of the USAID irrigation portfolio over a two year period (1983-84) when limited staff were developing four new projects. Also, a major reorganization of the USAID irrigation division took place in 1984. Unfortunately, one USAID FSN professional project officer died suddenly in the last year of the project. It is significant, however, that, at Wagan project where major progress was made the irrigation officers were on the job for continuous periods of three to four years. Continuity of staff at this sub-project was a factor in project progress. Also up to 1985 Gambhiri staff were posted for longer periods when some progress was made with new technologies.

Though assumed in the PP, Rajasthan Irrigation Department did not have adequate staff strength for this project especially when the additional software activities were added in 1983. Annex IV provides a brief summary of one Superintending Engineer's heavy workload who was involved in the RMIP. Inadequate staffing impeded the progress of project implementation but to what extent is difficult to estimate. For example, at the end of 1985, there was only one sub-division at four sub-projects, namely Chapi, Bilas, Sawan Bhadon and Gambhiri. The need for strengthening the organizational set-up was underlined when 9 of the sub-projects were appraised by the CWC up to June 1984. During 1984-85 28 sub-divisions were in position (as compared with 23 in 1983-84) to implement works estimated at Rs. 83.48 million. The requirements, however, assessed in 1984 showed that 69 sub-divisions were needed for works estimated at Rs. 216.34 million for 1984-85. Instead of 69 sub-divisions only 41 were made available. As of November, 1985, 38 sub-divisions were in place at 11 USAID assisted projects, excluding Som Kamla Amba, to implement works estimated at Rs. 129 million during the 1985-86 period. Given the extra software activities of RMIPs, the team's judgement is that this was inadequate. This was also considered greatly inadequate by local staff particularly at Chappi, Bilas, Sawan Bhadon and Gambhiri sub-projects which had only one sub-division each.

Since the USAID Project Officer could not be in the field on a regular basis he could not monitor all activities adequately. USAID officials, therefore, suggested in the third year of the LOP that a senior retired Indian professional approved by the GOR/ID be appointed as a laison person and funded by grant funds to provide better day to day monitoring, oversight, and guidance of routine project activities both for the GOR and USAID. This recommendation was not implemented and in retrospect the new GOR/ID Chief Engineer realizes that project implementation probably suffered due to the lack of such laison. With twelve medium irrigation projects with extensive construction activities plus new software activities, such a laison arrangement likely would have been useful to facilitate follow-up, and assisting in RMIPs implementation, monitoring Project activities and certainly in planning and helping to obtain clearances.

The construction of highly technical and complex medium irrigation projects including the first effort of on-farm development works, special studies, research and training activities planned in the RMIP, demanded more technical assistance and monitoring than either the GOR/ID or USAID could provide. Contract professionals or some other means to assure proper technical assistance was needed. Training of project staff in the new RMIP software activities started late in the LOP and much was never accomlished. The lack of appropriate training using TA was an opportunity missed.

Staff Team Work

The Evaluation Team Members noted that at the Wagon project there exists a well-knit team headed by a committed Executive Engineer. Wagan project has been managed well when compared with other medium irrigation projects visited by the Team. This level of team work was possible because staff remained at the project for reasonable periods of time. It is interesting to note that when the transfer orders came for one assistant engineer it was farmers who put pressure on his superiors to get the orders changed. It is significant that USAID staff probably gave more attention to Wagan project because it provided an opportunity to evolve into a project for the demonstration of several innovations. A little TA at Wagan produced significant results.

Similar levels of teamwork at project sites visited by the team might have been achieved if there had been more TA and less frequent staff transfers. This transfer situation is a most serious problem in Rajasthan as well as other States in India. It is also most complex and highly political.

G. Mid-term Evaluation

The project paper stipulated that the GOR and USAID would conduct a special evaluation of project performance about thirty months after project initiation. The project paper stated that USAID would provide grant financing for the services of an Irrigation Engineer Cum-Hydrologist, an Agronomist, and an Agricultural Economist to assist in this mid-term evaluation and that the CWC would also participate. The scope of work for the evaluation team was to be prepared by the GOR in consultation with both CWC and USAID. The areas to be covered in such an evaluation were clearly stated in the project paper. This mid-term evaluation however, was not performed and the in-house mid-term project status report prepared by USAID did not suffice. If the evaluation had been done, it is likely that some necessary mid-project adjustments and corrective actions could have been made. It should be stated though that USAID was rapidly expanding its portfolio with inadequate and over-worked staff. A good mid-project evaluation would have highlighted this problem. A small investment in a good mid-project evaluation might have made much difference in the outcome of this project.

H. Budgetary Process

Information on planned and actual budgeting support and impact of severe droughts on the RMIP implementation was provided by a GOI Planning Commission official and a former Secretary of Irrigation in Rajasthan.

The GOI and the GOR budgeting process is usually viewed as a grey area. Indeed it is complex and often frustrating to track. It was pointed out earlier in the Report that RMIP implementation suffered for lack of adequate budgetary support by the GOR during the LOP. The reason is obvious. The process of planned and actual budgetary support for the RMIP is inter-linked with the overall annual planning and budgeting processes both at the State and the Central Government levels. The exercise at the sub-project level starts sometime around September of the pre-budget year. The irrigation project authorities indicate to GOR/ID Chief Engineer their requirements of funds for the coming financial year. Individual project fund requirements are consolidated after scrutiny by the GOR/ID. Overall requirements of funds are the communicated to the State Planning Department by GOR/ID for incorporation in the overall draft Annual GOR Plan. Budget requirements are scrutinized by the GOR Planning Department while examining total financial resources made available by the GOR Finance Department for the annual plan budget for the coming financial year from internal and central (GOI) resources. Therefore, concurrently with requests for funds by sub-project authorities, an exercise is started both at the State and the Central Government levels in regard to various annual financial sources for funds for the total state plan. Thus the overall size of the state annual plan budget is constrained by the quantum of resources available to the State Finance Department. The general position usually is that the requirements of funds needed by sub-project implementing authorities may be two to three times what can ultimately be made available at the commencement of or during the coming financial year.

The draft annual GOR plan after finalization at the State level is then submitted to the GOI Planning Commission. After scrutiny by the GOI Planning Commission, the allocation of funds for individual medium irrigation projects of the State are recommended for inclusion in the irrigation sector part of the GOR's annual plan. Allocations actually made may be much less than sub-projects requirements. Political pressures are always great to special scarce financial resources thinly distributed over all the projects.

This imbalance between 'demand' and 'supply' of funds leads to reducing the overall size of the GOR/ID Plan during discussions between the GOR authorities and the GOI Planning Commission during the period of November-January of the pre-budget year. They examine priorities of various sectors of the GOR annual plan assigned both by the State Government and the GOI. The actual allocations of funds for medium irrigation projects typically always fall short of sub-projects requirements. These allocations jointly arrived at by the GOI Planning Commission and the GOR Planning Department are then communicated to the GOR Finance Department for incorporation in the GOR annual budget for the coming year.

Again, because of financial constraints allocations recommended by the Planning Commission may undergo further reductions in terms of funds for medium irrigation projects. Finally, when the GOR's annual budget is approved by the GOR legislature and final budget allocations are passed by the Finance Department to the GOR/ID, there is typically a large gap between planned and actual budgetary support. This was the case for medium irrigation projects in Rajasthan during LOP. This problem is inherent in the GOI and State processes of annual planning and budget formulation. Very little, it appears, can be done about this situation. Some delays in the USAID assisted RMIP implementation have been attributed to the inability of the GOR to make available the funds required to implement the project in a timely manner.

Impact of Drought on Irrigation Project Implementation

Another constraint that often requires improved forcasting and management is the factor of droughts.

Rajasthan State located in the arid zone of India experiences vast fluctuations in annual percipitation. Highly variably monsoon rains typically provide 90 percent of total rainfall. A poor monsoon period usually produces drought in some sections of the State.

During the LOP (FY 1980 to FY 1986), there were droughts each year. In 1982 and 1984 there were most severe droughts. Though droughts create a demand for irrigation projects they also slow-down implementation schedules of existing projects in the following ways.

1. Total resources of the State are less, due to reduced revenues and budget allocations, decision makers have to take into consideration the total available funds for the State. The RMIPs were affected by GOR budget allocations and USAID made adjustments.

2. Existing staff assigned to RMIP's also had extra responsibilities of supervising drought relief works, drawing technical plans, acquiring labor, supervising and making payments in cash and grain for food for work activities. The Superintending Engineers, Executive Engineers and staff in Bhilwara, Dungarpur, Udaipur, Jaipur, and Sawaimadhopur areas, for example worked on seven RMIP's but had unusual extra responsibilities. During drought periods their attention was drawn away from the RMIPs to provide emergency assistance for drought relief works.

3. Also existing staff on RMIPs and other projects with water available were often called on to provide extra water for human and animal drinking water and providing extra water for fodder crops to feed cattle. This is because when Kharif seasons monsoons fail in areas there are total crop losses. Whatever water is stored anywhere, is used to provide water for Kharif crops though most irrigation projects normally store water for only the Rabi or winter cropping season.

Therefore, in the setting of Rajasthan, severe droughts did slow-down RMIP implementation. To date no study has been made in Rajasthan or elsewhere how this phenomenon impact project implementation.

Chapter V

ECONOMIC AND SOCIAL ASPECTS

A. Introduction and Background

The analysis of economic and social aspects of the RMIP presents some enigmas. The major problem is the fact that none of the 12 sub-projects has been completed to date. At only four sub-projects with limited irrigation at one, where work is still in progress and some initial benefits to farmers are now beginning to emerge. This chapter provides information about the disbursement targets and performance, the costs outlays, benefits received to date and observations related to some socio-economic impacts of the RMIP up to June, 1986. Data are utilized from the 1984 Socio-Economic Base-Line Study draft report which included six RMIPs. This draft report was submitted to USAID by the National Council of Applied Economic Research in 1985. Some of these data have been used for estimates combined with the information from project documents and that obtained from site visits. Given these caveats plus inadequate time (five week period) for this evaluation, conclusions drawn about socio-economic impacts are based upon the team's best judgement. A future intensive impact evaluation of the RMIP is needed.

B. Disbursement Targets and Performance

Due to the late clearances of these sub-projects, no financial disbursements were made by USAID for the Rajasthan MIP in the first two years of LOP. Construction work on some sub-projects started prior to appraisals and before USAID-assistance. The disbursements began to accelerate from 1983-84 or three years after the RMIP was signed, June 30, 1980. Disbursements varied greatly for several reasons. For example, severe drought conditions in Rajasthan resulted in some State's resources being diverted from the annual GOR plan for projects. Disbursement of funds was a major problem until late in the LOP when USAID accepted some newly appraised projects. The last 3 RMIP sub-projects were finally appraised in 1985 the year of the original PACD.

Cost acceleration resulted from inflation and increases in the exchange value of the US dollar from Rs. 8 to over Rs.12 during the LOP plus long delays in implementation. This necessitated higher plan provisions in the very tight GOR budget to assure loan funds were fully utilized. USAID also made adjustments in reimbursement percentages and covered other items of cost in the projects, and also extended the PACD an extra year.

Table 8 shows the cumulative disbursements, the initial targets and the performance in terms of expenditures for the Rajasthan MIP. The cumulative USAID disbursements upto March 1986 were 35 million dollars of loan funds and $535,203 of grant funds through June 1986. The USAID loan funds were fully utilized but substantial grant funds will be deobligated.

C. Costs, Outlays and Benefits of Sub-Projects

The cost estimates of nine of the twelve sub-projects were revised upwards due to inflationary pressures and some modifications were made in the project design as well. The original and revised costs along with expenditures incurred and the reimbursement claims submitted by GOR up to June, 1986 are shown in Table. It is observed that an expenditure of Rs.940 million was incurred on these projects upto March, 1986, and that Rs.1546 million were yet to be incurred to complete these projects. Though the project agreement was signed in 1980, the first set of six sub-projects was appraised and cleared in 1982, two in 1984, and four in 1985, against a PACD later revised to June 30, 1986. Though not planned, the actual result was that USAID provided assistance to a time slice of these 12 projects.

It appears that the financial support from USAID might have helped in somewhat accelerating the slow pace of medium irrigation projects in Rajasthan. For example, the GOR received additional assistance from GOI to the extent of 70% of USAID contributed funds for RMIPs in addition to the normal GOI assistance which would have likely been made available. This was still not adequate to attain the targeted benefits. After this experience, the general view discussed by GOR/ID officials is that instead of spreading limited resources over 12 sub-projects, USAID should have supported fewer projects through completion and/or included more rehabilitation or modernisation type-projects. This might have accelerated benefits to users. This intensive approach is completing fewer projects earlier is not the approach used by the GOR or other Indian states primarily due to political pressures for new starts.

Since none of the projects are fully completed, substantial benefits are not evident. Therefore, in quantitative terms these projects cannot be evaluated adequately. Certain benefits, however, are evident where the irrigation potential has been created and utilization of water is just beginning such as at Wagon, Gambhiri, Kothari, Bhimsagar and Somkagdar projects. Against the designed potential of 81,500 ha, the irrigation potential created by June 1986, is 15,700 ha of which only 7195 hectares are being irrigated by farmers. In only one or two years of irrigation this has not produced the PP estimates of increased agricultural production, income and rural employment. In reality, all sub-projects are still in a mid stage of completion except Wagan project. Therefore, the validity and appropriateness of the assumptions made for parameters such as actual irrigated area, cropping patterns, yields, prices and farm income for the purposes of economic analysis of benefit/cost ratios cannot be adequately analyzed or verified. The cost/benefit ratios most likely will certainly decrease due to long delays in completion resulting in substantial increased costs. Increase in the cost of most projects due to inflation and changes in the design and scope of some sub-projects will definately affect most parameters of the original project paper's economic analysis. It is, therefore, suggested

TABLE 8 RAJASTHAN MEDIUM IRRIGATION PROJECT:
USAID CUMULATIVE DISBURSEMENT TARGETS AND PERFORMANCE
(BASED ON PROJECT PAPER PROJECTIONS AND THE GOI FINANCIAL YEAR)
(Million Dollars)

	LOANS			GRANT		
	TARGET	DISBURSEMENT	SHORTFALL	TARGET	DISBURSEMENT	SHORTFALL
1980-81	4.00	0.00	4.00	0.00	0.00	0.00
1981-82	10.00	0.00	10.00	0.30	0.00	0.30
1982-83	19.00	4.30	14.70	0.40	0.00	0.40
1983-84	28.00	14.27	13.73	0.70	0.32	0.38
1984-85	35.00	18.47	16.53	1.00	0.42	0.58
1985-86	35.00	35.00	-	1.25	0.535	0.715

TABLE 9 RAJASTHAN MEDIUM IRRIGATION PROJECT: USAID
COST ESTIMATE, EXPENDITURE AND REIMBURSEMENT CLAIMS OF 12 SUB-PROJECTS

(Rs. in million)

SUB-PROJECT	COST		EXPENDITURE ANTICIPATED	REIMBURSEMENT (MARCH 1986)	EXPENDITURE TO* BE INCURRED FOR COMPLETION OF PROJECTS
	ORIGINAL	REVISED			
1. Bhimsagar	141.78	160.00	73.43	50.00	86.57
2. Chappi	182.22	240.00	15.39	13.12	224.61
3. Bilas	62.90	80.00	20.00	12.05	60.00
4. Sawan Bhadon	85.59	113.00	25.58	15.35	87.42
5. Kothari	74.42	97.95	78.59	48.52	19.36
6. Bassi	60.33	85.94	50.74	32.21	35.20
7. Panchana	210.49	242.40	99.77	50.79	142.63
8. Wagan	110.60	110.60	79.20	43.53	31.40
9. Gambhiri	148.58	148.58	23.60	12.98	124.98
10. Somkagdar	196.88	196.88	125.75	43.70	71.13
11. Meja-Meja Feeder	261.37	281.94	188.03	48.89	93.91
12. Som Kamla Amba	728.78	729.86	160.67	59.34	569.19
TOTAL	2263.94	2487.15	940.75	430.48	1546.40

* Plus further c[illegible]

that an intensive study of the real benefit and cost aspects of one or more of the sub-projects be conducted when they are completed and have matured. Further, USAID should include post project intensive economic analysis especially for studies of impacts. Without hard economic data and analysis, future planning and design of projects might suffer in quality. The Mission must also realize that it is not possible to complete medium projects within a 5 to 6 year time frame perhaps anywhere and especially in the context of India's vast irrigation sector where the establishment is already over-extended.

D. Observed Socio-Economic Impacts

Of the twelve sub-projects, socio-economic baseline studies have been completed for six. These are Bhimsagar, Chappi, Bilas, Panchana, Somkagdar and Meja-Meja Feeder. The perceived socio-economic impacts of RMIPs is assessed primarily in qualitative terms for this final evaluation. Though time was inadequate to collect valid field data from farmers, information from about 40 farmers and irrigation and revenue officials at project sites provided a minimum of information.

[illegible] some evidence that the socio-economic status of some [illegible]ies at four sub-project command areas had just begun to [illegible]e. It is at this stage, however, not possible to attribute. [illegible]sults of the evaluation of socio-economic impacts are [illegible]ed under the following headings:

- Production and Farmer Income,
- Cropping Pattern,
- Marketing of Agricultural Produce,
- Rural Employment,
- Consumption Pattern,
- Land and other Agricultural Assets,
- Education,
- Role and Status of Women.
- Possible benefits foregone.

1. Production And Farmer Income

In the command areas of each of the sub-projects of Wagon, Gambhiri, Kothari, Somkagdar and Bhimsagar where land was not intensively farmed previously, production and yields increased with the availability of canal irrigation. Though the sub-projects are still incomplete, canal irrigation has been provided in a few areas in five project commands where work continues. Prior to canal irrigation, Rabi season crops were grown on a small scale under rainfed conditions or with well irrigation. The per hectare yields for wheat, for example were reported to be only about 3 to 4 quintals

* under rainfed as conditions. Under new canal irrigation, the yields of wheat were reported to have increased from 12-13 quintals to about 30 quintals per hectare at Wagon, Gambhiri and Kothari projects. At Somkagdar and Bhimsagar sub-project commands, the soils are not as good and yields ranged from 12 to 20 quintals per hectare. Table 10 provides data from six of the sub-projects which shows average yields for selected irrigated and non-irrigated crops. Prior to canal irrigation these data, however, must be viewed with much caution. One, irrigation is defined as one or more irrigations per crop per season. Two, these are reported yields and not from scientific crop cutting experiments. Three, these are yields primarily from wells and not from canal irrigated sources. Also shown are the estimated yields used in project paper for economic analyses. The estimates used in the PP for crop yields appear realistic, but somewhat conservative for areas like Wagan where good irrigation facilities exist. The rough net income from canal irrigated farms at Wagon and Gambhiri projects reported at 1986 prices to be Rs.3,500 to Rs.4,000 per hectares. (See table 11.) The composite farm budgets developed for the PP analyses was Rs.2,900 for irrigated farms and Rs.1,600 for non-irrigated farms per hectare net farm income at 1980 prices. Farm income per hectare will only increase substantially when the support services planned, but not yet made adequately available, are provided to farmers.

There is much varriation in yields and income per hectare for many reasons. For example, some farmers had never irrigated previously. Some are tribals who have few resources or experience. In the Somkagdar command, for example the farmers are from tribal groups, a most poverty stricken class in India. They do not yet have the means to purchase adequate inputs to benefit much from new canal irrigation. Their increased irrigated yields to date are reported to be only about half of those achieved at Wagan project. It has not been realized by the GOR/ID or AD that new irrigation farmers need much support services and advance training to learn how to effectively use irrigation water. At no project visited was the team convinced that adequate support services existed or were planned.

Table 11 shows the actual areas irrigated from the 12 projects with estimates of net income per hectare based on farmers' reports. Experience with irrigation projects indicates that it often takes from 10 to 15 years for a medium project to mature after completion and provide full benefits.

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* A quintal is a weight of 100 kilograms.

2. Cropping Pattern, Agricultural Inputs And Services:

Farmers in the command areas receiving canal irrigation water are growing wheat, gram, barley, and mustard in the Rabi season. Most of the irrigated area was covered with wheat in 1985-86 Rabi season. In Kharif season, groundnut is recently being widely cultivated which could not have been envisaged by project designers. Sugar cane and maize are being grown in some areas. Moong and other pulses are cultivated in the Zaid or summer season. The CWC and GOR/ID design analysis assumed the cultivation of inferior cereals. To date cultivators report that they have not cultivated these crops after irrigation began. Generally the cropping intensities and types of crops used by CWC and the GOR/ID to make design decisions for RMIP are not being followed in practice. For example, at Wagan project, the only sub-project where irrigation is substantially available, in the 1985-86 Rabi season farmers instead of having a 45 per cent area in wheat assumed for CWC design purposes, actually cultivated wheat on almost 100 percent of total land irrigated. The explanation is simple. Farmers respond primarily to market signals rather than to the plans of project designers. Cropping intensities are influenced by many complex factors which include farm size, market prices, type of irrigation source, rainfall estimates, home consumption needs etc. Table 12 provides general data from the socio-economic benchmark survey for six sub-projects before irrigation facilities were provided. Note how intensities vary by project and crops. The PP log frame estimated a 20% increase in irrigation intensity and therefore increased cropping intensities. The evaluation team based on interviews with farmers believe that present cropping intensities for most projects when completed can be increased more than the PP estimate due to canal plus well irrigation. New wells are being installed on some projects to take advantage of the GW build-up provided by storage in some reservoirs.

Agricultural inputs including fertilizers and improved seed are being used by farmers at Wagon, Gambhiri, and Kothari sub-projects. At the Somkagdar project, however, farmers reported that they are hardly using improved seeds and only little extra fertilizer. At Gambhiri project the diagnostic analysis study in 1982, prior to any modernization improvements, revealed that farmers with well irrigation were applying about 35 kgs/ha of inorganic fertilizer for wheat versus 0 to 20 kg/ha for farmers with only inefficient canal irrigation water. This may indicate that better water control results in the use of higher inputs. Credit arrangements are not satisfactory at Som Kagdar project. A reported reason was that the tribal cultivators have overdues with the cooperatives. At Bhimsagar project there are also in adequate arrangements for credit,

Table 10 AVERAGE YIELDS FOR MAJOR CROPS FOR SIX SUB-PROJECTS BASED ON 1985 BENCHMARK SURVEY UNDER PRESENT LEVEL OF IRRIGATION AND NO IRRIGATION.

RMIP Command	Present Irrigation			Non-Irrigated		
	HYV Wheat	HYV Maize (Kg/ha)	Paddy	Wheat	Maize (kg/ha)	Paddy
Panchana	1780	-	57*	265	-	178
Somkagdar	948	2061	948	613	842	613
Meja & Meja Feeder	1389	1867	791	680	782	NA
Bhimsagar	1360	678	NA	529	706	NA
Chapi	967	668	NA	619	632	NA
Bilas	2540	1055	2793	956	682	1712
** Wagon	1264	NA	NA	591	NA	NA
** Kothari	1264	NA	NA	545	NA	NA
** Gambhiri	1300	NA	NA	575	NA	NA
*** Project Paper	1364	1364	1591	332	318	500

* Data were collected here when the rice crop failed.
** Estimates provided by farmers and project staff which are a rough composite.
*** 1970-75 Data used in the project paper.

TABLE 11 ESTIMATED NET INCOME FOR RMIP'S PER HECTARE FORE AND AFTER IRRIGATION

SUB-PROJECTS	DESIGNED IRRIGATION POTENTIAL (HECTARES)	NEW IRRIGATION POTENTIAL CREATED BY JUNE 1986 (HECTARES)	ACTUAL AREAS IRRIGATED JUNE 1986 (HECTARES)	COMPOSITE NET INCOME/ HA ESTIMATED IN PROJECT PAPER WITHOUT IRRIGATION (RS)	ESTIMATED NET INCOME/HA AS REPORTED BY FARMERS TO EVALUATION TEAM (RS)
Bhimsagar	9986	1600	1200	1,600	2,500-3,000
Chappi	7000	-	-	1,600	
Bilas	2700	-	-	1,600	
Sawan Bhadan	3200	-	-	1,600	
Kothari	3075	3075	610	1,600	3,000-3,500
Bassi	3170	-	-	1,600	
Panchana	8787	1500	-	1,600	
Wagon	5706	5541	4048	1,600	3,500-4,000
Gambhiri (modernization)	4773	572	572	1,600	2,000-2,500
Som Kagdar	4935	4935	765	1,600	2,000-2,500
Meja Feeder Meja (modernization)	9424	-	-	1,600	
Som Kamla Amba	18788	-	-	1,600	
TOTAL	81554	17223	7195		

* Net income as reported by farmers has many pitfalls and can be used only as most crude estimates. Based on discussions, observations of irrigated land and without seeing the Rabi what crop removed before the June 1986 field visits we can only use our best judgement and alert the reader to the fact that these net income per hectare estimates are most crude.

TABLE 12 CROPPING INTENSITIES AT SIX SUB-PROJECTS AND SELECTED CROPS IN CROPPING PATTERN

SUB-PROJECTS	Cropping Intensity %	1) Jowar	Maize	2) Bajra	Paddy	Wheat	Gram
Panchana	130	11.2	-	37.7	2.1	28.4	11.9
SomKagdar	135	9.9	51.3	-	7.1	26.4	9.8
Meja and Meja Feeder	133	1.6	52.4	-	0.2	29.5	5.3
Bhimsagar	128	27.9	9.5	-	-	26.7	15.7
Chapi	121	44.4	13.7	-	-	16.4	8.0
Bilas	109	43.7	1.3	-	1.2	23.0	8.3

Source: Socio-economic baseline study, 1984

Note: It was found at Wagon project in talking to farmers that they expect their Rabi season intensities to reach 100 percent and their Kharif season intensities to reach about 50 to 60 percent utilizing well water.

1) Sorghum
2) Pearl Millet

supply of improved seeds and fertilizers. In these areas there is now a critical need for extension support services since farmers are just learning irrigated agriculture. Also at Bassi project farmers will receive canal water in 1986-87 but todate no support services are present.

The Project Paper and CWC appraisal reports assumed that adequate agricultural extension services would be provided to fulfil the needs of irrigated agriculture in most of the command areas of the sub- projects. This requirement has not been fulfilled. It was unfortunate that the designers of this project did not do a better analysis of the ability of the Agricultural Department to provide these services. No where during the evaluation could the team find evidence to confirm the assumptions made in the PP that "agricultural support services are adequate to that project needs". The findings of the 1982 DA workshop study under the RMIP for example, confirmed the evaluation teams information gained from interviews with farmers in June 1986. For example, the DA study found that 41 percent of the farmers did not know their extension workers and 85 percent did not know the contact farmer.

The Project Paper stated that irrigation and Agriculture Department workers have specified roles to play in the RMIP. Though the GOR/AD played little role, it is most necessary that they learn to work in a coordinated manner for on-farm water management which will be a critical need on all projects. The Agriculture Department has three Subject Matter Specialists in addition to Agriculture officers and other workers in each district but none to date to deal with on-farm water management. Subject matter specialists for irrigation water management recommended by CWC and trained field staff are probably some of the largest gaps in India's total agriculture services to farmers. The team found little evidence that the T and V system of extension was adequate to meet the needs of farmers at the projects visited though this general assumption was made in the Project design.

3 Marketing of Agricultural Produce:

It was reported by farmers and project staff that in the pre-project period, the sale of food grain crops constituted a much lower share of the total production in the project command areas. With higher production resulting from irrigation, the share of food grains going to markets has greatly increased. For example, in the Wagon market area, it was reported that the surplus of wheat coming to one local market had increased by 50 to 70 percent over 1984-85. In the Gambhiri command area, farmers also had a much larger share of their produce sent to market. In contrast, at sub-projects not providing irrigation water according to the 1984

Socio-Economic Benchmark Studies, the market surplus of wheat was only about 30 percent respectively for Panchana, Meja, Chapi and Bilas sub-projects with marginal and small farmers marketing virtually none.

Rural Employment and Consumption Patterns

The RMIP has had a significant impact on rural employment. Based on the study of project records and discussions with field staff on an average the labour content of the USAID assisted projects is reported to be about 40 to 50 percent of total project costs. The labor employed for construction is almost exclusively from the rural areas of the sub-project command areas. Before the construction of these projects, it was difficult for farm labor to get employment at minimum wages fixed by the Government. Now in some areas, labor is not available at minimum wages in the command areas during peak seasons. The wages of craftsmen such as carpenters, masons, and other artisons have also increased. The present rate for unskilled labor for dam, canal, and field channel construction is Rs.11 to 12 per day. At project sites visited by the team local staff and a few labor's stated that for several years two or more persons from village families have been employed. Roughly Rs. 38 crores will be made available for labor wages. At the Bilas and Bhimsagar sub-projects where construction work was underway from 1982 to the present the Socio-Economic Baseline Study included firm interviews with 50 village wage earners providing unskilled labor for the project. As a result of this construction work their consumption patters, incomes and quality of life have improved as compared with landless and marginal farm households at Panchana and Somkagdar project areas who were not involved in construction work. These differences are seen in table 13.

Table 13 Comparison of Selected Consumption Items and Expenditures of Households Involved and not Involved in RMIP Construction

Selected Expenditure item*	Bilas and Bhimsagar wage Earners Involved	Landless and Marginal Households not Involved in RMIP Construction
	RS.	RS.
Wheat	260	90
Edible oils	62	13
Milk and milk products	70	29
Fruit and vegetables	126	9
Eggs, fish, meats etc	50	5

Selected Expenditure item*	Bilas and Bhimsagar wage Earners Involved	Landless and Marginal Households not Involved in RMIP Construction
	RS.	RS.
Clothing	49	50
Fuel	70	12
Entertainment & travel	35	10
Total consumer expenses	1450	647
Purchases in village	1084	NA
Purchases outside village	212	NA
Gross income	1499	NA

Based on this information, we conclude that the income from employment generated has a significant impact on human nutrition.

The additional income of the landholders in RMIP command areas has also had some impact on investments for agricultural assets such as the construction and repair of wells, fitting of old wells with pumps, construction and repair of houses, etc., and in increased direct consumption. Also, it was reported by farmers and project staff that expenditures for marriages, death and other ceremonies have increased. Large expenditures are also reported by farmers for clothes, shoes, ornaments, cycles, watches and transistors. In the command of Somkagdar project some tribal cultivators reported that before the project they could hardly meet their needs for food and clothing. Now due primarily from income generated through labor on construction work, they stated that they now have no problem in food and are also able to meet other consumption requirements including some new house construction and repairs. One team member visited local markets for agricultural produce near the Wagan sub-project Grain dealers, cloth merchants, and other merchants provided a rough idea of the surplus being marketed and the increase in purchases by villagers from the Wagan command area now receiving irrigation.

4. Land and Groundwater Assets

The value of farm land has increased considerably following canal irrigation in all the command areas visited where irrigation is taking place. In the Wagon project command for example, the value of land was Rs.9,000 to 12,000 per hectare. before the project. It is now reported by farmers and staff to be as high as Rs.34,000 per hectare for land at a good

* The complete household expenditure and income provided are not reported here.

locations close to canals and having wells. Similarly, land values have increased in the commands of Gambhiri and Kothari depending on the soil fertility, topography, location of wells, and canal irrigation facilities provided to date. In Somkagdar project area where the soil is shallow and the land topography is undulating, the land values are much less than at Wagan projects.

Another important asset in RMIP irrigated commands are private wells benefiting from GW recharge The team inspected 23 wells in May and June 1986. The water levels in these wells have risen with the existence of dams and canals and stabilized even in early summer. For example, the water levels in wells at Wagon and Gambhiri projects prior to the project were reported to be 20 to 30 Mts. These levels are now about 6 to 7 mts. New private wells are being installed. On two minors of two sub-projects visited, the team counted 10 new wells installed by farmers. The potential benefits from the RMIP in creating ground water potential is great. For example, there are many open wells in all commands. The team was surprised that the local ID staff were unable to report the number and types of wells on most commands. The 1984 Socio-Economic Benchmark Study report, for example, shows that open wells and other sources such as ponds, river lifts etc. are respectively irrigating larger areas than expected by project designes. The percentage of areas irrigated for sub-projects primarily by wells are reported as 7.7 for Bilas 14.01 at Chapi, 15.2 at Bhimsagar, 34 at Panchana, 38 at Somkagdar and 55 at Meja and Meja Feeder. Some of these reservoirs at partially constructed dams have served as percolation tanks building-up valuable GW supplies. A word of caution however, is that the study cited defines irrigation of one application or more per season. At this stage of project progress, it is not possible to quantify the economic impact of these private wells. They do provide water control for farmers and more reliable water. Farmers especially along canals and minor canals are now investing more in new and improved private wells.

Well water with canal irrigation is used as a type of insurance. It will be necessary at some point to regulate the digging of new wells based on a comprehensive ground water survey followed by a definite action plan for conjunctive use of ground and surface water. It was interesting that the ID local staff was not monitoring the water levels in local wells. They also seen to not fully understand either the opportunities or possible hazzards of additional groundwater in project areas. The team, however, counted 150 wells along one 7 km. distributary and about 100 wells along another minor where canal water is now being provided.

Concerning other assets, the team observed only a few tractors in project areas owned by larger farmers. To date most other agricultural implements are of the traditional type but a few farmers are begining to invest in new ploughs, diesel engins, pumps etc. Two large farmers have acquired threshers at Wagon project.

Education

The impact on education in the command areas is not yet significant. In the Wagon and Gambhiri projects areas the existing school facilities were reported by farmers to be adequate. The farmers on most areas are not yet keen to send their boys beyond primary classes since they want them to work in the fields. In Govindpur village of the Kothari sub-project command area populated by the tribal group Bhils, there was no school. Farmers of this project reported that they were not in favour of educating their children, especially girls. In the Somkagdar project area there was also little improvement in education or school facilities. It is much too early to evaluate the impacts on education but this should be included in an impact evaluation study after about five years.

E. Role and Status of Women:

Women in the RMIP command areas have benefitted primarily from wages earned from providing unskilled labor for construction works. In the dam and canal works, women constitute 50 to 60 percent of the total labor force. This will amount to about Rs.18 to 20 crores in wages for women through completion of these 12 sub-projects. Both sexes are reported to receive equal wages in all the Irrigation Departmental works for unskilled labor. However, works executed by contractors is usually paid for on a piece work basis and women earn about 25 percent less then men. On Bassi dam construction, for example, it was reported that of the total labor employed at the time of the site visit, women made-up about 70% of the total labor force. At the Somkagdar project site, female labor for the canal works was estimated at about 80 percent of the total labor force.

In addition women work along with men on farms and as more irrigation is provided, their work loads in farm operations will substantially increase. Without data, and based on reports only, women seem to share in the well-being and the additional field work. The GOR as in other States in India has adopted a labor intensive approach for developing water resources. This report states that the labor component for irrigation projects would be about 78,000 million Rupees for non-skilled labor on major, medium and minor projects during the sixth plan (1980-1985) alone. It is not known how much of this employment generated will involve female

TABLE 14 PERCENTAGE DISTRIBUTION OF FEMALE DAILY LABOR IN AGRICULTURE RELATED ACTIVITIES AT SIX SUB-PROJECTS

Type of Activities	Panchana * n= 255	Somkagdar n=245	Meja and Meja Feeder n=266	Bhimsagar n=242	Chappi n=47	Bilas n=244
1. Direct agricultural operations						
Peak season	10.73	24.00	30.75	3.26	20.07	7.26
Low season	9.19	3.47	6.74	4.37	9.17	5.65
2. Collecting fodder						
Peak season	5.53	4.33	4.90	6.03	5.49	5.52
Low season	5.43	6.33	6.44	5.09	5.46	5.77
3. Core of cattle						
Peak season	6.89	8.40	5.71	4.42	4.40	7.69
Low season	6.84	9.08	6.78	4.02	4.33	7.36
4. Grazing cattle						
Peak season	4.64	4.41	1.82	0.70	1.87	1.29
Low season	5.02	4.90	2.24	0.70	1.99	1.60
5. Carrying food to fields						
Peak season	8.15	6.20	5.49	3.99	9.37	6.63
Low season	7.02	2.57	6.37	3.19	8.97	6.75
6. Marketing						
Peak season	3.23	1.13	1.83	3.67	2.31	5.22
Low season	3.43	2.09	2.36	3.22	2.73	5.37
7. Wage labor on construction primarily						
Peak season	7.13	0.38	3.71	9.54	4.58	6.57
Low season	5.18	7.53	6.01	10.72	14.30	5.87

* n denotes number

labor. Nor is it known what the positive as well as negative aspects of such work might be. Since the USAID is concerned about women in development, a most useful special social and economic study on this subject could be made in Rajasthan on these medium irrigation projects. The evaluation team based on experiences elsewhere expect that women's work activities will greatly increase with added irrigation. For example, data collected in the 1984 socio-economic benchmark surveys show in table 14 provide information on the types of agriculture related activities women were engaged in on six sub-projects. These data reveal that these activities constitute a large percentage of the daily work cycle especially during peak seasons.

To date we could not identify any changes in the social status of women as a result of these projects, though we talked with about 30 farmers in Wagon, Gambhiri and Kothari sub-project commands about this matter. In the project areas visited, except at construction sites, women were not often visible except in the fields weeding, cutting fodder, drawing water, and gathering summer vegetables. Many are still tradition-bound, and child marriages are still practiced. In a future impact evaluation of this project, a female professional might be utilized to gain more useful data on this important but little understood dimension of irrigation development.

F. Final Note on Benefits Foregone:

As discussed in the chapter on physical and technical aspects of the RMIP, the philosophy and approach in planning, design and implementing irrigation projects leaves much to be desired. The top-down approach from construction of the dam, the main canals and minor works, as presently practiced in Rajasthan and else where in India, results in having stored water for several years with no means to convey it to farms. Work at the micro level in preparing minors and at the canal level, observed on projects, was not sequenced in such a way to provide water early to farmers. A case in point is the Panchana project where for four years water sufficient to irrigate 1500 to 2000 hectares for Rabi crops was stored. This water could have been released through the stream bed or the existing completed part of the main canal and then delivered to the head reaches of the command and pumped-over into a temporary channel for farmers use. Technically and economically this was feasible. The estimated losses to farmers in terms of income per hectare using Rs.3,000 per hectare for four years times 2,000 hectares would result in estimated benefits foregone of (8,000 hectares x Rs.3,000) Rs. 24 million. When this loss is added to that resulting from similar practices followed at Bhimsagar, Kothari, Som Kagdar and other projects, the costs to society and direct losses to farmers are astronomical. As stated in the foreward of this Report, the conventional approaches to building irrigation projects must be drastically changed. Water can often be delivered much earlier

than after the final completion of all works. To achieve this, however, will take much more imagination and innovation than is presently obvious. It also does not make economic or practical sense to only begin preparing farmers for irrigated farming a few months or days just before water is to be released. This is a process which should begin two or more years in advance which also means assuring that the extension services, inputs, credit facilities, and training programmes are in place. This could and should be done on existing land irrigated by private wells and would likely pay huge dividends. The focus should be primarily on getting an early stream of benefits flowing to farmers so they can learn over time the value of water and other new production possibilities. This is basically what is now known as an irrigated agricultural approach versus the traditional irrigation construction approach.

Benefits Foregone to Farmers and Society

This final topic for this chapter is based on an exercise in attempting to estimate the benefits foregone resulting from the inability of the GOR/ID to complete these 12 sub-projects as planned in the project paper. A caveat, however, is that based on the team's findings and our own professional experience in irrigation development, it was virtually impossible for these sub-projects to be completed in five years. What if though the projects had been completed on schedule? Using three difficult scenarios with the following assumptions, an attempt is made to arrive at our best estimate about benefits foregone due to time lags in project completion. Assumption one, that the potential for water to irrigate the total command is created and 40 percent of that potential is used on farms. Assumption two, with fully created potential, 60 percent utilization takes place. Assumption three, 80 percent of the full potential water stored is used for irrigation. The first estimate is most conservative, the second compares with experiences in India on other projects, and the last is high by present experience on most Indian projects. Of the 12 sub-projects only Wagon project reached this high level (assumption three) of utilization where 5541 hectares of potential was created and 4084 hectares are utilized today. It should be stated again that of the 12 sub-projects, Wagon project received more technical assistance and had more adequately trained staff who remained on the project under good leadership over time than was the case with the remaining 11 sub-projects.

Table 15 shows each project by cost overruns, time lags in completion planned potential areas to be irrigated, actual irrigated areas to date and the benefits foregone to farmers and society using three assumptions discussed. The estimated value for each additional irrigated hectares over each rainfed hectare is RS.2,000 which is RS.700 greater than the value added by the project used in the 1980 Project Paper for the economic analyses. No estimate is made for increased land values in this estimate. We feel that with the 1980 prices plus the lack of expected agricultural support services the PP estimated value added per hectare with irrigation was probably realistic.

TABLE 15 ESTIMATED BENEFITS FOREGONE ANNUALLY TO FARMERS AND SOCIETY DUE TO PROJECT INCOMPLETION AS ORIGINALLY PLANNED USING THREE ASSUMPTION FOR UTILIZATION OF POTENTIAL CREATED

sub-projects	Time Lag (yrs)	Cost Over Runs (%)	Cost Over Runs RS. (Millions)	Potential Planned (ha)	Actual Irrigated June, 1986 (ha)	Value of full creation of Potential on target with following utilities rates of: 40%	60%	80%
						(Million RS.)		
1. Panchana	7	39	67.9	8787	-	7.03	11.44	14.06
2. Chappi	8	32	57.8	7000	-	5.60	8.40	11.20
3. Sawan Bhadon	5	32	27.4	3200	-	2.56	3.64	5.12
4. Bilas	5	27	17.1	2700	-	2.16	3.24	4.32
5. Bassi	4	42	25.6	3170	-	2.54	3.80	5.07
6. Bhimsagar	4	13	18.2	9986	1200	5.59	9.58	13.58
7. Som Kamla Amba	4	01	1.1	18788	-	15.03	22.53	30.06
8. Kothari	4	31	23.5	3075	610	1.24	2.47	3.70
9. Meja Feeder	2	0.6	9.5	9424	-	7.54	11.31	15.08
(Modernization)	2	13.2	11.1					
10. Wagon	2	Nil	Nil	5706	4048	-	-	0.96
11. Gambhiri (Modernization)	2	Nil	Nil	4773	572	1.40	2.30	3.25
12 Som Kagdar	0	Nil	Nil	4935	765	2.42	4.89	6.37
TOTAL	X = 3.73 Med.= 4		259.2	81554 ha	7195 ha	53.1	83.1	112.8

Note: At the two modernization projects the estimated shortfalls if any are estimated at Rs.1000/ha of assumed benefits of modernization. On all projects with limited areas irrigated the areas where deducted from the potential with the assumption that these areas have been irrigated since the

This exercise shows some startling magnitudes of benefits foregone. If the systems could have been completed as originally planned and only 40 percent of the planned area irrigated (utilization), the net farm income generated would have been some thing of the order of RS.53 million per year. If 60 or 80 percent could have been irrigated the net income to farmers respectively might have been of the order of Rs.83 and Rs.113 million per year. Since the 12 sub-projects have different lag times, each year of time lag can be multiplied by the net income foregone as shown below to estimate total benefits foregone from each project.

sub-Project Income	Time lag (years)	Utilization Assumptions A 40%	B 60%	C 80%
Panchana	7	49.21	79.08	98.42
Chappi	8	44.80	67.20	89.60
lawan Bhadan	5	12.80	18.20	25.60
Bilas	5	10.80	16.20	21.60
Bassi	4	12.16	19.00	25.35
Bhimsagar	4	22.36	38.32	54.32
Som Kamla Amba	4	60.12	90.12	120.24
Kothari	4	4.96	9.88	14.80
Meja	2	15.08	22.62	30.16
Wagon	2	-	-	.96
Cambhiri	2	2.80	4.60	6.50
Som Kagdar	0	2.42	4.39	6.37
TOTAL		237.51	369.61	493.92

The net farm income foregone under assumption A as shown above is almost equivalent to the revised total cost of Chappi project designed to irrigate 7000 hectares. If B assumption could have been met, it would have provided an amount sufficient to meet the total costs of another Chappi plus a Sawan Bhadon-type project. These two projects are planned for a combined area of 10,200 hectares of irrigated land. If by some unusual circumstances such as the political will to complete facilities for the 1984 Asian Games in New Delhi had occured through some unusual intervention, assumption C might have been met. This amount of Rs.494 million is equivelent to about 20 percent of the total revised costs of all 12 RMIPs.

This rough exercise may suggest the need for some good economic studies and a major policy point which requires serious consideration. The point is that there is most likely a real social and economic advantage in developing and completing fewer projects versus spreading scarce resources so thin across too many. There are, however, real political constraints in using this approach as discussed with GOR/ID officials. Hydropolitics in this respect requires in-depth studies not yet attempted in India. The savings to farmers and to society might be more than worth the effort. The evaluation team's considered judgement is that USAID and the GOR spread their scarce resources on too many projects. The Project Paper time frame was most unrealistic.

ANNEXES

I. Physical and Technical Description of Twelve Sub projects.

II. Results of Training Survey.

III. Attributes of 26 World Bank Projects World-Wide.

IV. Profile of an Engineers' Workload.

V. Farmer Involvement Activities (News Releases).

VI. List of persons contacted.

VII. Scope of Work

ANNEX I

PHYSICAL AND TECHNICAL DESCRIPTION AND STATUS OF EACH RMIP SUB PROJECT

A detailed description of the physical and technical aspects of each of the Sub-projects is provided. This summarizes achievements to date, provides comments about specific details and recommendations for the GOR/ID in completing RMIP's after PACD. This information is taken from project documents, seven site visits, discussions with officials and project site staff and information collected from a questionaire developed for the Evaluation.

1. BHIMSAGAR PROJECT

This is a project where a dam 40.54 meters high is being constructed across River Ujar, a tributary of the Chambal River, to impound 76.60 MCM of water for a command area of 9986 hectares. Water will be carried through two main canals, which are 29.26 and 16.36 km in length. The CCA is designed for irrigation intensities of 77.5% for Rabi crops and 22.5% for Kharif crops. The canal will be lined up to the 40 ha unit and 50% lining of the distribution networks system from 40 to 8 hectares is planned. The project as appraised will cost Rs.141.78 million (1982) and is planned for completion in 1985-86.

This project was started in 1943. The dam was started but work was suspended for a long period and began again in 1954. A serious and protracted dispute arose about the acquisition and compensation for land and village properties in the proposed submergence area. Also, due to GOR financial constraints, the work was again suspended. In 1978, the construction work on the dam was resumed. The earlier long delay was over the submergence of Asnawar village which had to be resettled on higher ground.

a) Achievements:

The dam is now completed up to the spillway crest level but the spillway crest gates remain to be fabricated and erected. Some minor works such as a road bridge over the spillway and the gunting on the face of the dam are presently in progress. Out of a total 166 km length of canals and distributions, lining has been completed upto 40 km and excavation up to the 84 km level. A total of 73 control and safety structures out of a proposed 99 have been constructed. Partial storage up to the dam crest level was created in 1984. This stored water is sufficient to irrigate about 1600 ha but the actual area irrigated was only 1200 ha. in 1985-86. Practically no work has been done for the planning and construction of the conveyence channels from the 40 to the 8 hectares units. The irrigation now provided for the 1200 ha area is through katcha channels. No APMS have been installed to date.

b) **Comments:**

(1) **The project is now estimated to cost Rs.160.00 million or about Rs. 20 million more than the 1982 appraisal estimates. The total expenditure incurred upto June,86 was 113 million rupees whereas the provision of the VIIth plan period-(1985-1990) is Rs.60.3 million. Project authorities have indicated that the project will likely be completed by 1989-90. Given the provision made for this project in the VIIth plan and the revised cost of Rs. 160.00 million, it is improbable that it will be completed by 1989-90.**

The total expenditures upto March 30, 1986 are:	Rs. 73.42 million
Funds available from April, 1986 to March 1990 are likely:	Rs. 57.17 million
TOTAL:	Rs.130.59 million

Given the fact that the revised cost is estimated at Rs.160.00 million, the project will likely spillover into the VIIIth plan period unless provisions made in the VIIth plan are revised drastically.

(2) The added amount of about Rs.20 million will likely be used for the completion of the canal system and other activities such as reimbursements for land acquisitions.

(3) Full storage will likely be achieved during the VIIth plan period but actual full utilization of the storage of the water on farms will not be achieved until the canal system is completed.

(4) Partial storage equivalent to water required to irrigate about 1900 hectares has remained under-utilized due to the incomplete canal system. Canal work has lagged considerably behind that of the dam work. A determined effort is needed to complete the canal system and water courses to provide the storage now available for farm use.

(5) Practically no action has been taken on the following items:

(i) Full compliance with the recommendations of the 1982 CWC appraisal report though this appraisal report has been available for four years!

(ii) The survey of the command area with 15-25 cm contour intervals and the network planning for the whole command. Only 3000 hectares of about 10,000 hectares has been surveyed to date.

(iii) Lining of the water courses on a selective basis and installing the APMS.

(vi) Field studies in portions of the canal where lining has been completed to ascertain loss rates for determining conveyance efficiencies.

(v) Planning and execution of the drainage system and the improvement of existing drainage systems.

(vi) The development of the rainfall runoff corelation for Parvati pick-up weir and Harish Chander Sagar and the discharge sites at Khatoli, Sangod, Barod as well as others in Kalisindh Basin in order to verify the assumptions made for developing reservoir yield estimates.

(vii) Installation of flow measuring devices on canals to measure the flow in all reaches of all the canals on a regular basis.

(viii) Provision of agricultural support services and the strengthening of the extension services by providing water management subject matter specialists.

(6) Partial storage has been utilized for irrigating only 1200 hectares of Rabi crops upto 1986. No kharif irrigation has been done. A 22.5 percent Kharif cropping intensity was adopted which include 10 percent paddy. Almost 72% of the land holdings are smaller than 4 hectares. Local information provided suggests that about 70% of the land holdings are less than one hectare in size. It is doubtful that 22.5 percent Kharif with 10% paddy crops will ever be adopted. There is and will continue be a tendency for farmers to grow wheat and other crops in their total farm areas. It is doubtful that the GOR/ID will be able to restrict this to 50 percent as planned.

(7) The sub minors from the 40 to 8 hectare units have been planned to run along the boundries of farm holdings rather than following ridges for irrigation on both sides of channels. The drainage system has not been planned. It is impractical and costly to take up only one component of this project at a time as is now being done. It will be most impractical and extremely expensive to super impose a drainage network over an existing channel network at a later date. An on-farm approach needs to be adopted to help farmers make better use of the water.

(8) Dam construction and the erection of spillway gates were delayed due to long and costly litigations with both contractors and suppliers. Such litigations should be settled early to complete the erection of the gates and for creating full storage as soon as possible.

(9) **The watercourse lining from the 40 to the 8 ha. unit was planned to be done on a selective basis. Guidelines on the methodology for doing this are not available. Also, the most suitable and cost effective types of lining have not been investigated because no special studies have been implemented as planned.**

(10) The finalisation of the report on the detailed soil surveys should be expedited so that the planning of channels and drains can be started.

C) Recommendations:

- The crest gates should be erected without further delay.

- The network planning including the drainage network must be planned. A comprehensive on-farm development program should be launched in the command area.

- Guidelines need to be prepared for the selection of the reaches of water courses needing lining and suitable types of lining should be investigated to provide data on the most cost effective type.

- Special studies need to be carried-out immediately in order to determine the conveyance losses in existing lined canals and for testing the validity of the vague assumptions made. These data may help in modifying the type and quality of lining being used and reduce costs. Without these studies general rules of thumbs will be followed.

- The detailed soil survey of the command area needs to be completed as well as planning for the drainage system. The cropping pattern proposed needs to be reviewed, particularly the assumptions about a Kharif intensity of 22.5% with paddy intensity of 10 percent.

- The completion of this project by 1988-90 will require substantially more funds and personnel now being provided.

2. CHAPI IRRIGATION PROJECT

This project is planned for a masonary dam 292 meters long and 34 meters high across River Chapi which is a tributary of Kalisindh/Chambal Rivers. It is to impound 78.59 mcm gross to 59.64 mcm live storage of water to be utilised for irrigating a cultivated command area of 7000 ha with intensities of 65% for Rabi and 35% for Kharif seasons. Two canals of 22.08 km and 10.3 km long with a distribution system fully lined upto the 40 ha level are planned. Lined water courses from the 40 ha to 8 ha levels in selective reaches are also proposed. This project was appraised in 1982 at an estimated cost of Rs. 182.22 million but the 1986 revised estimates is Rs.240 million. The project is scheduled to be completed by 1986-87.

a) **Achievements:**

Work has started on the excavation of the dam foundation which requires a total of 90000 cubic meters excavation about 75,000 cubic meters of excavation have been completed. The drilling work for the anchor in the dam foundation has also started. The work of excavation in a two km length of the left main canal is in progress. It was reported to the Evaluation Team that due to lack of funds and staff, progress has been delayed. An expenditure of Rs. 2.20 million was incurred upto March 3, 1986.

It is now anticipated that the project will be completed by (1990 - 1994/95). Full benefits of this project will probably accure by the end of the VIIIth plan period (1990-1995).

b) Comments:

(i) Financial outlays and available staff are vastly inadequate.

(ii) No follow up action on the suggestions and recommendations of the CWC appraisal report have been taken related to following activities:

- Detailed soil surveys of the command.
- Establishing rainfall runoff corelation.
- Review of spillway capacity.
- Review of the entire hydrology of the project.
- Review of the design of the dam by CWC or a panel of experts.
- Creation of an independent staff division.

c) Reccommendations:

- Hydrological and other studies essential for final dam design should be conducted before further work on the dam.
- Recommendations made in the CWC appraisal reports should be implemented.
- Adequate finances and staff are urgently needed if the revised completion schedule is to met.
- Appropriate types of canal lining especially to effectively reduce conveyance losses require investigation now before lining is done.

3. BILAS IRRIGATION PROJECT

This project will have an earthen dam of 3626 meters long with a maximum height of 19.70 meters across River Bilas. This is a tributary of River Parwati. The dam will impound about 26.9 mcm (24.90 mcm live) of water for irrigating an area of 2700 ha with Rabi intensities of 65% and Kharif intensities of 35 percent. One main canal 15.9 km long with a head discharge of 1.94 cumecs is proposed.

The canal system up to the 40 ha block is proposed for complete lining. The 40 ha to the 8 ha unit is planned for partial lining of channels on a selective basis. The project was appraised in 1982 and estimated to cost Rs. 62.97 million. The target completion date was set for 1986-87. The 1986 revised cost estimate is Rs.80.00 million and the new target for completion is 1991-92.

a) Implementation:

Work on this project was initiated in 1981. Due to reported financial and staff problems progress has been very slow. Expenditures upto June, 1986 are reported as Rs. 23.00 million.

The dam work and the head reach of the main canal are in progress. This canal will act as a feeder canal without irrigation enroute. About 34% of the dam work and 20% of the main canal work was completed by June, 1986.

b) Observations:

Though the construction of the main dam is in progress, follow up action on the CWC appraisal report recommendations have not been initiated. Key recommendations are:

- Development of rainfall runoff corelations for Parvati and Harish Chandra Sagar and discharge sites at Sangad and Barod for comparing the reservoir yields considered for Bilas.
- Reliability of yield series to be verified by flow measurements at Bilas.
- GOR may work out MPF on the suggestions made and the observed flood hydrograph of river Parvati at Khatoli to review the spillway capacity.
- The entire hydrology of the project should be reviewed by GOR in light of CWC recommendations.

These recommendations are directly related to the design and scope for the main dam and canal. Without acting on these, the dam and head reach work of the main canal have been started. This may result in additional cost when future problems emerge.

CWC also suggested that 27.6% of the poor class III land from the command of 2700 hectares be eliminated and that the original command of 3300 hectares of land be used. It is essential to act on this before the canal is designed and constructed.

Other CWC recommendations have not been acted upon. For example, the survey of commands and the detailed soil survey need to be taken up immediately. Network planning for the irrigation channels and the drainage system will need to be taken up simultaneously. Cropping intensities as well as cropping patterns need to be reviewed in light of past experience on other projects in the area. The fact that a large percentage of the small holdings are less than 4 hectares in size must be considered.

4. SAWAN BHADON IRRIGATION PROJECT

This project plan is for the construction of an earth dam 3750 meters long and 26.5 meters high across River ARU a tributory of Kalisindh/Chambal Rivers to impound 30.00 mcm gross storage and 27.85 mcm live storage for irrigating 3200 ha of land through a 9.3 km long main canal. The distribution channels are to be lined upto the 40 ha unit and partly lined from the 40 ha to the 8 ha blocks.

This project was appraised in 1982 at a cost of Rs.85-59 million. It was scheduled to be completed by 1986-87. The complete irrigation potential was to be available by June 1987. The cropping intensities prcposed were 65% for the Rabi season and 35% for the Kharif season of which 10% was planned for paddy rice.

a) Achievements:

Work on the main dam and canal is now in progress. About 15% of the dam and 35% of the excavation and lining of the main canal is reported to have been completed along with the topographical survey of the command.

b) Comments:

- The project is now estimated at a total cost Rs. 113.00 million. Due to the inadequate finances and staff, the new target completion date is set for 1991 or 1992. With more determined efforts, the creation and utilisation of the designed irrigation potential could have been achieved three or four years earlier.

- CWC appraisal reports recommend that the yield data be verified and rainfall runoff corelations be made before finalising the dam plan and beginning work.

- Flood studies to be conducted have not been done nor has the dam spillway capacity been reviewed. This is essential before the dam work progresses further.

- Several other recommendations made in the appraisal report have not been followed up with appropriate actions.

c) Recommendations:

- Urgent steps are needed to follow-up on the CWC approved recommendations.

- Additional effort is needed if full irrigation potential is achieved by 1991.

- The detailed soil survey of the command is urgently needed as well as an integrated plan for conveyance channels and the drainage networks.

- **Present cropping patterns plans need to be reviewed to ascertain how the Rabi cropping intensity can be increased.**

- **Plans are needed immediately for the studies to determine the most cost effective type of lining for canals and water courses. Tests will be needed to ascertain the effectiveness of various materials and methods to reduce conveyance losses.**

5. KOTHARI STAGE II PROJECT

This project will have an earthen dam 4066 meters long and 9.7 m high across the River Meja to tap the run off from the free catchment area below Meja dam. Kothari project will impound a live storage of 21.5 mcm for commanding an area of 3415 hectares with Rabi and Kharif intensities respectively of 54 and 36 percent. The length of the right and left canals are 7.87 and 14.1 kilometers. The canal system up to the 40 ha blocks is to be fully lined and the 40 ha to the 8 ha blocks will be partially lined on a selective basis. The cost of the project as appraised in 1982 was estimated to be Rs74.42 million. The project completion date was targeted for 1985-86. The revised estimated cost and completion dates are Rs.97.95 million and 1987-88.

a) Implementation:

1. The earthen dam as with an ungated spillway is almost complete except some concreting on a 7 meter width of the spillway.

2. Two main canals are almost complete with lining. A few control and safety structures are not yet provided.

3. The distribution system up to the 40 ha block is complete for the Right Main Canal but only 60% of the work is completed on the Left Main Canal. This work likely will be completed in late 1986.

4. Surveys of the command for network planning for the 40 ha to 8 ha units have been completed for 30 out of 70 chaks units. The planning and execution of water courses for the 40 to 8 ha units remain to be done.

5. Partial irrigation of 351 hectares on land area of the right main Bank Canal and 259 hectares on the left main canal LMC was achieved during Rabi 1985. This is a total of 610 hectares against the designed 3075 hectares area. The target for 1985-86 is 1190 hectares.

b) Comments:

All of the CWC approval report recommendations have not been acted upon. The most important of these is the installation of piezometers on the buried channel section to observe the rise in water table in that section due to possible seepage. Likewise, automatic water level recorders have not been installed.

The drainage network need to be planned and executed simultaneously with the channel network. An on-farm development approach for the whole command should be considered. Water courses are presently aligned along the borders of the farms which increase the length and therefore costs considerably. Since alignments may clash with the drainage lines. The complete network of water courses and drainage channels need to be planned from the beginning and not in a piecemeal fashion.

The water yield for the project should be reviewed after developing rainfall runoff corelations.

The costs of lining the canal system up to the 40 ha. unit and subminors from 40 ha to 5-8 ha are considerable. Therefore, it is worthwhile to investigate the most suitable types of lining with effective criteria including costs as main considerations. For subminors precast concrete sections are proposed. Since no tests have been conducted to date to verify the effectiveness of different types of lining, the suitability of various lining materials for the conditions of this area are not known. The conveyance losses in completed lined portions of the canal need to be studied. Water courses with different types of lining, need to be constructed in various reaches and seepage tests are needed to establish the validity of rough assumptions made for conveyance losses. Such studies are very low cost in terms of the project and possible benefits. These studies are needed to provide data to make important technical and economical decisions.

Partial irrigation has been provided for only 610 hectares in Rabi season, 1985-86. The designed intensity was 54% for Rabi and 36% for Kharif crops with wheat contributing only 30 percent. Since more than 80% of the land holdings are less than 2 ha in size, it may be difficult to restrict the Rabi intensity to 54 percent. In contrast to the planned cropping intensity for Rabi of 610 ha in 1985-86, 80 percent of the area is reported to have been under wheat. Therefore, the planned intensities and cropping patterns need to be reviewed. Given the fact that distributaries have been designed for a one cusec flow of water for 50 hectares and the main canal for a 70 percent intensity, there appears to be no problem in increasing the Rabi season intensity.

With additional finances and staff, the network planning and construction of water courses from the 40 to 5 or 8 ha. levels can be completed immediately. This would likely move the final project completion date back by a full year. This is feasible because the dam has stored water. Benefits could begin to flow earlier versus later. The APMs also need to be fixed on all outlets immediately. Either the warabundi or rozwari rotation water supply systems could be introduced to farmers now.

6. BASSI IRRIGATION PROJECT

The Bassi project has an earthern dam 343.0 meters long and 28 meters high across the River Orai which is a tributary of the Berch River. The reservoir is to impound 20.24 mcum of live storage to irrigate a cultivable command area of 3250 hectares with Rabi and Kharif intensities of 54% and 43.5% respectively. The length of the main canal, 16.5 km long is to be lined and the distribution system up to the 40 ha units plus 32 km of water courses are to be partly lined. This project was appraised in 1982 at a cost of Rs.60.33 million and work was scheduled for completion by 1984-85. The Bassi project, however, is now expected to be completed in 1988-89 at an estimated cost of Rs.85.94 million.

Implementation:

The earthen dam is nearing completion. Only stone pitching work has lagged primarily due to contract problems. It is unlikely that the pitching will be completed before the 1986 monsoon. Work on the spill channel and guide bund is in progress but will unlikely be completed by the 1986 monsoons which will fill the reservoir. Work on the canal head regulator and the head reaches of the main canal is now in progress. This is likely to be completed by the time water is released for irrigation in Rabi 1986. The bed of the main canal has been taken at elevations (EL) 401.00 but the sill of the head regulator has been fixed at EL 398.00 to feed the distributory which is designed to utilise the storage between EL 398 and EL401.

The earth work and lining in a length of 14 km out of the total of 15.60 km of the main canal have been completed. Only about 40% of the work has been done on the distribution system upto the 40 ha level. Practically no work has been done to date on channels from the 40 ha to the 8 ha units. Network planning and the installation of the APMS have not been done. Partial irrigation for 2000 ha is proposed for the 1986 Rabi season. An expenditure of Rs.58.73 million is reported to have been incurred by June, 1986.

b) Comments:

While partial irrigation for 2000 hectares is proposed for the Rabi 1986, no effort has been made to survey the command of these completed canals. Unless this is done, irrigation practiced in the traditional indisciplined and wasteful way will result. Immediate steps need to be taken to do the network planning for the command, especially, the area where irrigation is proposed in 1986 Rabi season.

The Chittor Bundi road bridge on the distributary is likely to be a bottle neck in providing partial irrigation in 1986 since work on the bridge has not begun. Since the road is used by heavy traffic, it may take longer than expected to complete it. The bridge work when started will have to continue around the clock. The head reach of the canal is in an area requiring deep cutting. The side slopes need to be stabilised more and catchwater drains provided. The team observed that due to unstable slopes there is already considerable erosion of earth into the canal caused by wind and rain.

No service roads exist along the canals, therefore, they need to be provided before the 1986 irrigation season. The chak plans need to be reviewed because some chaks now planned have areas greater than 40 hectares.

Given the fact that the main canal bed level is three metres higher than that of the distributary, there may be problem of providing supplies to the main canal during the 1986 Rabi season. Also a proper operational plan needs to be worked-out for this project, including a practical crop pattern which farmers can utilize.

The CWC recommendations in the appraisal report have not been followed by appropriate actions to date. For example, the reliability of the reservoir yield series needs to be checked.

Since water courses are to be lined on a selective basis upto 50% of their length, criteria and guidelines need to be worked out for selective lining. To date, little thought has been given to the economics or effectiveness of various lining methods.

Since soil conditions on this project are such that adequate drainage may be required to avoid water logging, it is essential that the drainage system be planned along with that of small channels from the 40 to the 6 ha. units.

7. PANCHANA IRRIGATION PROJECT

Panchana project includes the construction of an earthen dam 1040 meters long with a maximum height of 25 meters across river Gambhir to impound a gross storage of 59.45 mcm and a live storage of 52.65 mcm for commanding an area of 9985 hectares. The intensity of irrigation proposed is 88 percent (Rabi 59%, Khraif 27% and perennial 2%)for about 8800 hectares. Irrigation is proposed through a Main canal which will act as feeder canal with no irrigation enroute for a length of 11.57 km and by two branch canals of 14.8 km and 18.8 km in length. A gated spillway is designed to pass a routed flood discharge of 3795 cumecs. This project was appraised in 1980 for an estimated cost of Rs. 210.49 million with a scheduled completion date of 1984-85. The revised cost of the project is now estimated at Rs. 242.40 million. The new completion date is 1991-92, but project staff reported to the Team that Panchana project would probably be completed about 1992-93 or later.

a) Implementation:

Work on this project began in 1979. The earthen dam is completed to the top level, except for some riprap to be laid in accordance with the advise of CWC for the revised design. Riprap will be used from the spillway rock excavation, but to date the spillway has not been started. The construction of the spillway chute is said to have been allotted to a contractor who opted out of his contract. Attempts are now being made to start the work again. About 15% of the rock excavation was completed by small contractors. In the absence of a proper spillway the flood waters pass over existing rocky strata. Partial storage, however, has been created since 1981 up to the rock levels on the spillway site. An estimated 10

mcm is impounded every year but for 5 full years this valuable resource has not been used for irrigation to benefit farmers. Regarding the canals, out of a total quantity of earthwork excavation of 24.84 lakh cubic meters only about 59% was executed up to June, 1986. Only some lining has been done and control and safety structures installed. For water distribution up to the 40 ha and down to the 5-8 ha. units, about 275 km of distribution channels are required. To date no work has been done on farms except on 518 hectares where surveying and the planning for the watercourses is completed. No APMS have been installed and no Warabundi has been planned to date nor have actions been taken to prepare and help farmers organize. Work on the Karanli Town water supply projection is yet to be started. The diversion road has been started but is only about 30 percent complete.

The main bottleneck in the construction and completion of the main feeder canal is the deep cutting in some reaches which is being done by contractors. The authorities expect to complete this and the canal by Nov-Dec 1986. The evaluation team in reviewing the progress and problems to date judge that this is a highly optimistic target completion date.

Partial irrigation from the storage now available is proposed during the 1986 Rabi season. This is probably not possible because the deep cutting work for the canal will take much more time than anticipated.

Up to March 1986 an expenditure of Rs. 99.77 million was incurred on this project which is about one third of the new total cost estimate. Annual budget allotments have not been adequate. The follow-up actions for most of the CWC appraisal report recommendations have not been implemented.

b) Observations/Recommendations:

The work on this project has been underway since 1979. Still it is far from completion. Given the present rate of progress it will probably take five years more for completion. Inadequate finances and personnel along with long delays in finalizing the designs have been major contributing factors to a slow and costly process of completing this project. As reported by the hydrology and design clearance of the spillway from CWC took an unusually long time. The team learned in a visit to the CWC unit responsible for this clearance that their staff is also short.

Partial storage was created in 1981 which is sufficient to irrigate about 1,500 hectares. The quivalent volume of water to irrigate 7,500 hectares represents an estimated loss of production in terms of estimated net income of about Rs. 15 million for Rabi season using the wheat equivelent net income per hectares. A major problem was the excavation in deep cuttings in the main canal head reach which repeatedly was delayed due to reported failures of the contractors. Such an inordinate delay in terminating contracts and acquiring new contract certainly could have been avoided. Otherwise, an innovation not examined by USAID or the GOR/ID

staff was to release the stored water in the old river bed and pick it up by pumps to service the lower part of the command area or this scarce water could have been released in the main canal and pumped over the unexcavated canal portion for farmers who want water desperately. Local farmers stated they were ready to dig the watercourses. Unfortunately there was inadequate imagination or will to explore these options. Thus an opportunity to provide benefits to farmers for a five year period was missed. This provides a good example of the conventional thinking or mind-set on top-down planning, design and construction of dams, canals and then much later finally supply water to farmers. Evidently a complete change is needed in the philosophy and approaches for planning and building irrigation systems.

Though five years have been lost in terms of benefits to any farmers even at this late date after the excavation of the main canal in the deep cutting reaches, partial irrigation could be provided on two of the minors where the complete network planning, drainage systems could be completed soon.

Actions are needed on the CWC recommendations related to several factors which include: sedimentation, observation of water tables in wells before and after monsoon periods, establishment of an adaptive research farm planned for the project command and the establishment of the planned methodologies observation station.

8. WAGAN IRRIGATION PROJECT

Wagan project involves the construction of an earthen dam across the River Wagan which is a tributary of River Banes. The dam is to impound 40.67 mcm of water for commanding an area of 5,706 hectares of farm land. The dam is 3000 meters high with a maximum height of 14 meters. Earlier a project to divert the waters of Wagan to Jaisamand Town lake was conceived. Work was started on this in 1977. Later, the project was modified to provide direct irrigation for agriculture purposes instead. With intensities of irrigation for Rabi crops of 47% and for Kharif crops of 22%, an area of 5541 hectares is now proposed. This project was appraised in 1984 for an estimated cost of Rs. 110.60 million. An expenditure of Rs. 84.30 million has been incurred up to June 1986. The project was scheduled to be completed by 1986-87, however, work is still in progress. While no increase in the cost of this project is expected, it is likely to be completed during 1988-89.

a) Implementation

- The main dam and spillway have been completed. Only an additional spillway is to be added to meet the expected increased discharge worked out by the CWC Hydrology Directorate. For practical purposes this work is now finished.

- The canal system up to the 40 ha block is almost completed with control and safety sturctures.

- The distribution system from the 40 ha to the 8 ha units is 34 percent completed on a 100 km length of a total 290 kilometers.

- While the distribution system from the 40 to 8 ha block is still incomplete, the irrigation potential for 5541 hectares of land has been created. During 1985-86, for example, an area of 4048 hectares was irrigated with the reservoir having full storage. This shows that the irrigation efficiency is lower than designed.

- APMS have been fixed on outlet heads and network planning has been done with detailed surveys of each chak on a grid interval of 25 cm.

- Farmer organisations have also been formed at outlet heads and nakko points. This organisation, described in detail elsewhere in this report assists the Irrigation Department in various irrigation and field matters, arranges distribution of water below outlet and nakko points, arranges the supply of water on a rotation system, settles water disputes among farmers, and assists irrigation authorities in the assessment and collection of irrigation revenue and other matters. A unique token system to help implement a Rozwari Turn or rotation system has been successful. The cleaning and maintenance of the water courses is done by farmers.

- Unfortunately flow measuring devices have not yet been provided on all the canal reaches but canal service roads have been constructed.

b) Observations:

- No drainage network has been planned although drainage is required, as stated in the CWC appraisal report. Drainage should be taken up simultaneously with the channel network system. Some type on on-farm development approach should be organized for the development of this command area and tested for possible use on other medium irrigation projects.

- Water courses have been aligned along the borders of fields instead of on ridges which would make irrigation on both sides of the ridges possible. The present method used requires greater length of channels and therefore greatly increases costs of total lined water courses.

- For the last two years, irrigation has been available only during the Rabi season. No Kharif irrigation has yet been done though planned. In 1985-86 with a full reservoir, only 73% of the area was irrigated with three and four irrigations. Without reductions in water losses the total project command probably cannot be irrigated.

- Given the fact that more than 90% of the holdings at this project are less than 2 hectares in size, it is difficult, if not impossible, to restrict irrigation to the designed intensity.

In 1985-86 due to much higher returns per hectare, about all the command farmers cultivated wheat on a large proportion of their farms. Some small farmers actually cultivated wheat on their total irrigated land holdings. This is in contrast to the designed intensitites which provided 27% of the area for wheat, eight percent for gram and seven percent for mustard. This is another good example of planned versus actual cropping intensities. Farmers indeed respond primarily to market signals and not to planners who use guesses and rules of thumb. The whole matter of intensities of irrigation and cropping patterns requires objective analysis based on empirical field data. Though a part of this project, a training cum demonstration farm has not been established although Rs. 3.00 million was provided for this purpose. Over a three-year period, the planned agricultural support services have not materialized.

9. MODERNIZATION OF GAMBHIRI CANAL SYSTEM

This project unlike the 10 new projects in the RMIP is one dealing with modernisation of the canal system of the Gambhiri irrigation system constructed in 1953. This project ha had very low irrigation efficiencies for about 33 years. The impetus to include this project in the RMIP come from the first DA workshop held in Rajasthan (1981) which provided ample data for planning the modernisation. The modernisation plan includes lining both main canals which are 75 km long and the distribution system up to the 40 ha block which is 132 km long. The command area has 9796 hectares.

Thirty-six control structures and safety structures will be added to the system along with remodelling of 206 existing structures. The distribution system which is 740 km. long will be lined on a selective basis up to the 40 and 8 hectares units.

The project was appraised by CWC in 1984 for an estimated cost of Rs. 148.58 with the anticipated completion date as of 1991-92. The revised project is now estimated to cost Rs. 148.80 million and be completed the year 1993-94. This modernisation process will require long periods of time because work can be done only immediately before and after the summer monsoon rains when water is not being supplyed to farms.

a) Implementation:

An expenditure of only Rs. 26.4 million has been incurred up to June 1986. About 63% of the earth work excavation and 50% of masonery lining has been completed but no work has been done on pucca works. Practically no work has been done on the distribution system from the 40 ha to the 8 ha blocks. Network planning has been done for 1300 hectares and lined water courses are provided for only in 110 hectares of land to date.

No work has been done in raising a parapat wall on the main dam. Work on the drainage system including field drains in farmers fields remain to been started.

To date, no work has been done in converting the ungated spillway to a gated structure. By June 1986, only 19 of 245 planned APMS have been installed at the public outlets.

b) Recommendations:

This work has lagged due to inadequate planning, short budget allocations, and many exceptionally rapid staff transfers in the last two years. There is also a shortage of staff for the work when the canals are not operating. This project has introduced many innovations including the first DA training workshop in 1982 followed by significant improvements of a demonstration minor. Several new technologies have been introduced at Gambhiri with TA including APMS, pucca naccas, turnouts and on-farm structures.

The new staff posted at this project need the some determination and facilities that the 1983-84 staff had when the one demonstration minor was planned and implemented. Given the earlier successes with increased efforts Gambhiri could become a useful model project for Rajasthan. To achieve this more funds and staff plus technical assistance is needed. GOR/ID officials now realize the importance of having a few highly visible demonstrations. The costs including TA for the relatively large demonstration impact from the 1983-84 activities paid high dividends. But to have such pilot demonstrations or model projects, requires committed and trained staff who are on projects for longer period than two or three years.

10. SOMKAGDAR IRRIGATION PROJECT

Somkagdar is a new project. It includes the construction of an earthen dam 480 meters long at a maximum height of 24 meters across River Som. This is a tributary of Mani River. The Dam will impound 36.19 mcm of water sufficient to irrigate 5739 hectares of land with intensities of 59% for Rabi and 27% for Kharif season crops. An ogee shaped spillway is proposed to pass a flood discharge of 3259 cumec. The main canals proposed are 12.32 km in length on the right bank and 39.64 kms on the left bank. The distribution system up to the 40 hectares block will be fully lined and from the 40 hectares to the 8 hectare level selective linning is planned.

This project was appraised in 1985-86 for an estimated cost of Rs.196.88 million. The original completion date was 1989-90. There are no changes in the estimated cost or completion date. This project will benefit marginal classes of farmers, scheduled caste farmers and tribe farmers who own about 89.72 of the total land expected to be irrigated.

a) Implementation:

The main dam is complete and storage of water exists. This storage, however, is not fully utilised due to the canals not being completed.

About 76% of the excavation and 80% of the lining has been completed on the main canals. Of the 270 structures planned which include control, safety, and bridge structures, 197 have been completed. About 50% of the excavation and 23% of the lining has been completed on the distribution system up to the 40 hectare blocks. The important work of the Som acquaduct on the left main canal remains to be completed. This is due to a considerable area of land to be irrigated which lies below the acquaduct which has become a bottle neck to progress.

The survey for 10 chaks has been conducted for subminors from the 40 hectare to the 8 hectare blocks and network planning has been completed for four chaks. No water courses to date have been constructed on farmers' fields.

While the full storage and hence the full potential has been created, only 765 hectares are being irrigated due to long delays in the completion of the canal system. The drainage network has not been planned and executed simultaneously with the canal distribution network. This common practice results is time lost in delivery of water and the net income foregone to farmers is substantial.

Due to inadequate staff, planning and implementing the distribution from the 40 hectare to the 8 hectare level has been quite slow. This distribution network needs to be completed simultaneously with the canal because water is now available for use.

11. MEJA FEEDER AND MEJA MODERNISATION PROJECT

This sub-project provides for the remaining construction of the dam and the feeder canal and modernisation of the existing project. The construction work includes the completion of a gated diversion dam across the Banas River with a 58.2 km long feeder channel including a 1.5 km tunnel to divert the Banas River flood water to supplement the existing Meja reservoir. This project also includes the modernisation of the existing structures of the old Meja project comprising the dam and canal system. Meja Dam was constructed in 1956-57 but due to poor run-off from the catchment area for the reservoir, a diversion scheme by name of Meja Feeder Project was started in 1968-69 which is still in progress. The Meja modernisation project includes the raising of the free board of the dam, lining of the canals, providing additional control and safety structures, and the extension of the distribution system up to the 8 ha block with selective lining. The irrigated area benefited will be 9920 hectares. The project was appraised as late in 1985 for Rs. 267.27 million to be included in the RMIP. The Meja Feeder section is expected to be completed by 1986-87 and the modernisation of the project by about 1990-91. The revised estimated cost of these two USAID assisted sub-project, is expected to be Rs. 281.94 millions. The Meja feeder canal project is expected to be completed in 1988-89 and the modernisation scheme about 1992-93.

a) Implementation:

1. The crest gates for the diversion weir are yet to be erected. About 70% of the excavation and 90% of the concrete and masonary work on the weir have been completed. The feeder canal is completed lacking only minor touch-up work.

2. Practically no work has been done on the Meja Modernisation components such as on the head works and the canal system upto the 40 hectares. Only about 30% of the earth work and 52% of the lining has been done to date. Virtually no work has been done on the control and safety structures.

3. Work has also not been done on the distribution system from the 40 ha to the 8 ha levels. The detailed surveys network planning and the planning for the drainage system remain to be done.

5. Several other critical recommendations and suggestions incorporated in the CWC appraisal report also need to be acted upon.

b) Comments:

Unless the distribution system from the 40 ha to the 8 ha level is planned after the detailed contour surveys of the command and the control and safety structures provided, the whole purpose of modernisation might be lost. The type of lining to be used needs to be investigated thoroughly.

Special economic criteria for selective linning need to be established. Too many rough rules of thumb have been used in decision making about lining on all RMIP sub-projects. No field studies have been done to test assumptions made, therefore, it is most likely that the result will be higher costs.

12. SOM KAMLA AMBA IRRIGATION PROJECT

The Sam Kamla Amba project includes the construction of an earthen dam across river Som, a tributary of the Mehi River. The Dam will be 250 meters long with a maximum height of 21.5 meters. The dam will have four saddle bunds and one ogee shaped spillway 244 meters long and 34.5 meters high. The reservoir will impound 172.8 mcm of water in terms of gross storage capacity and 160.3 mcm of live storage. This life storage is sufficient to irrigate an area of 7724 hectares with cropping intensities of 50% for Rabi and 50% for Kharif. The maximum project flood and routed flood are estimated respectively at 30083 cumecs and 20045 cumecs. A flow of 9545 cumecs is estimated in the design through two main canals which are 19.95 km and 9.69 km respectively in length. An adequate conveyed distribution system is to be fully lined up to the 40 ha block. The 40 ha to the 5.8 ha will be lined on a selective basis.

This project was appraised in 1985 for an estimated cost of Rs. 728.78 million. It was initially scheduled to be completed by 1991-92. While an expenditure of Rs. 168.00 million has already incurred up to June 1986, the revised cost of the project is now estimated at Rs. 729.86 million. The revised completion date is 1995 or 1996.

a) IMPLEMENTATION:

The work on dam construction and its saddles is in progress. About 40% of the excavation 34% of the masonary and concreting work and about 23% of the drilling and grouting have been completed. The embedded parts for the radial crest gates have been received. About 68% of the excavation, 26% pucca works and 9% of the canal lining is reported as completed. The survey and planning of the water courses with contour intervals of 0.25 meter is now in progress. Only 261 of 1405 control, safety or other structures planned only were completed by June 30, 1986.

b) OBSERVATIONS:

This project is still in an early stage of construction. The CWC Appraisal Report recommendations should be followed by appropriate actions. Partial irrigation from the partially stored water will be possible in a few years. The network planning, lined water courses, lined canal system and on farm works with drainage networks need to be planned and implemented now. Advance planning and action are needed to assure adequate agricultural support services. There is ample time to complete this by first water deliveries if steps are taken now. Farmers receiving water for the first time need preparation at least two full years before irrigation begins. This could be started now especially for farmers around wells where demonstrations and training could be done. The GOR/ID must begin to evolve a new approach to building irrigation projects using a bottoms-up and a top-down total approach to assure that components and their facilities are ready to utilize the costly water stored.

ANNEX II

SUMMARY OF EVALUATION OF PROJECT TRAINING

A total of $430,000 was allocated for overseas and local training. Fifty-four professionals were trained in 9 USA short-term courses of about five to six weeks duration probably costing about $ 416,000 by PACD. The in-country training budget was estimated at $ 70,000 and about 381 professionals were trained but disbursements were only $7,271 by June 15, 1986.

Discussions were held with a purposeful sample of these participants during the project evaluation and a two page questionnaire distributed on short notice was returned from 20 participants. Of these, 11 had participated in overseas courses and 9 had participated in a total of 16 project assisted local training courses. Though this sample is too small from which to draw firm conclusions the information obtained is summarized below:

Table 1: Rank and Number: Who received no training prior to USAID assisted training.

Type/Rank	No. Reporting	No training 10 years prior to USAID assisted project*
Supt. Engineer	1	1
Exec. Engineer	6	5
Asst. Engineer	7	5
Junior Engineer	4	4
Agricultural Prof.	2	1
	20	15

Table 2: Participants Views of How Training Benefited Them in Present Job.

Perceived Benefits	Times Mentioned	
	Overseas training	In-country training
Understanding IWM	5	3
Planning and Design of Drainage systems	4	-
Design of on farm distribution system	2	3
Understanding of how to work with farmers	1	2
DA methodologies and interdisciplinary team work	4	6
Learned importance of quick decision making and good management	1	-

*It is significant that of these professionals of three professionals with 12 to more years of service about 80 percent had received no training prior to this USAID assisted training.

Table 3 Quality of Overseas and Local Training

Participants	Overseas courses					Local courses					
	VG	G	F	P	VP	VG	G	F	P	V	P
Supt. Engineers			1								
Executive Engineers	3	1					1				
Asst. Engineers	4	1	1			3	1				
Junior Engineers						1	1				
Agri. Professionals						2					

Note: VG is very good; G is good, F is fair, P is poor and VP is very poor. Of these 20 professionals all but three would recommend these courses to others of the same rank.

Table 4: Specific Types of New Skills, Knowledge and Attitudes Acquired From Training.

	Times mentioned
New Skills	
Design of chak networks	5
Use of small hand calculators	4
How to work on a team	3
How to analyze field problems	4
How to do quality lining	2
How to apply water to crops	3
New Knowledge	
About new technologies	7
About IWM	6
Role of Irrigation in Agriculture	2
Importance of farmer Involvement	4
New Attitudes	
Professionalism for IWM	8
Positive view of farmers	5
Role of IWM for India	4
Role of attitudes in design	2
Importance of continuous learning	1

Table 5 Perceived Future Training Needs Overseas and In-country

A. Type of Training Overseas	Supt.	Exec.	Asst.	Jr.	Agri.
Planning and Design of Irrigation systems		2		1	
On-farm Water Management		2	2		1
Water Measurements on Farm			1		1
Computer applications to Design		3	2		
Construction Management	1				
Irrigation Water Management		1			
Role of Extension and Farmers in IWM			1	1	1

B. **Perceived Future Training Needs (In-country)**

Type of Training	Times Mentioned In-country Training
How to improve construction	3
How to formulate crop water requirements, improve irrigation efficiencies, measure losses	5
How to better design canals and farm structures	2
How to do Irrigation Scheduling	1

Note: The primary in-country training was diagnostic analysis, construction quality control, network planning and design and farmer involvement. Overseas courses were: on-farm water management; design and evaluation of irrigation system; problems of irrigation; drainage and waterlogging; and study observation tour, irrigation policy analysis, and economic analysis.

Table 6: Utilization of This Training on USAID Assisted Projects

Rank/Type	USAID Projects	Number Responding other projects	No use
Supt. Engineer			1
Executive Engineer	6		2
Asst. Engineer	2	2	
Junior Engineer	2	2	1
Agri. Professional		2	
Totals	10	6	4

Summary of Findings

1. Of the 20 professionals interviewed 16 reported that the USAID training was the first they had received in 10 years of service.

2. The focus of most of this training was in the general field of IWM below the outlet which was an innovation of the RMIP.

3. The quality of training was perceived as fair to good and those completing the survey listed IWM and on-farm training as their major needs.

4. Those completing the survey listed a number of new skills, knowledge, and attitudes acquired.

5. Of the 20 professionals in this non-random sample, 10 stated that they immediately utilized the training on USAID projects. Four felt the training was of little use to them.

6. In conversations with Project Officers there was a concensus about the lack of a training plan, the need for more on-project site training, and that the selection of candidates for overseas training was both adhoc and sometimes political.

ANNEX III

Table: Summary of 26 World Bank Irrigation Projects World-wide showing Number with Selected Attributes.

ATTRIBUTES	SELECTED ATTRIBUTES	
	NUMBER OF PROJECTS	PERCENTAGE OF 26 PROJECTS
A. Water Supply Situation		
1. Adequate supply	6	23
2. Reliability of supply	2	8
3. Equitability of supply	3	12
B. Quality of institutional performance fair and good	9	35
C. Training provided in Water Management	6	23
D. Quality of physical infra-structure fair and good	16	62
E. Water Control Structures	2	8
F. Flexibility of design	3	12
G. Farmer Participation		
1. For operations	8	31
2. For maintenance	4	15
3. Acceptance of project objectives	7	27
4. Irrigation discipline	2	8
H. Tactical planning for		
1. Crops and Water demands	5	19
2. Water use on farm	4	15
I. Rehabilitation of new systems		
1. No provision for maintenance in project	14	54
2. Rehabilitation not required immediately after project completion	4	15

Source: World Bank, Water Management in Bank Supported Irrigation Project Systems: An Analysis of Past Experience, by Operations Evaluation Department, April 16, 1981, p.30

ANNEX IV

SUMMARY OF ONE SUPERINTENDING ENGINEER'S WORKLOAD WHO IS INVOLVED WITH THE USAID MEDIUM IRRIGATION PROJECT

Project Designers seldom do indepth analyses of staff availability or workloads of staff for designing or evaluating new projects. Though the designers of the RMIP received a dejure assurance that adequate staff would be available, the evaluation team found that the defacto situation was far different. Not only were there staffing problems throughout the LOP (due to many constraints, i.e. promotions and rapid transfers), but the staff available at the senior and middle levels had workloads which were virtually impossible for them to handle. To our knowledge no project design team of any USAID irrigation project has examined this issue in the depth required. Most PPs seem to assume that existing staff and their workloads will not hold back project implementation schedules.

This brief outline of one senior engineer's work load obtained during the evaluation of the RMIP compares with others completed in other states obtained by a member of the evaluation team.

1. Administrative Responsibilities:

a) Project/Works	Number New	Number Existing
Medium	1	15
Minor	8	200
Drough prone	20	280
TOTAL	29	595

b) Staff TYPES	Number
Executive Engineers	6
Assistant Engineers	25
Jr. Engineers/Diploma	100
Ziladar and Patwaris	41
Drivers/Equip. operators	62
Work charge	1,000
Labor	30,000
TOTAL:	31,234

c) Major Equipment		Number
Trucks		20
Tractors	20	
Dozzers		2
Cars/Jeeps		18
Compressors		2
TOTAL:		62

2. Financial Responsibilities:

a) Annual budget of 4 crores of rupees.
b) Collection of about 30 lakhs of rupees
c) Payments

3. **Legal Matters:**

a) **Related to contracts and violations**
b) **Labor disputes and inspectors of labor**
c) **Land acquisition problems**
d) **Problems of forest in submergence areas of projects**

4. Public Relations:

a) Meeting politicians and Ministers on visits to the area
b) Meeting and resolving problems with Panchayat and Pardhan village leaders
c) Entertaining political workers
d) Resolving staff transfer problems, payment issues etc. where political workers enter the picture.
e) Meeting with cultivators
f) Representing ID at special functions and committees in the area
g) Entertaining VIPs (GOI, GOR, Politicians, World Bank, USAID etc.)

Summary of an Average Work Week:

Item	Time Spent (hours)
Public Relations	15
Administrative matters	15-16
Financial matters	1
Legal matters	1-2
VIPs	1
Travelling	16-20
Technical work	5-6
TOTAL FOR A WEEK:	54 to 60 hours

Other profiles completed in Madhya Pradesh indicate that the typical Executive Engineer who is closer to the Project operations have workloads of 60 to 70 hours per week. It is evident from these profiles that a typical Supt. Engineer is able to devote only about 10 percent of his time to technical activities. It is estimated that Executive Engineers devote only from 15 to 20 percent of their total work time to technical matters.

ANNEX V

Water! God's or Farmers'? Water is Power - Get it to Farmer's Fields

(From Janju, Udaipur No: 9, September 22, 1984)

(Chittorgarh: Sept 21)

In India, the first farmer involvement action workshop is being held at Chittorgarh, Rajasthan, for five days. Dr. Max Lowdermilk of the United States Agency for International Development, stated that the purpose of the workshop is to create awareness and understanding of the fact that Irrigation and Agriculture Departments are partners in the process of making sure that there is a reliable supply of water and efficient use of water to improve agricultural production.

The workshop focused on the improvement work of the Gambhiri irrigation project and all workshop field exercises were conducted on this project. Lowdermilk, speaking in Hindi, stated that Engineers should take the lead in helping to build closer bradari relationships with farmers. He cited that without farmer participation improved irrigation agriculture is not possible. He discussed the fact that farming is one of the world's most complex business there is. The old approach of engineers blaming farmers and farmers blaming engineers, is a useless exercise. He cited cases in Sri Lanka, Pakistan, Phillipines, Thailand and other countries where farmer participation is gaining importance. Where there is no reliable supply of water, farmers can do little. They need to have a place to take their problems and obtain solutions to them.

Dr. Lowdermilk cited the Rigveda as providing a set of values about the importance and value of water. India is a great democracy and the agricultural community is the pillar of this democracy. Engineers and agricultural professionals need to work with them more and give them more attention and respect.

In the closing session, Shri L.N. Laddha, Secretary of Irrigation, Rajasthan, stated that new ways need to be evolved for identifying and solving farmers' irrigation problems. Shri G. C. Kanjolia, one of the coordinators of the workshop stressed that farmers and engineers must learn to conserve water and reduce the damaging waterlogging.

Shri K.C. Kang, the other coordinator of the program, stated that participants came from Maharashtra, Madhya Pradesh , Gujarat, Rajasthan, and Tamil Nadu for this workshop. "This is the first such workshop in India to my knowledge" stated Shri Kang. Mr. Kang went on to say that he hoped that Rajasthan would be the first state in India to demonstrate that farmers will participate effectively in improving and managing irrigation systems. We believe that farmers should be involved in canal irrigation projects.

ANNEX V

Irrigation Department Begins in Chittorgarh, Rajasthan
(Prabhavit, Bhilwara, Rajasthan, September, 18, 1984)

(Chittorgarh: Sept. 17)

A five-day farmers' participation workshop in improved irrigation management was inaugurated today in Chittorgarh. The chief guest who inaugurated the workshop was Shri Rao Kessi Singh, a local farmer of Bassi village, District of Chittorgarh.

In the opening, Dr. Max K. Lowdermilk, speaking in Hindi, stressed the need for farmer participation which is often a missing component of most irrigation projects. With active farmer participation on many systems the utilization of water can be more effectively utilized. He mentioned that in the typical village, farmers do feel a real ownership in their roads, temples, pumps and other collective goods. Farmers need to have a sense of ownership in water as well. As we begin to allow farmers to participate in their irrigation systems, we must provide them solutions to their priority problems. Until there is a safe and reliable supply of water, it is unlikely that there will be any environment for effective farmer participation in either the management or maintenance of a typical irrigation system. It needs to be realized that at the chak level, it is the farmers, who have the real knowledge. There is a need from the departments which serve farmers to the universities for professionals to learn from farmers. He stated that the best degree he ever obtained was what he learned working with farmers in their fields.

If engineers and agricultural professionals could learn how to work effectively as partners with farmers, one day India would lead the world in agriculture .

Director G.C. Kanjolia of the Kota Irrigation Management Institute stated that the available water for irrigation is not being properly utilized. There is a dire need for improved utilization of water on all our systems.

Additional Chief Engineer, Shri G.C. Kang of the Bhilwara Irrigation Department, in referring to the Puran Somriti of the Vedic period, stated that at that time farmers had an important role in water management and the distribution of water. Mr. Kang welcomed the participants of the workshop.

Shri Rao Kessi Singh paid tribute to the progress of farmers and engineers on the Gambhiri project.

JOSHI FOR OPTIMUM USE OF WATER

From: TIMES OF INDIA - JAIPUR, JANUARY 11, 1986

The chief minister, Mr. Harideo Joshi, has called upon irrigation engineers and agriculture experts to suggest ways to ensure optimum use of limited water resources of the state through scientific management.

Inaugurating a two-day state-level seminar on farmers' participation in irrigation management here today Mr. Joshi said in Rajasthan every drop of water was of great significance and this message needed to be spread to every nook and corner of the state.

The chief minister said while some areas suffered from water-logging caused by seepage in other parts crops were damaged for want to irrigation facilities. He emphasised the need for maximising utilization of available water and minimising the wastage.

MAJOR PROBLEM

The chief minister said of 264.10 lakh hectares of agricultural land in the state only 154.71 lakh hectares were under the plough. With the full utilization of its own water resources and those made available under the inter-state agreements irrigation facilities should be provided in a total area of 56 lakhs hectares. The major problem of farmers in the State was inadequate and irratic rainfall, he said.

But Mr. Joshi pointed out that despite spending 50 to 60 percent of the plan funds on the development of irrigation and power facilities over the decades an irrigation potential of only 21.34 lakh hectares has been created by March 1985. An additional irrigation capacity of 4.38 lakh hectares was proposed during the seventh plan, he added.

The chief minister said huge capital investment was required for generating more irrigation potential but the state's resources were limited. He questioned whether the capital invested in the past had provided the desired benefits to farmers and said returns had not been up to the expectations.

Departing from the prepared text he said even priorities for the distribution of available water had to be shifted depending on the exigencies. Normally, agriculture got priority over the industry. But in times of scarcity and drought water for drinking purposes got the top priority.

Mr. Joshi said that since water provided by the gravitation canals was cheaper than that made available through lift irrigation schemes, the involvement of agricultural agencies also acquired significance. Agriculture experts should evolve better know-how and agronomic viable in command areas of lift irrigation schemes.

The irrigation minister, Mr. Gulab Singh Shaktawat who presided over the seminar said that about Rs. 1,500 crores had been spent on the development of irrigation facilities in the state during the past 30 years. A target of extending such facilities in 35 lakh hectares has been fixed. Nearly Rs. 400 crores would be spent on it, he added.

Expressing concern that despite such huge capital investment in the past, the achievements has been much below targets. Mr. Shaktawat laid stress on checking loss of water due to seepage.

Mr. Shaktawat said at present the irrigation department was responsible for construction operation and maintencance of irrigation projects. He asked the participants to explore whether construction aspect could be separated from operation and maintenance for better and efficient management of the existing potential.

Earlier, Mr. G.C. Kanjolia, Director of the Kota-based irrigation management and training institute stressed the need for involving farmers in decision-making, planning, designing, implementation operation and evaluation of irrigation projects.

Presenting his theme paper, Mr. Kanjolia suggested the setting up of irrigation problems redressal committees at the sub-division level and water-users associations at the panchayat level for involving farmers in the water management process.

Welcoming the guests and delegates, the Irrigation Secretary, Mr. L.N. Ladha said irrigation played an important role in safeguarding the interests of farmers.

Mr. Ram Jain, Joint Director irrigation management and training institute which is organizing the seminar, proposed a vote of thanks.

Over 150 officials from various state departments farm experts from Rajasthan and other states and nearly 30 farmers from the state are attending the seminar.

Annex IV

LIST OF PERSONS CONTACTED

Government of Rajasthan

1. Mr. G.C. Kanjolia, Chief Engineer (Irrigation,, Jaipur.
2. Mr. R.C. Agarwal, Executive Engineer (Irrigation), Jaipur.
3. Mr. R.K. Sharma, Additional Chief Engineer (Irrigation), Udaipur.
4. Mr. U.R. Mehta, Agriculture Economist, Agriculture Department, Jaipur.
5. Dr. S.P.Tomar Agronomist, Agriculture Department, Hanumangarh.
6. Mr. A.M. Mathur, Deputy Director, Agriculture Dept. Chittorgarh.
7. Mr. J.P.G. Acharya, S.E. (Irrigation), Udaipur.
8. Mr. P.L. Roongta, S.E. (Irrigation), Bhilwara.
9. Mr. M.L. Mehta, IAS. Commissioner (Tribal Welfare), Udaipur

Irrigation Management Training Institute, Kota

10. Mr. B.D. Gupta, Director
11. Mr. Dulip Singh, Joint Director
12. Mr. Amar Singh, Joint Director
13. Mr. Robinson, Deputy Director and other staff members

RMIP Sub Projects

A) WAGON

14. Mr. P.S. Rathor, E.E.
15. Mr. C.S. Bapna, A.E.
16. Mr. R.C. Shrivastava, A.E.
17. Mr. S.L. Kalal, A.E.
18. Mr. M.L. Kansara, A.E.
19. Mr. A.L. Jain, A.E.
20. Mr. Lal Bucker, Farmer

B) Bassi

21. Mr. Hanuman Singh, Farmer
22. Mr. J.S. Chhajer, E.E.
23. Mr. M.C. Jain, A.E.
24. Mr. C.S. Mehta, A.E.
25. Mr. V.P. Agarwal, A.E.
26. Mr. Surender Roy, A.E.

C) Gambhiri

27. Mr. O.P. Shingal, E.E.
28. Mr. R.P. Tiwari, A.E.
29. Mr. R.L. Bansal, A.E.
30. Mr. Madan Lal Kumawat, Patwari,

D) Kothari

44. Mr. D.D. Derashri, E.E.
45. Mr. K.L. Dhakar, AEN
46. Mr. V.K. Jain, AEN
47. Mr. R.K. Katara, AEN

E) SomKagdar

31. Mr. D.S. Mathur, E.E.
32. Mr. C.P. Bhadiya, A.E.
33. Mr. V.P. Bhanderi, A.E.
34. Mr. G.C. Mathur, A.E.

F) Chhapi

48. Mr. M.P. Jain, E.E.

G) Bhim Sagar

49. Mr. S.C. Vijay, E.E.

G) Sawan Bhadon

35. Mr. G.C. Sharma, E.E.
36. Mr. R.P. Chabbra, A.E.

H) Bilas

50. Mr. D.C. Sood, E.E.
51. Mr. C.B. Lokwani, E.E.

I) Panchana

37. Mr. K.L. Nyati, S.E.
38. Mr. S.K. Bakliwal, E.E.
39. Mr. S.K. Rawat, A.E.
40. Mr. P.S. Gupta, A.E.
41. Mr. D.K. Sharma, A.E.
42. Mr. K.C. Pathak, A.E.
43. Mr. M.L. Vehar, A.E.

52. Mr. D.K. Misra, A.E.
53. Mr. S.V. Gupta, A.E.
54. Mr. B.P. Bansal, A.E.
55. Mr. K.L. Sharma, A.E.
56. Mr. P.N. Bansal, A.E.

USAID

57. Mr. Robert V. Thurston, Chief IRRAG, USAID
58. Mr. N.A. Dimick, Dy. Chief, Field Operations, Office of Irrigated Agriculture, USAID, New Delhi
59. Mr. D.R. Arora, Dy. Chief, IRRAG, USAID, New Delhi
60. Mr. J.R. Khanna, IRRAG, USAID, New Delhi

Farmers Contacted

A total of 44 farmers were contacted for discussions during project site field visits at Wagaon, Gambhiri, Bassi, Kothari, Somkagdar, Panchana and Bhimsagar projects.

Annex VII

SCOPE OF WORK

THE STATEMENT OF WORK

I. General

No previous major evaluation was undertaken for this project. Instead of the scheduled mid project evaluation planned in the PP for about 30 months after the Project Agreement. Only an interval mission review was done in 1983. The mission prepared three scopes of work for the Indian Professionals on the evaluation team. The information below is taken from these scopes.

1. Evaluation Team Leader

"This evaluation will be designed and conducted to include, but not limited to, project design issues, implementation (project input delivery) progress and problems, institutional issues and problems, physical infrastructure progress, the attainment of other end-of-project outputs, the planned and actual budgetary support, and issues related to project disbursement and reimbursement procedures."

In addition the Team Leader is responsible for the evaluation design, logistics, and preparation of the final report.

2. Irrigation Engineer

"The focus of evaluation will be on determining the extent to which the design elements, implementation performance and project outputs originally envisioned have been accomplished, with special emphasis on institutional and implementation issues. A broad assessement of the validity of assumptions and estimated outputs will be made and the principal factors which give rise to over and under estimation will be indentified. The other purpose is to draw some general conclusion which can help guide and strengthen future AID programming and design for future irrigation projects in India."

"Examine the issues, assumptions and performance related to such matters as the system hydrology, the physical infrastructure and its construction, operation and maintenance, water distribution effectiveness and efficiency both above and below the outlet, and institutional roles and capabilities related to system management."

3. **Economist**

A general evaluation will be made of the kinds and usefulness of the data, assumption and methodology used in prepraing the economic analyses for the schemes including under the Rajasthan Medium Irrigation Project. A broad assessment of the validity of those assumptions and estimates will be made and principal factors which gives rise to over or under specific improvement will be recommended.

The economist will prepare a written report which covers the following areas:

1. "A general review of the methodology, types of data and major assumptions used in conducting the economic analyses for the schemes in Rajasthan Medium Irrigation Project.

2. "A critical analyses of the validity of the types and appropriateness of the data employed and of the major assumptions used, including but not restricted to those related to inflation and cost increases, duration of construction, and of the timing and magnitude of the stream of benefits.

3. "Identification of any other major factors which undermine or weaken the validity, usefulness or conduct of the economic analyses.

4. "Specific recommendations for improving the economic analysis activity, including but not restricted to the choice of methodology, the data employed and the assumptions regarding costs, timing and benefits."

The USAID direct hire professional accompanied the evaluation team because the FSN Project Officer died suddenly on April 19, 1986. He was provided no scope but assisted the team in various ways. He was assigned the responsibility of assessing the use of grant funded software activities by the team leader. He also was asked to prepare various tables and materials for the Report. Since a 30 day contract period was not adequate for all the writing and final editing, Max K. Lowdermilk was given this responsibility assisted by D. R. Arora in the final review of the draft review.

USAID specifically requested the team to "draw general conclusions from the evaluation which can help guide and strengthen future USAID programming and design for the future irrigation project."