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386-0489

REVIEW OF THE HILL AREAS LAND AND WATER DEVELOPMENT PROJECT

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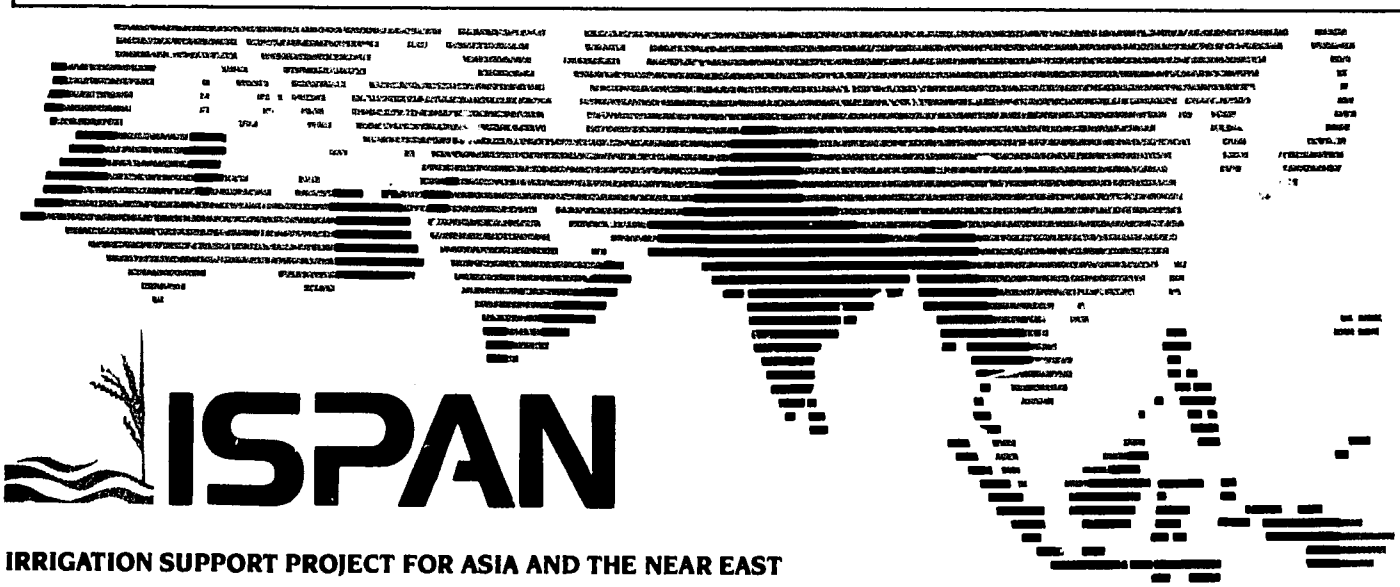

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REVIEW OF THE HILL AREAS LAND AND WATER DEVELOPMENT PROJECT

October 1988

by

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Prepared for the Office of Irrigation and Water Resources,
U.S. Agency for International Development
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EXECUTIVE SUMMARY

The Hill Areas Land and Water Development (HALWD) Project has had a major positive impact on irrigation development in the State of Himachal Pradesh and has considerable potential to resolve specific water and land use problems. Several critical actions are required to improve its technical quality and economic viability. The pace of scheme development should not increase and new schemes should be selected with greater emphasis on technical considerations and include watershed planning. Special training and research programs are needed in water management techniques appropriate to hill area conditions and requirements. Successful project implementation and management require the support of a substantial contract team of appropriate technical specialists.

Achievement and Impact

Although implementation has been slow at the start there is clear evidence of significant impact and progress toward realization of the project's potential. The project has had a major impact on irrigation design in the state. Evaluation of scheme investments, scientific determination of water requirements, distribution system planning, working relationships with users, and establishment of irrigation as a profession are significant changes in the state which have been introduced by the project. The potential also exists for broader, high impact efforts in related watershed forestry and conservation interventions. However, there is little institutionalization of these changes due to very slow progress in technical training, socioeconomic analysis, technology adaption and system research activities.

Economic Viability

Although there are indications of high returns to irrigation in Himachal Pradesh, the internal rate of returns (IRRs) of some of the surface water high lift schemes appear questionable due to high capital and recurrent costs (particularly for the increasing numbers of high-lift pump systems). Furthermore, given the low charges for water and particularly high operating costs, the recurrent costs to the State of the project investments will become increasingly burdensome. Three steps may resolve the economic questions: (1) technical selection of

optimal, less difficult sites, (2) increased community/farmer control and responsibility, and (3) ex-post analysis of actual benefit streams.*

Funding Requirements

All projections indicate that the project is substantially over-funded given its timeframe and the size and experience of the implementing departments' cadre. Options for the remainder of the project range from completing as pilots only those schemes already committed (approx. $20 million) to continuing with more schemes in an extended timeframe with concentration on watershed protection and the addition of the development of a major institution (approx. $45 million). The current commitment to the state and the obvious impacts and potential argue strongly for an option which strengthens and extends the project's activities. At the same time, the large number of schemes planned should be reduced and a necessary emphasis placed on the critical elements of planning, training, analyses, applied research and feedback monitoring.

Implementation Capacities

The substantial management demands of the project are due less to its apparent complexity than to the very limited staffing, technical and institutional resources in the State in relation to the project's size and objectives. Successful project implementation will require considerable assistance and support to the State's field staff, Project Cell and universities from a multi-disciplinary team of both U.S. and Indian specialists experienced in resource planning, hydrology, hydraulics, soil conservation, water resources engineering, monitoring/evaluation, in-service training, and rural organizations. Institutional development with these inputs is important. With this supplemental assistance, the project can be managed by the current Irrigation Water Resources and Resource Management staffs.

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* Note: Follow-up studies carried out by USAID/India and private consultants suggest that the IRRs of tube well, tank, and flow schemes are consistently above 12 percent. Many lift schemes (which are an increasing proportion of the schemes selected under the HALWD Project) also appear economically justifiable, but they are associated with comparably higher capital and recurrent costs. Economic viability of lift schemes is particularly dependent upon farmers' willingness to intensify cropping by adopting higher value crops. Electric charges will account for about 80 percent of total O&M costs on lift schemes. (See Analysis of Recurrent Costs and State Budget by Chhabra and Duda, USAID New Delhi, and Economic Appraisal of Some Selected Irrigation Schemes under USAID Hill Area Land and Water Development Project in Himachal Pradesh by Basawan Sinha, Metaplanners and Management Consultants, Patna. Both documents are appendices to this report.)

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ACRONYMS

AD	Agriculture Department
CCA	Cultivable Command Area
CD	Chak Development
FD	Forest Department
FIS	Flow Irrigation Scheme
GCA	Gross Command Area
GOHP	Government of Himachal Pradesh
HALWD	Hill Areas Land and Water Development Project
HD	Horticulture Department
IPH	Irrigation and Public Health
IRR	Internal Rate of Return
IWR	Irrigation Water Resources
LIS	Lift Irrigation Scheme
O&M	Operations and Maintenance
PACD	Project Assistance Completion Date
PIL	Project Implementation Letter
PP	Project Paper
RB	Road and Bridges
RD	Rural Development
RM	Resource Management
SE	Superintending Engineer
SLIC	State Level Implementation Committee
TA	Technical Assistance
TW	Tubewell
USAID	U.S. Agency for International Development
WAPCOS	Water and Power Consultancy Services
WST	Water Storage Tanks

ACKNOWLEDGMENTS

The review team is extremely grateful to the Government of Himachal Pradesh officials and staff personnel of the Project Cell, Department of Irrigation and Public Health, Agriculture Department, Horticulture Department, Department of Rural Development and the Agricultural Universities for sharing their insight and thoughts on the USAID/GOHP Hill Area Land and Water Development Project. We also appreciate the interest and comments from the USAID mission staff and in particular the help of Glenn Anders, as well as the contributions of John Grant and Sharon Holt. We wish to especially thank N. R. Banerjee for his patient and timeless efforts to provide us information and to assure that our activity was as successful as possible. We also appreciate the many kindnesses he has shown us to make our visit pleasant. Our most clear finding is that Mr. Banerjee is committed to making this the best project possible. We would also like to recognize the excellent work of Rita Soni and Doris Daniels in preparing this report.

Chapter 1

FINDINGS, RECOMMENDATIONS, AND OPTIONS

FINDINGS

General

1. Although activities in most components are now underway, start-up of the project was delayed more than a year and most emphasis has been placed on construction of schemes and not enough on training, special studies and development of institutional arrangements as planned. Consequently, schemes have been constructed at an accelerated rate, creating significant new irrigation potential. However changes resulting from improved design as a result of planned and required software inputs have not occurred at the anticipated level (exception see 4 and 5 below).

2. Although as a result of this project the budget for irrigation development has increased substantially, the number of professionals involved with irrigation in Himachal Pradesh has not increased proportionally. Consequently the project is out of proportion to the state institutional capacity to implement it.

Scheme Selection

3. Funds for irrigation development are distributed evenly among ten districts. Sites are proposed locally and then given priority by political representatives/officials. Neither comprehensive technical criteria nor a comprehensive land and water resource plan are used for site selection. The potential for technically and economically viable irrigation schemes in the future is yet to be assessed.

Specified Design Criteria

4. The criteria in the Project Paper (PP) requiring calculation of water demand based on estimated crop evapotranspiration is being used and has resulted in a more appropriate and greatly reduced water-to-irrigated-area ratio. This has resulted in more economical designs because delivery canals are not extended beyond the reasonable command area.

5. The criteria in the PP requiring calculation of internal rates of return (IRRs) for each scheme are being followed for the Irrigation and Public Health (IPH) minor schemes. Proposed schemes have ben disapproved primarily because the estimated cost per hectare exceeded the values given in the PP and because the calculated IRR values were less than 12 percent. Projects have also been rejected on technical grounds such as inadequate water supply.

6. The stated PP requirement of farmer participation in subproject design and implementation is seldom met although awareness of the need for such participation has greatly increased and in principle accepted by Government of Himachal Pradesh (GOHP) officials. Although typically farmers are advised that an irrigation scheme is to be built, no farmer input into subproject design has been sought. In some cases farmers were unaware that anything was going to happen until construction started. Pilot efforts are underway to identify strategies to involve farmers more meaningfully.

Implementation

7. Where flow schemes are being developed there is generally some type of khul already in existence. In such cases for IPH schemes, O&M responsibilities are taken over by the government. The design for rehabilitation of existing khuls typically includes major expansion of the command area. Preproject analysis of existing khuls has not been done to determine the potential of existing local organizations, the impact of new development on existing water rights and the like. Potential for greater cooperation between farmer groups and IPH has not yet been exploited. Farmers traditionally pay very little for use of water.

8. The proportion of IPH lift to flow schemes is higher than projected in the PP. High lift schemes are common and associated with relatively high capital and recurrent costs. In some cases the cost of bringing power to the site is a significant portion of the total capital costs. Electricity is heavily subsidized which reduces the direct operating costs of lift schemes to the project. The economic feasibility of high lift irrigation schemes is more problematic than for flow or tubewell schemes.

9. Development of irrigation activities by Agriculture Department (AD) has been slow with only 67 schemes approved and underway. AD staff express a preference to do soil conservation which is a more normal activity for them. Clearly AD, based on performance to date, will not be able to put into place by the Project Assistance Completion Date (PACD) more then a fraction (probably on the order of 15-20 percent) of the some 2000 schemes envisioned in the PP.

Training, Technical Assistance, and Special Studies

10. Training and technical assistance (TA) activities have been initiated but are proceeding very slowly. A major field training and study effort supported by US and Indian specialists is necessary if the objectives related to comprehensive development, agro-ecological stability, and community-based management are to be met. Support and coordination of training and technical assistance will require a full time management unit in Himachal Pradesh.

11. Special study activities on a few topics, including baseline studies, have started in recent months. Action research must be given much greater

emphasis if scheme designs are to be adapted to the hill areas of Himachal Pradesh in a manner that is technically sound, economically viable and socially acceptable. Particular focus must be given to issues of hydrology (e.g., water supply, silt loads, erosion), lower cost technologies, economic analysis, recurrent costs, community-based management, and comprehensive resource planning. Several existing state institutions can assist in special study activities but do not have the capacity or responsibility to carry out most of the required activities by themselves.

Project Monitoring and Management

12. Operational monitoring in the field has been given low priority. Proper monitoring providing feedback on a regular, continuing basis on the effects of project activities will require one or more staff in Himachal Pradesh dedicated full time to this activity. Currently feedback to the Cell leading to learning from experience is minimal because of the very limited exposure of Cell staff to the field sites.

13. The USAID project officer is overloaded with responsibilities and must receive assistance through more and better field-level assistance and help in identifying and implementing TA and research activities. To implement the integrated resource management component, the project officer should be teamed with someone from the Resource Management Office.

Integrated Inter-Departmental Efforts

14. Coordination and cooperation at the district level seems to work well between IPH and Forest Development (FD). At the State level various Secretaries discuss project-related issues and the SLIC meets when needed to give official approvals. The Project Cell operates on a self-contained basis and is not, thus far, a vehicle for inter-departmental cooperation.

    To achieve better inter-departmental cooperation at the State level, a Technical Appraisal Committee represented by CE/Project Cell, Director/AD, Chief Conservator of Forest, Director/Horticulture should be established. This committee should regularly review the planning processes for selection of Schemes, appraisal/approval of designs and estimates of subprojects, prescribe guidelines, and monitor the progress of project development activities throughout the State. Other members (e.g. Engineer-in-chief, Zonal Chief Engineer, SE/Planning and Monitoring of IPH) as appropriate should also be represented in this committee.

15. The concept of an integrated approach to development and management of a watershed as a resource unit needs to be introduced and institutionalized. The only apparent coordinated approach to date is the addition of FD activities to 21 previously approved IPH schemes. These generally have low budget levels, sufficient only for a partial response to watershed protection.

Recurrent Costs

16. Because of the relatively larger number of lift schemes being constructed we expect recurrent costs to be greater than the cost estimated in the P.P. Current scheme development decisions could place heavy demands on future State recurrent budgets for operation and maintenance.*

Institutional Capacity

17. There is no institution in the State with the capability or mandate to collect and analyze the land and water resource data needed for comprehensive development planning.

18. There is no institute for engineering technology in the State (or any other of the Himalayan States) with the capability to deal with mountainous environments.

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* Note: The USAID follow-up study carried out by Chhabra and Duda found that the State has made budgetary provision for recurrent costs in its non-plan budget through 1994. (See Appendix D).

RECOMMENDATIONS

Site Selection

1. Scheme selection should be based on a priority-setting planning process that gives greater consideration to technical and economic aspects even if the process results in an unequal distribution of schemes throughout the state.

2. Selection of future schemes should focus, to the extent possible, on watersheds, within which:

   - IPH would construct/upgrade an irrigation scheme requiring relatively low costs, or if high cost, demonstrated high benefits,

   - The Forest Department would undertake slope protection activities both above and below the Cultivatable Command Area (CCA) as needed,

   - The Horticulture Department (HD) would bring in horticulture crops within the Gross Command Area (GCA),

   - The Agriculture Department (AD) would carry out soil conservation and extension efforts with the farmers in the watershed.

3. Where groundwater is readily available, IPH and AD should be encouraged to continue with tubewell schemes.

Design Criteria

1. IPH activities should be limited to restoring or providing water as far as the farm turnout. Development below the turnout should be the responsibility of farmers with assistance from AD. Consideration should be given to the provision of farm credit for land development. The IPH should cooperate with farmers in establishing water distribution infrastructure and rotational schedules to be operated by farmer groups.

Implementation

1. Data should be collected on the physical, operational and organizational characteristics and water rights of any existing or previously existing irrigation khul and this information should be incorporated into the new scheme design.

2. Previously approved IPH schemes should be reviewed for the addition of forestry, horticulture, and agriculture components, wherever possible and appropriate.

3. AD should be encouraged to undertake soil conservation activities primarily within selected watersheds, with approval on a case-by-case basis for micro irrigation and other work in a limited number of other locations.

4. Farmers should be actively involved in the subproject planning, design and implementation stages. Farmers should be entrusted with the responsibility of O&M of the system below the outlet. They should also be encouraged to protect/manage the watershed and headworks and other works of the system above the outlet. Farmers should be required to pay a substantial portion of O&M costs.

   The Liaison and Coordination Unit should provide active support in establishing these on a sustained basis.

Training

1. A broad range training activities (as foreseen in PP for the first two years of project implementation) are critical for professional development of GOHP staff. These should receive priority and start not later than October 1988.

2. In-country training programs (e.g., action training, short technical courses on farmers participation/involvement, etc.), although initiated, need to be intensified to the level proposed by USAID to GOHP. The training should be conducted in the field (in Himachal Pradesh) on actual locations, but will probably require instructors from outside Himachal Pradesh.

3. Selected professionals should also be sent for overseas training to gain a better perspective of the opportunities and options available for use in developing land and water resources of the State.

Research and Applied Studies

1. Action research and applied field study activities are required to address problems that are being faced in scheme design related to hydrology, technology adaptation, cropping patterns, economic analysis, and O&M. These activities in some cases will include systematic review of currently developed schemes. These studies will require assistance from individuals and institutions outside of Himachal Pradesh.

Project Monitoring and Technical Assistance

1. A monitoring capacity of the type envisioned in the PP should be established within the Project Cell which will require staffing with one or more professionals at the executive engineer level. The monitoring function is to provide, in addition to regular reporting on construction progress and funds expenditures already being obtained by the Cell, constant feedback on the effects of project activities on 1) improved agricultural and horticultural production; 2) slope and watershed protection and stabilization; 3) operation and maintenance of irrigation delivery systems; and 4) the involvement of farmers and communities in the management and use of irrigation resources. Technical assistance will be necessary to serve as a catalyst to begin this type of monitoring and for implementation of this critical function.

2. Technical assistance on a continuing basis, some resident in Himachal Pradesh, should be provided in the areas of on-farm water management, community-based management, watershed management, project monitoring and organization/conduct of training and research programs. It is understood that the first three specialists are to be provided under the existing contract with Sheladia. The latter two should be provided in a manner similar to the "Liaison Coordination Unit" being used for the Madhya Pradesh Minor Irrigation Project. The Liaison Coordination Unit would serve both in a catalytic role to help get monitoring and training activities functioning and provide resource persons in guiding the organization and implementation of these two activities.

Project Management and Fund Disbursement

1. For well-coordinated and high-quality project management, it is necessary to develop the monitoring and training capabilities within the project cell and establish a technical resources group of expert consultants which can provide technical assistance and support to project cell staff. This will eventually reduce the work load of the USAID Project manager as capacity develops within the project cell. Given the recommended broader view of HALWD towards integrated water management, there should be more coordination between IWR and RM within USAID.

Institutional Strengthening

1. Consideration should be given to allocating resources to develop an institutional capacity in Himachal Pradesh to collect and analyze land and water resource data (including time series data) that could be used for comprehensive planning of development.

2. Consideration should be given to allocating resources to develop an institutional capacity to train engineers and other technical specialists to deal with technical and resource development in mountainous areas.

OPTIONS

1. The following options describe possible scenarios for the further implementation of HALWD. It is assumed that the grant of $4 million will be required for essential training and research no matter which path is chosen for the project. The table below provides general guidance as to probable levels of loan funds required by each Department to carry out the project under each different option.

2. It is the judgement of the review team that the project has made significant beginnings in several areas and that it should be continued until at least its current PACD. We feel that the completion of previously planned but, as yet, unprovided research and training along with a change in the focus for site selection will permit the construction and implementation of a significant number of sites that can both fulfill the original intent of the project and serve as living demonstrations of viable approaches to development and management of hilly areas. The review team favors moving toward attainment of the original project objectives albeit at a somewhat reduced number of sites. However, it may also be possible to focus only on development of a limited number of irrigation facilities for the remainder of the Project with no further attempt to attain the other objectives of the Project.

Option A

For the remaining life of the project concentrate on IPH irrigation schemes under current guidelines with no additional activities in agriculture, horticulture, forestry or rural development after September, 1988.

Option B

Adopt the recommendations in this review which center on future choice of sites which can demonstrate integrated development of watersheds, the upgrading of staff capacities through training programs and the initial stages of gathering basic data through research programs. Even with the PACD unchanged at 9/91 we believe that sufficient progress can be made in the 3-1/2 years remaining to provide a clear demonstration of hilly lands development on at least 20-30 sites.

Option C

This option is Option B with a two-year extension of the PACD to 9/93. This would give sufficient time to more fully institutionalize the process of hilly land development and the adoption of more rational land use patterns in such areas.

Option D

This is essentially the same as Option C with the addition of a major effort to establish an institute for hilly areas to develop a capacity to carry out both research and training. The addition of such an institute would represent a significant addition to the original concept of the project and would require assistance well beyond the PACD. The team is unable to provide an estimate for the probable costs of such an institute but suggest a range of $5-10 million.

Table 1

Funding Requirements for Loan Funds for Each Option
(in $ Mil)

	Option A	Option B	Option C	Option D
PACD	9/91	9/91	9/93	9/93
No. of IPH Schemes	187	150	210	210
IPH	$16.3	$13.9	$18.7	$18.7
CELL	1.8	1.8	1.8	1.8
AD	1.0	4.2	6.4	6.4
RD	0.5	1.3	1.3	1.3
HD	0	2.2	3.0	3.0
FD	1.0	7.0	10.0	10.0
Total Loan	$20.6	$30.4	$41.2	$41.2
Hill Land Inst.				5-10
Grant	4.0	4.0	4.0	4.0

Assumptions

1. No construction sub-project to be approved less than one year prior to PACD to permit sufficient time for completion.

2. Number of IPH schemes are approximately 90 approved at present with an additional 100 to be approved under Option A, 50 additional under B, and an additional 120 under Options C and D.

3. IPH schemes are assumed to remain at the current average level of $87,000 per scheme.

4. AD schemes are assumed to remain at the current average level of $11,000 per scheme with 200 schemes completed under Option B and 400 schemes under Options C and D.

5. HD and RD are continued at the PP budget levels.

6. FD - the cost of each scheme is increased from the current level of $11,000 to $70,000 to allow more complete development than is currently possible. They will be carried out on 2/3 of all TPH schemes. (Tubewell schemes will not need FD work since steep slopes are not normally a concern).

Chapter 2

BACKGROUND

2.1 Project Goals and Objectives

The Project has two broad goals of improving land and water resources and introducing new approaches to land and water development.

2.2 Project Components

The HALWD project is to create about 23,000 hectares of new irrigated area. Of the total, 15,000 hectares are to be in minor schemes built by IPH; 7,700 in micro schemes constructed by AD; and about 2,000 in currently existing Rural Development Khuls. In addition to the creation of new command areas, emphasis was to be placed on chak development including improved water management. The project contains components for afforestation, erosion control and horticulture.

In addition to the components aimed directly at physically improving land and water resources other components of a less direct nature are considered essential to the success of the overall project. These components included coordination of agency support, human and institutional development, research and technology adaptation, and community-based management of schemes.

2.3 Compatibility with Mission Strategy

The HALWD project was conceived as a comprehensive program to integrate land and water development but with a clear focus and emphasis on irrigation. Forestry, agricultural, and horticulture activities were all seen an supportive and protective of the irrigation system investment. The current HALWD approach gives more importance to balanced and integrated land and water resources development. Present Mission strategy would be more apt to view watershed management activities holistically rather than only to protect the irrigation investments.

Many of the design criteria in the PP and much of the technical assistance focuses on providing reliable water to the turnout level. These efforts are consistent with an emphasis on "looking upstream" or main system management, although the small scale of the schemes suggests that reliable delivery may not be as problematic as it is with the medium and large Indian schemes.

The mission has attempted to develop a disbursement strategy based primarily on performance criteria rather than just completion of construction. The HALWD Project uses such a performance-based disbursement process.

Chapter 3

PROJECT IMPLEMENTATION

3.1 State Level Implementation Committee

The implementation plan was designed such that high level decisions were to be taken and coordination done by the State Level Implementation Committee (SLIC) made up of administrative Secretaries of the concerned Departments. SLIC is responsible for approving work plans and budgets, assuring that adequate staff are deployed, that quality control is maintained, and addressing issues related to effective institutional arrangements and feedback from lessons learned from studies and project experiences.

The Land and Water Development Cell (Project cell) was established to provide technical and administrative support to the State Level Implementing Committee. The Project Cell is to prepare guidelines, review scheme proposals, and monitor project implementation. It is also responsible for assessing training needs and coordination of special studies and programs for technology adaptation.

The actual planning and design of schemes is to be done through existing units under the administrative control of the various Departments.

Sub-project committees are responsible for the detailed work plan for each scheme which is to include a calendar of operations and identification of opportunities for community-based participation.

Actual implementation of the project was delayed 12 or 18 months from the schedule in the project paper. Perhaps more significant however, the items listed in the schedule for project implementation have not been carried out in the order planned. The project was designed such that special studies, technical assistance, and training would be given heavy emphasis early in the project so that the results of these would be most effective later in the project when scheme development was at its peak. Unfortunately, all three of the above components have been delayed. Several baseline studies and applied research activities have been identified or undertaken within the last six months. The first U.S. technical assistance team began to provide input to the project only recently. Some in-country training has been done and 10 to 15 staff will be sent for training outside of India in the next few months.

The SLIC has met an average of three or four times per year to approve budgets and work plans but has not been able to deal in general and in a continuing manner with matters related to staffing, monitoring, and feedback of lessons learned. The Project Cell has provided technical and administrative assistance to the districts. Most staff time in the Cell is devoted to review and modification of scheme plans submitted by the district level staff.

3.2 Project Cell

The functional location of the Project Cell within IPH does influence inter-department coordination in the sense that Departments other than IPH tend not to give the HALWD Project high priority. The executive engineers in the Cell feel, in particular, that district personnel from other Departments do not give the emphasis necessary to the project to assure that complete and quality information is sent to the Cell. They feel that often the most junior staff are assigned the task of collecting data and doing initial designs.

The approval process for schemes, training, staffing and other matters have caused the Secretaries representing the various Departments to communicate about irrigation issues much more than they did prior to the project.

The staffing of the Cell seems to have been done on the basis of perceived needs, with most of the need being to design and implement schemes. The prescribed technical and economic design criteria required that the Cell include IPH design engineers and a few staff from the other involved departments. The staffing of the Cell is not yet at the level prescribed in the project paper. The three executive engineers are pivotal to most of the Cell's activities. These three do the design reviews and modifications before sending schemes to the Chief Engineer for approval. They have divided the state among themselves so that each has about three districts. Each of the Executive Engineers also carry duel roles that were anticipated in the PP to be assigned to separate units within the Cell. These roles include monitoring, training, and feedback of special studies and lessons learned from implementation. The three executive engineers state frankly that they prefer design activities and feel that the other required activities dilute their effectiveness. Our assessment suggests that attention to non design activities is minimal.

The non-engineering group is somewhat isolated from the IPH engineers. There seems to be a minimal amount of interaction between the agricultural, forestry, and rural development people and the IPH staff. Each seems to have a fairly well defined role in the design of schemes and therefore each person does his task and passes the results on to the executive engineer responsible for that scheme. We found the non engineering staff, in general, to be less pressed for time than the executive engineers.

A mechanism has been created in the Cell to sensitize the IPH staff to issues of soil conservation and agricultural production. IPH has itself, developed a somewhat broader view of irrigation because of the other departmental staff in the Cell. However the operation of the Cell does not optimize the potential for cross-fertilization of ideas. The engineers, more or less, assign agronomic issues to the agriculture staff without taking a lot of time to interact with these people in systematically reviewing at designs. Even with these limitations however, it is clear that the engineers in the Cell have developed a greater appreciation for irrigation as a component of an agricultural system not just a hydraulic system in isolation. Unfortunately none of the Cell staff routinely visit the field to learn from scheme implementation experience, however there are plans to begin doing so.

The Cell was conceived to have two superintending engineers with a compliment of staff under them but only one SE has been appointed. The lone SE has little time to devote to monitoring, evaluation, and training activities. A public relations officer was to be appointed to look after activities involving beneficiary participation. This hasn't yet happened and there does not seem to be plans to create such a position. Separate units to be headed by executive engineers were to be created to deal with monitoring, training, and technology adaptation. These units have not been created.

In summary, the cell staffing is such that it can review field designs and recommend modifications to them. We believe that the engineering and other inputs are carefully reviewed. Monitoring, Evaluation and training activities are given low priority probably due to staff limitations. In general, the Cell staff do things right but there is same question as to whether they are doing the right things.

3.3 District-Level Implementation

Scheme development and other departmental activities at the district level are conducted much as they had been before the USAID project with a few important differences. The HALWD projects require different and more rigorous economic and technical criteria which are being followed in the districts. These criteria tend to be followed "to the letter" but not necessarily in spirit. The broader spin-offs from the required water demand calculations in terms of understanding the agricultural system more completely have not yet occurred to the desired level, because there has been little follow-up to the initial training for doing these calculations. In the same way, the IRRs are seen as end products and not as a first step toward broader understanding of economic considerations.

The interagency coordination at the district level seems quite good. We saw a number of schemes involving both Forestry and IPH. We did not find the AD integrated into IPH schemes, except in the case of collection of soil survey data. We were told numerous times that the USAID project did provide a forum for interagency communication and interaction.

The most profound change at the district level was the increase in funding available to IPH and AD. Funds available to do irrigation development increased in some cases more that five fold with very little increase in departmental staff. Most staff of both IPH and AD at the district level felt that staff limitations were the greatest bottleneck to more rapid development.

Some training at the district level has occurred but this was not comprehensive nor sustained enough to make a major impact. Personnel associated with the project said that they saw a need for more training, particularly in the technical aspects of design. The general feeling at the district level is that farmer participation is important but there is little in-depth understanding of what form this might take or how department activities might be changed to improve local involvement. Some of the district engineers felt that farmers should not be contacted until after construction of the main conveyance structures because they would only serve to slow progress. There was in some

cases, the acceptance that the HALWD schemes would result in IPH assuming O&M responsibilities that were, at least in part, formerly with the local community. A great deal more effort is needed at the district level to institutionalize approaches to planning, design, and construction that will optimize farmer involvement and mobilize local resources.

3.4 Finances and Expenditures

The following table indicates the status, as of 3/31/88, of the numbers and types of activities which have been approved for use of Project loan funding and for which earmarking and commitment has been done. They are divided among the various Departments involved with a further division for IPH into type of irrigation schemes.

Table 2

APPROVED SCHEMES
(as of 3/31/88)

	IPH						
PIL NO.	FIS	LIS	TW	CD	AG	RD	FD
4/7	3	6	4				
8				6	19	2	
9/15	3	9	14				
14							3
16				12	36	5	
21*	4	13	13				
22							10
25					12		
27							8
	10	28	31	18	67	7	21

Subtotal IPH 87

For the subprojects indicated above, the following table provides indicative figures for the cost and size of the various irrigation schemes. FD activities are not included since they are carried out in conjunction with the above type of schemes and do not represent a different type of irrigated area.

*Detailed designs and estimates of these schemes have yet to be approved, only the preliminary/initial appraisals have been approved.

Table 3

INDICATIVE FIGURES FOR IRRIGATION SCHEMES

Type	Cost (Lac Rs)	Size (Has)
TW	8.4	30-40
LIS	28-30	50-100
FIS	18-30	50-100
AG	1.2	6-7
RD	0.6	50

The following tables indicate the amount of loan funds, by participating organization, that have been committed and accrued through 3/31/88, including the percentage of Planned Budget for LOP and the percentage accrued of the amounts committed.

Table 4

U.S. FUNDS (Loan) COMMITTED
(as of 3/31/88)

	IPH	AG	RD	FD	HD	Proj. Cell	Proj. Total
Budget($ Mil)	30.24	12.44	1.32	3.00	3.00	In IPH	50.00
Committed($ Mil)	7.85	0.73	0.02	0.33	0.00	0.69	9.62
Committed(%)	28.00	6.00	1.50	11.00	0.00	In IPH	19.20

Table 5

ACCRUED EXPENDITURE OF U.S. FUNDS (Loan)
(as of 3/31/88)
in $000

	IPH	AG	DR	FD	HD	Proj. Cell	Proj. Total
Accrued* ($000)	3,670	540	20	160	0	240	4,640
As % of Budget	13	4	2	5	0	In IPH	9.3
As % of Committed	46	74	100	48	0	35	48.2

* This figure is accrued expenditures to date including both disbursed and undisbursed funds.

Grant funds for the project have not been shown here in a detailed breakdown as for loan funds per above. As of 3/31/88 approximately 38.6 percent of Total Budget grant funds have been committed and 11.7 percent have been accrued.

3.5 Project Management and Monitoring

According to the Project Paper the Project Cell was to have two Superintending Engineers dividing responsibilities for subproject design, project implementation, monitoring and training. To date only one Superintending Engineer has been assigned and only the design functions of the Cell are fully operational. The Project Cell obtains progress reports on construction activities and on expenditure of funds through regular IPH channels. The Chief Engineer/Project Director and the Superintending Engineer have each made several trips to the field to verify progress and discuss design questions. However the three Executive Engineers who are responsible for the review of all materials received from the District level and the preparation of final subproject proposals have made only three field trips among them (one hasn't been out at all). There are four AD and FD staff assigned directly to the Cell who review and correct, if necessary, the agriculture aspects of subproject proposals (primarily before project and after project cropping patterns and yields for calculation of water requirements and IRR's) and forestry aspects of certain subprojects. Visits to the field on either design or implementation aspects of the Project by AD and FD staff in the cell are rare.

The lack of institutional capacity in the Project Cell for monitoring of qualitative aspects of project activities or for organizing and managing training and research activities have placed an undue burden on the USAID Project Manager, particularly in view of the large number of potential sites scattered through a terrain where access is difficult and time-consuming. In addition to the normal spot checks in the field to verify physical progress and fund expenditures the USAID manager has essentially taken on all of the missing management aspects of the Project Cell indicated above. Without his inputs there would basically be no research or training taking place and very little understanding or information about the qualitative aspects of the project.

Chapter 4

DEPARTMENT ACTIVITIES

4.1 IPH Schemes

There have been 87 HALWD schemes approved for IPH. Of these 31 have been tubewells, 28 lift systems, 10 flow systems and 18 chak development. The tubewell schemes are typically 30 to 40 hectares while the flow and lift schemes are in the range of 50 to 100 hectares. IPH has assumed technical responsibility for any major rehabilitation of the seven approved RD schemes. Details of approved schemes are given in the Table 2 in section 3.4 above.

Site Selection

The scheme site are initially determined by community request and then given priority on a political basis. Basically, project funds are divided evenly between ten districts and then further allocated to specific political divisions within each district. It remains unclear what technical criteria other than very general ones of distance from electric sources, height of lift, or water and land availability are used at this initial phase of selecting scheme sites but presumably some local judgement, including that of district IPH staff, is input into the decisions. Master plans were completed for each subdistrict in the early 1980s but we found no evidence of these being used to assist in site selection.

The selection process has resulted in a higher proportion of lift schemes being selected as compared to gravity diversions than was projected in the Project Paper. This is, in part, because of the distribution of funds to the ten districts, some of which have only relatively difficult sites from which to choose. The lift schemes also have a somewhat smaller command area than anticipated.

We feel that the current selection process does not lead to the best sites from a technical or economic point of view. On the other hand, we are unable to find any comprehensive state plans that identify the physical resources on which irrigation site selection could be based. Without this information it is difficult to judge the relative technical or economic improvement that could be made by a more technically oriented selection process. Master plans were developed for all subdistricts. These, however, have not been updated since the mid-1970s. The two master plans we reviewed seemed to contain a great deal of information and detail, particularly on existing schemes and water sources. No effort was made to give priority to proposed schemes or to coordinate the plans at levels above the subdistrict. Water rights data are not included in the master plans.

In summary, the site selection, though initiated by local individuals and communities, is given priority by political concerns with technical and economic criteria used to screen out unacceptable schemes. This process has lead to more lift schemes than anticipated (potential economic and environmental concerns discussed later) and schemes of somewhat smaller commands than expected

(potential management concerns due to larger number of schemes). No comprehensive plan has been developed for the irrigation potential at the state level. Technical criteria for selection are being discussed that would discourage selection of some pump systems, especially those with high lifts or very long electric supply lines.

Technical Aspects

Design: Once a candidate scheme site has been selected an initial design is developed by the district IPH staff which typically include an assistant engineer supervised by an executive and superintending engineer. A design once approved at the various levels up to the circle is forwarded to the Project Cell where it is reviewed and approved, modified or rejected. If modified it goes back to the district for another iteration. If approved, the design is formalized with blueprints, typed report etc. and passed on the Chief Engineer for approval and solicitation of construction bids. The design includes engineering, agronomic and economic analyses.

The engineering design criteria specified in the HALWD project is considerably more rigorous than what had been used by IPH previously. Two important purposes for the specified USAID project criteria were 1) to more accurately correlate cultivatable command area (CCA) with water supply and 2) bridge the gap between the main water supply system and the on-farm use of the water.

Criteria to achieve the first purpose included rigorous analysis of crop water requirements and other agronomic factors (e.g. soils) instead of the traditional use of a generalized water duty (e.g. 1 cubic foot per second per 150 acres). Every indication suggests that although the analysis is data intensive and time consuming it has produced several very positive results. First the command areas, in general, have been reduced relative to supply from the traditional approach. In the judgement of both Indian and expatriate irrigation professionals, the new designs are more appropriate and cost effective. Second, the rigor required to do the analysis has raised the level of professionalism of the engineering staff. Third, (and very much related to the second purpose of the criteria i.e. bridge the main system/on farm gap) engineers have begun to understand irrigation systems as agricultural production systems and not just as hydraulic systems.

The second purpose was to develop a design process that both encouraged the engineer to design for agricultural production and integrated the farm community at all levels of planning, design and implementation of the project. No process has been institutionalized to fully integrate farmer participation into all levels of design and implementation (though they may be involved in site selection). In general significant farmer participation is sought only after the main supply and delivery system has been designed and constructed. The project, however, is making progress toward the goal of achieving community

participation. There are numerous indications that 1) it is being taken seriously by GOHP officials, 2) in some cases it is beginning to be thought of as an important component following the recent TA on the topic and emphasis given it by USAID staff and 3) IPH can provide significant assistance to existing locally managed systems without "taking them over" (e.g. assistance to Rural Development Khuls). Nevertheless, we are concerned that the technologies being designed into many of the schemes may be inconsistent with local management.

In our judgement, although the design analysis for water requirements is fairly rigorous, it is based in some cases on a fairly weak data base, particularly anticipated cropping patterns and time series data. Water supply is often determined on the basis of a few measurements during a low flow period in one or two years only. We found no use of rainfall-runoff analysis as a means of developing a longer time series data set (presumably rainfall data are more available and somewhat more transferable than runoff data). A number of the lift schemes have been constructed on perennial streams or rivers where low flow is not likely to limit supply. However, even these systems suffer from a lack of data on stream sediment loads and flood frequency levels.

Although the procedures are followed, the results may not be as accurate as expected because many of the data that are input into the procedures are themselves only approximate. We questioned several of the design engineers, "have the new design criteria for water demand improved design?" The answer was always yes, and the reason given was always that the water duty was reduced from the former 1 cusec per 60 hectares to a more accurate 1 cusec per 35 hectares, in some cases only 30. The benefits of the rigorous approach to calculating water requirements have been realized but perhaps now a set of improved water duties associated with several typical cropping patterns and soil types could be adopted in place of the rigor of calculating water requirement at each site. There is as yet no empirical evidence from the newly constructed projects that the "new duty" is better than the old one, but experience elsewhere and the logic of the approach would suggest the new designs are more appropriate.

The HALWD Project design criteria attempt to provide a more comprehensive systems approach than currently exists but the IPH staff are still biased toward the hydraulic system. Before the HALWD project, the IPH staff concentrated on design of hydraulic lift systems for public water supply. It is likely that the IPH engineering orientation and familiarity with lift systems has biased them towards lift irrigation systems with a heavy emphasis on the hydraulic component of the total irrigation system. Our brief examination of the systems designed to date, together with a review of staff expertise, suggests that the most serious problems are not with the technical hydraulic design (with the exception of silt concerns on some lift systems) but rather with the hydrologic design, water distribution and management, and controlled drainage aspects.

Chak Development: The PP placed considerable emphasis on chak development, including land leveling, bunding, terracing and the like. This emphasis was possibly based on the belief that unless such development took place farmers would not use the water and thus the potential of the irrigation scheme would not be realized. We believe that in general professionals have changed their ideas on this as government development at the chak level has a very negative impact of further penetrating the government physical infrastructure even deeper into the community. This almost totally discourages local resource mobilization. Management assistance in chak development in the small Himachal Pradesh commands does not seem us to be practical.

IPH has defined chak development to be the extension of field channels from the chak turnout to individual fields. This we were told is done in consultation with farmers. In our view, the government chak development component of the project should be reviewed and probably dropped, except in those cases where it is required to assure environmental stability.

Typically much of the land in the scheme commands was already terraced for rainfed crops. In some cases where there had been an existing Khul, land was developed for irrigation use. We saw no cases where farmers had developed fields for irrigation following construction of an IPH system. Certainly on farm development was not occurring rapidly but even the oldest schemes we visited had been in operation for only a few seasons.

The officials we talked to expressed concern that farmers were not making use of the potential created for them and that they would have to be taught to do so. Two concerns expressed by individual farmers were that 1) if they used the irrigation water from IPH systems the water use fee would be raised and 2) they would develop their fields only after they were assured reliable water delivery.

Operation: Water distribution schedules are not normally developed during project design but only after the scheme is constructed. Pumps on lift schemes are designed to operate only at peak demand for 16 hours per day. Storage tanks are designed for four to six hours of temporary storage. Distributary canals are sized on the basis of one to one-half cusec depending on the command area to be served. None of the above criteria are designed with an operational system in mind but each will influence the operational systems that are possible. Although we did not review them, we were told that two schemes had operational plans developed by the IPH.

Presumably in both the IPH and AD schemes farmer will be responsible for developing a plan for water distribution. We found that no particular thought had been given to the interface between the government operated main systems and the farmer operated chaks on the IPH schemes. The turnouts on the schemes we visited were designed as open/closed pipe inface. This suggest that IPH will have to operate on a rotational schedule but little information is available on how

farmers will be involved in decisions concerning rotation schedules. The schemes are very vulnerable to farmer interference once water is delivered into the main canal.

Economic Aspects

The implications of the new design approach are very significant due to of the requirement for each scheme to have an IRR of 12 percent or greater. Because the new designs often result in a four-fold reduction in the expected irrigable area, it is more difficult to economically justify projects (Appendix C). Perhaps even more importantly the actual cost of schemes is reduced since "excessive" distribution canals are not constructed.

The AID mission provided a three day course on the procedure for calculating IRRs. Although this initial activity was modest and definitely needs additional follow up, it did have a very significant and positive impact on irrigation design in the state. Consideration of benefits and costs of individual schemes has been institutionalized and while additional training is needed to refine the process and quality input data are generally lacking, the process is taken seriously and results of economic analyses are used for project approval. Many of the necessary input data, such as crop yields under irrigated conditions, are difficult to find. The after-project crop pattern and yields selected for the IRR analyses seem rather optimistic.

The economic viability and long term sustainability of the project irrigation schemes relate to the technologies adopted and the environmental conditions. The viability of some of the high lift schemes seems particularly problematic, because of expected high recurrent costs and environmental problems resulting from uncontrolled drainage from some steep command slopes. One executive engineer told us that about five years ago a policy decision was taken that no lift schemes of over 150 meters would be constructed except under unusual circumstances. The reason given was the high cost of such systems although no formal benefit cost analyses were done before the initiation of the AID project. High lift schemes, a few over 150 meters, have been approved under the HALWD project. We can anticipate that more lift schemes, some with over 150 meters lifts, will be planned in the future as sites for flow and lower lift schemes in some districts become more difficult to locate. One constraint on IPH scheme site selection is access to a road. Where as the community-managed AD and RD projects may be located in rather remote areas, the IPH schemes are generally not. A second constraint is access to electric power. The cost of bringing an electric transmission line to the site of a lift scheme can be a major portion of the total capital cost of the project.

Recurrent costs of the schemes, particularly the IPH lift schemes, should be a major concern for the long-term viability of the project (Appendix D). All operation and maintenance costs of the IPH schemes is now assumed by the government. The project paper estimated recurrent costs for O&M at 10 percent of the capital costs. This estimate was based on an expectation of a higher portion of systems being gravity flow schemes than are being constructed. Based on the project paper estimates the recurrent costs on 30 million dollars invested in irrigation would be 3 million dollars, the bulk of this borne by the

government. We judge that this figure is probably low, in part because of the higher percentage of IPH lift schemes being built than expected. IPH estimates of typical operational costs for existing lift schemes are 4000 to 5000 Rupees per year per hectare. Estimates of AID staff who interviewed engineers on one lift scheme are 8000 Rs. per hectare per year for both operation and maintenance. These estimates would be even higher if the heavy subsidy to electricity was removed. A study of two HALWD lift systems by the Institute for Economic Growth estimated recurrent cost at 5000 to 6000 Rs/year. On the other hand the estimated benefits to farmers from the few existing operational systems are generally much greater than 8000 Rs. per hectare per year. In some cases where vegetable seeds and other high value crops are being grown the farmers are receiving returns reportedly over 20,000 Rs. per hectare per year. A recent study by the USAID/India controller's office says that the state will have the budget to meet even the relatively high projected recurrent costs through 1994.

Intuitively we feel that some of the very high lift schemes are probably not going to meet the economic criteria in the long run. Case studies by both the Institute for Economic Growth and IIM/Ahmedabad indicate that while flow and tubewell schemes are potentially very economic, only about half of the four lift schemes meet the 12 percent IRR criteria. Some simple criteria that require certain projects to be specially scrutinized might be helpful. These criteria could include limitations on the elevation to which water could be lifted or the distance from existing electric power to the site. There has to be some flexibility, however, or such fixed criteria become distorted resulting in selection of even less desirable schemes. On the benefit site, more consideration needs to be given to site-specific land resources, markets, and farmer experience.

The proportion of schemes considered under the project is increasingly toward lift technologies. The project paper estimated an equal number of lift and flow schemes. The number of approved schemes thus far, not including the tubewells is about 70 percent lift and 30 percent flow. A letter from the former Chief Engineer of the project Cell suggests that this ratio will tilt more and more toward the lift schemes in the future because of a general lack of good sites for flow systems. Without a comprehensive land and water resources plan for the state we are unable to judge whether or not good flow sites are available (Appendix E). We have been unable to determine the basis on which the original project paper projections were based.

Lift Schemes

As mentioned above the site selection process has lead to far more lift systems being chosen than anticipated in the project paper. Several of the first projects selected that are now under construction, have extraordinarily high lifts (e.g. over 150 m). Intuitively, we expect that the cost of such systems, especially when recurrent operation and maintenance are considered, will be extraordinarily high.

A second aspect of the lift schemes that has increased the cost of such systems above expectations is the need for relatively long electric transmission lines. Construction of three to five kilometers of line to a site is not uncommon and

some few transmission lines have been even longer. The cost of one kilometer of transmission line is on the order of $15,000. Therefore, if five kilometers of line are needed to supply a lift for a system with a 50 hectare command, the added capital cost alone for the transmission line is $1,000 to $1,500 per hectare, a major portion of the total anticipated construction capital cost in the project paper. The project officer has been pressing the GOHP to institute a selection criteria that limits the length of electric transmission line necessary and/or pay for the transmission line out of non project funds.

A third economic concern, relating particularly to the lift systems, is that of recurrent costs. The project paper estimated operation and maintenance costs at 10 percent of the total capital costs. We anticipate the O&M costs of lift systems to be higher than this projected average figure which was based on a different mix of lift and gravity systems than has resulted. Furthermore, the operational costs of pumps are somewhat confusing because of the high subsidy to electric power. This electric subsidy not only biases the selection of lift systems but may also encourage over-pumping of irrigation water.

Finally the lift systems pose an environmental concern that is associated with the subsidized cost of pump operation but also a whole complex set of other influencing factors. The concern is this: water is pumped to an elevated and often undeveloped or under developed command area. The distribution net work ultimately discharges a concentrated stream of water (e.g. 30 l/s) onto the command. Depending on the degree to which the fields have been developed (e.g. bunding, land leveling) and the management capabilities, capacities and incentives of the farmers, this water may be used or simply run off. If it runs off the command area, this concentrated flow in some cases, has very high potential to cause serious soil erosion problems.

It is common in India to substitute excess irrigation water for management inputs and costly land development necessary to use water efficiently. Therefore, if water is relatively cheap it will be used in excess and thus runoff of drainage water can be expected. Since electricity is highly subsidized and in many cases water flow in supply streams are far in excess of pumping capacity, it seems reasonable to expect excess water usage. In any case, unless farmers are required to pay a major portion of recurrent costs they will press to have excess water pumped.

We are concerned that the design and implementation of some of these lift systems together with incentives to pump water in excess of what can be utilized will lead to severe soil erosion cases. Attention must be paid to both better designs that assure land development and stable drainage networks and management incentives that encourage reduced recurrent costs and less over-pumping.

IPH Staff Capacity and Constraints

The prevailing opinion seems to be that public health (domestic water supply) concerns will continue to be given priority over those related to irrigation. The reasons for this seem to relate to the tradition of IPH placing emphasis on public health. Although the Decade of water, which has focussed the IPH on domestic water supply ends in 1991, the general feeling is that water supply

needs will continue to require a high level of input even after 1991. Most IPH officials and staff we talked with expected that irrigation and public health would be separated but not for several years. The separation is delayed in part because of the anticipated expense of extra staff and a shortage of accommodations. Because most of the engineers appear to have a bias toward public health work, the irrigation group after the split might initially include primarily the more junior staff.

4.2 Agricultural, Forestry and Horticulture Activities

Site Selection and Technical Aspects

Many of the comments above on site selection and design aspects for the IPH schemes appear to apply equally to AD schemes. However the command areas (CCA) under the Agriculture Department are usually (although not always) considerably smaller than those under the Irrigation Department. The AD schemes approved thus far are of six different types characterized by the type or source of water as shown below. These divide into small CCA's and those with large CCA's.

Table 6

AD 67 SCHEMES APPROVED

TYPE	NO.	AVE SIZE (Has)	RANGE (Has)
Wells (Sh/Dg)	10	5.5	3.6-11
WST	26	5.3	2.9-10
FIS	17	7.0	2.5-14
LIS	2	10.0	8-12
TW	6	40.0	25-47
FIS (Repair)	6	64.0	5.8-179

Avg. small system 6.65 ha
Avg. large system 40 ha

The small CCA's obtain water from: Water Supply Tanks (26 schemes), Flow Irrigation Systems (17), Shallow or Dug Wells, (10) and Lift Irrigation Systems (2). These small systems under AD have CCA's that average 6.6 ha in size with a range from 2.5 to 14 ha. The large systems approved for AD are either supplied from a Tubewell (6) or represent repair to an existing FIS (6). Tubewell systems average 40 ha in size with a range of 25-47 ha. Existing FIS's being repaired average 64 ha in size with an extremely wide range from 5.8 to 179 ha. The large systems approved under AD seem to represent an overlap with IPH and RD. It is not readily apparent why such schemes are being done by Agriculture instead of by IPH/RD.

Forestry Department components, primarily watershed protection above the irrigation command site, have been approved for FD action on 21 schemes under

construction by IPH. This coordination of efforts is in accordance with the original objectives of the project. However these 21 schemes seem to be the only examples of inter-departmental cooperation that are in effect thus far in the project.

To date no activities by the Horticulture Department have received approval for project funding. However our field visit to Himachal Pradesh indicated that HD is working quite actively on developing activities for approval. In the areas visited Himachal Pradesh representatives had paid field visits to the farmers where they seemed to have at least some credibility. Several HD schemes are likely to reach the approval/execution stage in the near future.

This was not the case for representatives from AD, particularly from Extension, who had seldom, if ever been in touch with the farmers to whom we talked. As might be expected, there has been no movement in the use of Extension activities under Agriculture. It would appear that Ag Extension should be considered as a "downstream" activity that cannot take place until a water delivery system is in place, but after which production will then most probably be improved with or without project intervention and/or funding.

Watershed Erosion Control

Forestry Department activities in watershed protection above the irrigation command site, have been approved for several IPH schemes. In general the FD activities seem to cover rather limited portions of the slopes, usually only the areas with the greatest erosion problems which present a threat to the irrigation infrastructure. In general, sufficient funds have not been provided through the Project to permit installation of erosion control measures for the entire watershed. Furthermore the control measures being used are largely concentrated on check dams and the planting of some trees. There seems to be no effort underway on project sites for more comprehensive control programs using trees, shrubs and grass species designed to help prevent sheet erosion as well as the more obvious gully erosion. Such more comprehensive protection programs will clearly require a greater allocation of funds to FD than seems to be the case to date.

Marketing and Extension

Clearly, availability to markets is an incentive for farmers to develop fields in irrigation commands and move to higher value crops. But, in some cases, markets develop or improve because of the crop production. Once irrigation water is available on a regular, sustained basis it appears that the farmers, themselves, are prepared to proceed with necessary efforts leading to improved production levels with or without project intervention and/or funding. Both IPH and AD officials stated time after time that the farmers would not permit either Department to undertake "land development" or "land improvement" activities on the farmers' lands. At the same time numerous examples were cited of farmer initiative in applying new techniques and varieties and changing to new crops as irrigation became available and as the farmers were able to observe changes being made and increases being realized by other farmers in similar areas.

Likewise, for a shift to new crops such as vegetables and vegetable seeds, marketing would not appear to be a major constraint, although some locations clearly have better access to existing or potential markets than others. A market infrastructure seems to develop from the private sector when crops become available to be marketed. In the case of vegetable seeds the market may be a key initiator of such production with companies contacting and arranging with farmers to produce seed on a contract basis.

Scope, Integration and Necessity of Various Activities

The Review Team is recommending a focus for future sub-projects on an integrated approach to watershed development and management. As such, the necessity for various activities by all concerned Departments and their integration into a common approach is evident. The scope and type of activity by each Department will be determined by the particular requirements of chosen sites. For example, a site developed around a tubewell irrigation scheme by IPH is not likely to require soil conservation and stabilization efforts by FD but would have roles for AD and HD.

Chapter 5

INTER- AND INTRA-DEPARTMENTAL COORDINATION AND COLLABORATION

5.1 Project Cell

The structure of the project is such that the HALWD Cell is administratively located in IPH under the Secretary of Public Works. Therefore all activities under the project must ultimately be approved by the IPH Chief Engineer. There are representatives of all the concerned departments in the Cell but they are more or less on loan to the IPH. The result of this is that IPH has developed a capability to deal with irrigation design on a broader basis and include agricultural considerations more effectively.

5.2 IPH

IPH is a department that is concerned with both public health and irrigation. Originally the staff of Public Works were moved in and out of irrigation, public health, and roads and bridges pretty much at random. A separation between Road and Bridges (RB) and IPH is nearly complete. In fact only a very few individuals have moved from IPH to RB in the past three years. There seems to be a commitment to keep these two cadres separate in the future. The regular movement between positions at three year intervals in public health and irrigation still occurs and probably will for at least the next three to five years.

Although in general the order of preference is for engineers to work in RB, public health, and irrigation, there were a number of engineers who said they preferred irrigation because the work was more scientific. The Secretary of Public Health said he felt an important aspect of overseas training was that it gave engineers a more professional feeling about the worth of working in irrigation.

5.3 Inter-Departmental Models

This project deals broadly with land and water resources and therefore cuts across the responsibilities of many departments. On any given scheme however, the fewer departments involved the less will be the need for complex and time consuming inter departmental coordination. We observed a number of schemes where IPH and Forestry, Rural Development, and/or Horticulture had coordinated their efforts. Agriculture seemed to be more involved with the micro schemes under its jurisdiction. Activities that can be effectively conducted between two or three departments will probably be more efficient than those where all project departments are involved.

Chapter 6

COMMUNITY-BASED MANAGEMENT

The concept of community-based management is not yet pervasive in the HALWD schemes. The situation before the USAID project was to have RD and AD schemes locally managed and IPH schemes operated and maintained by the government. Basically that is still the situation in Himachal Pradesh although there is a general recognition that farmer participation is necessary to distribute water and that at some point in the development process involvement of farmers is necessary. Farmers in Himachal Pradesh have traditionally paid almost no water charges.

A technical assistance activity has been initiated in several schemes starting with a collective meeting of farmers and concerned government agencies. Similar meetings have now been conducted under the leadership of the Chief Engineer in ten other schemes. These meetings have all occurred after construction of the irrigation main system. Plans are now being made to follow up on these initial meetings by encouraging farmers at the chak level to organize and function as collective groups.

The need was identified by a recent TA activity for two staff persons to deal specifically with farm-based management. One is to be an experienced Indian sociologist the other an experienced field assistant. The field assistant position has been filled. The sociologist is needed to provide support in the Cell for identifying and adapting approaches to design that provide for community-based management. This position is still vacant.

An action research effort to identify and develop new strategies for operational procedures that effectively involve farmers has been initiated on one RD and two IPH schemes. All of these schemes have been constructed and emphasis is being placed on outlet groups. Results from this action research could be available for guidance in other schemes within one year or less.

We observed three flow schemes in the field and reviewed plans for development of several others. All of these schemes had at least some pre-existing irrigation physical infrastructure. In the case of the IPH schemes this infrastructure was upgraded and O&M responsibilities assumed by the government. Those schemes designed by the AD formally remained the responsibility of the local community. However, because the command had been increased the group of cooperating farmers was different than before the new schemes were constructed. We are uncertain as to how much attention is being given to water rights issues that surely are important locally when the area served by a water source is expanded.

Chapter 7

HUMAN RESOURCE DEVELOPMENT AND INSTITUTIONAL STRENGTHENING

7.1 General

Training was considered to be an essential early component of the project in order to expand the capability of engineers and others involved in the irrigation sector. Many of the involved engineers are young and have very limited irrigation experience. To date 10 to 12 short training courses have been offered in Himachal Pradesh to about 200 participants. These courses are a start but much more emphasis must be given to this component of the project. The quantity of training taking place is far less than anticipated in the PP and much less than is needed to assure that this complex project will succeed.

Expatriate technical assistance for training has been provided on a limited number of topics including the initial action training, farmer participation, and in several of the courses under the leadership of Water and Power Consultancy Services (WAPCOS). A number of these activities are expected to continue at an accelerated pace in the future including those listed below.

7.2 Action Training

The purpose of the action training program is to strengthen collaboration and coordination among the concerned departments, to ensure effective farmer involvement, and to improve the overall technical process used. This activity is field oriented and focuses on in-service training using in an inter-departmental team approach. The first phase of this activity was used to develop a plan for monitoring and a model for scheme assessment, among other things. A follow-on program has been proposed that must be reviewed by project personnel so that continued implementation will take place. Our impression is that the next critical phase of the action training must include specific training on critical technical design concerns and continued development of approaches to farmer involvement.

7.3 Farmer Participation

The initial meetings between farmers and agency personnel were arranged with the assistance of an expatriate experienced in approaches to farmer participation. These were held in a pilot session at two or three sites where schemes had been constructed. The Chief Engineer of the project Cell subsequently held at least one farmer meeting in each of the ten participating districts. It is expected that at the district level the leadership will now begin to hold similar meetings at each scheme site.

Follow up to the initial farmer meetings in terms of organizing farmers into user groups that will begin to participate in the scheme management has started in two schemes but will need to be expanded, this will require outside assistance from the Project Cell. Farmer involvement will vary from scheme to

scheme depending on the type of technology, number of farmers, relationship between farmers, type of cropping and so forth. Therefore different participatory approaches will have to be tried to determine which is best for each situation. These training efforts will be supported by an action research project that is now underway at three sites.

7.4 Technical Training

A spin off of the action research effort has been the identification of a technical training program for IPH engineers that focuses on selected problems in irrigation design and management. This program will be conducted in the field by selected Indian engineering experts with the assistance on a US irrigation engineer with special expertise in training. Problems that have been identified for this training include design of intake structures for lift schemes, design of water distribution and application systems for steep lands, design of intake structures for water diversion, and water control in main canals.

In addition to the above technical training program there are plans to station an irrigation expert in Himachal Pradesh within the next few months whose primary role will be technical training but who will also coordinate training and TA activities. This individual will be able to provide direct technical assistance as well as provide the link to identify and access other needed technical assistance. In addition to the specialist stationed in Himachal Pradesh there is a contract with a US-based consulting firm to provide sixteen additional months of short term technical training.

7.5 Overseas Training

Only four individuals have been sent abroad for study and specialized training but there are plans to send about 10 more before fall 1988. Exposure to different irrigation technologies, approaches to design, methods of monitoring, approaches to research, and new training methods are essential inputs of a major irrigation development project aimed at new and innovative approaches. Such exposure can only result from encouraging professionals to experience these innovations in other parts of the world.

7.6 Institutions for Training

The universities in Himachal Pradesh can provide limited support for irrigation training and some facilities. These institutions, however, are not staffed or equipped to carry a major component of training for this project. Either these institutions will need some direct support to allow them to accommodate an irrigation training program or other facilities and staff will need to be developed for this purpose. The topical responsibilities of the two universities do not place high priority on engineering or water resources technologies. Therefore it might be desirable to explore opportunities to begin to develop an institution with specific focus on mountain engineering technologies and/or hill area land and water resource management.

Chapter 8

APPLIED RESEARCH AND TECHNOLOGY ADAPTATION

Applied research activities under the HALWD project have recently begun with both Palampur and Solan Universities initiating baseline socioeconomic studies. In addition to these Palampur University is doing a study on seepage and Solan one on trickle irrigation. An action research study was started in December with assistance from a research US consultant on identifying and developing options for community-based irrigation management.

A number of important applied and action research topics were identified in the PP and others through project implementation that have not yet been initiated. These include hydrologic studies to determine water supply, soil erosion, and flood frequencies. Action research is needed to optimize cropping patterns, identify promising new technologies and understand the complex set of relationships among and between government and farmer groups. Scheme operational options have received very little attention but ultimately will profoundly influence the equity, productivity, and environmental stability of the schemes.

Experience to date suggests that lower cost diversion structures might be structurally sound and yet meet the needs of some IPH flow schemes. Design options need to be field tested to verify that these lower cost structures will in fact perform up to expectations. Design options for dealing with fluctuating water levels and high silt loads need to be studied in the field on a trial basis to identify the most cost effective designs for the HALWD lift schemes. Along with a procedure and resources to collect and analyze hydrologic streamflow data, better procedures are needed to estimate supply wherever such time series data are not available. Better and more reliable procedures need to be developed to predict irrigation intensity and cropping patterns after scheme development, and to relate actual demand with actual supply on a monthly basis. This development requires that careful analysis be done of the development to date as well as to initiate action research on these topics.

There is tremendous scope for monitoring competed schemes for the purpose of learning, especially as related to project economics, verification of design assumptions and identification of technical and social problems.

Adaptation of new irrigation technologies is being tried in a few areas, particularly the use of sprinkler application techniques. Demonstration sites and technical handbooks were envisioned in the PP as methods to extend the lessons learned from the applied studies. No activities to extend lessons learned and to provide valuable feedback have been undertaken.

Appendix A

LIST OF SCHEMES VISITED

Appendix A

LIST OF SCHEMES VISITED

Sundernagar

1. LIS Sai Bhardwan (IPH)
2. LIS Bahlvalley Medium Irrigation (State System)

Mandi

1. LIS Gumanoo (IPH)
2. Tank Irrigation Scheme Talyhar (AD)

Kullu

1. FIS Targali Kuhl (IPH)

Bilaspur

1. LIS Neri Jamli (IPH)

Solan

1. LIS Bhud (IPH)

Shimla

1. Panog (AD)

Appendix B

LIST OF GOHP OFFICERS MET

Appendix B

LIST OF GOHP OFFICERS MET

Shimla

1. Commissioner, IPH
2. Commissioner, Agriculture
3. Chief Engineer, Project Cell
4. Superintending Engineer, Project Cell
5. Director Agriculture
6. Executive Engineers, Project Cell
7. Deputy Director, Horticulture, Project Cell

Sundernagar

1. Superintending Engineer, IPH
2. Executive Engineers, IPH (Sundernagar and Baggi)
3. Assistant Engineers, IPH (Construction, Tubewells and Design)
4. Assistant Soil Conservation Officer, Mandi
5. Assistant Soil Conservation Officer, Sundernagar (in charge of soil surveys)

Kullu/Aut

1. Superintending Engineer, IPH
2. Executive Engineer, IPH
3. Executive Engineer, Design
4. Divisional Forest Officer, Seraj Division
5. Assistant Engineer, IPH

Appendix C

ECONOMIC APPRAISAL OF SOME SELECTED IRRIGATION SCHEMES UNDER USAID HILL AREA LAND AND WATER DEVELOPMENT PROJECT IN HIMACHAL PRADESH

by Basawan Sinha

Metaplanners and Management Consultants
Patna
September 1988

Executive Summary

ECONOMIC APPRAISAL OF SOME SELECTED IRRIGATION SCHEMES UNDER USAID HILL AREA LAND & WATER DEVELOPMENT PROJECT IN H.P.

Executive Summary

1. BACKGROUND

The United States Agency for International Development (USAID) is assisting the Government of Himachal Pradesh in its efforts directed towards rapid development of irrigated agriculture in the State under the Hill Area Land and Water Development Project (HALWD). The USAID intends to introduce new approaches to land and water management, as well as to support initiative in developing its land and water resources. It is a Seven Year Programme under which approximately 150 minor and 2000 micro Irrigation systems with emphasis on irrigation planning and design, integrated upstream development, on-farm development works, users involvement, and associated support of human and institutional capabilities. The Minor Irrigation schemes planned comprise deep-drilled tubewells, Lift irrigation from rivers, Small reservoirs (tanks), and Diversion (flow) Irrigation works. Some of the schemes included in the programme are reported to be under execution.

2. SCOPE & OBJECTIVE

USAID, NEW DELHI under Purchase Order No. 386-0249-0-00-&223-00 dated July 15, 1988 intrusted the job pertaining to estimation of the internal Rate of Return (IRR) of approximately eight small-scale irrigation proposals of which, two are high

lift pumping systems, two are gravity-flow stream diversion systems, two are tubewell pumping systems, and two are small storage or tank systems. It was also stipulated in the statement of work that the contractor will clearly state in his report the assumptions used in the IRR Analysis, will carry out Sensitivity Analysis for some important variables and will also carry out an analysis using shadow prices for traded commodities, viz. electricity and water based on values of alternative uses (if known).

3. SELECTION OF EIGHT SCHEMES

The following eight projects were selected in consultation with Shri N.R. Banerjee of USAID for estimation of IRR:

I. Tubewell Irrigation

1. Dhakeri Scheme in Solan District
2. Gugwara Scheme in Una District

II. High-Lift Irrigation

1. Bhaura Scheme in Kangra District
2. Neoli Therman Scheme in Kullu District

III. Storage Tank Irrigation

1. Gurla Scheme in Shimla District
2. Ropa-Buda Scheme in Mandi District.

IV. Flow Irrigation Scheme

1. Bari Kulwara Scheme in Mandi District
2. Jond Bhajanu Scheme in Shimla District

These eight schemes comprise all the four types of irrigation works, are located in six districts of the State spread over three out of four Agro-Climatic Zones of Himachal Pradesh. And yet it would not be prudent to claim that the results of the instant study on the above mentioned individual schemes will be straight away applied to all schemes of corresponding type and size located elsewhere in the state because the soil characteristics, cropping pattern, consumers preference, design and the cost of the engineering structures with its appurtenent works, developmental prospects, etc. vary significantly in the hilly terrain especially of the type met within the hilly State of Himachal Pradesh.

3. An Overview on Parameters of Project Proposals:

After obtaining the data and informations contained in the project reports and estimates of the above mentioned eight schemes, a thorough analysis of the various parameters relevant to calculation of IRR was done by a team of experts in the fields of economics, agro-economics, water resources development and management, and other professionals and sub-professionals.

The salient features having bearing on estimation of IRR noted are:

3.1 The existing cropping intensities in the command areas of all the eight selected schemes were very high, about 200% in un-irrigated condition.

3.2 Proposed irrigation intensities were more or less the same as the cropping intensities in pre-irrigation condition. In other words, the gross cropped areas (GCA) in with and without irrigation situation were equal.

3.3 Shift in cropping pattern from unirrigated to irrigated agriculture as proposed was largely in favour of cash crops, mainly vegetables in both Kharif and Rabi seasons.

3.4 Vegetables are grown in the command areas of Lift irrigation scheme)LIS), Kullu (2.03% in Kharif and 1.02% in Rabi), Una Tubewell scheme (6.34% in Rabi); Shimla Tank Scheme (11.11% in Kharif, 11.11% in Rabi and 11.11% Patato); and Mandi Flow Irrigation Scheme (0.87% aid). No vegetable is grown in command area of other four schemes.

3.5 The project estimates prepared were in detail so far as engineering works were concerned but how the choice was made in favour of the proposed structure

had not been given in the report. It was also not clear as to why costly piped water supply was provided in the Flow Irrigation Scheme. From the Project Reports it was also not clear as to whether Soil surveys and irrigability classification were conducted by the project authorities.

3.6 The project report did not contain discussions on and the basis of proposed cropping pattern, irrigation intensities, crop yields etc.

4. FIELD VISITS AND COLLECTION OF RELEVANT DATA & INFORMATIONS

As stated above, the project reports lacked in presentation of details relevant to irrigated agriculture envisaged in the proposals. In such an Area or Regional approach to planning for land and water resources development through a number of small size schemes, dotted over the in patches of cultivable lands of the hilly terrain, it would be too much to expect that for each individual minor irrigation scheme, elaborate details or determination of irrigation intensities, crop-yield rates, farm cost, etc. will be made available. But, at least such a presentation on each agro-climatic Zone and on each type of scheme should have been made. These being not there, attempts were made to obtain as much as could be available from secondary sources.

A team of experts was deputed for this. The following offices/departments were contacted for collecting data on crop parameters-cropping pattern, crop yields and prices. The offices visited were :-

1. Agro-Economic Research Centre, H.P. University, Shimla.
2. Directorate of Agriculture, Govt. of H.P.
3. Directorate of Land Records, Govt. of H.P.
4. Directorate of Economics and Statistics, Govt. of H.P.
5. Office of the Chief Engineer (Irg.), Govt. of H.P.
6. State Planning Board.

Data on cost of production of different field crops, horticultural crops, growth of agricultural development in different districts of H.P., market infrastructure, present methods of disposal of crop and horticulture produce practised by the farmers etc., were collected from the Agro- Economic Research Centre, Shimla. In addition an important document obtained was an unpublished Ph.D. thesis on various aspects of vegetable production and marketing of vegetable crops, in some of the selected districts of Himachal Pradesh. This study is based on a well defined stratified during the course of data collection under the comprehensive cost of cultivation scheme (CCS).

In course of visit to the Directorate of Agriculture, data on various aspects of crop cultivation specially the information relating to estimation of crop yields on the basis of crop cutting surveys were collected. In the course of discussion with Dr. Mittal, Economist, Directorate of Agriculture, it was revealed that separate yield estimates for irrigated and unirrigated yields of various crops were not available. The cyclostyled sheets issued by Dr. Mittal on the results of crop cutting experiments did not contain separate yield estimates for irrigated and unirrigated crops. Package of practices issued by the H.P. Krishi Vishwa Vidyalaya every year for Kharif and Rabi season was found more useful in this aspect.

An important source of document that is, Season and Crop Report (ASCR) which give detailed information on various aspects of agricultural production districtwise, cropping pattern, crop yields, farm harvest prices was obtained from the Directorate of Land records. Their report provides two types of yield estimates - the standard yield and the current yield but does not distinguish between the irrigated and unirrigated crop yield. The intensive search for relevant data revealed that the ASCR was perhaps the only source of information in the State which provides such detailed estimates of various crop parameters at the district level. The latest Season and Crop Report available is for the year 1984-85.

For time-series data on growth of agriculture in H.P. as also on various other aspects of agricultural economy, irrigation, infrastructure, etc., the Directorate of Economics & Statistics was contacted and various publications providing requisite information both at the district level as well as State level were collected.

To collect data on policy parameters the Plan documents of the Govt. of H.P. were collected. The document provides useful information not only in respect of the current state of affairs of various sectors of the Himachal's economy but also provides useful information on the priority areas of development in the State. It provides information on irrigation, crops, infrastructural development, etc.

The office of the Chief Engineer, Irrigation was also visited by the Team to collect information on the growth of irrigation and performance reports on different types of irrigation schemes. The officials over there were not aware of any Ex-post evaluation having been carried out ever on any irrigation project in the State.

The Team members had also informal discussions with a number of people who had intimate knowledge of agricultural economy of the State. Some of these people were in fact practising farmers and provided useful information on various technical aspects of crop cultivation in the State.

The visits of the team to various offices at Shimla, and some project sites, their discussions with knowledgeable professionals and farmers and the reports as well as other publications collected were found in objective assessment of the situation and in adopting pragmatic approach in economic analysis of the proposed schemes. It would not be an exaggeration to claim that in the situation obtaining nothing more could be collected and/or ascertained through extended field visits.

5. REVIEW OF RELEVANT PARAMETERS

This report presents the results of economic evaluation of eight small scale irrigation projects in Himachal Pradesh which are included under the HALWD project of the USAID. The report begins with a review of assumptions contained in the Project Reports suggested modification therein gives estimates of shadow prices for major outputs and inputs and provides a range of estimates of economic rate of return (ERR) under alternative assumptions.

The assumptions made in the project reports on various parameters are reviewed in the light of existing crop situation, relevant information/data from published and unpublished reports and discussions with experts and knowledgeable farmers in the field. Data on cost of production of different field crops, horticultural crops in different districts of Himachal Pradesh, market infrastructures, present methods

of disposal of crop and horticultural produce were collected from the Agro- Economic Research Centre, Directorate of Economics and Statistics, Directorate of Agriculture, Directorate of Land Records and State Planning Board. Since vegetable crops are very important components of benefits of these irrigation projects. Projects and not even secondary data were available on this, unpublished Ph.D. thesis was referred to for detailed information on various aspects of vegetable prices, yields, marketing practices etc. Based on these reports, observations and discussion the cropping pattern, yield levels, crop outflow prices have been modified and adjusted in subsequent economic analysis. Specifically the area under vegetables: Yield flows and prices used in the report reflect the existing area, marketability conditions given the fact that existing cropping intensity of 200% does not increase under irrigated conditions, the project proposals envisaged a major shift from cereals to cash crops, particularly vegetables. This shift has been moderated to some extent keeping in view the subsistence nature of farming, present level of vegetable cultivation, emphasis on growing vegetables in the State all over through an intensive Vegetable Cultivation programme and market-ability condition. The existing cropping pattern, the pattern envisaged in the project proposal, and

the pattern adopted in the report for economic appraisal are given in Table 1.1.2 of the Report. To illustrate the basis of modification, the cases of a few lift irrigation, tubewell and flow irrigation schemes appear worthwhile. In case of L.I.S., Kangra, the existing area under Cereals is 92.5% of the Gross Cropped Area (GCA). In the project proposal it was brought down to 67.5%. This has been increased to 72.5% in this report. Similarly, in case of Kullu L.I.S., the existing area under Cereals was brought down from 43.34% to 20.31% in the project proposals. This has been increased to 39.58% in this report for economic evaluation. So far vegetables are concerned, similar adjustments had to be made. In case of Kangra L.I. Scheme, there is no vegetable cultivation at present but 20% of the G.C.A. was proposed in the project proposals. This has been moderated to 15%. In L.I.S. Kullu, under existing conditions of 3.05% of G.C.A. is under vegetables and 45.18% under orchards. In the project proposals area under vegetable was increased from 3.05% to 26.89%. Keeping the area under orchards unchanged, this has been moderated to 9.14% under vegetables and area under orchard has been kept intact. In case of Solan T.W. Scheme, the project proposals envisaged 22.29% of G.C.A., under vegetables against NIL area under existing conditions. This has been moderated to 13.43%. Similarly, in F.I.S., Shimla area under vegetables plus

potato has been kept at 39.72% against 49.69% proposed in the project proposals and 26.77% under existing conditions. All these will show that while objective of intensifying vegetable cultivation in the hill State has been the guiding factor in determining, crop intensities, the need for sustaining the pace of food production has not been lost sight of.

6. APPROACH TO ECONOMIC ANALYSIS

Economic Rates of Return (ERRs) for the eight projects have been calculated by estimating benefits and costs of the project using shadow prices for major outputs and inputs. The benefits of the project are essentially identified with direct primary benefits while indirect and induced effects of the project could not be incorporated due to lack of information. Similarly, only the direct costs have been considered and indirect costs including externalities and environmental impacts could not be quantified in short time available for the project and due to the fact that the individual schemes under appraisal were too small for any such meaningful analysis. Of course, a passing reference has been made in the report drawing attention towards preserving the fertility of the thin mantle of soil generally met with in hilly tarrain. The direct benefits of a project have been calculated as the value of the incremental

net farm income defined as "With project" minus "Without Project" i.e. the entire increase in net value added under "With Project" condition over that under "Without Project" condition is due to or attributable to irrigation.

Since in a developing country such as India, the prices of foodgrains and other agricultural commodities, major agricultural inputs (fertilizers, diesel oil, electricity) and components of project costs (cement, steel, unskilled labour) are "administered prices", these do not reflect their true social value or opportunity costs. Shadow prices for major outputs and inputs have been estimated as follows:

(i) Traded or tradable commodities (foodgrains, fertilizers, sugar) have been valued at c.i.f. or f.o.b. prices adjusted for the shadow exchange rate and domestic transport costs;

(ii) For the non-traded outputs (vegetables, apples) shadow prices are equated to the "consumers willingness to pay" as reflected by the market prices for these commodities;

(iii) Non-traded inputs (e.g. electricity) have been valued in terms of long-term marginal cost of supply. Cost of supply after taking into account the transmission and distribution losses.

Using these criteria, the estimated shadow prices for paddy are about 45 per cent higher than its market price while the shadow prices for wheat, barley and oilseeds are 74 per cent higher than their corresponding market prices. The estimated shadow prices for introgenous fertilizer and phosphatic fertilizers are 27 per cent and 13 per cent higher than their market prices, respectively. The estimated shadow price of electricity is almost 107 per cent higher than the tariff rate used in the tubewell and lift irrigation schemes. Given the resources and short time available for the project, it was not possible to estimate shadow wage rates for unskilled labour in each project region. A notional value of 0.4 has been used to convert the wage cost at market prices into wage cost at shadow prices. The possibilities of higher shadow wage rates have been considered through sensitivity analysis of capital costs. Since, estimation of shadow exchange rate and opportunity cost of capital were outside the scope of this project, notional values currently used in the Planning Commission for appraisal of projects have been adopted. A premium of 25 per cent on foreign exchange has been used to reflect its scarcity value i.e., a shadow price of Rs. 17.5 per U.S. dollar, as compared with the official exchange rate of Rs. 14 per U.S. dollar, The opportunity cost of capital in the Indian economy has been taken as 12 per cent. Sensitivity analysis

has been performed with respect to shadow exchange rate, capital costs, electricity price and value of output.

The results of using these shadow prices are that, except in the case of L.I.S. Kullu, the ERR at shadow prices is higher than the IRR at market prices. In Kullu, since orchards account for about 56 per cent of the total net benefit (where shadow price is considered equal to the market prices), the use of shadow prices on the benefit side does not increase the value of benefits while the use of shadow price for electricity almost doubles the O&M costs. These aspects are discussed in detail later.

7. ECONOMIC RATES OF RETURN

Economic Rates of Return or the Internal Rates of Return for all the eight projects have been calculated. One section has been devoted to each project. The IRRs for each project, one on market price and the other on shadow prices of inputs and outputs have been calculated. The results are as under:

PROJECT	IRR IN MARKET PRICE SOLUTION	IRR ON SHADOW PRICE SOLUTION
TW at Una	18.37%	26.0%
TW in Solan	15.38%	16.60%
L.I.S. in Kangra	20.32%	23.42%
L.I.S. in KULLU	11.71%	4.9%
Tank in Shimla	13.59%	21.0%
Tank in Mandi	22.9%	31.0%
F.I.S. in Mandi	13.45%	14.56%
F.I.S. in Shimla	20.3%	24.2%

It would be seen that in all cases except in case of Lift irrigation scheme in Kullu district the IRR in shadow price solution is more than that in market price solution. The details of IRR calculation in Table 3.2.4 show that (a) the net benefits increase from Rs. 10.85 lacs in market price solution to Rs. 12.78 lacs in shadow price solution; (b) O & M cost increases from Rs. 5.6 lacs to Rs. 9.94 lacs per annum; (c) it is mainly because of over 70% increase in the O & M cost that the IRR in shadow price solution is so low. This was inevitable because the project involves very high head lift consuming more electrical energy which was charged at subsidised rates in the market price solution. The real cost of energy being much more,

the value of O & M costs at shadow prices has gone up substantially. There are two lift irrigation schemes, one in Kangra involving a lift of 138.0 metres, and another in Kullu involving a lift of 151.0 metres, both having almost equal C.C.A. But, in Kangra L.I.S. the O & M cost at shadow prices is only Rs. 6.93 lacs as against Rs. 9.96 lacs in case of Kullu L.I. Scheme. This difference is mainly due to higher energy consumption in Kulu L.I.S., because the unit rates of energy are the same in both cases.

Some other factors also have caused lower value of IRR in Kullu L.I.Scheme. About 45% of G.C.A. is under horticulture which is reported to yield net annual benefits much less than that of the vegetables. Besides, the area under orchards is not available for raising more than one crop in the year. The capital cost of Kullu L.I. Scheme is also relatively higher than that of Kangra L.I. Scheme. The incidence of cost per hac. is Rs. 18,126.0 in Kullu L.I.S. as against Rs. 15,955.0 for the other L.I. Scheme. The incidence of cost in case of Kullu L.I.S will go up further if it is calculated reckoning the area under orchards as a single crop and not double crop as it has been done according to standard practices in agricultural economics.

The unit rate of Rs. 1.14 per KWH as adopted in shadow price solution could in no case be considered high because

it is almost the same as the actual cost incurred by Himachal State Electricity Board. It would not be out of place to mention here that in the Bihar Tubewell Project, 1986 (aided by the World Bank) a rate of Rs. 1.03 per unit had been adopted though the subsidised rates charged was only Re. 0.34 per unit.

The results of ERR estimation indicated that out of eight proposals under review, the following four needed to be carefully examined through sensitivity tests.

i) T.W. Scheme in Solan District

ii) L.I. Scheme in Kullu District

iii) Tank Scheme in Mandi District

iv) F.I. Scheme in Mandi District

RESULTS OF SENSITIVITY ANALYSES

Results of Sensitivity Analysis are presented in Section 6 of the Report. The conclusion drawn from the analysis as conducted has been that the L.I. Scheme in Kullu district and the T.W. Scheme in Solan district need further analysis specially with respect to level of benefits and shadow price of power. The other six schemes appear to be economically viable within expected range of uncertainties. The Tank Scheme in Shimla and F.I. Scheme in Mandi no doubt yield lower values of IRR (10.8% and 7.9% respectively when

tested for 25% reduction in gross value of output combined with 25% increase in capital cost, but since area under vegetable is not much higher than what exists under irrigated condition, there be no apprehension of fall in the value of outputs. In the case of F.I.S., Mandi the area under cash crops has also been substantially moderated for economic analysis, there should be no apprehension for 25% fall in the benefits. All the same, the F.I. Scheme, Mandi yields first 12% IRR when tested for 25% rise in capital alone. Therefore, there remains the need for closer watch on the capital cost.

The other two types of schemes are (i) the T.W. Scheme in Solan district and (ii) the L.I. Scheme in Kullu district in which use of electric power plays main role, especially in OMR costs. The IRR of T.W. S. in Solan decreases to 12% when tested for 10% decrease in net benefits, drops down to 4.4% from 16.6% when tested for 25% fall in gross value of output (GVO) but increases to 20.9% when tested for 10% increase in GVO. The ERR decreases to 14.8% (from 16.6%) in case of 33% increase in shadow price of electricity, and to 13.7% when tested for 25% increase in capital cost. Thus, this project is highly sensitive to GVO. In this scheme, the chance of 10% fall in GVO cannot be altogether ruled out because 43.43% GCA is now included under vegetables

against NIL in pre-project condition. But, even then the ERR equals the cut-off value of 12%. The L.I.S. in Kullu is the most critical case because the IRR is first 4.9% in the base case and when tested for 10% increases in the GVO, it rises to 7.0% only. As stated earlier, about 54.32% of the GCA is already vegetables (9.14%) and orchards (45%) and as such prospects of increase in GVO through increasing area under cash crops is rather bleak. However, the economics of orchards which are reported to be yielding higher value of benefits than that from vegetables and is the most dominant crops in the command of the scheme deserves further in-depth study if the decision is in favour of considering it for approval.

SOME OTHER ASPECTS OF INTEREST

Incidence of Irrigation Costs

The incidence of capital cost of tubewell scheme varies Rs. 22,780/- to Rs. 24,430/- per hectare of cultivated command area (CCA) while for the L.I.S. it varies from Rs. 31,640/- to Rs. 35,090/- per hactare. Except for F.I.S., Mandi where it is Rs. 18,120/- per hactare, in all others, the range is more or less the same as in T.W. and L.I.S. schemes. Since cropping intensity is taken as 200 per cent, the incidence cost per hactare of gross cropped area gets

reduced by one-half. Using a discount rate of 12% and 30 years life, the annualized capital costs are around Rs. 1,550/- per hactare (of GCA) for tubewell schemes and around Rs. 2,000/- to Rs. 2,200/- per hactare for lift irrigation schemes. The incidence of O & M costs at shadow prices is around Rs. 2,700/- per hactare of cropped area for tubewell projects. Thus, annual costs are of the order of Rs. 4,250/- per hactare of cropped area in tubewell schemes. In the case of L.I.S. the incidence of O & M costs at shadow prices Rs. 3,460/- per hactare for Kangra and Rs. 5,020/- per hactare for Kullu. This gives an incidence of annual costs of Rs. 5,460/- to Rs. 7,220/- per cropped hactare under lift irrigation schemes. Thus, even if only annual O & M costs have to be recovered from the farmer, the irrigation charges would have to be of the order of Rs. 3,500/- to Rs. 5,000/- per hactare for L.I.S. and Rs. 2,700/- per hactare for tubewell schemes.

REPLACEMENT LIFESPAN OF EQUIPMENT

The Project Reports estimate that the lifespan of pumping machinery will be 15 years. Accordingly there has been one replacement of machinery in a project life of 30 years. This has been adopted as such in the economic analysis. However, generally the replacement lifespan of pumping units in large size tubewells is taken as 10 years, that of the well as 10 years and that of the pumphouse and distribution chamber

as 20 years. Although taking two replacements of pumping units in the 30 years lifespan of the project may affect the ERR marginally, this factor may have to be taken into account in some projects.

Appendix D

SUMMARY OF OBSERVATIONS: HILL AREA LAND AND WATER DEVELOPMENT PROJECT ANALYSIS OF RECURRENT COSTS AND STATE BUDGET

by

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SUMMARY OF OBSERVATIONS

OBSERVATIONS:

I. Based upon review of the old State sector Lift Irrigation Schemes (LIS), State budget and cost records, it can be concluded that the GOHP will have sufficient resources to support the recurrent costs of LIS (head not to exceed 150 meters) for another 8-10 years. After 8-10 years GOHP will have to face a huge liability for replacement of Pump & Machinery. The conclusion for sufficient State resources is based upon the trend of actual expenditures vis-a-vis budget provisions since 1983-84.(Refer para 4.0)

II The energy charges per hectare for LIS increase substantially beyond a head of 150 meters for lift irrigation schemes. (Refer para 3.2.1)

III Energy charges stand out to be the major cost parameter of the recurrent cost. Energy costs account for 70% of the average recurrent costs (including depreciation) and 78% of the average recurrent costs if depreciation is excluded. (Refer para 3.2.1)

IV The maintenance and operation costs of schemes are budgeted under the "Non Plan" budget. The state budgeting is not based on the maintenance cost of irrigation schemes but on the actual expenditure incurred in the previous year adjusted for inflation and the additional area brought under irrigation.

V Over the last four years the cumulative actual expenditure of maintenance and repairs for minor irrigation schemes has exceeded the budget estimates by only 0.6%. (Refer para 4.1)

VI The budgeted amount for repair and maintenance for the year 1987-88 falls short of the anticipated actual by only 7% (Refer para 4.2)

VII As against the original budget estimate of Rs 29 million for repair and maintenance in the year 1988-89 the actual expenditure is expected to be Rs37.5 Million. However, as has been happening in the past the budget estimates will be revised (in Sept-Oct'88) to take care of the shortfall.(Refer para 4.2)

SUGGESTIONS:

I IRR should not be the sole criteria for the selection of lift irrigation schemes. It is suggested that additional criteria like a) capital cost per hectare should not exceed Rs32,000 and (b) the projected recurrent cost should not exceed Rs3,600 (excluding depreciation) per hectare, should be incorporated for AID-financed schemes. (Refer para 3.2.2)

II The minimum coverage of CCA under the LIS and FIS should be prescribed.

III LIS's with a head of more than a 100 meters should have a greater coverage to offset the higher recurrent costs.

Appendix E

OBSERVATIONS AND RECOMMENDATIONS FOR IRRIGATION MASTER PLANS IN HIMACHAL PRADESH

Observations and Recommendations for Irrigation Master Plans in Himachal Pradesh

Prepared by
Mike Walter and N.R. Banerjee.

The following discussion of H.P. irrigation master plans is based on a two-day visit by M.Walter, J.Grant, and N.R. Banerjee. We looked at two master plans (that for the the Rohru subdistrict of Shimla in great detail) and talked with ID officials who participated in preparing the plans.

H.P. had a master planning division within IPH until about 1983 when it was abolished because the task had been completed for all subdistricts in the state. It is not clear what uses, if any, were ever made of the master plans. Planning was done over a nine year period starting in about 1970. It was done at the subdistrict level and no further aggregation or compilation has been done.

The master plans were developed by two ID staff in each subdistrict, one junior engineer and one surveyor, spending an extended time on site in each subdistrict. These planners would contact local panchayats to determine the location of potential irrigation schemes as well as existing community and government systems.

The master plans appear to be fairly comprehensive in many respects. They include a listing of existing systems, some details about those systems (e.g. command area, water source, length of conveyance canal), and a map showing their locations. The map is relatively detailed with a scale of about 1 to 1500. A rough analysis has been done of the cost and benefit of each proposed system which, of course, includes anticipated cropping patterns.

Not included in the master plans we saw are any detailed soil survey, data on water rights, or local farmer organization.

Illustrative of the type of information in the master plans is that for Rohru subdistrict.

Total area	22,000 hectares
Cultivated area	15,000 hectares
Additional area that could be cultivated	7,500 hectares
Irrigated area	810 hectares
Community	600 hectares
Government	210 hectares
Potential irrigated area	7,500 hectares
Flow schemes	5,000 hectares
Lift schemes	2,500 hectares

Economic analysis was done for each scheme and then catagorized in summary form as follows:

	B/C Ratio
Flow schemes	20:1
Lift 0-150 m	4:1
Lift 151-300 m	3:1
Lift 301-700 m	2:1

No other priority ordering of schemes was done although each scheme could have been ranked by economic factors such as B/C ratio, total cost, or cost per hectare.

In our opinion, the potentially most useful component of the master plans are the detailed information and mapping of community and other existing and potential schemes.

By way of general discussion, a few aspects of the master plans and comments made about them seem particularly enlightening. These include:

- Master plans are rarely referred to in selecting new schemes; never as the initial starting point. In Solan, no master plan could be located at the district office.

- The Rohru subdistrict (one of nine in Shimla which is one of ten districts under the AID project) master plan identified 58 potential flow schemes (as of about 1976) with a cumulative command area of about 5000 hectares (the target for the new schemes under USAID HALWD project is 15000 hectares).

- The Solan Executive Engineer estimated that 25 to 30 schemes with potential command areas of 50 hectares each and lifts of 40 - 80 m could be constructed in his area.

- Potential sources and areas included in the master plan were first decided upon in consultation with the local Pradhan. They were not initially identified by an analysis of the local natural resources.

- There is a notion that the goal is to irrigate all earmarked areas so that it does not matter which scheme is developed first (e.g. there is no need for a master plan for setting priorities or economic planning)

We were impressed by the master plans we saw and encouraged that if master planning as an ongoing process was established in H.P. it could be very useful in developing a rational long range strategy. It must, however, be done in such a way that it complements rather than competes with the established practices for selecting schemes with heavy involvement by local representatives.

This might be done effectively through one or several of the following options:

- A Master Planning Unit could be developed at the state level to act as an advisory body. Such a unit would have primary responsibility of familiarizing itself of the natural resources of the state and opportunities for environmentally sound exploitation of these. An analysis of water resource development potential based on the physical environment, available markets, and the like would aid state and administrative officials in setting an irrigation development strategy. Such a unit might initially evaluate potential schemes, including primarily those in the existing Master Plans, to determine priority in selection of the most cost effective system in the state.

- A Master Planning Division could be reestablished within the IPH with a somewhat more forceful role than the unit mentioned above. In support of the AID HALWD Project, the short term task of this division would be to use information available in the existing Master Plans together with any necessary supplemental data to give clearance for any proposed scheme with certification that no other technically and economically viable schemes are feasible for serving the area or using the water source proposed. Supplemental information would include local water rights. The detailed planning and investigation works for the proposed scheme would only be taken up thereafter.

  In the long term, such a division would assume the role of continually updating the subdistrict plans on district and state levels. The resources and opportunities of a state as highly variable as H.P. cannot be optimized unless this analysis is done at the state level and development is coordinated so as to give priority to the best schemes.

- With or without either of the above groups, a natural resources survey unit is required. Such a unit would be responsible for quantifying and identifying the land and water resources of the state. With new technologies for monitoring, remote sensing, taxonomy, and the like, such a unit could provide invaluable information for environmentally and economically sound development.

Immediate steps should be taken by the Cell to use the Master Plans that are available. These plans can be utilized by the Project Cell to identify and give priority to the potential irrigation schemes, which are technically and economically feasible on a statewide basis. The Cell could design a certification similar to that discussed above. Final selection of schemes will be done from this list thus prepared. H.P. seems to have a mind set toward appraising and building irrigation schemes. Soon, however, it must divert some attention from the pre-occupation with individual irrigation schemes to a broader irrigation strategy based on national policies. This strategy must be statewide, not just subdistrictwise.

A state irrigation planning approach will be based on needs and possibilities only after an analysis of different irrigation options including future land and water use possibilities. Such an analysis will lead to selection of only the best choices of schemes for a given area. The state needs to back off and take a broader view of its irrigation sector, and maybe all of its water resources.