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PAKISTAN USAID

LONG-RANGE STRATEGY OPTIONS FOR WATER RESOURCES

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I. SUMMARY

Using WAPDA's "Revised Action Program for Irrigated Agriculture" as a sector analysis a long-range strategy for irrigation for AID in Pakistan is suggested. The basis for this strategy is that attention should be focussed successively on the most critical constraint. Having successively firmed up its water supply, arrested the spread of waterlogging and salinity and begun a sustained attack on the problem of watercourses, the most critical current untackled constraints facing the Indus system are unreliable delivery by deteriorated canals to watercourse outlets and poor integration of gains in farmer production environments. Alleviating these constraints constitutes the focus of the AID/World Bank Irrigation Systems Management (ISM) and Command Water Management (CWM) projects. CWM is also the most promising instrument for shifting management of the Indus system from supply-driven centralized management of canals toward decentralized demand-driven management of irrigation water for improved agricultural production.

The suggested strategy gives first priority to continuing and strengthening institutional development along the lines of the amended On-Farm Water Management (OFWM) Project and continuing and expanding CWM efforts. These tasks will need sustained attention over at least the next decade. Once technical standards are in place and institutional capability strengthened (in three or four years) continuation of AID support of canal rehabilitation operations is not recommended because other donors plan to continue this activity. Adding water use extension and

support for irrigation in outlying regions are also accorded high priority.

A set of technology-intensive low cost activities promising high payoff in overall systems operations and, if shown feasible, supervised credit for land levelling are given medium-high priority. Supervised credit for tubewells, again if shown feasible, is given high-medium priority. Medium priority is accorded to canal rehabilitation and subsurface drainage projects. Low priority is given to projects to increase surface storage and to replacement of SCARP tubewells. The priorities tend to favor programs which are country-wide rather than large non-divisible capital projects.

The present CDSS projection for the sector for the three-year FY 1988-90 period is $85 million. Levels of potential AID interventions are estimated in order to give a sense of relative magnitude:

	$ Million/Year
High priority items	47-69
Medium-high priority items	8-12
High-medium priority items	5-10
Medium priority items	7-60

Issue questions include:

(a) how to develop water user association programs which will involve users in management at the highest practical level on a continuing basis;

(b) determining the best management arrangement for CWM units;

(c) technical standards for canal rehabilitation and remodelling;

(d) how to learn from and extend CWMs;

(e) kareze versus tubewell development in outlying regions;

(f) extension of Irrigation Department responsibility by subdividing chaks; and

(g) subsidies.

Issues (a) through (d) and, to some extent, (e) are project design and implementation issues. The Mission has utilized the best expertise available to them in design, and a good disciplinary mix is proposed for the expatriate technical assistance. Some minor suggestions are made. Trying to find better answers to (a) and (b) are CWM project objectives. Issues (e) through (f) are principally policy ones.

With regard to university and research questions, it is judged premature to try to assess the eventual need for and viability of a degree program specializing in water management. The best strategy for the medium term is focused on training programs to meet project objectives. Agency responsibility for "systems" type water management research needs careful consideration. The question might best be approached pragmatically through experience with CWM. CWM units could be ideal sites for

this type of research. Collaboration and joint projects with the World Bank and other donors has made it possible for USAID to program a larger share of its resources to technology transfer and institution building with important benefits to the combined programs his approach should be continued. There appear to be opportunities for collaboration with the International Irrigation Management Institute (IIMI) through the CWM Project. IIMI should be in a position to discuss these by late FY 1984.

For the reader with limited time, the report can be read in parts. Chapters V and VI, which are fairly short, describe the strategy content and issues. Section B of Chapter II gives a short background description of the setting. Section A of Chapter III gives a short summary of Pakistan's macro-strategy. Section B of Chapter III is quite long and would be of interest to those interested in a rather detailed description of the various options considered.

II. INTRODUCTION

A. Scope

This report discusses AID/Pakistan's strategy in water resources. It results from a three-week's study by the writer (April 1-22, 1984) in Pakistan made at the request of the Mission. The writer's services were provided through a "buy-in" under AID's Water Resources Synthesis II Project. The scope of work is covered in Attachment A (1984 Islamabad 06208). The objective of the study was to produce "a report that delineates a recommended long-term strategy for AID/Pakistan's intervention in the water sector."

The study comprised a review of Mission and other donor programs; Pakistan's "Revised Action Programme for Irrigated Agriculture;" pertinent sections of the country's Sixth Five-Year Plan; pertinent Project Papers and various other documents; and discussions with GOP officials and USAID program managers.

The report discusses GOP strategy in irrigation including its future directions, sector relations to Mission strategy, future sub-sector program and project options for USAID, policy and implementation strategy considerations and linkages with programs in other sectors and with the new International Irrigation Management Institute.

B. The Setting

The bulk of irrigation development in Pakistan comprises the contiguous Indus River canal system under development since 1859. This area of 30 million acres contributes 80 percent

of the nation's total agricultural production. The additional 20 million acres of culturable land in Pakistan is watered by rain, residual flood moisture, isolated irrigation systems and groundwater. Though the Indus canal system dominates irrigation in Pakistan and will remain the centerpiece of irrigation development, this does not rule out the importance of irrigation in other outlying areas where many of the poorer, more disadvantaged people live.

The Indus canal system was primarily a settlement scheme. Its early objective was mainly revenue raising. Irrigation was provided for only a fraction of a farmer's holdings in order to spread the benefits to as large an area as possible, since revenues were based on landholdings, and to benefit a maximum number of people. Because of the flatness of the land, the frugal allocation of water also reduced waterlogging hazard. Early canals, "inundation canals," were simply extensions of the river and provided supplementary irrigation to rainfed agriculture. Later, barrages directed snow-fed base flows to provide some irrigation during periods when water could not be delivered through inundation canals, called "perennial" irrigation. Up to Independence, authorities were occupied primarily with completing the canal systems.

With Partition, flows of the eastern tributaries (Beas, Sutlej, and Chenab) were allocated to India. Construction of large link canals to transfer waters of the western tributaries (Indus, Jhelum, Chenab) to serve the Pakistan canals left dry by the Indian diversion, and development of surface storage (Mangla,

Tarbela and Chashma reservoirs) during the 1960s under the Indus Basin Treaty Settlement added flexibility and increased dry-season supplies. In the late 1950s, Pakistan also began an assault on its waterlogging and salinity problems--a threat regarded to be of magnitude equal to those posed by Partition. This led to tubewell drainage (Salinity Control and Reclamation Programmes, SCARPs) in critical areas. These and a spurt of private tubewell development also added to the amount and flexibility of the irrigation water supply. During the early 1970s, attention turned to include improving canal water service to farms, largely through improving water courses which were supposed to deliver water to farm fields from public canal outlets (Maghas) serving units (Chaks) of 200 to 700 acres. Existing water courses as constructed and maintained suffered water losses in the range of 40-60 percent and their inefficiency was regarded as a major contributor to Pakistan's low crop yields--among the lowest in the world for irrigated agriculture.

The Indus system is not just another very large canal irrigation system. The combination of conditions that define the limits of irrigation activities in the Indus system make it unique. It is unlike any other irrigation system in the world, including those in India. A comprehensive list of these conditions would be long. Among them are the very low land slope, the high sediment loads, salinity of much of the ground water, the arid, semi-monsoon climate and cultural heterogeneity of the population. These are a few of the factors beside sheer size which, in combination, make the system unique in the world.

Outside of the Indus area, Baluchistan, Northwest Frontier Province and Federally Administered Tribal Areas, irrigation opportunities are fairly extensive but small scale and widely scattered. They are very important to economic development in these areas. Oasis agriculture, exploiting ground water using Karezes and surface water from small diversions and canals, has been a way of life for centuries, but there remain substantial opportunities for extension and improvement of facilities.

C. The Revised Action Program as Sector Analysis

Probably no irrigation system has been studied as much as the Indus. Since the 1950s, extensive studies have been made of the ground and surface water supply base, waterlogging and salinity, agricultural production, etc., with a large number of feasibility studies of development options. In spite of these and major investments, irrigated agricultural productivity remained remarkably low. Tables II-1 and II-2 list AID and other donor investments in the sector. The "Revised Action Programme for Irrigated Agriculture"[1] was a three and one-half year study finished in 1979 with the objective of "realizing the full agricultural potential of Pakistan's irrigable lands and to fully utilize the water resources of the Nation." The study was conducted under a UNDP agreement with the World Bank as the executive agency by the Master Planning and Review Division of WAPDA with Harza Engineering and World Bank providing technical

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[1] "Revised Action Program for Irrigated Agriculture," Main Report (3 Volumes), Summary. Master Planning and Review Division, Water and Power Development Authority, May, 1979.

TABLE II-1

Summary of U.S. Assistance to Pakistan
for Water Resources Development Activities (1953-1981)

Activity/ Project	Obligation Date	Disbursements (In $ Thousands) Grant	Loan	Total
1. Bolan Dam	1953	75	--	75
2. Groundwater Exploration	1953	188	--	188
3. Soil and Water Conservation	1954	561	--	561
4. Groundwater Survey	1954	4,608	--	4,608
5. Taunsa Barrage	1954	5,894	--	5,894
6. Water Resources Development	1955	134	--	134
7. Punjab Ground-water Reclamation	1959	--	14,963	14,963
8. Indus Basin Replace-ment and Development	1960	295,600	649,100	944,700
9. Salinity Control and Reclamation (SCARP)	1963	--	21,122	21,122
10. Land and Water Use	1967	213	--	213
11. Hydro Monitoring and Research	1967	433	--	433
12. On-Farm Water Management	1977	2,145	4,635	6,780
TOTAL		309,851	689,820	999,671

TABLE II-2

Summary of Other Donor Assistance Activities
In Irrigation Water Development

Activity	Executing Agency	Donor	Allocation (In U.S. $ '000)	Undisbursed Balance (9/30/81) (In U.S. $ '000)
ONGOING				
SCARP Mardan	WAPDA	Canada	30,000	29,700
SCARP VI	WAPDA	KFW	8,414	8,414
Rigs, Dredges & Other Equipment	PID Sind	Netherlands	227	3
SCARP VI	WAPDA	U.K.	16,977	16,766
On-Farm Water Management	MF&A	IDA	41,000	41,000
Drainage and Irrigation Farming	WAPDA	IDA	14,000	7,204
Salinity Control & Reclamation	WAPDA	IDA	70,000	69,060
Salinity Control & Reclamation	WAPDA	IDA	60,000	59,000
On-Farm Water Management	MF&A	ADB	25,000	25,000
Tarbela Dam Repair	WAPDA	Saudia Arabia	58,692	47,507
Chashma Right Bank Irrigation	WAPDA	EEC	4,677	3,042
Chashma Right Bank Irrigation	WAPDA	EEC	25,360	25,240
Chashma Right Bank Irrigation	WAPDA	ADB[a]	31,500	30,684
South Rohri Fresh Groundwater	WAPDA	ADB	47,000	47,000
South Rohri Fresh Groundwater	WAPDA	Saudi Arabia	14,339	14,339
Baluchistan Minor Irrigation & Agriculture Development	PID Baluchistan	IDA, KFW, Netherlands	32,700	NA
Tarbela Dam Development Fund	WAPDA	Australia, Canada, France, Germany, Italy, UK, USA, IBRD, IDA, EEC	674,727[b]	6,084
Total			1,154,613	NA
NEW				
Irrigation Systems Rehabilitation	PID	IDA	40,000	
SCARP Transition and Command Water Management	WAPDA	UNDP	1,400	
Total			41,400	

[a]Loan suspended on GOP request and has not yet been re-activated.

[b]Total pledges including "Indus Balance" transferred from the Indus Basin Development Fund to the Tarbela Development Fund.

Exchange Rates Used: U.S. $1 = 2.37704 DM; = 5.65520 FF;
= 2.64566 DFL; = 0.50655 Pounds; = 3.49300 SR.

assistance. Coordination with the Federal Ministries and Provincial Governments was achieved through a National Board and Coordination Committee. The study collected information and made analyses of the agricultural setting; demand projections for agricultural products; climate, land and human resources; agricultural performance and constraints; water resources and their management; and sector programs and policies and modes and potential for agricultural development. Criteria for plan and project formulation were developed; project and program alternatives were examined. Given financial and other constraints, a schedule of water sector program and project investments perceived as best meeting criteria and objectives was developed for the period 1980-1990, with implications beyond 1990 noted. A complementary agricultural sector program was included. Finally an analyses of policies and institutions led to recommendations for certain changes. The substantial content of the plan is summarized in Chapter III.B.1.

Since the report is now more than four years old, consideration was given to its current timeliness. My assessment is that very little has occured during this interim which would change the report, particularly the arrangement of program and project priorities and suggestions for policy and institutional changes. Accordingly the RAP stands as an exhaustive water-sector analysis at a scale USAID could not begin to duplicate and against which USAID can confidently assess its strategy.

D. Water Resources/Irrigation Relationships

The scope of work calls for a "water sector strategy." Some thought was given to the relative emphasis of the water resources sector generally in relation to its irrigation subsector. Other water resource subsectors were identified as hydroelectricity, flood control, municipal and industrial water supply and water resource information, planning and management.

Irrigation is linked somewhat competitively with hydroelectricity at the planning and management level for multi-purpose reservoirs because of non-concurrent demands for releases. I am informed that as policy, irrigation demands take precedence over hydroelectricity so this competition is not an issue. The main content of the subsector would be hydroelectric plant design, construction and operation. Except possibly for multi-purpose planning AID would not seem to have a strong water resources rationale for entering this subsector.

Flood control is also linked to irrigation through operation of multi-purpose reservoirs. Irrigation strategy calls or filling the reservoir as rapidly as possible; flood control strategy would withhold storage to moderate floods. AID may have some comparative advantage in reservoir operation strategies. Protection from riverine flooding mainly using levees, although non-structural approaches are to be studied, does not appear as a high priority candidate for AID assistance given CDSS criteria, limited budgetary resources and what appear to be more justifiable claims in the irrigation subsector. The U.S. might claim some comparative advantage, but its record is controversial.

Removal of local rainfall flooding is included in the irrigation subsector.

I also do not see urban, municipal and industrial water supply as having a high AID priority for the same general reasons as riverine flood control. Village water supply could, however, be important in programs for outlying regions.

AID possibly could make some important contributions in overall water resource planning and management at fairly low cost. Some possibilities are mentioned in Chapters IV and V.

Based on the above screening, the following analyses and report will concentrate on the irrigation subsector.

III. PAKISTAN IRRIGATION STRATEGY

A. Introduction: Strategy from Independence to Present

A basic strategy principle for improving a sector or system is to successively identify and reduce the most critical constraint; this is analogous to the economic principle of investing in that activity having the highest marginal return. This strategy can almost never be followed neatly. There may be joined constraints and interventions will overlap in time and in effect.[1] Constraints are not necessarily technical; very often they are social, financial, or political. Pakistan's post-Independence Indus Basin water strategy has, in broad terms, followed this strategy with successive emphasis on: (1) firming up the basic water supply (Indus Basin Project); (2) control of salinity and waterlogging (SCARP Projects); (3) improving distribution of water--now substantially increased--to farm fields (On-Farm Water Management). While SCARP projects were floated largely under the waterlogging and salinity label, increased water supply was part of the calculus. More serendipitous, was the remarkable way in which the private sector picked up tubewells as an additional source of dependable water supply. Nearly 200,000 private tubewells now produce an estimated 26 million acre-feet (about 20 percent of the annual total supply) annually.

While the contents of development efforts in the sector remain broad, cutting edge efforts now being implemented and in

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[1] Full scale, real world testing and revision applies to technology development generally; witness the development of nuclear energy, for example.

which AID is involved follow the rule. Having at least alleviated water supply, salinity and watercourse problems, the strategy turns to improving the reliability of canal delivery to outlets and removing rainfall and excess irrigation water so that farming operations can proceed more expeditiously through remodelling and rehabilitation (Irrigation System Management (ISM), in part) and to integrating gains into system operation and toward improvement of the environment in which farmers are expected to practice irrigated agricultural production (Command Water Management (CWM)).

B. Strategy Options for the Future

1. Revised Action Program, Criteria and Considerations

a. Policy

The Revised Action Program for Irrigated Agriculture (RAP) suggested an investment of Rs 68.42 billion (1979 price level) over the 1979-1990 decade. Recommended policy changes are in two major categories:

> Water-related policies are based on the premise that provision of "controlled" or "guaranteed" water supplies is the key to improving the production environment of the farmer. Irrigation water supply should match crop water needs to the extent possible. This can best be accomplished by the farmer having as much control of his water supply as possible. Financial policies are addressed to creation of an economic environment that will provide incentives for increased production, and to implement the strategy of

increased mobilization of domestic savings to finance further investment.[2]

Suggested specific policy actions are:

(1) Development of all usable groundwater areas by private sector, financed by supervised credit.

(2) Gradual transfer of usable groundwater area SCARPs to the private sector.

(3) Elimination of all tubewell and fertilizer subsidies.

(4) Increasing water charges[3] threefold over the next five years.

(5) Public investments in watercourse lining should be fully recovered from beneficiaries.

(6) Capital recoveries in irrigation and drainage infrastructure should be partially recovered from the beneficiaries, but the developmental charges should not exceed 35 percent of the incremental income of the beneficiaries.

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[2] "Revised Action Programme for Irrigated Agriculture," Main Report (3 Volumes), Summary, Water Planning and Development Authority (WAPDA), May 1979.

[3] With the recent introduction of Usher and Zakat and the abolition of the land revenue tax, the tax service charge structure to farmers would have to be carefully examined. Usher is a flat rate tax on agricultural production, nominally 10 percent. Zakat is a tax on savings not productively invested.

(7) Basin-wide water management would be a major objective of the government through the integrated use of rivers and reservoirs, conjunctive use of surface and groundwater, and advance crop planning to accomplish the above.

b. Institutional Recommendations

Recommendations for institutional arrangements are summarized as follows:

(1) Commission for Agricultural Policy and Planning (CAP) directly under Chief Executive to spearhead agricultural production.

(2) Provincial Additional Chief Secretaries for Agricultural Production (ACSAP) to coordinate water and related agricultural subjects.

(3) Autonomous Provincial Minor Works Corporation (MWC) to undertake watercourse lining, facilitating private tubewell installations; and managing a SCARP Transition Programme.

(4) Command Area Management (CAM) for area-based management of major water sector projects.[4]

CAP would provide policy and program direction at the Federal level to agencies functioning in the agricultural sector. It would be headed by a Minister reporting directly to the National Chief Executive and supported by a small interdisciplinary professional staff.

Command Area Management: The report strongly recommends that water sector infrastructure projects be managed as area

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[4] "Revised Action Programme for Irrigated Agriculture," Op. Cit., p. IV-14-18.

development projects with their objective to generate improved returns for the farm population of the area. Two levels of Command Area Management (CAM) are visualized. In CAM-I (project) the Project Director would be responsible for integrated and conjunctive use of water supplies in the area and insuring the timeliness and adequacy of supplies of non-water inputs and extension advice. CAM-I projects would be headed by a Director appointed by either the Provincial Irrigation or Agriculture Department. CAM-II (non-project) is designed to meet coordination needs where projects are not planned for the future. CAM-II units would be headed by an official of the Provincial Agricultural Department who, with staff, would be responsible for insuring timely availability of production inputs. CAM-I projects are visualized as covering an area of the order of 500,000 acres. CAM-II areas would be about 100,000 acres.

Over time CAM would tend to diminish the functional responsibilities of present Irrigation and Agriculture Departments, but a complete transfer of function is not visualized because of the integrated nature of the surface system which has to be managed on a basin-wide basis. CAM-II is recommended as the basic module for implementing the Revised Action Programme.

c. Planning Strategies

Identified potential programs or project activities called "Modes of Development" were divided into programs and projects. Programs are distinguished from projects in that they are not bound to any specific area, but rather are

applicable to all or most of the Indus Basin. Three alternate investment schedules were developed, emphasizing (1) rapid increase in economic growth by improvement of productive efficiency and completion of early maturing projects; (2) preparation of foundation for long-term economic growth by investment in major infrastructure development, usually capital intensive projects to be initiated ahead of demand; and (3) lifting of income of the low income segment of the population and development of distressed regions.[5] Lists of modes and investment schedules under each alternative were then compared.[6] In summary, this analysis demonstrated that:

(1) resource limitations required choices as to strategy and priority;

(2) emphasis on shorter maturing projects resulted in higher production by 1990 than larger, longer maturing surface storage or extension schemes;

(3) water sector programs will result in greater production at less cost than alternative project schemes;

(4) water sector programs will need to be supplemented by relieving non-water sector constraints, largely in the agricultural production sector, if domestic demands are to be met;

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[5] Ibid., Vol. III, p. IX-1,2.

[6] Ibid., p. IX-66-77.

(5) replacement of SCARP tubewells with private wells will result in higher output and an accumulated savings to the public sector of Rs 2 billion by 1990; and

(6) emphasis on canal irrigation extension schemes to improve income distribution could provide irrigated farmland to 300,000 families by 1990, but the assumption that these would be an efficient means of income distribution needs examination.[7]

Modes of development were also classified into two categories: (1) modes for increasing the resource base like increasing the water supply or area of irrigable land; and (2) modes for improving the utilization of the existing resource base such as improving the distribution and timing of irrigation water or redistributing control of land and water resources to improve their intensity of use, giving as much control as possible to the farmer. Principal parameters for comparing modes on this basis were "non-divisibility of capital cost, approximate rate of return, energy generation or production characteristics, benefit gestation periods and previous experience in Pakistan with the mode."[8]

Table III-1 gives an assessment of the various modes in the suggested RAP portfolio. The RAP was not simply a program of ranking projects to develop an investment schedule but involved

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[7] Ibid., p. IX-92, 93.

[8] Ibid., Summary, p. 9.

Table III-1

Alternative Development Modes

Mode	Unit Cost Rs/Unit	Cost per Acre-foot Farmgate (Rs.)	Approx. Rate of Return (%)	Time to Benefit (Yrs)	Electricity	Previous Experience
Multi-purpose Reservoirs		200-240				
Kalabagh	12,850 M		12	10	Produce	Much
Thal	2,950 M		15	5	Firm up	Little
Single-purpose Reservoirs				4	—	Some
Canal Remodelling	450-800/ac		12-15	3	—	Little
Canal Extension	1000-3000/ac					Much
Groundwater Development						
Public 3 cfs	.45M/TW	85-100	9-12	3	Significant	Much
Private 1.0 cfs		50-110	25+	1	Some	Much
Private 0.5 cfs		50-115	25+	1	Some	Some
Private 0.25 cfs		80-150	20+	1	Some	Some
Riverain Reservoir	.7M/TW			3	Significant	None
Watercourse Improvement						
Lining 100%			6-8	1	—	Little
Lining 75%			10-13	1	—	Little
Lining 50%	35/ft		15-20	1	—	Little
Earthen	3/ft		10-12	1	—	Some
Saline GW Area Drainage						
Tubewells	2800/ac		6-12	3	Significant	Some
Tiles	4000/ac		6-10	5	Some	None
Soil Reclamation						
Easy	300/ac		20-40	1	—	Much
Difficult	1000/ac		10-25	3	—	Some
Surface Drainage			15-20	4	—	Much
Agricultural Extension			50+	1	—	Some
Agicultural Research			50+	1	—	Some
Agriculture Input Supply						Much
Rural Infrastructure			25+	1	—	Much

> (1) choosing that package of "projects and programmes" which will maximize returns in the short run (next five years); insuring not only that inputs (water, fertilizer) will be supplied in larger quantities, but that policies will be adopted, and that institutions will be developed to enable farmers to make effective use of inputs and generate returns; (2) designing cost recovery, taxation, and/or financing policies so that the resultant increments in incomes will be partially available to finance additional capital formation; and (3) using the generated public savings only for selective capital formation,[9]

e.g., development of riverine groundwater. Under this scrutiny a number of modes originally included in the three schedules did not survive and the non-water sector modes relating to agricultural production were added.

Of the Rs 68.42 billion proposed by the RAP, Rs 14.16 billion are suggested for the agricultural subsector; in the water subsector Rs 16.49 billion are suggested for improving existing infrastructure and Rs 37.77 billion for additions to the system. See Table III-2.

d. Programs and Projects[10]

Distribution of allocations to programs and projects is shown in Table III-3. Annex III-1 shows a more detailed list. Following are descriptions of programs and projects.

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[9] Ibid, p. 8.

[10] Ibid, pp. 27-38.

Table III-2

Distribution of Expenditures

Item	Estimated Cost Rs Billion		Percent Plan Cost
Agriculture Sector		14.16	21
Extension	(3.28)		
Current Inputs	(3.00)		
Animal Husbandry	(3.00)		
Research	(1.50)		
Other	(3.38)		
Water Sub-Sector			
a. Improvements of the Existing Infrastructure		16.49	24
Groundwater (credit)	(6.20)		
Watercourse Improvements	(5.64)		
Irrigation System Improvements	(3.95)		
Basin and Canal Management	(0.70)		
b. Additions to the System		37.77	55
Ongoing Commitments	(9.57)		
New Projects	(28.20)		
TOTAL		68.42	100

Table III-3
Investment Allocations to Programmes and Projects

	Total Cost --(M Rs)--	Percent of Total	REGIONAL DISTRIBUTION North Cost -(M Rs)-	North Percent of Line	South Cost -(M Rs)-	South Percent of Line
PROGRAMMES						
Groundwater Development	4,004	6.9	2,560	64	1,444	36
Tubewell Replacement	4,390	6.4	3,560	80	880	20
Watercourse Improvement	5,640	8.2	3,090	55	2,550	45
Irrigation System Improvement	3,950	5.8	2,370	60	1,580	40
Basin and Canal Management	700	1.0	—		—	
Agricultural Research	1,500	2.2	—		—	
Extension—Agriculture, Water	3,280	21.0	—		—	
Other[a]	14,348	21.0				
Sub-Total	37,812	55.3	(11,530)[b]	(64)	(6,454)	(36)
PROJECTS						
Sub-surface Drainage	6,562	9.6	1,969	30	4,593	60
Surface Drainage	3,157	4.6	1,110	35	2,047	65
Canal Remodelling	4,400	6.4	1,390	32	3,010	68
Reservoirs	6,850	10.0	—		—	
Canal Extension	3,580	5.2	2,580	72	1,000	28
Flood Control	6,066	8.9	3,640	60	2,426	40
Sub-Total	30,615	44.7	(10,689)	45	(13,076)	55
TOTAL	68,427	100.0	(22,219)	53	(19,530)	47

[a]Includes special areas, other Federal, rural infrastructure, animal husbandry, institute costs, working capital, etc.

[b]Indicates sum or percentage of allocable costs.

(1) Supervised Credit for Tubewells

In place of the subsidy program which would be phased out, supervised credit would be provided for private tubewells. Credit financing of 80 percent of about 80,000 new one-half cusec equivalent wells, 100,000 one-cusec equivalent wells to meet replacement requirements of existing wells and 27,000 one-cusec equivalent wells to meet replacement requirements in SCARPs. Private wells would add 11 million acre-feet of fresh groundwater annually. The banks would be used as the channel for introducing appropriate size tubewells, and providing advice on complementary investments and improved cultural practices.

(2) SCARP Transition

Because of complex logistic financing the development of a "SCARP Transition Plan" is proposed. RAP proposes funding for improved water production until 1986 pending implementation of the transition plan.

(3) Watercourse Lining

Priority is recommended for some 29,000 watercourses overlaying unusable groundwater in perennial canal commands. From 50 to 70 percent of the watercourse length would be lined. Financial costs would be borne by beneficiaries because of high expected returns. The RAP recommends that this lining be done by the proposed autonomous provincial Minor Works Corporations.

(4) Water Use Extension

RAP estimates that about 48,000 watercourses of the 60,000 in areas of usable groundwater could be rehabilitated at a cost of Rs 3 per foot from a well-directed watercourse improvement and maintenance program including heavy cleaning, shaping, compaction, provision of pacca nakkas (concrete farm turnouts) and, in some cases, partial lining. Costs of extension and materials would be recovered from farmers.

Most of the remaining salt affected land, about 30 percent of the Indus plains, could be reclaimed by improved water supply and drainage. Only about 10 percent of these lands would require chemical amendments. Cost range from Rs 300 to Rs 1,000 per acre with economic rates of return of 10-40 percent. Farmers would carry out the reclamation. The public sector would provide extra inputs (water, gypsum) and credit for improvements such as land levelling.

A total farm-level Water Use Extension Program is recommended. This activity would complement the private tubewell credit and agricultural extension programs.

(5) Irrigation and Drainage System Rehabilitation

This program provides for significantly increasing the rehabilitation of the system's badly deteriorated canals. Costs are from Rs 10 to Rs 25 per acre and would be offset by increased water charges. A phased basin-wide program would rehabilitate facilities serving 30 million acres by 1990.

(6) Basin and Canal Command Water Management

Fully integrated operation of Mangla, Tarbela and Chashma Reservoirs could yield substantial improvements in irrigation water utilization by providing canal water in timely fashion to meet crop needs and in a way that would encourage better utilization of conjunctive groundwater.

At watercourse level, RAP recommends reduction of chak size to extend the management responsibility of Irrigation Departments to outlets serving about 25 acres.[11] Management and investment tasks are massive and full implementation would take decades.

About Rs 700 million has been projected for the decade, primarily to catalyze the required policy decisions and create the required institutions.

(7) Agricultural Extension and Inputs

Present extension activities in Pakistan are viewed as essentially ineffective. The program would provide better trained personnel and decrease the service of one worker from 600 to 200 farmers, implementing the Training and Visit (T&V) system. Worker personnel would be increased from the present 7,000 to 21,000 by 1990.

(8) Agricultural Research

Needed improvement in research requires training, but more importantly pay incentives to offset

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[11] I have serious reservations on this recommendation.

international opportunities for highly-trained individuals. RAP also suggests that focus must shift from university and agricultural station to farm-based research. A significantly expanded allocation for research is included in the RAP Plan, but policy rather than funding is the real issue.

(9) Seed Certification

Only about six percent of wheat and rice requirements are met using certified seed. Two recently created provincial Seed Corporations should target 100 percent certification. Rupees 500 million is planned for revolving capital for this purpose.

(10) Projects[12]

Because of their large number (see Annex III-I) projects can only be described by category.

Sub-surface drainage projects are given high priority. Plan proposed: RAP includes financing of drainage of areas overlying unusable groundwater. Drainage in usable groundwater areas provided by private tubewells.

Surface drainage projects are scheduled for relatively high rainfall areas in eastern Punjab and Sind. Flood control investments are mainly for protection from river flooding but also include projects for protection from hill torrents. The Left Bank Outfall Drain (LBOD) and Right Bank Outfall Drain (RBOD)

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[12] Revised Action Programme for Irrigated Agriculture," Op. Cit., Summary, p. 38-41.

projects are the central elements for regional development complexes. The Plan provides for Phase II of LBOD and a revised feasibility study and regional plan. For RBOD a set of alternative regional development concepts has been formulated as a first step toward preparation of a regional development plan.

Canal remodelling projects are scheduled for areas where delivery of surface supplies is constrained by canal capacity, or where modifications are needed for improved water management.

Thal multi-purpose reservoir fed by the Chashma-Jhelum Link Canal has been scheduled for 1986 completion.

Extensions of canal irrigation to new areas is included primarily as a measure for distribution of economic benefits. These projects generally have low rates of economic return.

Kalabagh Dam has been scheduled to begin in 1987 with 1994 completion. Live storage is 7.9 million acre-feet with 880 MW firm and 1500 MW peak electricity capacity. This large non-divisible Rs 13,000 million investment has a long (10-year) gestation period. In terms of water production, Kalabagh ranks below tubewell, watercourse lining, canal rehabilitation, and basin and command water management schemes. From the power point of view, Kalabagh ranks higher.

2. Sixth Five-Year Plan

a. Objectives

The principal objectives of the Sixth Plan (1983-88) in the water resources sector are:

"A. Protection of Land and Infrastructure

(i) to protect the Tarbela Dam and the IBP works by quickly completing the repair and remedial works.

(ii) to protect fertile lands from waterlogging and salinity, by giving priority to the disastrous area having saline groundwater underneath.

(iii) to protect lands and infra-structure from floods by completing Phase-I of the flood programme and by undertaking some portion of the Phase-II programme.

(iv) to protect ground water irrigation by replacing the deteriorated public tubewells.

B. Improvement of Existing Irrigation and Drainage System

(i) to improve the water delivery efficiency of canals and drains by remodelling.

(ii) to achieve equitable distribution of water by rehabilitating the existing irrigation and drainage system.

(iii) to improve the overall working efficiency of the irrigation and drainage system by appropriate training of personnel and reorganizing the institutional framework.

(iv) to achieve optimal use of water by introducing command water management.

(v) to achieve high irrigation efficiency by reducing water losses through an accelerated 'On-Farm Water Management Programme'.

C. Extension of Irrigation and Drainage System

(i) to initiate new irrigation schemes in areas suffering from water deficiency.

(ii) to embark on construction of new medium-size reservoirs for increasing cropped acreage.

(iii) to exploit ground water by installing public tubewells in under-developed areas.

(iv) to construct small surface irrigation schemes, check dams, infiltration galleries, diversion weirs, delay action dams, flood irrigation schemes in FATA and Baluchistan."[13]

b. Budgetary Projections

The Plan projects Rs 32,100 million for the five-year period. Table III-4 shows the distribution among the various subsectors. For detailed budgets see Table III-5. Rupees 14,024 million is allocated to continue ongoing activities, leaving Rs 18,076 million for new starts. The Plan shows a substantial increase of emphasis on drainage and irrigation and a decrease in Tarbela and Indus Basin Works because of essential completion of the massive rehabilitation at Tarbela. The drainage and reclamation subsector provides for extension of public tubewells in saline groundwater areas and fairly large (lumpy) investments in areas where waterlogging is critical. The irrigation subsector includes canal rehabilitation and remodelling, small irrigation schemes in outlying regions and command water management. While the percentage remains the same, the watercourse improvement is doubled in terms of current rupees. Thus the shifts are consistent with the RAP philosophy which gives higher priority to improving the utilization of existing

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[13] Sixth Plan, Chapter 16, "Irrigation Water: A Diminishing Resource."

infrastructure, quicker maturing investments, programs over projects and divisibility of capital.

Table III-4

Plan Allocations by Subsectors

(Rs. Millions)

Subsector	Sixth Plan Allocation	--%--	Throw Forward	New Projects	Fifth Plan Expenditure	--%--
1. Drainage & Reclamation	13,815	43	6,467	7,348	4,003	25
2. Irrigation	10,919	34	5,489	5,430	3,697	23
3. Flood Control	1,867	6	--	1,867	1,209	8
4. Tarbela/IBP	2,690	9	1,289	1,401	5,552	35
5. OFWM Programme	1,060	3	60	1,000	555	4
6. Survey, Investigation & Misc.	1,346	4	473	891 }		
7. Research	425	1	246	139 }	751	5
TOTAL	32,100	100	14,034	18,076	15,767	100

(1) Drainage and Reclamation

The Sixth Plan strategy for controlling waterlogging and salinity includes giving emphasis to "disastrous" areas where the water table is within five feet. Priority would be given to saline groundwater areas and reclamation of the fresh groundwater areas in the private sector would be encouraged by providing electrical grid, subsidy and advancing loans.

Table I

Water Resources
Financial Alloca

Subsector	Federal	Punjab	-Sind-	-NWFP-	Baluchistan	Azad Kashmir	FATA	-NA-	- Total -
	Million Rs								
Tarbela/IBP	2,690								2,690
Irrigation	4,250	2,610	1,582	1,118	603	200	476	80	10,919
Surface Irrigation									
- Reservoirs	200	—	—	—	-	-	-	—	200
- New/Extension of Canals	2,400	688	716	200	-	106	-	—	4,090
- Canal Remodelling	—	800	435	651	-	-	-	—	1,886
- Canal Rehabilitation	1,550	350	216	59	48	-	-	—	2,223
- Small Dams/Check Dams	—	300	20	40	112	-	-	—	472
- Small Schemes	—	50	100	40	256	90	290	80	906
- Command Water Management	—	150	75	25	30	-	-	—	280
Groundwater									
- Public Tubewells									
(i) New	—	—	—	100	150	4	186	—	440
(ii) Replaced	—	200	20	—	-	-	-	—	220
- Private Tubewell Subsidy	100	92	—	3	7	-	-	—	202
Drainage and Reclamation									
- Federal	13,500	—	—	—	-	-	-	—	13,500
- Provincial	—	300	10	5	-	-	-	—	315
Flood Control Regulation									
- Federal	1,802	—	—	—	-	-	-	—	1,802
- Provincial	—	50	10	5	-	-	-	—	65
Water Management									
- Federal	60	—	—	—	-	-	-	—	60
- Provincial	—	740	148	75	37	-	-	—	1,000
Survey, Investigation and Miscellaneous	593	250	40	192	160	-	124	—	1,361
Research	320	50	10	5	-	-	-	—	385
TOTAL	23,220	4,000	1,800	1,400	800	200	600	80	32,100

Completion of ongoing programs will require Rs 6,467 million. An allocation of Rs 7,348 million is made for new programs, making a total of Rs 13,814 million, which would provide protection to 2.88 million acres of disastrous area. The private sector is expected to install about 25,000 tube wells. Public sector investment would provide 4,312 new tubewells, 810 tubewell replacements, 3,065 miles of surface drains and 8,381 miles of tile drains. No provision appears to have been made for financing additional loan capital for supervised credit for private tubewells, but this may not be necessary. The Plan, however, provides for continuing the subsidy of private tubewells. Further detailed description of the subsectoral activity follows:

(2) Surface Irrigation

(a) Canal Remodelling: For the Punjab, proposed remodelling serves mostly SCARP VI. Remodelling of 1,795 miles of canals will benefit 40,000 acres. In Sind and NWFP, principal beneficiaries are the Rohri and Lower Swat canals.

(b) Canal Rehabilitation: This program would rehabilitate 39,000 miles of canals and 3,700 miles of drains to serve about 42 million acres. About 10 percent will be completed under the Fifth Plan and the program will extend beyond the Sixth Plan.

(c) Small Dams: Construction of small dams is primarily in Punjab but also in NWFP and Sind.

(d) Small Irrigation Schemes: The allocation is for development of a large number of small schemes in Baluchistan, Federally Administered Tribal Areas (FATA), Azad Jammu and Kashmir (AJ&K) and Kohistan and the Northern Areas (NA). In Baluchistan and NWFP these include enhancing karezes. Small irrigation schemes in outlying regions are given equal importance with settled areas in the Indus Basin.

(e) Command Water Management: CWM will cover 620,000 acres in the various provinces.

(3) Groundwater Irrigation

(a) Public Tubewells: New public tubewells (approximately 260) will be financed in Baluchistan, FATA and NWFP, primarily in Baluchistan.

(b) Tubewell Replacement: In SCARP areas about 1000 tubewells in Punjab and 183 in Sind will be replaced.

(c) Private Tubewell Subsidy: Up to 1982-83 Rs 211.6 million had been allocated to subsidize 19,433 tubewells. The Sixth Plan proposes subsidy for an additional 8,195 tubewells.

(4) Flood Control and Regulation

Flood damages during 1973, 1975 and 1976 were estimated at Rs 20 billion, primarily to agriculture. Rs 1,802 million have been allocated for civil works for flood

control and protection during the Sixth Plan.

(5) Tarbela/Indus Basin Projects

Of the subsector allocation of Rs 2,690 million, Rs 1,465 is allocated to completion of Tarbela; Rs 780 million to other Indus Basin project activities, including canal maintenance, watershed protection and completion of Chashma Barrage and Chenab-Jelum link. Rupees 445 million is to be devoted to a reservoir maintenance facility financed by UK and WB, designed to update WAPDA's operation and maintenance capabilities at Tarbela, Mangla and Chashma dams.

(6) Water Management

Under the AID-sponsored program, 1,316 watercourses were rehabilitated and precision land levelling provided 74,857 acres by June, 1981. Under the Crash Programme (heavy maintenance) 52,000 watercourses were improved by July, 1982. A modified project initiated with assistance of World Bank, Asian Development Bank and others plans to improve 3,315 watercourses and clean 16,500. Sixth Plan targets are to continue the Crash Programme by improving 20,000 watercourses and provide full improvement (installation of pacca nakkas and lining) on 8,000 watercourses.

Water user associations, now given legal status as corporate bodies with powers to hold property, enter into contracts and carry out legal proceedings are regarded as an essential element of the water management program. Their primary purpose is to improve and maintain watercourses with a secondary function of

obtaining other agricultural inputs. The Plan document has some reservations about availability of personnel to fully implement the program.

(7) Surveys, Investigation and Miscellaneous Programs

This activity includes collection of hydrological and meteorological data and provides basic geodetic and topographic surveys. It also includes specific investigations needed for feasibility studies and planning made primarily by WAPDA. Some new observational and training facilities will be provided for support of the survey program.

(8) Research

Major emphasis will be given to control of waterlogging and salinity and enhancing water availability at farmgate. WAPDA, the Irrigation Research Council, and in the provinces the Punjab Irrigation Research Institute, Directorate of Land Reclamation, and the Sind Hydraulic Laboratory at Karachi are principal beneficiary agencies. WAPDA plans to continue reclamation work at Mona and to develop a similar project in the lower Indus. An International Waterlogging and Salinity Research Institute is being established. WAPDA will also conduct research on tubewell rehabilitaion and prototype research on alluvial channels. The program of the Irrigation Research Council primarily includes establishment of a National Institute of Hydrology, modernizing the Irrigation Research Institute,

studying and monitoring drainage projects, establishing a second desertification monitoring unit and creating a water harvesting unit.

(9) General Issues

(a) Decision on Indus Waters: Distribution of Indus waters among the provinces at present is ad hoc and is such that allocated waters frequently do not match crop requirements, with built-in waste in some situations and shortages in others. This structural constraint contributes significantly to water use inefficiency. The matter is under study by a Commission headed by the Chief Justice of Pakistan but a report has not yet been made.

(b) Federal-Provincial Division of Responsibility: Certain general functions have been transferred from Provincial to Federal responsibility, e.g., operation of large dams (Tarbela, Mangla), flood protection, certain research activities, and the rehabilitation program.

(c) Implementation Arrangements in the Less Developed Regions: Doubling the development budget in these regions as planned will tax the capacity and capability of existing agencies. This should be enhanced by providing for active participation of private contractors.

(d) Standards for Suitability of Groundwater: Because of the high salinity of groundwaters underlying 60 percent of the total Indus cultural command area, there

are needs for standards for evaluating the suitability of groundwater, directly or blended with surface water, for irrigation.

(e) SCARP Transition: A UNDP-financed and World Bank-supervised study is being undertaken to consider ways and means of transferring SCARPs to the private sector.

(f) Master Planning: A Master Planning Unit would be provided for the Water Resources Section. It would adjust and review the Revised Action Plan, provide information for annual and medium-term plans and for technical review and serve as a nucleus for training activities for provincial officials involved in project planning and preparation.

Annex III-1

Revised Action Programme
Programme and Project Investment Schedule
(1979-90)

COST ESTIMATES

(Million Rupees)

	1979-80	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total 1979-80	Post-1990
A. PRIOR CLAIMS													
- SCARP VI	94	230	255	295	320	150	—	—	—	—	—	1344	Nil
- Khairpur East Tile	75	76	77	—	—	—	—	—	—	—	—	228	Nil
- Mardan SCARP	132	243	243	220	200	66	—	—	—	—	—	1104	Nil
- Chashma Right Bank	200	350	500	400	85	—	—	—	—	—	—	1535	Nil
- Rohri North	40	—	—	—	—	—	—	—	—	—	—	40	Nil
- Sukkur Right Bank	37	30	—	—	—	—	—	—	—	—	—	67	Nil
- Khanpur Reservoir	170	—	—	—	—	—	—	—	—	—	—	170	Nil
- Indus Basin Works	500	250	110	90	—	—	—	—	—	—	—	950	Nil
- Kotri Surface Drainage	80	80	80	80	80	80	80	80	80	80	80	880	Nil
- Special Areas[a]	96	83	98	115	126	139	153	168	185	204	225	1592	Continue
- Other Federal[b]	112	110	130	137	144	151	159	166	175	184	193	1661	Continue
Sub-Total A	1536	1452	1493	1337	955	586	392	414	440	468	498	9571	
B. PROGRAMMES													
Capital Creation													
- Private Tubewells (PT)													
New	100	110	130	150	150	160	160	160	160	160	160	1600	Continue
Replacement of existing PT	320	320	320	320	320	320	320	320	320	320	320	3520	Continue
Replacement of SCARP TW	—	30	60	95	95	95	95	100	100	100	100	870	Continue

Annex III-1 Continued

Revised Action Programme Continued

COST ESTIMATES

	(Million Rupees)												
	1979-80	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total 1979-80	Post-1990
B. Programmes: Capital Creation Continued													
- Watercourse (WC) Improvements													
WC lining (SGW)	—	170	175	175	265	350	440	525	610	700	790	4200	Continue
WC structures	30	60	90	90	120	150	180	180	180	180	180	1440	Continue
- Irrigation System Improvements[c]	25	75	125	200	275	350	425	500	575	650	750	3950	Continue
- Rural Infrastructure (Road, Storage, Markets)	} To suit local development needs. To be defined by CAMs.											500	Continue
- Animal Husbandry	}											3000	Continue
Capital Utilization													
- Basin and Canal Command Management	15	25	35	50	50	60	70	80	90	110	115	700	Continue
- SCARP Use (Incremental O&M)	40	50	45	35	25	15	5	—	—	—	—	215	Nil
- Agricultural Research	50	75	100	125	150	160	160	160	160	180	180	1500	Continue
- Agricultural Extension	160	180	210	240	270	300	330	360	390	420	420	3280	Continue
- Seed Certification	- - - - - - Revolving Capital Per Annum - - - - - - - - - -											500	Continue
- Working Capital for Current Inputs	- - - - - - Revolving Capital Per Annum - - - - - - - - - -											3000	Continue
- Incentive Fund for Selected Public Sector Institutions	20	40	60	80	100	120	150	190	230	270	300	1560	Continue
- General Institutional Costs	10	25	40	60	85	100	100	100	100	100	100	820	Continue
Sub-Total B	770	1160	1390	1620	1905	2180	2435	2675	2915	3190	3415	30655	

Annex III-1 Continued

Revised Action Programme Continued

COST ESTIMATES

	1979-80	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total 1979-80	Post-1990
	(Million Rupees)												
C. PROJECTS													
PUNJAB													
Sub-surface Drainage													
- Shorkot Kamalia	—	100	100	50	—	—	—	—	—	—	—	250	Nil
- Bahawal	—	—	30	50	50	20	—	—	—	—	—	150	Nil
- Fordwah Sadiqia	—	30	100	100	100	20	—	—	—	—	—	350	Nil
- Thal Saline	—	—	—	—	15	50	50	—	—	—	—	115	Nil
Surface Drainage													
- Pandoki Drain	—	40	50	20	—	—	—	—	—	—	—	110	Nil
- Upper Rechna	—	—	—	80	200	300	300	120	—	—	—	1000	Nil
Canal Remodelling													
- Sidhnai	—	—	30	80	80	10	—	—	—	—	—	200	Nil
- Upper Chenab Canal	—	—	—	—	—	—	20	100	100	100	100	420	Nil
- Gugera Branch	—	—	—	70	200	200	200	100	—	—	—	770	Nil
SIND													
- LBOD Drain	50	150	150	200	250	350	350	350	350	—	—	2200	Continue
Saline GW Tubewells													
- Nawabshah	—	—	—	25	50	50	20	—	—	—	—	145	Nil
- Rohri South	—	—	—	—	25	75	75	15	—	—	—	190	Nil
- Nara North	—	—	50	150	200	200	20	—	—	—	—	620	
- Ghotki	—	50	100	60	30	—	—	—	—	—	—	240	Nil
Saline GW Tiles													
- Rohri South	—	—	—	—	—	—	—	—	70	100	150	320	480
- Nara South	—	—	—	—	—	—	—	—	50	100	100	250	4750
- Gaja	—	—	—	40	150	150	60	—	—	—	—	400	Nil

Annex III-1 Continued

Revised Action Programme Continued

COST ESTIMATES

	(Million Rupees)												
	1979-80	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total 1979-80	Post-1990
C. Projects: Sind Continued													
RBOD Regional Development													
- RBOD Drain } - Hamal Lake } - Manchhar Lake } - Surface Drain } - Canal Remodelling }		—	—	—	—	—	—	100	300	300	400	1100	3900
Canal Remodelling													
- Khairpur East	—	—	20	40	60	90	—	—	—	—	—	210	Nil
- Rohri	—	100	100	250	325	325	200	—	—	—	—	1300	Nil
- Nara	—	—	—	—	—	—	200	400	400	400	100	1500	Nil
Local Storage													
- Chotiari	—	—	—	—	—	—	—	100	200	150	30	480	Nil
BALUCHISTAN													
- Groundwater Development } - Other Irrigation Schemes }	80	80	80	80	100	100	100	100	100	100	100	1020	Nil
NWFP													
- Pehur High Level Irrigation Project	—	—	—	—	—	65	90	90	15	—	—	260	Nil
- Tochi Baran Link	—	—	—	15	15	—	—	—	—	—	—	30	Nil

Annex III-1 Continued

Revised Action Programme Continued

COST ESTIMATES

(Million Rupees)

	1979-80	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total 1979-80	Post-1990
NWFP Continued													
Canal Extension													
- Dajal Extension	20	80	150	150	150	30	—	—	—	—	—	580	Nil
- Sutlej Valley Canals	20	30	40	45	40	—	—	—	—	—	—	175	Nil
- Pat Feeder Extension	—	—	—	—	—	100	200	200	200	200	100	1000	Nil
NATIONAL PROJECTS													
- Kalabagh Dam	—	—	—	—	—	—	—	800	900	1000	1500	4200	8650
- Raised Mangla	Power Sector Funding. Project Initiation in Mid-1980s.												Continue
- Flood Investments	270	350	420	476	500	550	600	650	700	750	800	6066	Continue
- Thal Reservoir and Greater Thal	—	—	—	300	400	600	700	—	—	—	—	2000	Nil
PLANNING AND INVESTIGATIONS:	110	150	100	50	40	30	20	20	10	10	10	550	Continue
Sub-Total C	550	1160	1520	2331	2980	3315	3205	3145	3395	3210	3390	28201	
TOTAL A+B+C	2856	3772	4403	5288	5840	6081	6032	6234	6750	6868	7303	68427	

NOTE: Figures are derived from estimates in Chapter IX.

[a]Fifth Plan estimates until 1983; allowed to increase at 10 percent per annum in real terms for the 1983-90 period.

[b]Fifth Plan estimates excluding Federal Flood Commission; the flood expenditures provided by the Federal Food Commission Study (NESPAK Cum Harza) are provided in "Projects," Section C, of this table. The "other Federal"is allowed to increase at 5 percent per annum in real terms in the post-Plan period.

[c]At the rate of Rs 25/acre to cover the entire Basin by 1995. Present expenditure level is about Rs 10 per acre. In a sense it is a capital maintenance expenditure, but given the deteriorated condition of the Irrigation System we consider these expenditures to be capital creating.

IV. USAID IRRIGATION STRATEGY/1986 CDSS[1]

A. Current and Projected Program

USAID response to irrigation sector problems for the past decade and a half has been toward improving the delivery of water to fields through watercourse improvement and improving farm efficiencies by land levelling and, beginning in FY 1983, canal and drainage system rehabilitation. Over the past decade, AID projects supported the efforts that proved that watercourse losses were grossly underestimated and which developed much of the technological and management approaches undergirding the present large program of watercourse improvements being financed by World Bank, Asian Development Bank and others. Scheduled for FY 1984, USAID will broaden its efforts to include cutting-edge activities in command water management. Command water management focuses on the "bottom line" of the irrigation system--the productive environment of the irrigation farmer. Also in AID's projected portfolio are area development programs in Baluchistan and NWFP which contain significant irrigation activities.

USAID's current irrigation sector program (except for Baluchistan and NWFP) is being carried out under two projects: On-Farm Water Management (OFWM) and Irrigation Systems Management ((ISM). The first was fully funded at $10 million in FY 1982 and 1983 and will continue the program through FY 1987. The second is being jointly supported by World Bank with USAID committing a

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[1] Country Development Strategy Statement, FY 1986, Pakistan, February 1984.

total of $65 million during Fy 1983-86. Under preparation is a $25 million amendment for Command Water Management (CWM) bringing the funding to $90 million through FY 1987 with a PACD of 1990. Projections shown under the ISM/CWM title for FY 1988-90 total is an additional $85 million. For watercourse development World Bank, IFAD and ADB funding totals $78 million. World Bank is planning to continue its support through additional Phase II funding. World Bank provides $40 million under the ISM title and has already approved $42 million under the CWM component. USAID's share is oriented heavily toward institutional development. All of the OFWM effort is so committed. Scheduled technical assistance and training activities total $52 million under ISM/CWM with World Bank funding largely supporting the physical infrastructure. AID's success in devoting this large share of its resources to institutional development activities strengthened through its collaboration with World Bank is strongly commended and represents a style that should be continued in the irrigation sector.

B. Relation to Mission Strategy Efforts

1. GOP Objectives

The Mission commends the irrigation sector objectives of the GOP Sixth Plan (see chapter IIIB.2.a.) but points out that

> Aid and the other major donors share the view that this approach is commendable but insufficient. It does not make explicit the necessity for bringing

private sector resources and management into the water sector and neglects the crucial cost efficiency questions associated with the sector:

d. how to insure that the farmer has an economic incentive to use water efficiently;

e. how to insure that system managers in irrigation have incentives to allocate and deliver water efficiently;

f. how to insure that the system rewards maintenance and sound stewardship of public irrigation assets; and,

g. how to insure a sustained flow of revenues for irrigation O&M.

It is against this added agenda that donor resources will be increasingly targeted over the CDSS period, although the GOP also is continuing to seek direct capital contributions to major irrigation and drainage projects.

Item d. is a key in CWM. Items e. and f. may require structural modifications in institutional responsibilities, but CAM or CWM seems to be the best instrument for testing and perhaps even shifting these functions. (See chapter III.B.1.b.) Improving returns to farmers is, of course, an element in increasing revenues, but the political will to do so is essential.

2. Key Elements of USAID Strategies

Review of key elements in USAID strategy shows that the irrigation sector provides opportunities to give good support to all of these elements. Supporting local costs of irrigation infrastructure and possibly supervised credit for

private wells and land levelling support the balance of payments. USAID, through its access to U.S. institutions, has a large comparative advantage in the irrigation field, particularly in on-farm water and systems management involving multi-disciplinary approaches. AID and USAID's style, in contrast to large international donors for example, permits higher use of technical assistance resources in the irrigation sector. Irrigation development certainly will be a key factor in developing the economies of lagging areas. Certainly the opportunities for technology transfer, research and human resource development are large in the sector.

Program sustainability will be a continuing uphill struggle in many irrigation subsectors. Recurrent cost financing is troublesome, but there are a number of strategy elements in the sector such as greater water user participation which could transfer some of these from the public to private responsibility. After more than a decade, it looks like watercourse improvement may be approaching an institutional maturity which will persist in Pakistan, but will still need continuing donor reinforcement for some time in the future.

Shift to a persisting Command Area Management mode may take an even longer period of gestation. Personnel resources for support of watercourse programs are in short supply. This will be a continuing consideration in program design. For this reason, a large share of USAID investments in the sector are going into training and personnel development.

3. Program After 1987

USAID plans to continue substantial commitments to irrigation by intensification of current work in system maintenance and management or participation in one of the major multilaterally financed capital programs scheduled for the coming decade. In terms of Mission priorities, of 13 subsectors, Energy and Agriculture are given maximum priority with water, population and lagging areas rated high. Through FY 1982-87 the subsector is allocated $100 million or about six percent of $1,625 million portfolio. Though high in technology transfer compared to more costly physical infrastructure, given irrigation's Mission priority and its importance as the "backbone of Pakistan's agriculture",[2] the sector's share of financial commitments through 1987 are modest. Post-1987 schedules project $85 million or 13 percent of the three-year projection.

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[2] Ibid., p. 16.

V. STRATEGY OPTIONS FOR USAID

A. Selection Considerations

In selecting priorities, USAID's CDSS "Key Elements" were kept in mind. The principal consideration was relieving constraints to optimal water environments on farms. Severity of the constraint was balanced against the prospect for effective intervention. Preference was weighted toward divisibility of capital investment, shorter term returns, higher economic rate of return and private sector involvement. Involving water users effectively is a high priority and pervasive objective. Bureaucratic difficulties were kept in mind, but the assumption was made that these might be alleviated. Opportunities for a high proportion of technology transfer and institutional development were given preference and the possibility for enhancing these activities and broadening their extension through collaborative projects with other donors was a strong consideration. Opportunities for technology-intensive contributions to system improvement at relatively low cost were included. Investment in surface storage was screened out; while RAP viewed this as a major strategy alternative to prepare the ground for long-term future water use efficiency, surface storage is by no means the critical constraint, nor will it likely be for some time. Until the more intimate problems of water distribution and use are alleviated, adding surface storage can make little difference at farm level.

High priority by RAP and inclusion in the Sixth Plan budget were strong considerations, but some options were included which appeared in only one of these sets.

The RAP included a set of non-water agricultural activities in its recommendations. (See chapter III.B.1.d.) Only the water-sector options are discussed in this chapter.

B. Specific Options

Priority categories were: High (H), Medium High (MH), High Medium (HM), Medium (M), Low Medium (LM) and Low (L). Table V-1 compares specific options. Core activities in the high priority category are continuing and increasing support of the Mission's OFWM institutional development effort and CWM. Budget range is projected at $38-$51 million annually.[1] Present sub-sector CDSS projection for 1988-90 are $85 million for three years for CWM. Adding water use extension, which is also supportive of the CWM centerpiece, and efforts in outlying areas would add up to a high priority package in the annual range of $47-$69 million. Medium high priority items include mostly technology extension; low-cost, technology-intensive opportunities which would include feasibility or planning studies and improvement of overall systems operation and management; and, if further study shows need and feasibility, supervised credit for land levelling. These would total to $8 to $12 million annually. Supervised credit for supporting private tubewells, in the $5-$10 million range, has been given High Medium priority. Medium priority is given first to canal remodelling and second to large subsurface drainage and waterlogging projects with a range from

[1] These are indicative only for comparison with present and projected programs.

Table V-1

Comparison of Strategy Options

Item	1a. Continue OFWM	1b. Credit for Land Levelling	2. Continue ISM/CWM	3. Outlying Regions	4. Tubewell Credits	5. Water Use Extension	6. Drainage and Waterlogging
1. Priority	H	MH	H	H	HM	H	M
2. Term Years	10+	10	10+	5+	5+	5-7	5
3. AID Annual Cost Range ($ Millions)	3-6	3-4	35-45	6-12	5-10	3-6	5-25[b/]
4. Inclusion							
a. In RAP	Yes	Yes	Yes	Yes	Yes	Yes	Yes
b. In VI Plan	Yes	d/	Yes	Yes	No	d/	Yes
5. Capital Divisibility	N/A	High	Med.	High-Med.	High	High	Low
6. Rate of Economic Return	-	-	50	-	25	50	6-10
7. Tech. Transfer/ Instit. Develop.	High	Med.	High	Med.-High	Med.+	High	Med.

Continued . . .

Table V-1

(Continued)

Item	1a. Continue OFWM	1b. Credit for Land Levelling	2. Continue ISM/CWM	3. Outlying Regions	4. Tubewell Credits	5. Water Use Extension	6. Drainage and Waterlogging
8. Comparative Advantage	High	Med.	High	Med.-High	Med.+	High	Med.
9. Private Sector Involvement[f/]	Low	High	High-Med.	Med.-Low	High	-	Pot.[e/]
10. User (Farmer) Participation	High	High	High	Med.-High	High	High	Pot.
11. Strategy Option Decision Needs Further Study	No	Yes	No	Some	Yes	Some	Some
		Need & feasibility should be studied	Restructure from rehabilitation to CWM emphasis	Consider planning and agency development also	Need & Feasibility should be studied	Institutional arrangements need to be clarified	Master plan option has MH priority

Continued . . .

Table V-1

(Continued)

Item	7. Canal Remodelling	8a. Basin Management	8b. Canal Command Management[a/]	9. Public Tubewells	10. Riverine Aquifer Storage Feasibility Study	11. Water Research	12. Survey and Investigation
1. Priority	M	MH	L	L	MH	M to H	MH
2. Term Years	5	5	15+	10+	3	5	3-4
3. AID Annual Cost Range ($ Millions)	7-35[b/]	1-2	-	2-4	2-3	1-1.5	1-2
4. Inclusion							
a. In RAP	Yes	Yes	Yes	?	No[c/]	No[c/]	Yes
b. In VI Plan	Yes	Yes	Yes	Yes	No	Yes	Yes
5. Capital Divisibility	Low	-	High	Med.-High	NA	NA	NA
6. Rate of Economic Return	12-15	High	-	-	High	Med.-High	High
7. Tech. Transfer/ Instit. Develop	Med.-High	High	Med.	Pot.	High	Med.-High	High

Continued . . .

Table V-1
(Continued)

Item	7. Canal Remodelling	8a. Basin Management	8b. Canal Command Management[a]	9. Public Tubewells	10. Riverine Aquifer Storage Feasibility Study	11. Water Research	12. Survey and Investigation
8. Comparative Advantage	Med.-High	High	Med.	Med.	High	Med.-High	High
9. Private Sector Involvement[f]	Pot.	Pot.	Pot.	Low	-	-	-
10. User (Farmer) Participation	Nil	No	Med.	No	NA	NA	NA
11. Strategy Option Decision Needs Further Study	No	Yes	Yes	Some	Yes	No	Some
		Identify specific opportunities	Strategy is possibly counter-productive	Look at possibility for improved technology. Could be RM priority.	Discuss with GOP. Make feasibility study.	Selected items only	Identify specific opportunities

[a] Public channels are extended to 25 acres.

[b] Low number would be high level collaboration with other donor. For high number other donor collaboration would be limited or nil.

[c] Included initially but dropped in final.

[d] Not specifically included but relevant subsector is.

[e] Pot.: Potential could be developed.

[f] As entrepreneur, not as contractor.

$7-$60 million. The lower figure is for a largely technology transfer effort in canal remodelling with other donor collaboration ranging to efforts in both areas without other donors. It would be unlikely that all suggestions would be brought to maturation for various design reasons, so budget ranges represent outside numbers.

Detailed discussion of the several options considered follows.

1. Continue OFWM

a. Institutional Development in OFWM Directorates

AID's continuing involvement in OFWM has high priority with GOP officials both in Agriculture and Irrigation. There is no need for AID to invest in physical infrastructure because of substantial interests by other donors; rather AID would continue and refine its efforts to develop institutional capability mainly of the On-Farm Water Management Directorates in order to support the large investments in physical infrastructure supported by other donors. Because of importance to the CWM program AID's OFWM Project will need to be continued through the early 1990s. Strengthened training efforts are needed, especially in the provinces other than Punjab. Efforts to involve water users on a continuing basis in watercourse and community drainage facilities maintenance, much less getting them involved in managing water distribution at some level, have not been very successful so far. Aggregating WAU's as instruments for articulating demand has not been done even on a pilot basis. In spite

of its importance in effective irrigation production, land levelling has fallen by the wayside. A high priority is recommended for AID's continuing efforts in this activity at a modestly increased level.

b. Supervised Credit for Land Levelling

Support of land levelling using supervised credit has been suggested as an approach to solving the problem of improved water application to fields. Technical assistance could flow through the institutional credit mechanism. I visualize this as being reinforcing to extension rather than exclusive. If an opportunity for productive technical assistance arose, USAID might consider becoming involved directly or in collaborating with another donor to provide the technical assistance component of a broader credit support program. Medium high priority is accorded this item because of the great need for land levelling in the OFWM subsector and the inability to fill it using the conventional mechanism of reimbursing government agencies for constructing public works.

2. Continue ISM/CWM

Rehabilitation of canals and drains is an important activity and one that will need to go on in a continuing cycle. A strengthened annual recurrent maintenance program might reduce, but would not eliminate, the need for periodic rehabilitation of Indus canals. There is an important need for technical assistance to define and strengthen the technical and management aspects of

the rehabilitation program. I believe this can be put in place on a self-sustaining basis in three or four years. Once this is done and because of other donor intentions, continued USAID support of rehabilitation operations would have low priority. This is consistent with USAID's implementation plan for ISM with projected completion of the rehabilitation phase in about three years. On the other hand, the CWM program is viewed as long term. There is much to be learned before this program will become replicable. Specific site situations which involve cultural, social and demographic as well as agro-ecological and economic variables will continue to be of major importance in implementing CWM. The ultimate form of CWM is not even clear, but here seem to lie the best opportunities to improve irrigated agricultural production environments for farmers and to shift from a centrally administered supply system toward a decentralized management system based substantially on demand. Pilot models will take time to develop and test. There will need to be more of them and they will have to be widely extended. I suggest highest priority for continuing and increasing, possibly doubling, AID participation in CWM over at least the next 10 years giving emphasis to providing technical and institutional development support. This will need a continuing relationship with World Bank or other donors who are interested and can afford larger investments in physical infrastructure.

3. Small Irrigation Development in Outlying Regions

USAID's area development project in Baluchistan, now being designed, includes rehabilitation of Karezes,

percolation dams to replenish Kareze aquifers and a small irrigation scheme served by a reservoir. GOP's mix also includes public tubewells. Irrigation development in these regions has its difficulties: lack of hydrological information for both surface runoff and ground water, flash flooding which fills up reservoirs with silt and requires large spillways, increasingly heavy maintenance costs for Karezes and under-developed institutions. Nevertheless, given the strong equity needs and AID likely comparative advantages, programs in outlying regions are interesting candidates for USAID support. These small programs may have community development potentials by getting villagers to participate in small irrigation development including improving, protecting and utilizing small watersheds.

Besides specific infrastructure projects, planning and institutional development; developing agency capability; user or village organizations; policy, e.g., groundwater management; and strengthening the resources data base are good possibilities under a planning or provincial institutional development mode. Cautious but high priority is recommended. Activities might be under area development projects or as water sector projects depending on circumstances and objectives. AID should include conditions which guard against the hazards of uncontrolled groundwater exploitation and of inadvertent or careless preemption of existing water supply sources by competing development activities which could result in displacement of people.

4. Credit Program for Private Tubewells

This concept is a satisfying one and is consistent with USAID's objectives of involving the private sector and improving the productivity of irrigation water. The instrument is supervised credit. I have not traced out how the increased credit capital needed will be provided. Nothing seems to be included in the Sixth Plan, but allowance for this was in the RAP.

Technical and management assistance to farmers is visualized as flowing through the credit establishment and this could provide an opportunity for some innovative technical assistance. Inclusion of this component in the assistance package should be a condition for participation. Tubewell pumping equipment is reportedly inefficient and poorly selected. There may be better and less expensive ways and better materials to construct small tubewells. This is only one example of possibilities for technical or managerial improvements. A collaborative arrangement with World bank or another donor who might provide a substantial share of the capital transfer component would be attractive. High medium priority is assigned to this item.

In the area of policy dialogue USAID should strive for elimination of tubewell subsidies and for reducing supplies of and increasing charges for canal water during rabi in fresh groundwater areas.

Conventional wisdom points to electrification of tubewells and this is less expensive to farmers than diesel. However, according to the RAP this is because of heavy fuel oil subsidies

accorded WAPDA resulting in underpriced electricity. With proper shadow pricing the real economic rate of return is reported to be higher for diesel installations. The diesel/electricity alternative though complex, merits considerable study.

5. Water Use Extension

Improvement of farm level water use extension with the objectives suggested in the RAP should have a high priority. This doesn't explicitly appear in the Sixth Plan budget but could likely be included in the water management item. There are two dimensions to farm water management extension. One, the agronomic dimension includes crop production under irrigated conditions--crop selection, inputs, cultural practices, etc. This needs to be tailored to specific irrigation environments. The water distribution dimension includes improving and maintaining watercourses, water scheduling, land levelling and on-farm subsurface drainage, forming and vitalizing WUAs, development credit, etc. While the agronomic side certainly needs upgrading in the classical agricultural extension establishment, the second does not seem to fit well with that organization. The agent works in the context of the water distribution systems, clients are groups rather than individuals and their interaction with agencies is an important part of their activities. The agricultural extension service is already overloaded.

This activity deserves high priority, but likely will be fraught with bureaucratic problems. Probably the most sensible course would be to develop this capability in the OFWM

Directorates. Some of this is being done under the present OFWM Project, but the directorates need a broader mandate. Another separate agency should not be started, but this might be preferable to trying to build it in the agricultural extension service. This activity is assigned a high priority.

6. Drainage and Waterlogging

One project mode activity would lower water tables in several fairly large "disastrous" areas using tubewell and tile drainage. The Sixth Plan suggests 15 new subsurface drainage projects totalling 750,000 acres. AID involvement could be reasonably attractive based on comparative advantage and the importance of relieving this constraint to production. Capital investments are large and relatively indivisible. GOP has some interest in developing a master plan for drainage also. Medium high priority is given to a master planning activity. A drainage infrastructure project as such is accorded low medium priority with AID as sole donor. Jointly with another donor, who would emphasize infrastructure, permitting AID to give considerable emphasis to technology transfer, a medium priority is assigned. There should be opportunities for institutional development and policy dialogue.

Regarding the large Right Bank and Left Bank outfall drains, these are important but a low priority is visualized for AID involvement, partly because the planning is already fairly well matured and opportunities for technology transfer seem relatively small. This would seem to be true of large surface drainage

projects generally.

7. Canal Remodelling

Canal remodelling is accorded a medium priority. Capital investments are relatively non-divisible but not as much as for large dams. The U.S. has considerable comparative advantage in this technical field. Lack of canal capacity is a significant constraint to delivering canal water efficiently to meet crop requirements, but once done, increased returns to agricultural production should develop rapidly, faster than for drainage. With other donor collaboration on infrastructure costs, this option would be more attractive. Very high priority is given to involving AID in supporting research and technology transfer because of high comparative U.S. advantage and the high risk involved in applying the complex and sensitive design technology involved.

8. Basin and Canal Command Management

Except for computer hardware, at the macro-level this is largely a software program. There are significant opportunities to improve the match of water supply to demand by computerized management strategies. For example, joint operation of Tarbela, Mangla and Chashma Reservoirs. Each reservoir is now operated separately using computerized projections of most likely future demands and hydrological events rather than as a pool even though interchange is physically possible. A complete water allocation model, COMSYM, for planning the Indus system has been developed by Harza Engineering. Conceivably this could be

adopted to operation. World Bank and Great Britain are providing funding in this area; however, there could be significant opportunities for AID involvement in certain software features at fairly modest cost. USAID should explore opportunities with WAPDA and other donors giving high priority to technology intensive but fairly low cost opportunities. A symposium or workshop on operational management of the system could have some merit.

At Chak level, extending public channels to outlets (Moghas) serving about 25 acres has been proposed under this title by RAP. This has some counter-productive implications which need to be explored prior to any serious consideration for AID involvement. (See Chapter VI.B.7.)

9. Replacement of Public Tubewells in SCARP Areas

Tubewells in SCARP areas have depreciated so that after about 15 years water production has dropped to about one-half the original. These wells are being gradually replaced. Unless there would be an opportunity to conduct research on how to improve technology, this activity is given a low priority for AID participation. Perhaps the research investment risk is high, but there could be opportunities to identify materials and well construction techniques better suited to local conditions as well as ways to improve maintenance. Research might be conducted under a more general water or irrigation research project.

10. Riverine Aquifer Storage Feasibility Study

Riverine reaches presently are acting as uncontrolled underground reservoirs. By pumping these during rabi, low season water supply can be increased and the groundwater reservoir emptied so that more river water can be stored during the high flow season. Estimated potential storage is 12 million acre feet. Compared to surface storage, costs are low and time for realizing returns is short-term.[2] This mode did not survive the selection process for RAP apparently because of lack of experience by Pakistan. Nevertheless it could be very attractive. USAID may wish to consider supporting a feasibility study either separately or jointly with World Bank. If preliminary conversations with GOP and a technical reconnaissance were favorable, I would assign this feasibility study a medium high priority.

11. Research

Of a fairly long list of water research activities included in the Sixth Plan, only five are suggested for AID consideration: the Mona Reclamation Experimental Project, the Lower Indus Water Management and Reclamation Research Project, Tubewell Rehabilitation Research, Prototype Research on Alluvial Channels and Study of Drainage Projects and their Monitoring. Medium range priority is accorded all except research on alluvial channels, which would fall in the high range. If

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[2] RAP, Vol. 9, 10.

tubewell research were expanded to include improved technology for tubewell replacement, its priority could be raised.

Water use research was included in the activities considered by the RAP but did not survive in the final plan. Objectives were to:

a. better define watercourse losses and economic means of improving delivery efficiencies;

b. identify optimum organizations (formal or informal) for ensuing maintenance after watercourse improvements;

c. define alternative means of improving field efficiencies, including their economic and institutional reliability; and

d. establish crop water needs for optimum growth including critical periods in the water cycle.

CWM would provide ideal sites for approaching the first three issues. Unless these studies are based on real irrigation systems, they will be academic and unrealistic. The same thing may be said of improved technology for tubewells, better data collection systems, etc. Component agronomic-based research like item 4 can be done at experiment stations or preferably on farmers' fields.

12. Survey and Investigation

There are opportunities to introduce more modern technology--both hard and soft--into the collection and

processing of water and water resource related information and to improve the efficiency of the data aquisition system. In outlying regions, the problem is more basic and relates to the initial design and implementation of data networks. AID likely could make useful contributions in this field at relatively small cost and medium high priority is assigned. I recommend that USAID, perhaps using consultants like U.S. Geological Survey, explore possibilities with GOP organizations.

VI. STRATEGY RELATED ISSUES

A. Technical Assistance Resources Available

As the Mission mobilizes its planned technical assistance personnel, it will be quite well endowed with resources to examine details of advance strategies and research out technical and institutional problems. These resources can and should be augmented as new projects come on-stream. Much of the present programmed effort will be focused toward the implementation problems of CWM, but broader issues within the sector may also be examined. The Mission has designed the technical assistance program in anticipation of the major problems facing successful implementation of its sector portfolio.

B. Principal Issues

1. Mobilization and Utilization of Water User Associations

As part of its effort to move from input driven to demand driven strategy the concept of Water User Associations (WUAs) as "articulators of demand" has wide acceptance in Pakistan. Water User Associations are also visualized as potential managers of at least part of the irrigation distribution system; this concept seems an essential part of CWM. The Sixth Plan looks to WUAs to improve and maintain watercourses.[1]

Formation and utilization of WUAs at Chak level is a necessary feature of the watercourse component of the OFWM

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[1] Sixth Plan, Chapter 16, p. 306.

activity. These were successfully formed and participated in the initial planning and construction. However, they did not usually persist into the maintenance phase. An effective strategy to bring these organizations into the system on a persistent basis must be found. This will be a prime target of the supporting technical assistance effort under the ongoing OFWM and ISM projects. Part of the problem may be lack of definition and incentives for useful involvement beyond the construction phase. How can WUA incentives be structured into future programs? The importance of bringing the skills of social scientists including social anthropologists to bear on this problem has been recognized by the Mission. The resident team for OFWM does not include a social scientist as such but USAID/ARD anticipates that this resource will be provided by TDY consultants. This should work out, especially if the ISM research team is fielded promptly, as now planned. The ISM team includes a resident anthropologist for 24 months. Consideration should be given to increasing this time up to the full 36 months. TDY allowance seems ample for broadening the mix to include support from sociology, extension and possibly geography.

Some apparently successful organizations have been generated/evolved in some other countries. Perhaps the most relevant to Pakistan is Sri Lanka, on the Gal Oya (which is being supported by A.I.D.) and Mahaweli "H" projects. In the former case, professional "institutional organizers" (IOs) are included in the implementation cadre. I strongly recommend that at least one concerned USAID project manager and appropriate counterparts and

contract personnel visit these projects and possibly others to see how they were implemented, what the WUAs do, how their interest is maintained, what training is required, etc. IIMI plans to develop capability in this area also and could be a resource, but this may be two or three years or more down the road.

Conventional wisdom, in fact the enabling legislation providing corporate status for WUAs, visualizes that they should become involved in procurement of other inputs. My own opinion is that they probably should not. These are quite different functions; the support structure is different. The strategy probably should be to aggregate Chak level WUAs into hierarchical systems at distributary and CWM area levels. WUAs should, of course, be represented on Union Councils.

2. Institutional Arrangements for CWM Management

Farmers are, of course, the ultimate managers of irrigation agriculture. They, not the bureaucrats, are the entrepreneurs. They make the final decisions and take the risks, based on their perception of the current agricultural environment and their productive assets. Irrigation strategy ultimately has to be toward improving that environment. This is what CWM is about. Except for subsidy transfers, improvement of water users' asset base, as well as their household and farm enterprise needs, has to come from that environment.

The problem is to bring the inputs from public agencies and the private sector into that environment in a balanced, optimal fashion. Market forces tend to do this for the private sector.

Services provided by public agencies are a different matter and seem to be particularly difficult for irrigation agriculture partly because of the inherent inflexible cussedness of canal irrigation systems but also because the geography of irrigation systems which deliver water is different than the administrative ones on which agricultural services are structured.

India tackled this problem with its Command Area Development Authorities. Each state handled this differently, the main variable being coordination of resources in contrast to control of them. Several good evaluations have been made with the usual conclusion that the more control the CADA had, the more effective it was. Recognizing, of course, that GOP (probably the provinces) will make the final decisions, institutional arrangements for CWM is high on the investigative agenda. USAID/ARD as been concerned with this problem through the discussion period leading up the joint WB/AID ISM/CWM design. Consulting efforts have been intensified, and USAID is planning senior officers workshops including a visit to India to look at Command Area Management there.

Donor supported projects can help to crystallize multi-agency commitments, through project criteria, conditions precedent, covenants, etc, substituting in part, for Command Area control.

In addition to research USAID has allocated a substantial share (about one-fourth) of its TA resources under the ISM project to management. Efforts of the management team should be closely linked with those of the research anthropologist. These

resources are to be augmented under the CWM Amendment which will provide two resident interdisciplinary teams, one based in Lahore, one in Karachi. These will each include a specialist in water management, farm management, extension, agronomy and computer. The extension specialists have basic training in rural sociology. Besides two research engineers, the resident Engineering Team provides for four design engineers--one for each province. As the team moves into the design of CWM activities, involving more farmer participation, USAID may want to consider adding a social scientist.

The institutional weakness in the area between the outlet and the farm is a serious problem. This has been described as a "no man's land". In Pakistan, one agency, the OFWM Directorates, has penetrated that area. There is a strong need for extension activities relating to the distribution and scheduling of water among farms, maintenance and rehabilitation of water courses, forming water user organizations and helping them to relate to agencies, etc. These activities are all community based, so skill in working with groups is a requirement. The water distribution and use extension function could be attached to the regular extension service or it could be strengthened in the OFWM. It might be better placed under the latter. Land levelling on individual farms should be included in the water distribution extension package.

The main activity left in the current OFWM project is training and strengthening the capability of the OFWM directorates in order to support CWM and back up the large watercourse improvement program, revive interest in land levelling and organize and

assist in developing WUAs. The Sixth Plan points out the need to increase the number of qualified personnel available to support this activity.[2]

A hierarchical interagency committee structure is visualized for inter-agency coordination on CWM units. This is essential, but a line responsibility for change agency seems desirable. Expanding the role of the OFWM Directorates in the implementation and management of CWM projects, possibly as the responsible line agency, should be explored.[3]

3. Rehabilitation and Remodelling Criteria for Canals

Although these activities overlap in practice, "rehabilitation" means restoring the canal so that it functions the way it was intended, whereas "remodelling" means changing canal configuration to handle increased water supplies. In a sense, rehabilitation is deferred maintenance, but it is not clear that continuing maintenance would be a substitute for periodic rehabilitation. Heavy silt loads eventually raise canal bed elevations so that hydraulic performance in delivering water to outlets depreciates. The remedy, apparently, is not to remove the deposition, but to raise and strengthen the banks, re-position outlets and take simple measures, like staking and planting brush, to prevent bank erosion. Standards for rehabilitation possibly may be found in simple hydraulics, but one should be

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[2] Ibid., p. 306.

[3] See RAP Report, Summary, para 39, p. 17.

suspicious of simplicity where sediment transport in erodible channels is involved. In any event, a consistent set of standards for rehabilitation should be developed if possible.

Remodelling is more interesting because canal capacities are changed, which means that the issue of stable channel design is a larger one. The art of stable channel design in erodible materials, largely developed by investigators in the Punjab beginning about a century ago, permits stable channels, but only if the quantity of flow does not vary widely. Much data has been collected in recent years and there is hope that this art might be extended to deal with more variable flows and possibly the effects of checking using cross regulating structures to raise the water level so that outlets function properly when discharges are low. Finding better designs for canal outlets also may have possibilities.

USAID/ARD is well aware of the problems of channel design and has drawn on well-qualified consultants. Included in the ISM engineering team is a full-time resident research engineer specializing in alluvial channels with potential for additional short-term and local assistance.

4. Learning from CWMs

Because they will need to be replicated widely, CWMs should be regarded as research pilot projects. This approach has been called "action research". It emphasizes "systems" rather than components and involves successively diagnosis of constraints, selection of interventions, collection of

information, evaluation, and extension to other sites. USAID/ARD has this in mind, but the concept doesn't come through in the World Bank's appraisal report. USAID will give particular attention as to how this process will be carried out and resources needed as it develops the CWM Project Paper. This activity should be of interest to the International Irrigation Management Institute (IIMI) and the Mission may want to examine possible collaboration with that institution. (See Chapter VII.D.)

5. Organizational Proliferation in OFWM Area

There may be some tendency to create competing organizations which could tend to weaken the institutional structure in the OFWM area. One example was the move to place watercourse development under union councils. This apparently has been abandoned. Another example is a RAP recommendation that autonomous Provincial Public Minor Works Corporations be created under the Provincial Secretary to execute watercourse lining programs, facilitate installation of private tubewells and stimulate domestic production of fractional tubewell components, and facilitate SCARP transition. This may have some merit for some of these functions, but watercourse development is strongly linked to farmer participation and is already being handled by the Provincial On-Farm Water Management Directorates. For private tubewells the need for this mechanism in addition to the planned supervised credit program through the banks should be considered.

6. Kareze versus Tubewells

USAID proposes to become involved in irrigation development in outlying areas such as Baluchistan. Both rehabilitation of Karezes and groundwater development using tubewells are on GOP's agenda for these areas. Karezes are expensive to maintain and wasteful of water because flow cannot be controlled. Tubewells require power, but Karezes do not. Tubewells are more efficient than Karezes as far as water use is concerned and, in Iran, public tubewell schemes usually served higher quality uplands in contrast to the lower more saline lands served by Karezes but they dried up the Karezes. These considerations raise such questions as to the validity of trying to continue Kareze technology in contrast to tubewells; whether or not Kareze technology can be substantially modernized, e.g., by inserting PVC conduit in the tunnel, etc.; and how mixed Kareze and tubewell development should be managed. Would it be wise to try to move Kareze villages to alternate tubewell sites? In any event, the future of Kareze villagers needs to be protected and some institutional arrangements for assessing groundwater potential and monitoring and controlling its development appears necessary.

7. Subdivision of Chaks

The RAP, under its System and Canal Command Water Management Program, suggests that Irrigation Departments extend their responsibility beyond the present outlet (mogha) serving 200-700 acres to outlets serving about 25 acres. This would appear to be counterproductive to stated objectives of developing

more viable WUAs and increasing the private sector's responsibility. It would add very appreciably to the staff needs and the complexity of management within Irrigation Departments. It is hard to see how the public sector could afford this additional large capital cost or to finance the large recurring costs which would be generated. WUA management should be encouraged at the highest possible level of the distribution system. I have serious reservations on this suggestion. The proposal should be deferred at least until WUA effectiveness can be thoroughly tested under the Command Area Management program.

8. Subsidies

The RAP clearly shows there is no need to continue the present subsidy of private tubewells as an incentive and proposes to strengthen supervised credit for this activity instead. The Sixth Plan allocates resources to continue these subsidies. USAID supports and should continue to support the RAP position. The RAP also targets substantial increases in water charges, which USAID supports. With more effective WUAs, private resources can be mobilized to meet recurring maintenance needs which are not being met or which are being met inadequately in the public sector.

VII. OTHER RELATED CONSIDERATIONS

A. Research Arrangements for Water Management

Part of water management research, soil water relationships, evapo-transpiration, irrigation application, methods, etc., can be done under controlled conditions on experiment stations or on farms. The process is deductive. The other part of water management research is concerned with the functioning of total irrigation systems from the reservoir to the farmer's market. Here research cannot be done under controlled conditions, rather the behavior of the system defines the conditions and research must be done on actual irrigation systems. Performance, operation and maintenance of watercourses and canals, conjunctive use of fresh and saline groundwater, canal operations, optimal cropping systems, water user involvement, water scheduling and canal operation for example need to be considered interactively on real systems. Approaching some of these topics as detailed components has led to misconceptions about what needs to be done to improve irrigation systems. This kind of research is interdisciplinary and inferential, clinical in its nature. CWM areas would be ideal sites for the second kind of research. The approach needs to be interdisciplinary. The program needs to be peripatetic, moving from site to site. Permanent physical research infrastructure can become an encumbrance.

The preferred strategy is a small network of interdisciplinary cells working at each site following the style of decentralized teams used in the high-tech industries. One good, well-supported site is to be preferred over two or three partly-

supported ones; however, studies will eventually be needed at a number of sites. I visualize two linked levels of scale: the intensive problems related to watercourses, farmer organizations, etc., would be studied at distributary scale--say 1000-2000 acres. For canal operation and management, a more extensive study, say at secondary or main canal level; 25,000-100,000 acres is visualized.

The question is under what auspices should the second kind of research be conducted. It could have difficulty within traditional agricultural research organizations. An alternative would be the Irrigation Departments, but these also would encounter constraints. The best strategy would appear to be to keep the effort under the CWM project until the network gains some institutional strength in its own right.

B. University Education and Training

Time did not permit an in-depth look at the potential for university-level undergraduate academic training in a water management specialty. At present there are no academic programs leading to this specialty as such. B.Sc. degrees in agricultural engineering which include some courses in soil and water subjects are offered at Peshawar, Faisalabad and Tando Jam Agricultural Universities. Graduates find employment in agricultural agencies such as the Soil Conservation Service, Extension and OFWM Directorates, but are not employed by Irrigation Departments or WAPDA.

There are two obstacles to developing an undergraduate specialty in this field. One is the difficulty of pulling together the disciplines, particularly agriculture and engineering because these are in separate universities; the second is the desire of students to have a broad range of employment options. Thus a preference for more general curricula. I have no suggestions regarding what should be done about formal academic training in water management except to continue a dialogue as CWM experiences is gained. I do not see that a special study at this time would yield very much.

For the moment more focused training to support project objectives remains the strategy. This is being done. A substantial in-service training program has been developed to support the OFWM program. Training Centers have been established in Punjab, Sind and NWFP provinces. Short and long-term training courses are also given at Faisalabad University. These courses serve degree-level agricultural engineers employed on OFWM field teams, sub-engineers and supervisors holding diplomas from Polytechnic Institutes, sub-professionals, and Chairmen and members of WUAs. A water management course is also given for extension specialists. USAID and, more recently, World Bank and Asia Development Bank have helped support these training efforts.

Besides expatriate training, in-service training in-country is provided to strengthen the technical and management functions of ISM/CWM.

C. Relations with Other Donors

USAID has developed a joint working relationship particularly with World Bank which is advantageous to both and which improves the product over what one donor could do separately. Under On-Farm Water Management, the pioneer investment in development of 1500 watercourses was made by AID. Financing the infrastructure for watercourse development has been picked up by World Bank and ADB in amounts of $53 million and $25 million respectively. World Bank is planning to continue financing under a Phase II project. This arrangement has permitted USAID to turn its resources toward supporting much needed institutional development and training of the implementing agencies, the provincial OFWM Directorates.

Joint financing of the ISM/CWM project with World Bank likewise has been beneficial to both parties. World Bank is unable to give technology transfer and institutional development as much emphasis as AID can.

Of this $175.5 million foreign assistance package (AID, $93.5 million; WB, $82 million) AID will commit just over $50 million to technical assistance and training, World Bank will commit $2.5 million. AID's allocation to civil works is $31.6 million; World Bank's is $66.6 million. For the rehabilitation portion AID will strengthen the institutional capability of the implementing Provincial Irrigation Department and help emplace the technological standards for the continuing physical rehabilitation program under World Bank and other donor funding support. ISM technical assistance resources will lay the technical ground-

work for implementing the seven CWM pilot sub-projects being jointly supported. There is no doubt that AID by itself would have found it very difficult to gain acceptance of a project in this area in which more than 50 percent of the funding was programmed for training and technical assistance. This joint relationship has also broadened the base and the resources for policy dialogue.

While there are differences of style, bureaucratic requirements, etc., which can be frustrating to both parties, the joint strategy in the irrigation sector is very effective and is to be commended.

D. International Irrigation Management Institute (IIMI)

Thomas Wickham has been named IIMI's director general. He will arrive permanently on board in Kandy, Sri Lanka in June, 1984. Staffing and evolution of program will occur probably over the following 18 months within guidelines which are fairly well established by IIMI's charter.

IIMI's scope is fairly restricted. It is to be concerned primarily with the behavior of irrigation systems as systems. This does not mean that component research will not be undertaken; it does mean that this will be done in the context of real irrigation systems where variables can be measured but are not controlled as on experiment stations. This means study sites will normally be operating systems. IIMI will not do controlled experiment station type research like consumptive use, water fertilizer interactions, etc., which others are doing quite well. Obviously IIMI must collaborate with countries in order to have

study sites. Several levels of collaboration are visualized. Branches, which have essentially the international characteristics of the main center, are contemplated in three or four countries. Other forms would emerge as collaborative agreements at some level or another. Pakistan, largely through PARC, has proposed that a Branch be established in Pakistan. Core IIMI funding would pay for the costs of Branch Directors and be available for initial design and planning including financial planning. Other Branch financing would have to be provided by the host country with, doubtless, donor support or directly by donors. The IIMI Board at its June meeting will probably decide whether or not to commit core resources for a feasibility study for IIMI/Pakistan Branch.

USAID could not, of course, commit unrestricted core funding to Branches. My view is that restricted funding support by USAID for special activities should be strictly in furtherance of USAID program objectives. For special studies, IIMI can be expected to follow the same mode as for USAID financed special studies in the CGIAR IARCs. Within IIMI's charter, IIMI is not viewed as having resources to provide advisory services on irrigation policy or design of specific irrigation projects but rather as collaborators in research and training. I should think one or more of the sites in the planned CWM project as learning experiences would be attractive to IIMI; conversely IIMI might contribute something to their design and to identifying lessons learned. Some sort of collaborative relationship with the research component of the first phase ISM would also be a

possibility. IIMI will no doubt have a strong interest and will develop capability in the area of user organization and participation which could in time be of interest to USAID.

Regarding strategy, I suggest that at some time after IIMI is more firmly operative, perhaps late CY 1984, GOP/USAID discuss these specific interests with IIMI staff as a first step and that USAID consider some limited support for collaborative studies under its CWM amendment. A collaborative program could go ahead regardless of whether or not a Pakistan Branch is decided upon.

TELEGRAM

AID

AMERICAN EMBASSY COLOMBO

ATTACHMENT A

INFO	
AMB	✓
CHARGE	
DCM	✓
POL	
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TO AMEMBASSY COLOMBO IMMEDIATE 3357
BT
UNCLAS ISLAMABAD 06208

AIDAC

PASS ADO FOR DEAN PETERSON

E.O. 12356 N/A
SUBJECT: IRRIGATION SYSTEMS MANAGEMENT PROJECT (391-0467) - DEAN PETERSON SERVICES THROUGH AMS II

REFS. A. STATE 63405 B. ISLAMABAD 5385
- C. PETERSON/BACKUS 3/2/84 TELECON

1. ARRANGEMENTS ARE BEING MADE WITH AID/W TO PROCURE YOUR SERVICES FOR THREE WEEKS THROUGH WATER MANAGEMENT SYNTHESIS II TO PERFORM THE FOLLOWING:

A. TO ASSIST IN PREPARING A DESCRIPTION OF AID/PAKISTAN'S LONG-TERM STRATEGY IN THE WATER SECTOR. THIS WILL INCLUDE:

I. STUDYING THE REVISED ACTION PROGRAM FOR IRRIGATED AGRICULTURE, WAPDA, 1979; IRRIGATION SYSTEMS MANAGEMENT PROJECT PAPER; PAKISTAN SIXTH 5-YEAR PLAN; AND OTHER PERTINENT DOCUMENTS.

II. DISCUSSING ON-GOING AND PLANNED AID/PAKISTAN PROJECTS WITH PROJECT OFFICERS IN ORDER TO GAIN AN OVERALL PERSPECTIVE OF THE CURRENT AID PROGRAMS.

III. DISCUSSING WITH KEY GOP OFFICIALS THEIR VIEWS WITH REGARD TO WATER POLICY AND DEVELOPMENT IN THE WATER SECTOR.

IV. PREPARING A REPORT THAT DELINEATES A RECOMMENDED LONG-TERM STRATEGY FOR AID/PAKISTAN'S INTERVENTION IN THE WATER SECTOR.

2. PLEASE CABLE YOUR TRAVEL ITINERARY FROM COLOMBO TO ISLAMABAD AND PROVIDE YOUR CONTACT (PHONE) SO THAT PTA CAN BE SENT. HINTON
BT
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Islamabad

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Ministry of Power and Water
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