Document of
The World Bank

REPORT No. 16336-IN

STAFF APPRAISAL REPORT

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

April 25, 1997

Agriculture and Water Operations Division
South Asia Country Department II
(Bhutan, India, Nepal)

CURRENCY EQUIVALENTS

Currency Unit	=	Rupee (Rs.)
US$1.00	=	Rs.35.84

FISCAL YEAR

GOI; GOAP - April 1 - March 31

WEIGHTS AND MEASURES (METRIC SYSTEM)[1]

1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 miles (mi)
1 hectare (ha)	=	2.47 acres (ac)
1 million cubic meters (Mm^3)	=	804 acre-feet (ac-ft)
1 cubic foot per second (cfs or cusec)	=	0.0283 cubic meters per second (m^3/s)
1 kilogram (kg)	=	2.2 pounds (lb)
1 metric ton (mt)	=	2,205 pounds (lb)
1 Thousand Million Cubic Feet (TMC)	=	28.3 million cubic meters (Mm^3)

Vice President	:	Mieko Nishimizu
Director	:	Robert Drysdale
Division Chief	:	Shawki Barghouti
Task Manager	:	Theodore Herman

[1] The metric system has been used in most cases. However, India is still in the process of transition to the metric system; non-metric units are still widely used and have been used in this Report where a conversion to the metric system may confuse the reader.

PRINCIPAL ABBREVIATIONS AND ACRONYMS

AP	-	Andhra Pradesh
AP II	-	Second Andhra Pradesh Irrigation Project
APAU	-	Andhra Pradesh Agricultural University
APM	-	Adjustable Proportionate Module
ARO	-	Assistant Rehabilitation Officer
BPL	-	Below Poverty Line
CAD	-	Command Area Development
CADA	-	Command Area Development Authority
CAS	-	Country Assistance Strategy
CCA	-	Cultivable Command Area
CNS	-	Cohesive Non-Swelling
COT	-	Commissionrate of Tenders
DC	-	Distributary Committee
DOA	-	Department of Agriculture
EMP	-	Environmental Management Plan
ERAP	-	Economic Rehabilitation Action Plan
GOAP	-	Government of Andhra Pradesh
GOI	-	Government of India
GSDP	-	Gross State Domestic Product
GWD	-	Groundwater Department
ICADD	-	Irrigation and Command Area Development
ICB	-	International Competitive Bidding
KKC	-	Kakatiya Canal
M&E	-	Monitoring and Evaluation
MEH	-	Minimum Economic Holding
MSL	-	Mean Sea Level
NCB	-	National Competitive Bidding
NGO	-	Non-Governmental Organization
O&M	-	Operation and Maintenance
OC	-	Outlet Committee
PAP	-	Project Affected Persons
PDP	-	Project Displaced person
PIM	-	Participatory Irrigation Management
PPM	-	Project Preparation and Monitoring Unit
QCU	-	Quality Control Unit
RAP	-	Remedial Action Plan
R&B	-	Roads and Bridges
R&R	-	Resettlement and Rehabilitation
RD	-	Revenue Department
RO	-	Rehabilitation Officer
RWS	-	Rotational Water Supply
SIN	-	Structured Irrigation Network
SOE	-	Statement of Expenses
SRBC	-	Srisailam Right Branch Canal Project
SRSP	-	Sriramasagar Project
TMC	-	Thousand Million Cubic Feet
VAP	-	Village Action Plan
VRC	-	Village Rehabilitation Committee
WALAMTARI	-	Water and Land Management Training and Research Institute
WUA	-	Water Users Association

FREQUENTLY USED ABBREVIATIONS FOR OFFICERS

AEE	-	Assistant Executive Engineer
AE	-	Assistant Engineer
CE	-	Chief Engineer
CI	-	Canal Inspector
DDA	-	Deputy Director of Agriculture
DEE	-	Deputy Executive Engineer
EE	-	Executive Engineer
JDA	-	Joint Director of Agriculture
LDC	-	Lower Division Clerk
SE	-	Superintending Engineer
VEO	-	Village Extension Officer

GLOSSARY

Hot Season	-	March to May
Irrigation Dry (ID)	-	Irrigated land designated for crops other than rice and sugarcane
Irrigated Wet (IW)	-	Irrigated land designated for rice and sugarcane
Kharif	-	Wet Season (June to September)
Chak	-	Area served by watercourse, between 15 ha to 40 ha
Rabi	-	Dry season (October to February)
District	-	The lowest administrative unit where the State Government is directly involved.

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

STAFF APPRAISAL REPORT

Table of Contents

Page No.

III. COST ESTIMATES, FINANCING AND DISBURSEMENTS

IV. ORGANIZATION, MANAGEMENT AND IMPLEMENTATION

V. BENEFITS, JUSTIFICATION AND RISKS

VI. AGREEMENTS AND RECOMMENDATIONS 56

ANNEXES

MAPS

This report is based on preparation work done by the the officials of the Irrigation & Command Area Development Department of the Government of Andhra Pradesh and the findings of an appraisal mission that visited India in May/June 1996. The mission comprised Theodore Herman (Task Manager), N.K. Bandyopadhyay, M. Chand, M.M. Shah, S. Subramanian, S. Thangaraj and C. Zhang; H. Freestone and T. Lohavisavapanich of FAOCP; and consultants K. Craig, R.K. Malhotra and V.P.S. Verma. The Peer Reviewers were H. Plusquellec (Irrigation Design Issues), G. Spencer (Irrigation Management Issues), R. Reidinger/W. Nickel/R. Nelson (Economic Issues) and A. Subramanian (Institutional and Beneficiary Participation Issues). Doreen Feerick and Marcia Whiskey provided secretarial support. Shawki Barghouti (Division Chief, SA2AW), R. Drysdale (Director, SA2DR) and H. Vergin (former Director, SA2DR) provided managerial oversight.

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

Credit/Loan and Project Summary

Borrower:	India, Acting by its President
Executing Agency:	Department of Irrigation and Command Area Development (ICADD), Government of Andhra Pradesh (GOAP)
Beneficiary:	The State of Andhra Pradesh (AP)
Amount:	IDA Credit SDR108.10 million (US$150 million equivalent), IBRD Loan US$175 million.
Poverty:	Not a poverty targeted intervention but the project would raise the present income of beneficiaries to above the poverty threshold
Terms:	IDA to GOI - Standard with 35 years maturity. IBRD to GOI - LIBOR-based variable lending rate and repayable over 20 years, including a five year grace period.
Commitment Fee:	0.5% on any undisbursed IDA credit balances, beginning 60 days after signing less any waiver. 0.75% on any undisbursed IBRD loan balances, beginning 60 days after signing less any waiver.
On-Lending Terms:	From GOI to GOAP under standard arrangements for developmental assistance to the states of India. GOI would assume the foreign exchange and interest rate risks.
Project Description:	The project would be an investment credit and loan with the primary objective of assisting GOAP to improve the productivity and income of farm families in two sub-project areas by completing irrigation works and a social improvement program begun under the Second Andhra Pradesh Irrigation (AP II) Project (Credit 1665-IN/Loan 2662-IN), pilot statewide reforms to improve public irrigation scheme performance,. The project's components are: (a) Irrigation Works (80.0% of total base costs) to complete the irrigation network and feeder roads of the 65,000 ha SRBC irrigation project, and rehabilitate 253,000 ha of the SRSP scheme's irrigation system; (b) Agricultural Support Services (2.5% of total base costs) to foster agricultural diversification and productivity through irrigation agronomy research and improved command area extension services, and to improve irrigation services by participatory irrigation management through the project-wide establishment of Water User Associations (WUAs); (c) Resettlement and Rehabilitation Program (5.0% of total base costs) to mitigate adverse social impacts of land acquisition for irrigation works resulting primarily from AP II works; (d) Environmental Management Plan

(7.5% of total base costs) to implement a GOI mandated regional program of environmental safeguards and conservation in sub-project districts; (e) Dam Safety Assurance Works (5.0% of total base costs) to ensure the safety and structural sustainability of the three dams serving the sub-project areas; and (f) Project Monitoring and Evaluation (0.5% of total base costs).

Project Benefits: The project would reduce production variability in the sub-project areas and enable an increase in their production of high value cash crops estimated at about US$140 million per annum (in 1995 constant prices). Irrigated production would generate over 105,000 farm jobs and generate employment in the transport, marketing and processing of farm produce. The incremental farm income generated at full development is estimated to raise the income of small farmers owning less than 2 ha (who comprise about 70-80% of farming families) above the current Andhra Pradesh "Poverty Line" threshold. The environmental investments would also generate salable timber while the feeder road program would generate economic benefits due to improved village access and time savings. The piloting of irrigation management reforms and beneficiary participation modalities is expected to result in replicable innovations throughout the public irrigation sector and contribute to improving its efficiency and performance. The dam safety component involving two major multi-purpose dams would not only ensure sub-project irrigation sustainability but also irrigation and hydroelectric production in the Krishna and Godavari river basins within Andhra Pradesh.

Project Risks: *Government commitment* to the project and its irrigation reform objectives is strong and already well-demonstrated. GOAP has ensured O&M cost recovery by an unprecedented increase in statewide irrigation water charges and is proceeding with a statewide program of participatory irrigation management by promoting the establishment of WUAs on all major irrigation schemes. There are, however, several ubiquitous risks which have been addressed through the project design. Firstly, *implementation agency motivation risks* arising out of a preference for construction work and lack of interest in operations and maintenance (O&M) have been addressed by organizational separation of construction contract management from O&M responsibilities, and spreading responsibility for the agricultural support, social and environmental components. Secondly, *works implementation capacity and delay risks* are mitigated by safeguards in project design which include a project Annual Review, Action Plan and Budget process, strict procurement processing requirements, improved contract management procedures and strengthened quality assurance arrangements and training. Thirdly, *beneficiary response and water availability risks* are difficult to eliminate by controlled mitigation measures. Public information and consultation has been extensive and it is assumed that social and political pressures may be brought to bear on recalcitrant irrigators by farmers who are to receive reliable water supplies for the first time. *Financial sustainability risks* are to be monitored by a standing GOAP Water Charges Review Committee.

Estimated Project Costs:

Components	Rs. Million			US$ Million		
	Local	Foreign	Total	Local	Foreign	Total
Irrigation Works	10,599.89	1,348.16	11,948.05	307.24	39.08	346.32
Dam Safety	623.89	75.80	699.69	18.08	2.20	20.28
R & R Program	738.93	13.38	752.31	21.42	0.39	21.81
Agricultural Support	345.36	24.23	369.59	10.01	0.70	10.71
Environmental Plan	1,017.74	102.73	1,120.47	29.50	2.98	32.48
Project Monitoring	85.08	0.00	85.08	2.47	0.00	2.47
Total Baseline Costs	13,410.89	1,564.30	14,975.19	388.72	45.34	434.06
Physical contingencies	709.97	92.26	802.23	20.58	2.67	23.25
Price Contingencies	2,794.23	326.19	3,120.42	18.02	2.09	20.11
Total Project Costs[a/]	16,915.09	1,982.74	18,897.83	427.32	50.11	477.43

a/ Including taxes and duties of US$52.98 million equivalent

Financing Plan: (US$ Million)

Finance Source	Local	Foreign	Total Financing
GOAP	152.26	0.00	152.26
IDA/IBRD	274.89	50.11	325.00
Total	427.15	49.69	477.43

Estimated Disbursements (US$ Million)

Bank Fiscal Year	1998	1999	2000	2001	2002	2003
Annual Amount	73.4	52.4	78.2	69.8	40.9	10.3
Cumulative Amount	73.4	125.8	204.0	273.8	314.7	325.0

Economic Rate of Return: 24%

Maps: IBRD 18986R1, IBRD 18842R and IBRD 18843R

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

I. PROJECT BACKGROUND

A. The National Context

Agricultural Development and Poverty

1.01 Agriculture and its allied activities is still a key sector in India's economy, contributing about 32% of the real Gross Domestic Product (GDP) and 69% of employment in 1991. Due to population growth, the average size of operational agricultural holdings has dropped from 2.7 hectares (ha) in 1960/61 to 1.7 ha in 1985/86. Thus increasing land productivity is the main challenge to overcoming population growth and maintaining rural income. Bank research indicates that rural economic growth in India has a salutary effect on poverty alleviation as the bulk of the consumption gains to poor people since about 1970 are attributed to the direct and indirect impacts of agricultural growth. Higher yields helped reduce absolute poverty through induced wage effects, employment and own-farm productivity.

Irrigation Development and Management

1.02 The net irrigated area has grown to about 45.1 million (M) ha in 1989/90, and represents about 32.4% of the net sown area of India. Only about 36% of the net area (15.9 M ha) is irrigated by public canal systems, while private tubewells, tanks and shallow wells account for the remainder. At least three-fourths of India's agricultural growth since 1947 stems from the synergy of fertilizers, improved crop varieties and irrigation. While irrigated cereal yields are over twice those of rainfed cereals. their average yield is about one third below the all Asia cereal average.

1.03 Public canal system performance has been below its potential, and significant problems need to be addressed to maintain its past contribution: completion of state irrigation projects is increasingly delayed; the gap between the planned cropping intensity and area actually irrigated has widened; and the economic returns to project investment have been disappointing. The public irrigation sub-sector has weaknesses in most areas of implementation and management: resource planning is weak, water distribution is unreliable and often inequitable, maintenance is insufficient to sustain existing infrastructure, institutions require strengthening, and in most states, construction quality and cost recovery are inadequate. Until the early 1950s, revenues from water charges exceeded government expenditures for operations and management (O&M) plus interest imputed on investment. By 1989, current expenditures on O&M for public canal schemes exceeded revenues from water charges by an amount equivalent to 2.1% of the current agricultural contribution to GDP.

Development and Irrigation Lending Strategy

1.04 **Country Assistance Strategy (CAS).** The Bank's country assistance strategy for India--reviewed by the Board on June 20, 1995 and September 5, 1996 respectively--supports GOI efforts to provide an enabling environment for efficient private sector-led growth while strengthening the effectiveness of government interventions in areas where it complements the private sector--poverty alleviation, environment, human resource and infrastructure development. Reducing poverty,

developing the private sector, improving environmental protection and natural resource conservation, strengthening institutions, increasing the role of beneficiaries and Non-Governmental Organizations (NGOs) in project design and implementation are all important elements of the CAS. Since agricultural growth bolsters the rural poor (para. 1.02), national and state agricultural policy reform are important instruments of the CAS. State fiscal reform is a focus of the CAS: hence Bank-supported state investment projects should be consistent with state fiscal and financial capabilities.

1.05 **India Irrigation Lending Strategy**. In line with India's 1987 *National Water Policy,* the Bank's irrigation sector strategy (*India Irrigation Sector Review*, Report No. 9518-IN, June 27, 1991) identified sector reforms in four priority action areas. These areas are: (a) strengthening of river basin planning and environmental monitoring capabilities; (b) increase of O&M works expenditure and water charges, and re-prioritization of capital expenditure to favor scheme rehabilitation and completion of ongoing works over new projects; (c) improvement of canal management and water distribution performance; and (d) adoption of management and organizational reforms to strengthen state Irrigation Department management accountability for irrigation services, and fostering of beneficiary participation in scheme management.

B. The Andhra Pradesh Context

Economic Growth and State Finances

1.06 The economy of AP is still predominantly agrarian and agriculture employs about 67% of the work force. Given its poor economic growth performance, AP has failed to expand its revenue base needed to finance its subsidy and welfare programs and has been under fiscal stress since the mid 1980s. This was created by (a) declining own state revenue as a share of Gross State Domestic Product (GSDP); and (b) rapid change of state expenditure composition with substantial increase in the share of subsidies, welfare programs, and salaries, together with a corresponding fall in the share of non-wage O&M, and expenditure on physical and social infrastructure. As a result, the principal fiscal and debt indicators have deteriorated along with growth performance. The fiscal deficit has grown to 3.4% of GSDP by FY95/96 with total revenue and expenditure constituting 14% and 18% of GSDP respectively. In recent years, about 22% of the State's total expenditures were financed through borrowings and the capital expenditure share of total expenditure has been only about 15%.

1.07 An increasing reliance on central loans to finance State Plan expenditures has led to a high level of debt relative to the state revenues. Interest payment have reached 28% of AP's own revenue (2.3% of GSDP), while the total state debt amounts to 24% of GSDP. Consequently, the state government has been increasingly forced to divert funds away from productive uses and resort to borrowing to meet its commitment to expensive welfare schemes. The state's fiscal stress has been aggravated in the past two years by introduction of a subsidized rice distribution scheme for the poor, and loss of revenue due to prohibition of alcoholic drinks in the state. These programs together have put an additional burden of about 4.2% of GSDP on the state's budget, and has precipitated an acute fiscal crisis and liquidity difficulties.

Rural Demography and Poverty

1.08 Andhra Pradesh (AP) is India's fifth largest State (275,100 km^2) and fourth most populous (66.51 million in 1991). Over 73% of the population resides in rural areas but rural to urban migration has led to a high urban growth rate. A continuous increase in the number of agricultural holdings is occurring with the average size of agricultural holdings dropping from 2.51 ha in 1970 to

about 1.55 ha in 1991. Marginal and small farms represent about 77% of all holdings, but only about 36% of the farm area. Whereas AP was the fourth highest state in percentage of population "below the poverty line" (BPL) around 1960, it declined to about the nation's fourth lowest around 1990. Poverty alleviation has improved more slowly in the 1980s despite the resources allocated by AP to subsidies and direct welfare programs. This is explained by two factors. First, a large proportion of AP anti-poverty programs are related to broad-based, badly targeted current consumption programs, and not to asset building and employment generation. Among Indian states, AP now has the highest proportion of its non-interest expenditure allocated to such programs. Secondly, higher subsidy and budgetary allocations for welfare programs has crowded out physical infrastructure expenditure.

Agricultural Performance

1.09 **Economic Productivity**. The economic performance of AP's agriculture lags behind that of India and prices for all crops except tobacco lag behind national averages. Since agriculture is the main activity inter-linked with other sectors, growth in rural economic output in AP is largely dependent on removing policy constraints which either inhibit cultivation or depress farm-gate prices. Despite relatively high crop yields, real economic productivity was not achieved in the 1980s because of use of costly modern inputs. Due to the large size and importance of the agricultural sector, agriculture has always been the main focus of AP government policy and budget: irrigation infrastructure and agriculture have respectively received about 40% and 12-14% of total public investment. Prior to recent reforms, agriculture received large irrigation and power subsidies which amounted to 2.7% of the GSDP, or 7.1% of agricultural value added.

1.10 **Agricultural Output**. The cultivable area of 15.65 M ha comprises 57% of the State. The net sown area (i.e. net of the fallow area) in 1989/90 was 11.09 M ha and utilized with a cropping intensity is 120%. Food crops constitute about 64% of the cropped area and about 71% of these crops are grown in the monsoon season. AP produced 7.2% of India's total foodgrains in 1989/92, and is the fourth largest grain-producing state in India. With the exception of rice--whose area has grown over the last decade--the cultivated area of all other cereals is declining in response to rising prices of oilseeds, pulses, and cotton.

1.11 Expansion of irrigation has had a major impact on agricultural productivity and the share of irrigation in gross sown area was 40% in 1993/94. Irrigated rice constitutes about 52% of the total foodgrain area. Irrigation and agro-chemicals are a major factor in increasing agricultural output in AP. The average fertilizer consumption per gross cropped area was about 119 kg/ha in 1991 (the second highest in India after Punjab). AP's pesticide use is the highest of any state. Since 1989/90, however, agricultural production has been stagnant due to the continued decline in canal command area (para. 1.12). which, in turn, led to a fall in cropped area and fertilizer use.

Public Irrigation Scheme Management

1.12 **Scope of Public Irrigation**. With a total net area of 4.029 M ha under irrigation in 1993, AP is the second largest irrigation state after Uttar Pradesh, and accounts for about 9% of the nation's irrigated area. Its canal command net area of about 1.73 M ha is the second largest in India. The composition of the net area under various irrigation sources in terms canals, tanks, wells and various other sources was about 43%, 18%, 35% and 4% in that order. Canal schemes are used predominantly for rice and cotton production, comprising about 52% and 39% respectively of the gross area crop irrigated. The areas irrigated by private wells are predominantly used for irrigation

of most other foodgrains and cash crops. The net area under public surface irrigation reached a peak of 2.9 M ha in 1990, but declined to 2.3 M ha by 1994 due to inadequate funding of O&M.

1.13 **The Irrigation & Command Area Development Department**. All public investment in major and medium irrigation schemes, i.e. schemes larger than 2,000 ha (Map IBRD 18986R1)--along with water resources planning, regional flood control and drainage, and construction of multi-purpose reservoirs--are the responsibility of the Irrigation & Command Area Development Department (ICADD). Minor irrigation investments are undertaken by ICADD's Minor Irrigation Department and the Rural Development and Agriculture Department. Private sector participation is limited to private funding of wells and small pump schemes. On three major schemes covering a substantial portion of the canal command area, canal water management and on-farm development are undertaken by a Command Area Development Authority (CADA) under ICADD control. The construction of hydroelectric plants for multi-purpose reservoirs is undertaken by the AP State Electricity Board, which operates them in coordination with ICADD with respect to water release regimes. ICADD's budget resource allocation emphasizes starting new major and medium projects rather than rehabilitation of existing schemes. This leads to time and cost overruns due to the spread of limited capital resources and upkeep of under-employed personnel. Furthermore, zonal restrictions on transfer or retrenchment of lower level staff prevent staff reduction when an ICADD project is completed.

1.14 **Irrigation Laws**. AP has no comprehensive irrigation law. Up to 1984, there were two regional Acts: the Irrigation Cess Act, 1865 applicable to the Rayalaseema and Coastal Region; and the Telangana Irrigation Act 1948, applicable to the Telangana Region. The 1865 Act made it lawful to levy irrigation water charges on an scheme constructed by government, and to regulate cultivation in designated areas (*localized* land) by imposition of a penal cess for: (a) irrigation outside a defined six month irrigation season; or (b) by interfering with water supply to other irrigators. The 1948 Act extended these regulatory concepts to include seasonal prohibition crops such as rice on the basis of their water requirement. However, most of the provisions under the 1948 Act have been superseded by the Irrigation Utilization and Command Area Development (IU & CAD) Act 1984. The 1984 Act is applicable in any project placed under a CADA and enlarges ICADD's functions beyond water management to include voluntary beneficiary participation and on-farm development. This Act has not been effective in enforcing localization fostering voluntary beneficiary management, or improving water management. Irrigation water charges for public schemes are levied under the 1988 Water Tax Act and are a function of crop type, season and size of scheme.

1.15 **Localization**. Irrigated areas in AP are classified as "Irrigated Wet" (IW) and "Irrigated Dry" (ID) under a legal procedure known as "Localization". Under the 1984 Irrigation Utilization and Command Area development Act, localization determines the water delivery regime that may be supplied based on annual water availability, or a project planning policy of spreading the benefits of irrigation as widely as possible by banning water intensive crops. This allows ICADD to prescribe the season of irrigation for a canal, and the cropping pattern, period of sowing and crop duration based on irrigation requirement considerations (IW, ID, double or perennial crop). Accordingly, IW and ID localization designation of a canal command generally applies to either the monsoon and post-monsoon seasons. In IW designated areas, all crops may be grown but farmers grow mostly rice and sugarcane. In ID designated areas (usually lighter soils), rice and sugarcane are specifically banned under the provisions of the 1984 Act because farmers in the canal head reaches would prevent water from reaching the tail-end areas. Section 24(2) of the 1984 Act allows GOAP to alter the Localization designation of an area if it wishes to advance the technology of land and water management practices.

Previous Bank Involvement and Lessons Learned

1.16 **Previous Involvement in Irrigation**. As of 9/30/95, the Bank commitment of US$492.91 million for 16 ongoing projects in AP was the fourth largest state project portfolio. In water resources development, a Hyderabad Water Supply Project (Cr.2115-IN/Ln.3181-IN), and hydrological data network improvement under the multi-state Hydrology Project (Cr. 2774-IN) accounted for US$91.35 M. Previous Bank support for four irrigation projects has played a major role in the irrigation development of AP These are: (a) Pochampad Irrigation (Cr. 268-IN); (b) Godavari Barrages (Cr. 532-IN); (c) AP Irrigation and Command Area Development Composite (AP I) (Ln. 1251-IN); and (e) Second Andhra Pradesh Irrigation (AP II) Project (Cr. 1665-IN/Ln. 2662-IN). The National Water Management (NWM) Project (Cr. 2179-IN/Ln. 3260-IN) included an AP component to demonstrate improved network designs in six medium schemes.

1.17 **General Lessons Learned**. The Pochampad, AP I and MWM projects provided valuable lessons such as: (a) a canal system must be properly designed and constructed to deliver water to the individual farm; (b) major and minor conveyance systems, and main drainage, must be built simultaneously; (c) to ensure project viability, water should not be released for irrigation until the minor system is ready to receive it; (d) the minor system, from government outlets to farm gates, must be operated by farmers organized in water user associations (WUAs); (e) the need for full canal lining and more attention to a project's agricultural aspects during supervision; (f) development of realistic operational plans for water management and O&M based on a prior diagnostic analysis; and (g) increased training of irrigation staff in O&M, and training of agricultural department staff and farmers. The AP component of the NWM Project was not successful because attention was not given to eliciting farmer agreement to de-localization of IW lands.

1.18 **The Lessons of AP II**. As the proposed project is a follow-on project to, inter alia, complete AP II (para. 1.22), the key lessons[1] of AP II are important. The primary lesson is that a project will not succeed unless it is well prepared and appraised. Project appraisal lessons include: (a) water supply availability and reliability must be unambiguously established and command areas sized accordingly, but consideration should be given to possible system expansion at a later date; (b) detailed designs for major works must be available at appraisal and should be based on cost-effective design alternatives, field surveys and sub-surface investigations; (c) appraisal cost estimates should be based on prevailing contracting industry prices; (d) introduction of new methods of design and canal management must be fully documented by appraisal to ensure their understanding and acceptance by the Borrower; and (e) appraisal missions must review the implementing agency's ability to control construction quality and ensure efficient operation and management. Project implementation lessons are: (i) procurement of works contracts must follow a logical implementation sequence to facilitate timely realization of planned benefits and permit program adjustments if problems arise; and (ii) project implementation success depends on the establishment of viable institutional arrangements for participatory beneficiary involvement, and particularly where water delivery arrangements are to be changed, appropriate administrative frameworks must be in place to implement the new system.

---

[1] Implementation Completion Report: *Second Andhra Pradesh Irrigation Project (Loan 2662-IN/Credit 1665-IN)*; Report 15708, June 11, 1996.

C. The Second Andhra Pradesh Irrigation (AP II) Project

The AP II Sub-Projects

1.19 **AP II Objectives and Canal Management Policies.** The proposed project is a follow-on operation to complete the Second Andhra Pradesh Irrigation Project (AP II) and support irrigation reforms in AP. Bank support for AP II (Credit 1665-IN/Loan 2662-IN) consisted of a loan and credit of US$131 million and SDR127.5 million to increase agricultural production by: (a) rehabilitation of the existing 234,000 ha Sriramasagar Project (SRSP) command and its extension by another 34,000 ha to km 284 of Kakatiya Canal (KKC); and (b) development of a new 65,000 ha command served by the Srisailam Right Branch Canal (SRBC). New water management principles were to be introduced to implement GOAP's policy of equitable and cost-effective delivery of available water to a maximum number of beneficiaries. These included: (i) reduced water allocation by "Irrigated Dry" (ID) localization of land for all new command areas, and de-localization of "Irrigated Wet" (IW) land to ID in SRSP; (ii) Rotational Water Supply (RWS), i.e. intermittent deliveries on a 7-14 day "on-off" basis to outlets serving 40 ha blocks within which water would be distributed by farmer-managed Outlet Committees according to a roster of pre-arranged turns; (iii) setting the capacity of irrigation outlets to deliver a discharge proportional to the land area to be served according to the Structured Irrigation Network concept of canal design and operation; (iv) throttling of oversized outlets and significant elimination of uncontrollable direct farm outlets from large canals in SRSP; and (v) requiring rice farmers on de-localized IW land to accommodate reduced and intermittent water deliveries by supply augmentation from their private wells.

1.20 **The SRBC Sub-Project.** The SRBC command area is located in AP's Rayalaseema Region and is situated along the west bank of the Kundu River, a tributary of the Krishna River (Map IBRD 18843R). The command area is about 130 km long and 5-10 km wide, with a cultivable command area (CCA) of 77,000 ha. The area became potentially irrigable after completion of the Srisailam Reservoir [live storage of 250 thousand million cubic feet (TMC)] on the Krishna River in the late 1970s. This reservoir was originally designed for hydropower generation only but was later converted to a multi-purpose facility for water supply and irrigation. When SRBC was originally conceived, all its water requirements were to be abstracted from the Srisailam Reservoir within 3-4 months during the monsoon season and conveyed over 70 km to the Gorakullu and Owk seasonal storage reservoirs within the irrigation command. However, during the AP II appraisal these two reservoirs were dropped. A description of the socio-environmental features of SRBC is given in Annex 2 (paras 5-10). The SRBC planning history and Krishna River water allocation is described in Annex 1.

1.21 **The SRSP Sub-Project.** The SRSP command is located in the Telengana Region of AP in the Godavari river basin (Map IBRD 18842R). It is served by the Sriramasagar Reservoir on the Godavari River. The upper portion of the command served by the Kakatiya Canal (KKC) was originally developed up to KKC's km 113 under the Bank-supported Pochampad Project (para. 1.16). By the early 1980s, GOAP had extended the KKC up to km 234 to create an irrigation potential of 323,000 ha. These works included construction of the Lower Mannair Dam (LMD) across the Mannair River (a tributary of the Godavari River) at KKC's km 146 near Karimnagar. LMD augments SRSP water supply by capturing the runoff from the Mannair River's free catchment and serve as a balancing reservoir for SRSR. Under AP II, the KKC was to be completed to km 284 and its command extended to an additional 34,000 ha. A description of the socio-environmental features of SRSP is given in Annex 2 (paras. 11-15) while its development history and Godavari River water allocation are described in Annex 1.

Causes of AP II Implementation Failure

1.22 **Implementation Problems**. AP II did not achieve its development objectives: by the time of project closure no additional area was ready for irrigation in SRBC and SRSP. Many of the reasons for AP II's poor implementation progress arose from delays in land acquisition, procurement difficulties and litigation, staff changes, counterpart funding shortages, and limited logistics resources. Other causes of delay were the technical differences that arose between the Bank and GOAP as a result of inadequate project quality-at-entry (paras. 1.21 and 1.22). Furthermore, Bank funding was reduced during the course of the project due to: (a) reallocation of SDR40.8 million to implement the AP Cyclone Emergency Reconstruction Project (Cr. 1770-IN); and (b) cancellation of the entire loan by 1993 on the grounds of slow disbursement and Rupee devaluation. Thus, despite improved implementation in 1993/94, it was not possible to extend the project period as all Bank project funds would have been disbursed by June 1994. These financing difficulties were partially overcome in November 1993 when the Bank announced that: (i) it would consider supporting completion of AP II works under a follow-on project, provided a satisfactory feasibility study was submitted by GOAP resolving all outstanding issues; but that (ii) all interim procurement would be at GOAP's own risk. At project closure, GOAP was left with contractual commitments of about US$118 million.

1.23 **Resettlement & Rehabilitation (R&R)**. The AP II R&R component provided for retrospective actions to rehabilitate Project Affected Persons (PAPs) displaced by the construction of the Srisailam Reservoir in the 1960s, and the Lower Mannair Dam in the 1970s and 1980s. However, project effectiveness was delayed about 15 months till October 2, 1987 due to GOAP's inability to submit a Resettlement and Rehabilitation Action Plan (RAP) satisfactory to the Bank, and only after the Bank waived this effectiveness condition. Instead the Bank accepted a continuously evolving RAP without defined action targets or a R&R policy: thus at closure, it is not certain whether the R&R component fully achieved acceptable targets. No provision was made in the project RAP for PAPs affected by canal or road construction as this was assumed to have insignificant impact.

1.24 **Inadequate Public Consultation in SRSP**. To ensure that the AP II water management strategy (para. 1.16) would be undertaken in a systematic manner, GOAP was to introduce and apply RWS and an ID water allocation regime (para. 1.15) in SRSP. Since rehabilitation and de-localization would take time, a phased program was agreed whereby the whole IW area of 62,000 ha above LMD would be converted to ID by June 1993. However, when the first Government Order (G.O.) for de-localizing 5,299 ha from IW to ID in the Karimnagar district was issued in July 1987, the district's public representatives opined that the conversion would entail hardship and financial losses to the affected farmers, and petitioned GOAP to reconsider the matter. Given that maintenance of the status quo would defeat the whole purpose of the AP II project, a GOAP Expert Committee upheld the project's water management principles (para. 1.19) but recommended that de-localization would be slower with 80% of the de-localization to be undertaken during the last year of the project prior to its closure on June 30,1 994. Thus, due to difficulties with rice cultivators, no rehabilitation works were undertaken in SRSP and instead, only works to extend the command area below km 234 of KKC were undertaken.

1.25 **Design And Appraisal Inadequacies of SRBC**. The technical and cost overrun difficulties of SRBC implementation may be traced to Bank acceptance of a project prefeasibility study instead of a feasibility study. Cost estimates were not based on detailed designs but on prefeasibility study estimates, detailed operational hydrology assessments were not undertaken, and design alternatives were not based on detailed field studies and sub-surface investigations. The lack of prior canal

alignment studies and detailed sub-surface investigation resulted in the SRBC main canal cost overruns due to: (a) the frequent need to excavate in unanticipated rock outcrops; and (b) construction of unforeseen high concrete walls to retain canal flow at locations where the main canal crossed flat valleys. Since main canal alignment was not reviewed after dropping of the seasonal storage reservoirs (para. 1.20), the Owk Tunnel and Owk Reservoir became inevitable. Furthermore, despite Bank review of SRBC water availability during appraisal, Bank concerns about water availability became a major issue and led GOAP to prepare simulation studies to reintroduce the Gorakulu and Owk reservoirs into AP II (Annex 1).

Resolution of AP II Project Design Issues

1.26 **Project Design Revisions**. Preparation of the proposed project sought to apply the lessons of prior Bank involvement in AP irrigation projects and those of AP II in particular (paras. 1.24-1.25). The AP II project design was reviewed and modified to mitigate project implementation risks and resolve planning issues. This included: (a) detailed feasibility studies, sub-project feeder road traffic surveys (Annex 10, para. 34) and participatory rural appraisals to determine farmer irrigated cropping pattern preferences (Annex 10, para. 15); (b) river basin and project simulation model studies on water supply availability and reliability (Annex 1); (c) formulation of a R&R policy and action plans for rehabilitation of families affected by canal and road construction (paras. 2.40-2.47 and Annex 5), and completion of the AP II R&R program for reservoir oustees (para. 2.48); (d) improvement of detailed engineering designs (para. 2.13) and bid documents; (e) construction quality assurance arrangements (paras. 2.26-2.28); (f) undertaking of a priori and fully documented public consultations in SRSP regarding farmer acceptance of project de-localization and rotational water supply policies (Annex 14); (g) a framework for participatory irrigation management based on turnover of tertiary irrigation networks to registered WUAs (paras. 2.32-2.36, paras. 4.01-4.05 and Annex 3); (g) an improved framework for project operations and maintenance (O&M) organization, management and funding (para. 2.19, paras. 4.06-4.08); (h) an improved irrigation agronomy and extension program (paras. 2.29-2.31); (i) an expanded staff and farmer training program (paras. 2.37-2.39); (j) environmental impact analysis and environmental management plan (paras. 2.49-2.52 and Annex 2); and (k) statewide increase of irrigation water charges (paras. 4.09-4.11 and Annex 11). The need for investments to ensure the safety and sustainability of project reservoirs that had became apparent during AP II led to inclusion of a dam safety component (paras. 2.21-2.25). Particular attention was given to project performance indicators (para. 4.35), implementation monitoring arrangements (paras. 4.38-4.41) and required project staffing schedules (Annex 8).

Investigation of Scheme Design Alternatives

1.27 **SRBC** (Annex 1). The water availability issue was resolved by a GOAP simulation model of the existing and proposed schemes and facilities in the AP portion of the Krishna Basin. The model examined various planning options related to the size of SRBC command area and the need for off-channel storage reservoirs to ensure its water supply reliability. It was found that--under full anticipated development of the Krishna river basin--a 75% annual water supply reliability to SRBC would be ensured to a command of 65,000 ha with an Owk Reservoir of reduced capacity (para. 2.11). Water availability for SRBC should not be a sub-project viability issue. To ensure that adequate priority would be allocated to seasonal water supply to SRBC, appropriate operating rules were developed for Srisailam Reservoir and institutionalized by a Government Order (para. 4.18).

1.28 **SRSP** (Annex 1). Water availability and command area size alternatives were reviewed by means of a simulation model which focused on water supply reliability to the existing and proposed

extension of the command below LMD. The model results clearly indicated that supply reliability to any extension of the existing command area would be unacceptably low given upstream riparian water rights and the limited storage capacity of the Sriramasagar Reservoir. Thus the proposed project would only undertake rehabilitation of the existing SRSP command and not support completion of the 34,000 ha extension begun under AP II except for retrospective R&R of families affected by land acquisition for AP II SRSP network extension works. The model also exhibited sensitivity to overall irrigation efficiency which should attain about 40% if water supply to the below LMD command is to have a reliability of 75%. Consequently, in addition to public consultations regarding the RWS policy, a Government Order for de-localization of the command to an ID supply regime was issued prior to negotiation of the proposed project. The delocalization was required to ensure the irrigation efficiency improvements expected under the project from network rehabilitation, RWS and introduction of water distribution by WUAs to achieve water distribution equity and control wasteful irrigation (para. 2.18).

II. THE PROJECT

A. Project Rationale, Objectives and Components

Rationale for Bank Involvement

2.01 **Irrigation Sector Reform**. In line with the India CAS (para. 1.04), the Bank has been engaged in a dialogue with GOAP about fiscal measures to alleviate its irrigation sector financial crisis. Subsequent statewide public consultations on irrigation water charges resulted in GOAP issuing an Ordinance for an unprecedented increase in irrigation water charges. A complementary increase in O&M budgets is also being considered. Dialogue with GOAP has also set in motion an ICADD organizational reform process including plans to place tertiary irrigation networks under beneficiary control through participatory irrigation management (PIM) institutions. Having adopted a PIM Policy, GOAP is engaged in the formation of autonomous WUAs throughout the public irrigation sector. GOAP is also addressing the management and operational performance problems in ICADD. Since the project is intended to serve as pilot for GOAP's strategies of decentralized management and beneficiary empowerment, promotion of this effort via the project would be consistent with the Bank's irrigation lending strategy for India (para. 1.05). Involvement in the project at this juncture would strongly support GOAP's irrigation sector reform program and enable the Bank to maintain an irrigation policy reform dialogue with India's second largest irrigation state.

2.02 **Rural Infrastructure Development**. The Bank's support for the project would contribute to GOAP's high priority goals of improving the performance of upland irrigation schemes and their expansion (paras. 1.09 and 1.16). The economic potential created by AP II investments have yet to be tapped, and Bank financing as a "lender of last resort" would help make this possible. The Bank's involvement would significantly reduce the time it would take GOAP to complete the AP II works using its own meager resources. The project would also support the safety and sustainability of two multi-purpose reservoirs of vital regional importance and also facilitate the execution of an otherwise unaffordable environmental conservation initiative. Thus, Bank support to increase rural productivity in an environmentally sustainable manner would contribute to improved economy and efficiency in public expenditure. The project has a potential for rural transformation : thus Bank involvement would thus support GOAP's strong political-economic commitment to poverty alleviation (para. 1.06) and contribute to raising the family incomes of marginal and small farmers--who comprise the majority of project beneficiaries--above the official poverty threshold.

Project Objectives

2.03 The primary objective of the project would be to complete ongoing irrigation development and scheme rehabilitation works begun under Second Andhra Pradesh Irrigation Project and thus realize the potential for increasing agricultural productivity and rural incomes in two economically backward regions of Andhra Pradesh. The other objectives would be to: (a) pilot implementation of management reforms to improve public irrigation performance by facilitating beneficiary participation in the operation and maintenance of major irrigation schemes, and upgrade GOAP capacity to improve irrigation services and command area management; (b) retrospectively mitigate the adverse impacts of land acquisition under the Second Andhra Pradesh Irrigation Project, and proactively provide economic rehabilitation for those families still to be affected by completion of SRBC works; (c) ensure the safety and sustainability of three dams supplying water to the project areas; (d) implement a mandated regional program of environmental improvements, safeguards and natural resource conservation; and (e) improve GOAP monitoring and evaluation capability for large externally aided irrigation projects.

Project Components

2.04 The proposed project would incur a base cost of US$434.06 million over a five and one half year period to implement the six components needed to achieve project objectives. A summary description of these components follows below while their detailed features are given in Section B to D thereafter.

2.05 **Irrigation Development and Rehabilitation Works** (Base Cost US$346.32 million). This component consists of two sub-projects as follows:

- **SRBC Sub-Project** (Base Cost US$166.14 million). The SRBC component would support completion of the scheme including all civil works begun under AP II. Structures and activities include: (a) completion of sections of the main canal and the Gorakullu By-Pass Siphon; (b) construction of the Owk Tunnel and Owk seasonal storage reservoir; (c) lined irrigation network for 65,000 ha; (d) drainage system and on-farm development; and (e) completion of feeder roads begun under AP II and about 50 km of new feeder roads.

- **SRSP Sub-Project** (Base Cost US$180.18 million). The SRSP component would support the rehabilitation of 165,000 ha of irrigation system above the Lower Mannair Dam (LMD) and 88,000 ha of existing network below LMD up to km 234 of Kakatiya Canal. Necessary works and activities include: (a) selective rehabilitation of canal lining and structures of Kakatiya Canal up to km 234; (b) rehabilitation and modernization of the existing irrigation network (inclusive of on-farm development and drains where necessary); and (c) completion of feeder roads begun under AP II and about 50 km of new feeder roads.

The base costs of each sub-project include the following common implementation activities and investments: (i) procurement of equipment for communications, construction quality assurance laboratories and O&M organization; (ii) construction quality assurance training of construction supervision staff and irrigation training of O&M staff; (ii) establishment of a computerized Management and Information system; and (iv) surveys, studies and technical assistance .

2.06 **Agricultural Support Service Programs** (Base Cost US$10.71 million). The component would support programs for improving the technical performance and productivity of irrigated

agriculture. The Irrigation Agronomy Program for SRBC and SRSP includes: (a) applied research and demonstration of irrigation practices and agronomy to improve irrigation practices and crop yields; (b) upgrading of the agricultural extension services in SRSP; and (c) program of applied research, demonstrations and extension to promote high value horticultural crops. The WUA Promotion Program includes: (i) completion of a pilot program to develop WUA frameworks, training modules and joint system management modalities involving 32 WUAs in SRSP; (ii) implementation of an Action Plan to establish WUAs for the whole command areas of SRBC and SRSP; (iii) technical assistance by NGOs for the WUA program; and (iv) studies of indigenous irrigation institutions in SRBC and SRSP. The Farmer Training Program includes: (i) provision of training facilities and courses in irrigation agronomy to ICADD staff and farmers; and (ii) irrigation and management training courses for ICADD staff and WUA office holders.

2.07 **Resettlement and Rehabilitation (R&R) Program** (Base Cost US$21.81 million). This program provides for economic rehabilitation of the families of three groups of Project Affected Persons (PAPs) and their major (adult) children adversely affected by past and proposed land acquisition for SRBC and SRSP works. This includes: (i) retrospective assistance to about 6,000 PAPs (including their 2,787 major children) affected by land acquisition for canals and roads under the AP II project; (ii) rehabilitation of about 500 PAPs (including their 244 major children) to be affected by SRBC canal works under the project; (iii) assistance to 778 "below poverty line" reservoir oustee families who were not assisted under the AP R&R component; and (iv) PAP vocational training for income generating schemes. The program would also complete the AP II R&R component's program of provision of community facilities and house plots for reservoir oustees in 104 resettlement villages.

2.08 **Environmental Management Plan** (Base Cost US$32.48 million). This component supports a GOI mandated regional program of environmental safeguards and nature conservation in command area districts. It includes: (a) compensatory afforestation; (b) improvement and protection of six Forest Reserve areas and two wildlife sanctuaries; (c) establishment of an LMD bird sanctuary and fish farm; (d) catchment area treatment programs to mitigate reservoir sedimentation ; (e) an environmental health program; (f) construction of three environmental education centers and establishment of project environmental monitoring units; and (g) an SRSP agro-forestry program.

2.09 **Dam Rehabilitation and Safety Assurance** (Base Cost US$20.28 million). This component supports investments to: (i) maintain the structural and mechanical integrity of Sriramasagar, Lower Mannair and Srisailam dams; and (ii) works to prevent failure of the Srisailam dam spillway.

2.10 **Project Monitoring and Evaluation** (Base Cost US$2.47 million). This component provides for strengthening of ICADD's Project Preparation and Monitoring Unit.

B. Detailed Features of Irrigation Investments

SRBC Civil Works

2.11 **Main Canal** (Annex 2, Figure 1). The partially completed main canal, flows south along hillsides for 50 km before reaching the partially completed Gorakullu By-Pass (GBP) aqueduct/siphon and the irrigation command. Beyond GBP, the canal flows for about 63 km commanding about 41,000 ha divided into 11 irrigation blocks (of which two are under construction). Between km 113.6 to km 119.5, new conveyance system investments consist of: (a) the 2 km long Owk Tunnel and (b) the linkage of two existing irrigation tanks by low dams and a central spillway to create the 1.9 TMC capacity Owk seasonal storage reservoir. The existing tanks

command about 670 ha under rice cultivation and provision is made for a reliable supply to this area. A pumping station at Owk Reservoir is provided to fully evacuate reservoir dead storage every year. After Owk Reservoir, the existing main canal continues for about 26 km. Five irrigation blocks covering 24,000 ha would be constructed to complete a total command area of 65,000 ha.

2.12 The main canal works and GBP are divided into eleven ongoing construction contracts begun under AP II and continued through 1994-1996. With the exception of GBP, these works are in an advanced stage of completion and have been inspected in June 1996 by an independent construction quality audit team to certify their eligibility for retroactive financing. The planning, subsurface investigations and designs for the Owk Complex (tunnel and reservoir) have been continuously monitored and reviewed by an independent Dam Safety Review Panel (DSRP). The Owk Complex is divided into 3 contract packages based on detailed designs and bid documents reviewed by an experienced construction specialist.

2.13 **Irrigation Network**. Management and control of canal flow is based on Rotational Water Supply (RWS) (i.e. "on-off" alternate supply periods of at least 7-10 days each) and structure designs suited to the "structured irrigation network" (SIN) principle. The SIN principle provides no gated structures below the head of a minor canal serving 2,000-4,000 ha and which is to flow at full design discharge during each irrigation period. Distribution canals for the 16 irrigation blocks offtake from the main canal through head regulators located adjacent to, or upstream of a main canal cross-regulator. The head regulators are equipped with manually operated undershot gates, however consideration will be given to installation of overshot gates for more reliable control. Technical assistance would be utilized to analyze the viability of this possible innovation. In order to facilitate efficient conveyance (including partial reduction of seepage losses), maintenance and canal sustainability in Black Cotton Soils, the canal network utilizes a lined section down to a discharge of about 0.028 cumec (1 cusec). Since the distribution network is aligned predominantly on swelling Black Cotton soil, the lining is to be placed on a compacted layer of cohesive non-swelling (CNS) soil of appropriate thickness (based on standard field investigation of soil swelling properties).

2.14 The irrigation network has been divided into 16 contract packages. Construction of Blocks IV and VIII was begun in 1994 and is ongoing and were found eligible for retroactive finance by the construction quality audit. These blocks were originally to be lined to a 1 cumec capacity only: thus the works for lining to a 0.028 cumec capacity will be a separate contract to be bid during the project. Irrigation water is to be supplied to watercourses through adjustable proportional module (APM) and open flume module (OFM) outlets to ensure that each 30-40 ha watercourse command receives a flow in proportion to its size. No direct outlets will be allowed from the main canal. The APMs and OFMs are capable of being shut by sliding shutters if some watercourse commands do not wish to draw water after heavy rainfall: hence all minor canals are also to have a tail-escape structure into the main drainage network.

2.15 The project will assist farmers in laying out the micro-network within a watercourse command and with the lining the first 10 m of each watercourse. Separate contracts will be used for drainage and watercourse command on-farm development works. The latter are to be begun about nine months prior to the completion of civil works in each irrigation block and their designs would be vetted by farmers after preparation by consultants. *Assurances* were obtained at negotiations that all micro-network designs for each watercourse command ("chak") in SRBC would be completed by consultants at least 15 months prior to completion of each irrigation network works contract, and that these designs would be reviewed and accepted by the prospective beneficiary farmers prior to initiation of the micro- network works.

SRSP Civil Works

2.16 **Scope**. Rehabilitation and modernization works are to be undertaken in two command areas (Annex 2, Figure 2): "above LMD"(km 0-146 of KKC) and below "LMD" (km 146-234 of KKC). The works are grouped under a number of contract "packages": a package being either a specific length of Kakatiya Canal (KKC) and/or a portion of the command area--normally a distributary canal command or part of one, an area of watercourse command development and/or an area of drainage works. There are 16 rehabilitation packages above LMD covering an existing area of 165,000 ha and 7 rehabilitation and network completion packages below LMD covering 88,000 ha. One package above LMD and three packages below LMD are ongoing works begun under AP II which are deemed eligible for retroactive financing by the construction quality audit.

2.17 **Kakatiya Canal Rehabilitation and Improvements**. The conveyance capacity of KKC is about 40% below its nominal design discharge of 243 cumec because of damaged lining, channel side slope slips, neglected silt deposition etc. Many of the mechanical appurtenances in its regulating structures are also in poor condition or barely operable. Simulation studies (Annex 1) have indicated that, unless its capacity is restored after rehabilitation of the command above LMD, it will not be able to convey monsoon surplus water stored in the SSR to LMD for irrigation of the area below LMD. As per the designs prepared under AP II, the KKC discharge capacity is to be restored and increased from 243 cumecs to 274 cumecs from km 0 to km 146 by increasing the full supply depth of the canal by 0.46 m and raising the canal lining. KKC also requires repairs to its existing lining in many reaches and completion of some structures.

2.18 **Distribution Network Rehabilitation**. The design for the rehabilitation of the irrigation network is based on introduction of RWS and remodeling of structures according to SIN principles and is otherwise similar to that of SRBC (para. 2.13). Accordingly, all SRSP lands have been de-localized to ID irrigation (para. 1.15). The number of gates are therefore to be reduced, and suitable SIN structures are to be provided. About 30% of the lined network is aligned through Black Cotton soils where lining is to be placed on a CNS soil layer. Where possible, small distributaries are to be linked to enable efficient water control and canal regulation. Many outlets for these small areas are oversized and would be throttled to reduce their excessive and wasteful discharges, while all watercourse pipe outlets would be replaced by APM or OFM modules. All broken structures and mechanical appurtenances are to be repaired. Prior to Negotiations, GOAP issued a Government Order de-localizing all SRSP command lands up to km 234 of Kakatiya Canal to ensure the viability of RWS implementation.

2.19 **Interim Repairs and Maintenance**. Currently only about Rs.19/ha/year is allocated for maintenance for the SRSP scheme as a whole. Consequently, much deferred maintenance needs to be carried out (such as desilting and small structure repairs) just to keep the remaining network in minimal running order prior to completion of rehabilitation. The pilot WUA establishment program has shown that with minor repairs and farmer cooperation under a WUA framework, the irrigated area could be increased by as much as 20-28%. GOAP has therefore issued a Government Order in 1995 allocating a sum of Rs217.1 million for interim repairs to be spent over a period of 7 years beginning in FY95/96. As an incentive for farmers to form WUAs, all deferred maintenance works would be undertaken by WUAs under contract with ICADD. However, as irrigation network and main canal contracts in SRBC and SRSP are completed, normal O&M expenditure would be provided with project assistance on a declining scale (para. 3.18)

Rural Feeder Roads

2.20 The AP II program for construction and upgrading of SRBC and SRSP feeder roads to provide all-weather access to villages having a population of over 1,000 would be completed under the project. Thus no part of the irrigated portion of the sub-project areas would be further than 3-4 km from an all-weather road. To date, 107 km have already been completed under AP II: therefore about 50 km of new roads would be undertaken in each of sub-project command areas respectively. The feeder roads would conform to GOAP design standards satisfactory to the Bank. These include: (a) 3.5 m wide roads with surfacing of water-bound macadam and no black topping; and (b) construction of hard passages instead of concrete bridges over seasonal streams. The sub-grade design would be according to requirements dictated by forecast rural traffic (typically 15 cm deep) and the foundation according to California Bearing Ratio criteria. To ensure that planning, design and construction of the road sub-component can progress unhindered, an *assurance* was obtained at negotiations that, by October 1, 1997, and thereafter by April 1 of every year, GOAP would submit to the Bank/IDA for review: (i) plans for the extent of the sub-project road reserves to be acquired for development in the following or subsequent construction season; and (ii) detailed designs, cost estimates and bid documents satisfactory to the Bank/IDA for the roads to be newly constructed.

Dam Safety Works and Assurance

2.21 The dam safety component for project reservoirs has been prepared by ICADD on the basis of DSRP site visits and recommendations from 1988 to 1996. These were compiled into two 1995 *Notes on Dam Safety and Sustainability* and a 1996 summary report entitled *Dam Safety Assurance and Rehabilitation - Identification Report* (Annex 14). The latter report summarizes the project program and outlines a general dam safety assurance program for all dams in the state.

2.22 **Srisailam Dam Spillway Safety**. The plunge pool downstream of Srisailam dam's ski-jump spillway is becoming scoured and the possible progressive movement of the scour upstream could endanger the foundation of the ski-jump bucket. The consequent exposure of the weak seams occurring in dam's foundation may adversely affect the gravity dam's safety against sliding. The two outer gates of the spillway cannot be opened because of dangerous erosion of the river valley hill slopes by flaring of the spillway water trajectory. Thus spillway modifications are also needed to ensure dam safety against large floods.

2.23 Based on model tests, the solution suggested by the DSRP envisages construction of: (a) a coffer dam for dewatering the plunge pool; (b) construction of a toe wall with its top about 2-3 m above the bed and its foundation firmly anchored into hard rock to a depth of about 2 m; and (b) the space between the toe wall and existing apron would be filled with concrete up to 3 m thick, and covered with a 3 m thick concrete blanket firmly anchored in rock with passive anchors. Model tests indicate that construction of a divide wall on the downstream spillway face and bucket adjacent to the non-overflow 'river sluice' block could curb the spillway water jet flaring problem. Implementation of these solutions will require: (i) assessment of the magnitude and extent of the existing scour by detailed inspection of the plunge pool by underwater photography; and (ii) a feasibility study including analysis of construction methods. Technical assistance from international experts would be sought evaluate the feasibility study.

2.24 **Sriramasagar Dam and LMD River Sluices Repair**. Silt has accumulated behind the six river sluice gates of Sriramasagar dam and thereby jamming them completely (one river sluice of LMD has been similarly jammed). These gates are now inoperable, cannot function as permanent low-level outlets and also compromise structural safety since emergency gates were never installed. The immediate silt will have to be removed by deployment of desilting machinery (e.g. mini-dredgers) and divers are needed to clear the gate grooves to make them operable. Some gates may have to be replaced, but due to the height of accumulated silt it may be necessary to block the sluice tunnels permanently: the need for this contingency would be determined by dam safety studies.

2.25 **Dam Sustainability**. A number of investigations and improvements have been identified by the DSRP to ensure the sustainability of the Srisailam, Sriramasagar and Lower Mannair dams. These activities, to be undertaken under DSRP supervision, would include: (a) detailed structural behavior, dam deformation and instrumentation studies for Srisailam Dam; (b) installation of additional structural and uplift pressure monitoring instrumentation and devices; (c) modernization of disposal of internal drainage water in the dams and provision of ventilation in their internal inspection galleries; (d) petrographic analysis of rock and concrete samples (including coring of samples) to check alkali-aggregate reactivity potential; (e) procurement of lightweight pneumatic diamond core drilling machines and compressors for reaming of choked drainage holes in foundation galleries; (f) field and laboratory equipment for concrete leaching investigations to mitigate the clogging of porous concrete drains which drain seepage water from the dam body; and (g) technical assistance to undertake a Probable Maximum Flood studies.

Construction Quality Assurance Plan

2.26 **Laboratory Equipment**. ICADD has prepared an *Action Plan for Quality Control Organization* (Annex 14) to cope with the increased construction supervision load that would be generated by the large number of construction contracts that would be simultaneously active in SRBC and SRSP. In addition to defining the duties, functions and numbers of staff required by the Quality Control Units (para. 2.27), this Plan also provides for upgrading of inadequate central and field laboratory equipment and facilities based on the listing of cement, concrete, aggregate, steel and soil tests to be performed by these laboratories (Annex 9). The existing four laboratories in SRSP are to be expanded into three central laboratories and four field laboratories (for routine daily tests). Because of the more compact nature of the SRBC scheme, upgrading of the existing central laboratory is proposed with routine tests being carried out by three mobile field laboratories. Detailed lists of the laboratory equipment required are given in the Quality Control Action Plan.

2.27 **Supervision Staff Training** (Annexes 4 and 9). Because it involves new major works, SRBC requires highly trained supervisory staff if quality assurance is to be achieved by supervisory staff. The project has already benefited from participation of 20 SRBC engineers in a National Council for Cement and Building Materials (NCCB) course in concrete construction practice. Under a *Training Program* (Annex 14) prepared by ICADD it is proposed that the NCCB training program would continue under the project and include 60 and 150 SRBC and SRSP officers respectively. The program would include 'hands-on' and 'on-the-job' training to construction and quality control personnel. This would be followed by periodic quality audits and re-training. The training program envisages 16 three-day Quality Control and Assurance courses for 20 Supervisory Engineers (SEs) and Executive Engineers (EEs) per course at the AP Water and Land Management Training and Research Institute (WALAMTARI) campus over a five years.

2.28 **Contract Management**. In addition to the extant Quality Control Manual, Quality Audit Guidelines and an 'OK Card' system have been introduced during project preparation with salutary results. The OK Card system is a pro-forma check-list of all tasks, installation and construction activities associated with each structure and separate civil construction type for each contract. The cards are inspected by quality control staff and are duly signed and remarked upon by both supervision and contractor representatives when each work is ready for execution and upon its completion. These procedures would be continued under the project. In addition to the above, a training program envisages 16 three-day Contract Law and Administration courses for 20 SEs and EEs per course at the WALAMTARI campus over a five year period. An *understanding* was reached at negotiations that the OK Card system would be followed by GOAP and maintained.

C. Detailed Features of Agricultural Support Service Programs

Irrigation Agronomy Program

2.29 **Applied Research and Demonstrations**. Irrigation agronomy in SRSP would be improved by an active program of applied research on farmer's fields with the objective of evolving and demonstrating profitable diversified cropping sequences for horticultural and 'dry' crops (e.g. maize, cotton and sunflower) under an RWS regime. Extension 'messages' would be developed with respect to optimal crop wetting and time of application, improved field irrigation techniques, fertilizer and agro-chemical application, and use of improved cultivars and varieties. The program would be undertaken along two selected distributaries above and below LMD respectively over a period of five years. Each distributary would have three 40 ha sites at selected locations along its upper, middle and lower reaches: thus the test area would total 240 ha. There would also be sprinkler and drip pressurized irrigation demonstration plots of 2 ha each. These sites would preferably be where WUAs have been organized and would be selected jointly by ICADD, Department of Agriculture (DOA) and farmers' representatives. A third test area of 120 ha would be selected in either Block IV or Block VIII of SRBC depending on which is completed first.

2.30 Lists of required vehicles, laboratory and field equipment and necessary farm implements have been prepared. The sub-component would require temporary recruitment (for 5 years) of 3 research associates and 3 data recorders. Aside of extension to disseminate findings, a Farmer Exchange Program would form part of the demonstration strategy. Under this program, funding is provided over a five year period to arrange 2-day observation visits of 2,700 selected farmers from new and rehabilitated commands to research stations and other commands.

2.31 **Upgrading of SRSP Extension Services**. The existing agricultural extension service would be strengthened in the area of irrigation water management, systematic land development, and credit for land leveling through cooperatives and banks. The Contact Farmer approach of the Training & Visits (T&V) system was found to be ineffective and has been replaced by more effective mass contact through regular large group meetings and exhibitions. Participatory Rural Appraisal techniques for eliciting farmer feedback would be an element of the extension approach. The compulsory fortnightly Village Extension Officer (VEO) orientation and training meetings of the T&V system would be maintained to ensure uniform and timely extension message transfer. Andhra Pradesh Agricultural University (APAU) staff would participate in bimonthly workshops organized by the agricultural research stations in the command to deal with location-specific problems, and to maintain a linkage to the concurrent applied research program.

Water User Association Promotion Program

2.32 **WUA Promotion Strategy**. Based on GOAP's PIM Policy (paras. 4.01-4.02 and Annex 3), ICADD has prepared an *Action Plan for the Promotion of Farmers' Organization in Irrigation Management of Sriramsagar and Srisailam Right Branch Canal Projects* (Annex 14). The Action Plan target is phased establishment of 472 autonomous WUAs covering 256,000 ha in SRSP and 150 WUAs covering 69,000 ha in SRBC. Each WUA will be responsible for: (a) manage the minor canal command under its control to equitably deliver water supplied under a RWS regime to each irrigation block outlet; and (b) maintain its canal network. The Action Plan provides a generic model format of WUA Bye-Laws and a Memorandum of Understanding (MOU) for partial management transfer. Both documents have been reviewed and found satisfactory to the Bank. Copies of these model documents are exhibited in Annex 3. Each WUA will be governed by an elected executive committee of nine members and include a President, Treasurer and Secretary.

2.33 GOAP's decision to attempt joint management and partial transfer of irrigation networks to farmers is based on a *phased process-oriented* strategy of coordination of the many administrative, organizational, financial and institutional supporting actions to achieve turnover initially at the minor canal level. The process-oriented approach focuses initially on the effectiveness of the different decision-making processes in achieving satisfactory performance. Accordingly, the generic WUA framework currently being piloted in SRSP (para. 2.35) with 32 WUAs would be modified as necessary on the basis of experience and success. Management transfer would concentrate on establishing WUAs with jurisdiction over 400-750 ha by associating defunct voluntary Outlet Committees into a WUA on the basis of maximum social homogeneity within a single "Revenue Village" if possible.

2.34 A second phase of participative management would involve consolidation of WUAs into a larger organization at higher levels for managing a portion of the larger irrigation system. The WUAs would be expected to federate into apex committees on a distributary level (Distributary Committees) so as to provide a coordinating function for member WUAs and ICADD staff. At Command Area Development Authority (CADA) level in SRSP (and later in SRBC), a reconstituted CADA Board would be responsible for overall scheme management (paras. 4.04-4.06) along with an executive committee of composed of representatives of Distributary Committees. When the minor/distributary is handed over to a WUA, ICADD involvement would consist of technical advice. Other government support such as training, extension and management support would be provided as needed to further strengthen WUA participation in decision-making processes and foster a sense of partnership. It is envisaged that successful WUAs may amalgamate to enter into marketing, transport and agro-processing ventures.

2.35 **Implementation Approach**. Mass education and motivation campaigns would be organized in the project area. For SRSP, a consultative process in relation to system rehabilitation diagnostics would be carried out with respect to designs, outlet locations, the direct outlet problem etc. Training modules to facilitate implementation are being developed under the ongoing pilot program. The MOU defining WUA rights and responsibilities and the WUA bye-laws would be finalized in a democratic manner during WUA establishment, and support arrangements would be adapted to local conditions. The generic framework of latter aspects are being developed in an ongoing 2-year pilot program for 17,021 ha in SRSP with the assistance of two experienced NGOs. The NGOs are working in collaboration with WALAMTARI to develop location-specific training materials and modules.

2.36 The programs for WUA establishment in SRSP and SRBC (Annex 3) would vary in detail because of basic differences in scheme type (rehabilitation only in SRSP and introduction of irrigation in SRBC), local established practices and perceptions. The common framework includes:

- *Social Preparation and Socio-Anthropological Studies.* Motivation camps and meetings in each village to promote WUAs with audio-visual aids, training materials and direct discussion over a period of 6-9 months. In this period, irrigators would be identified, WUA boundaries would be finally determined and potential members who can serve as office bearers and training needs would be identified. GOAP is of the view that local indigenous farmer organizations (such as those for tank irrigation), and their linkages and community roles, need to be understood and integrated or associated with the WUA framework. Two such studies by consultants will be undertaken in SRSP and one in SRBC.

- *WUA Formation.* In this process, WUA representatives would be selected through the existing village structures and other functional organizations. The working modalities, responsibilities, functions, duties would be formalized as bye-laws for the WUA. The WUA's relations with ICADD would be determined by a MOU. Training would begin in this period which is expected to take 3-4 months.

- *WUA Legal Registration.* WUAs would be required to register as legal entities under AP's Societies or Cooperatives Acts, or under appropriate provisions of the 1984 IU & CAD Act (para. 1.14). Although the choice of registration modality will be left to WUA members, guidance will be provided based the experience gained under the ongoing SRSP pilot program. Prior to registration, 51% of farmers in terms of numbers or landholdings must be enrolled as members of the WUA.

- *Financial Arrangements.* WUA financial sustainability is proposed to be achieved primarily through the efforts and initiative of its members, but the modalities to be finally used will depend on the findings of the ongoing pilot program and the evolution of GOAP's initiative to require WUA formation on all public irrigation schemes. WUA revenue options being considered include: (i) individual membership fee payment on a per ha basis for upkeep of the irrigation network and administrative costs[2]; (ii) a commission to collect water rates and benefit from a rebate of 40% thereof (para. 4.10), or government support by earmarked sharing of the per ha O&M budget for the scheme; and (iii) initial managerial support grant of Rs.275/ha over three years available from a GOI PIM program. GOAP policy at present is to minimize dependence on direct government subventions and rely on incentives for WUA formation to foster self-reliance based on beneficiary empowerment.

- *Consultative Process.* In SRSP, the system rehabilitation and watercourse improvement designs prepared by ICADD would be reviewed with the affected WUA members prior to their procurement. Seasonal canal closure periods to facilitate rapid completion of works would be explained. This would also involve the issue of controlling irrigators served by direct outlets from a large canal: it is proposed that these irrigators would be placed under WUA jurisdiction under the provisions of the MOU. In SRBC, the system and watercourse designs would be explained to prospective irrigators and their inputs sought through existing organizations. *An*

---

2 E.g. a one time initial membership payment of Rs.250/ha to be held in a fixed deposit interest bearing account yielding Rs.30/year/ha to be used for maintenance;

assurance was obtained at negotiations that, prior to the award of any SRSP contract for rehabilitation of the irrigation network, the beneficiary farmers would be consulted on the modifications to the tertiary network designs with respect to relocation of irrigation outlets to farm watercourses or farm block watercourses, and shall take into account the views of beneficiaries.

- *WUA Establishment.* ICADD and NGO Social organizers would provide technical assistance to WUAs for 2 years (including the preparatory period) after which they are expected to be self-sufficient enough to discharge their obligations as per the MOU. During this period, the SRSP WUAs would be expected to undertake emergency repairs and works with the funding provided for this purpose (para. 2.19). The WUA establishment program will be implemented by WALAMTARI, NGOs and trained SRSP CADA staff. An NGO Adviser will be retained according to terms of reference satisfactory to the Bank at the state level to provide support on WUA establishment and operation.

Farmer Training Program

2.37 **Training Infrastructure.** At present, WALAMTARI has a campus in Hyderabad, four farmer training centers (FTCs) in SRSP and one in the SRBC area. Since the available training facilities and infrastructure are inadequate, in addition improving the training facilities and infrastructure at existing FTCs, the project would support establishment of two new FTCs in SRBC and one additional FTC in SRSP. GOAP has prepared a *Training Implementation Plan* in which all equipment lists, course details and proposed expenditures are specified.

2.38 **Extension Training.** An extension staff training plan has been prepared for VEOs, Agricultural Development Assistants (ADAs) and Agricultural Officers (AOs) in SRSP and SRBC. The training would be conducted by staff of the WALAMTARI with inputs from APAU. Staff from Officer level and above would be sent to the WALMTARI campus for training in water use management, while tailor-made courses for VEOs and ADAs would be organized on site as off-campus courses at regional agricultural research stations. This program envisages 24 basic and refresher courses for 364 VEOs, ADAs and AOs over a five year period.

2.39 **WUA Training.** Training is a key element of the WUA Promotion Program. The five year program of training courses by WALAMTARI and NGOs would cover all WUA office bearers, selected contact farmers, agricultural officers and ICADD staff involved in the WUA promotion process. Sixteen 3 day workshops on PIM and WUAs would be offered at the WALAMTARI campus for a total of 480 senior engineers and agricultural officers. The sub-project FTCs would provide: (a) 600 WUA courses for a total of 18,000 SRSP WUA members and 360 courses for 10,800 SRBC WUA members; and (b) 32 farmers' participation and public relations courses for 960 ICADD and agriculture staff at or below Deputy EE and AO rank posted to SRBC and SRSP.

D. Detailed Features of Social and Environmental Programs

Resettlement and Rehabilitation (R&R) Program

2.40 **Land Acquisition.** The total amount of land required for all project works, including roads, amounts to 7,981 ha, including 4,877 ha of land already taken over for the project since 1985 and 3,104 ha to be acquired for the proposed project. Of the total amount of land required, 6,479 ha is privately owned land, of which 4,030 ha have already been acquired and 2,449 ha are at different

stages of acquisition. Compensation for land was paid in line with the Land Acquisition Act (LAA) of 1894, amended in 1984. This compensation proved inadequate and many landowners sought and received redress of grievances in the courts. GOAP issued Negotiations Committee Rules in 1992, stipulating the constitution of Negotiation Committees and procedures for negotiated compensation with landowners affected by land alienation for public projects. Persons whose land acquired after 1992 received consent awards. Thus, for land still to be acquired, GOAP will seek utilize the Negotiation Committee procedure to pay land compensation at the prevailing land market value in addition to entitlements under para. 2.44. For trees, structures and other assets to be acquired, replacement value will be paid. If the negotiations fail to result in consent awards, the affected person could resort to the legal proceedings under the LAA.

2.41 **Eligible Project Affected Persons (PAPs)**. New irrigation commands potentially improve the livelihood of all command area population: thus loss of a small area of dry land to canal construction would be offset by increased income from the remaining holding. Thus PAPs are defined by the project R&R Policy as including all persons who have lost--or stand to lose--a "minimum economic loss" of his/her land, including land utilized under customary usufruct rights, and is either left with less than a "minimum economic holding", or whose income has fallen below the state's poverty line due to land acquisition. The "minimum economic loss" of holding is considered to be loss of 25% of the holding size on the date of Notification under the LAA, while a "minimum economic holding" (MEH) is defined as 1 ha of irrigated land or 2 ha of dry land. The PAP definition also includes landless persons, dependent on manual labor and living below the state's poverty line, whose livelihoods have been adversely affected due to alienation from land or property upon which such livelihood previously depended. Persons suffering less than a minimum economic loss would receive normal compensation under the LAA (para. 2.40).

2.42 **PAP Categories (Including Scheduled Tribes)**. The following population categories are eligible for R&R benefits under the project: (a) land holders and their families losing at least a minimum loss of their land holdings, or otherwise relegated to the official BPL livelihood category by past or future land acquisition; (b) landless persons (such as tenants, sharecroppers and encroachers) and their families losing at least a minimum loss of their cultivated land; and (c) the major children of PAPs of either sex who are more than 18 years of age, irrespective of his/her marital status, *at the time of the socioeconomic survey*. Two specific categories of PAPs entitled to additional benefits are: (a) those who lose any of their homestead land or are otherwise displaced from their village as a result of land acquisition; and (b) PAPs belonging to Scheduled Tribes who are entitled to replacement of land [para. 2.44(a)] in addition to all rehabilitation benefits. In the SRBC area, Scheduled Tribes constitute about 2.2% of the total population and 1.2% of the PAPs; in SRSP, Scheduled Tribes comprise about 15.5% of the project area population and about 10% of PAP households. In both cases, Scheduled Tribes are engaged in farming and are project beneficiaries, and accordingly no separate Tribal Development Plan has been prepared.

2.43 **Number of PAPs**. Independent consultants conducted detailed socioeconomic surveys in the project affected areas on the basis of the approved R&R Policy. The surveys were satisfactory to the Bank and completed: (a) verification of the extent of land and other assets acquired under AP II and to be acquired by the project; and (b) identification of individual PAPs in each category and their socio-economic profile. Thus the total number PAPs is about 6,500 scattered in 308 villages and includes 3,031 major children at the time of the socio-economic survey in 1994. The sub-categories include: 121 PAPs who have lost their houses/homesteads; about 675 PAPs rendered landless; about 311 PAPs that became functionally landless (i.e. losing so much land that they ceased farming); 7

tenant PAPs; and 61 PAPs belonging to Scheduled Tribes of which 49 will get replacement land. and all are farmers who would be irrigation beneficiaries.

2.44 **R&R Entitlements and Benefits** (Annex 5). The R&R Policy aims at improving, or at least restoring, the living standards of PAPs by providing--along with irrigation benefits--an assistance framework for replacement of lost assets and economic rehabilitation activities. Thus, in addition to mandatory compensation under the LAA, the following entitlements are provided under the R&R program to PAPs:

(a) Land-for-Land Option. Replacement land of comparable quality will be provided to PAPs through allotment of government land or ceiling surplus land to the extent of their loss up to a limit of 2 ha of dry land or 1 ha of irrigated land, preferably in the same revenue village. Preference will be given to persons belonging to the weaker sections. In the case of PAPs belonging to Scheduled Tribes: those rendered landless will be given 2 ha of new land while those losing part of their holding would be given replacement land

(b) Economic Support Package. In case of unavailability of nearby government land, a package of economic support programs will be implemented to purchase productive assets for income generation. The package will consist of the following ex-gratia grants:

(i) *Productive Asset Grants*. The following grants are available for PAP categories:

- Rs.8,000 to each PAP that has obtained judicial awards under LAA grievance procedures in the past, or whose land has been acquired under the consent award system after 1992;
- Rs.8,000 for *all* major children of each PAP (irrespective of PAP category);
- Rs.13,000 for each PAP that has not obtained judicial or consent award for their land; and
- Rs.16,000 for each PAP rendered landless or functionally landless by the project.

(ii) *Womens' Thrift Group Grants*. Women groups of PAP spouses will be organized for income generation activities. Financial assistance will be provided to each group of 15 women at Rs.15,000 (i.e. Rs.1,000 per spouse).

(iii) *Vocational Training*. Each PAP will be provided Rs.3,000 for vocational training linked with relevant economic activities for himself/herself or family members.

(iv) *Maintenance Allowance*. Each PAP will be given a maintenance allowance at Rs.500 per month for nine months irrespective of whether his/her land was acquired in the past or would be acquired in future. He/she will also be given a smokeless stove (chulla) at project expense.

(v) *Cattle Maintenance Allowance*. Each PAP will be given a cattle maintenance allowance at Rs.200 per month for 6 months irrespective of whether his land has been or will be acquired.

Each PAP may pool his productive assets grant together with that of one or all of his major children to purchase land or income generating assets such as livestock, machinery or equipment. The grants will be held in joint bank accounts and released only for an approved income generating scheme. Maintenance and cattle allowances may also be deposited in the joint account for income generating schemes if a PAP so desires.

(c) Homestead Land and House Construction Allowance. Each PAP family losing its house or homestead will be provided 200 m^2 of developed land for homestead land and Rs.14,000 for house construction with provision of free transport facility to the new site.

(d) Access To Government Programs. The R&R Policy states that PAPs may also be provided access to ongoing GOAP welfare programs such as: (i) subsidized rice schemes; (ii) Scheduled Caste and Scheduled Tribe development programs; (iii) employment guarantee and assurance programs; (iv) provision of protected drinking water; (v) adult literacy programs; (vi) Integrated Rural Development Program (IRDP) and Development of Women and Child in Rural Areas (DWCRA).

2.45 **Economic Rehabilitation Action Plans.** Based on the above R&R Policy framework, GOAP prepared separate economic rehabilitation action plans (ERAPs) for each sub-project's PAPs affected by the construction of main canals, distributary canals and farm roads constructed prior to and under AP II, as well as the small number of families that will be adversely affected by construction of the SRBC command area. The ERAPs contain detailed planning of rehabilitation activities, including household-oriented economic activities, training programs, organizational arrangements, community mobilization through NGO facilitation and monitoring mechanisms. In preparing the ERAPs, the consultants have planned R&R activities by villages and consulted each PAP about his/her preferences for income-generating schemes. The ERAPs were found to be satisfactory to the Bank.

2.46 **Village Rehabilitation Action Plans.** To orient R&R implementation towards each village containing a significant number of PAPs, 95 Village Rehabilitation Action Plans (VAPs) are to be prepared during project implementation on the basis of a sample VAP included in the ERAPs. This will provide an opportunity for further consultation with the PAPs in refining the PAP-specific income generation activities and promote PAPs' participation in planning and implementing of their R&R programs. VAPs will further confirm the identified economic activities and detail all PAP-specific rehabilitation measures on the basis of the following factors: (a) village resources potentials and PAP skills; (b) linkages with government programs; (c) support needs for carrying out income generation activities, including new skills, financial services and market analysis; and (d) training needs for PAPs with different income generation schemes.

2.47 **R&R Training.** Each ERAP contains a training program to ensure successful R&R implementation in facilitating all income generating schemes and women group economic activities. R&R staff training and PAP vocational training would be provided as follows:

- Training for Engineers. Training for 20 engineers will cover R&R policy and the R&R program to raise their awareness to R&R issues and help resolve difficulties and conflicts in R&R.

- Orientation Training For Rehabilitation Officers & NGOs. The training of Rehabilitation Officers and NGOs is aimed at upgrading their skills, familiarizing them with R&R planning and R&R implementation planning. The training would be implementation and problem-oriented and will be conducted in working sessions in highly participatory manner. R&R officers at the state level and consultants previously involved in the R&R planning would deliver the training on the R&R Policy's entitlements and rehabilitation activities, while NGOs would provide the training in community mobilization. Training topics would include the following: (a) community mobilization techniques; (b) income generation schemes in various sectors; (c)

identification and verification of all developmental schemes; (d) organization of womens' thrift groups; (e) operation of joint accounts and disbursement; (f) identification of training programs for youths; (g) risk analysis of various economic schemes and possible measure to prevent and correct them; and (h) R&R monitoring arrangements

- Training For PAPs. The success of income generation programs is crucial to the R&R target of improving and restoring the living standards of the population adversely affected by the project. As most of the identified schemes are new to the PAPs, they require new knowledge, techniques and skills to carry out the schemes. The ERAPs provide for training of about 3,440 PAPs in nearby training centers. Detailed vocational training programs, trades and schedules would be provided in the Village Action Plans. PAP training would cover the following topics: (a) technical skills required for different trades; (b) maintenance of productive asset; and (c) womens' group economic activities. A total of 5,063 women would receive training to facilitate success of their womens' thrift group income-generating schemes.

2.48 **AP II Reservoir R&R Remedial Action Plans**. A Remedial Action Plans (RAP) was prepared for retrospective completion of residual works and rehabilitation begun under the AP II project for the displaced families in the resettlement villages of the Srisailam and Lower Mannair Reservoirs. The RAP is based on a detailed survey in the 104 resettlement villages to evaluate the status of the infrastructure (roads, electrification drinking water needs, primary education facilities, medical and veterinary service facilities and other community buildings) provided under AP II and determined residual requirements. The Remedial Action Plan includes three components as follows:

- Infrastructure Provision. The survey identified remedial works according to planning norms and proposed the following groupings of investments: (a) balance works which are incomplete and required to be completed as per the R&R Action Plan of AP II; (b) improvements needed for improved utilization of the facilities already provided in the resettlement villages; and (c) additional facilities which are required as per the perceptions of the village population.

- Free House Plots. Free house plots are to be provided to the homeless people in the 104 resettlement villages. The survey has identified 2,231 people without houses, 379 in the 81 Srisailam Reservoir resettlement villages and 1,852 in the 23 LMD oustee villages. GOAP will provide each homeless family with 200 m^2 of developed homestead land free of cost.

- Income Generation Schemes. Due to the absence of detailed surveys for the AP II R&R component, the survey could not identify the 778 PAPs in the 23 LMD villages who had not received their income generation scheme benefits under AP II. Therefore the RAP's income generation programs would target the poorest 778 families in the 23 resettlement villages of Lower Mannair Reservoir.

An assurance was obtained from GOAP at negotiations that the R&R program would be implemented according to the provisions of paras. 2.40-2.48 above and the R&R Targets and Actions matrix in Annex 5.

Environmental Management Plan (Annex 2)

2.49 **Potential Environmental Impacts**. The project has been designated as falling into Environmental Category 'B'. Five principal types of environmental impact are potentially of concern in the development of SRBC and rehabilitation of SRSP. These impacts are: (a) the

potential for soil waterlogging and secondary salinization due to rise of the groundwater table as a result of canal irrigation; (b) loss of reservoir storage through sedimentation caused by watershed degradation; (c) increase in malaria and waterborne diseases; (d) loss of forest land due to reservoir and canal construction; and (d) adverse impact on flora and fauna as a result of construction of irrigation canals. Separate EIA studies analyzing the above potential impacts for SRBC and SRSP were compiled by consultants and submitted to the Bank in May 1994 as part of the initial project feasibility study. These studies were based on existing and new surveys of soils, land use, flora and fauna, and on specialized groundwater monitoring investigations and analysis undertaken by GOAP's Groundwater Department (GWD).

2.50 **Environmental Clearances.** In order to receive national environmental clearance for the project, GOAP prepared a *Environmental Impact Assessment and Environmental Management Plan* (EMP) for both SRBC and SRSP according to national guidelines in March 1995. However, prior to according its clearance in March 1996, MOEF required that the EMP include several natural resource and nature conservation programs which would benefit the sub-project districts. The need for these interventions are not attributable, for the most part, to any adverse impact caused by irrigation works per se, but ensuring that development would not impinge on, or affect, natural resource and wildlife assets in the project area's districts, and raising its population's environmental awareness.

2.51 **Impact Assessment.** No irreversible, diverse or complex adverse impacts were found by the MOEF review committee in either of the sub-project command areas which would change the project's 'B' environmental category rating accorded by the Bank. Given GOAP's obligation to carry out the regional EMPs, they have been included as a monitorable investment under the project. Bank missions confirmed GWD's assessment that waterlogging and secondary salinization would not be caused by a rise of groundwater tables into the crop root zone except, possibly, in isolated pockets. The EMP has provision was made for promotion of groundwater development and conjunctive use to mitigate such impacts if they arise (Annex 2, paras. 16-25).

2.52 **EMP Components.** The EMP for the SRBC and SRSP sub-project areas includes: (a) compensatory afforestation of 1,910 ha of in degraded areas; (b) eco-restoration programs consisting of habitat protection and infrastructure improvements in the Pakhal and Rollapadu bird and wildlife sanctuaries, afforestation of 2,100 ha of degraded areas in Forest Reserves, establishment of three environmental education centers and an LMD Bird Sanctuary, and anti-poaching units; (c) catchment area treatment programs consisting of 55,102 ha of afforestation and soil conservation measures to reduce sedimentation of the Srisailam, Sriramasagar and LMD reservoirs; (d) improved prophylactic programs for prevention of waterborne diseases such as immunization of 13,600 children in SRBC, chlorination, anti-mosquito spraying and establishment of mobile health units and dispensaries; (e) agroforestry extension support consisting of distribution of 100,000 teak stumps and 20,000 fruit tree seedlings and establishment of two mobile extension units; (f) 275 km of canal plantation and construction site restoration measures; (g) establishment of a fish farm at LMD; (h) two environmental monitoring and evaluation units; (i) support for anti-poaching vigilance arrangements; (j) continuation of groundwater monitoring programs in SRBC and SRSP command areas; and (k) farmer conservation training. Further detailed descriptions of these components is given in Annex 2.

III. COST ESTIMATES, FINANCING AND DISBURSEMENTS

Cost Estimates

3.01 **Project Cost Summary**. The total project costs over a five and one half year period are estimated at US$477.43 million including physical and price contingencies (US$43.36 million). This amount includes foreign exchange costs of about US$50.11 million (10.5% of the total cost) and about US$52.98 million for taxes and duties (11% of the total cost). Table 3.1 gives a summary of project costs by component. Detailed summary cost tables including a breakdown by expenditure categories are given in Annex 6. Detailed project cost tables are available in the Project File (Annex 14).

Table 3.1 Project Cost Summary by Component

Components	Rs. Million			US$ Million		
	Local	Foreign	Total	Local	Foreign	Total
Irrigation Works	10,599.89	1,348.16	11,948.05	307.24	39.08	346.32
Dam Safety	623.89	75.80	699.69	18.08	2.20	20.28
R & R Program	738.93	13.38	752.31	21.42	0.39	21.81
Agricultural Support	345.36	24.23	369.59	10.01	0.70	10.71
Environmental Plan	1,017.74	102.73	1,120.47	29.50	2.98	32.48
Project Monitoring	85.08	0.00	85.08	2.47	0.00	2.47
Total Baseline Costs	13,410.89	1,564.30	14,975.19	388.72	45.34	434.06
Physical contingencies	709.97	92.26	802.23	20.58	2.67	23.25
Price Contingencies	2,794.23	326.19	3,120.42	18.02	2.09	20.11
Total Project Costs	16,915.09	1,982.74	18,897.83	427.32	50.11	477.43

3.02 **Cost Estimate Assumptions**. The estimated base costs are given in 1996 prices. The cost of ongoing civil works eligible for retroactive financing are based on the actual tender costs, while the costs new civil works have been based on the GOAP "Schedule of Rates" adjusted upward by 30% to cater for market conditions. The unit costs of equipment and vehicles are based on prices quoted by suppliers. Physical contingencies of 10% are included for the ungrounded civil works. Price contingencies for foreign exchange costs are based on annual international inflation estimates of 2.5% in 1996, 1.7% in 1997, 2.2% in 1998, 2.6% in 1999, 2.8% in 2000 and 2.6% in 2001. Likewise for local costs, the annual local inflation rates used are: 6.0% in 1996; 7.0% in 1997; 6.7% in 1998; 6.5% in 1999 and 6.0% in 2000 and thereafter. No price contingency was allowed for retroactive funding (para. 3.16) of project expenditures in FY 95/96 and FY96/97.

Financing

3.03 **Financing Plan**. Bank support would consist of an IDA Credit of SDR108.10 million (US$150 million equivalent) and an US Dollar Loan of US$175 million at the IBRD variable interest rate, and include up to SDR30.50 million (US$42.25 million equivalent) for retroactive financing (para. 2.17). Thus the Bank would finance about 68 percent of total project costs (77 percent net of duties and taxes), or the equivalent of 100 percent of the foreign exchange component and 73 percent of the local costs net of taxes and duties. The remaining 32 percent of expenditures (US$152.43 million) or 23 percent of expenditures net of taxes and duties (US$99.45 million) would be funded by GOAP. The financing plan is summarized in Table 3.2 below: Detailed tables with a breakdown of components by expenditure categories and by financiers are given in Annex 7.

Table 3.2 Financing Plan (US$ Million)

Finance Source	Local	Foreign	Total Financing
GOAP	152.43	00.00	152.43
IDA/IBRD	274.89	50.11	325.00
Total	427.32	50.11	477.43

3.04 **Financing Conditions**. The project would be completed in about five and half years by July 31, 2002 and would be closed on January 31, 2003. The loan/credit would be made available to GOI on standard IDA/IBRD terms and conditions, and on-lent to GOAP by GOI under GOI's standard terms and conditions for developmental assistance to the states with GOI assuming the foreign exchange and interest rate risks. Under current GOI policies, on-lending to GOAP takes the form of a 30% grant and 70% loan at the interest rate of 13% per annum. The first half of the loan is recovered by GOI over 10 years without a grace period, whilst the second half is recovered by GOI over a period of 20 years, including a grace period of 5 years.

Procurement

3.05 **Non-Bank Finance** (US$53.03 million). This includes expenditures for land acquisition (US$13.90 million), engineering survey and administration (US$34.33 million) and operating costs for the agricultural support services and the EMP (US$4.80 million), which would be fully financed by GOAP. This expenditure category would be incurred for the existing staff of the ICADD, WALAMTARI, and other agencies involved in agricultural extension and the EMP.

3.06 **Civil Works** (US$371.62 million). Bidding for civil works contracts would not attract foreign bidders due to the relatively small size of the individual contracts for irrigation works, feeder roads, and buildings. Therefore all civil works would be procured through National Competitive Bidding (NCB) using standard bid documents, Direct Contracting, Quotations and Force Account as follows:

- National Competitive Bidding (US$350.09 million). All irrigation civil works and feeder roads (74 packages of which 77% are over US$100,000 and above), O&M upgrading and about 110 buildings would be procured using standard NCB bid documents and procedures satisfactory to the Bank/IDA. Post-qualification criteria satisfactory to the Bank/IDA would be used for these contracts with the exception of the Owk Tunnel and Owk Reservoir in SRBC where prequalification would be required. Foreign contractors would be fully eligible to participate.

- Direct Contracting/Quotations/Force Account (US$21.53 million.). Scattered soil conservation works in inaccessible locations, O&M works support on a declining scale (para. 3.18) and command area development (watercourses, land leveling and field drainage), valued individually at US$20,000 equivalent or less up to an aggregate amount not exceeding US$21.53 million, are not suitable for NCB. These would be procured following procedures acceptable to the Bank/IDA either through: (a) Direct Contracting with non-governmental organizations and WUAs; and (b) quotations solicited from at least three qualified contractors (unit rate/piece rate system). Force Account would only be used in a manner satisfactory to IDA/Bank.

3.07 **Afforestation** (US$ 20.07 million). All the compensatory afforestation, the green belt and reservoir plantation, degraded forest rehabilitation and canal bank plantation would be carried out under a unit/piece rate system, or under force account as a last resort, by the Forestry Development Corporation, and Departments of Forestry and Agriculture.

3.08 **Goods and Equipment** (US$16.76 million). Standard bidding documents (Supply, Supply-cum-Erection) would be used for both ICB and NCB. All contracts for goods, equipment and materials costing US$250,000 or more (totaling about US$7.40 million) would be awarded following ICB procedures with a domestic preference for national suppliers. Contracts, not exceeding individually US$250,000 and in aggregate about US$3.31 million, would be procured following NCB procedures acceptable to the Bank/IDA. Isolated or small lot purchases including, in particular, immediate requirements of equipment individually costing the equivalent of US$25,000 or less up to an aggregate of US$1.02 million would be procured following National Shopping procedures. Items costing less than US$250,000 equivalent, which are not locally available would be procured through International Shopping. All goods and equipment for PAP income-generation schemes (US$4.03 million) are to be procured by local shopping with project assistance so as to be eligible for reimbursement. Disbursements against such purchases of goods and equipment would be made subsequent to eligible expenditures on the basis of supporting documents furnished to the Bank.

3.09 **Vehicles** (US$0.80 million). Vehicles would consist of 40 cars, jeeps and vans and 42 motorcycles. All contracts for vehicles under the project would be procured under national shopping procedures as procurement would involve different types of vehicles. Such national shopping would primarily involve the use of Director General, Supplies and Disposal (DGS&G) rate contracts. Contracts for hire of vehicles up to an aggregate of US$2.1 million equivalent would be procured through quotations from three domestic suppliers.

3.10 **Training, Technical Assistance and Studies** (US$11.25 million). These comprise of: (a) farmer and project staff training (US$4.15 million); and (b) consultantcy services (US$4.91million) and studies (US$2.19 million). Except the training carried out by WALAMTARI and other concerned implementing agencies, all training would be carried out largely by local professional institutions and NGOs and procured through direct contracting. All technical assistance and studies would be contracted on terms and conditions in accordance with the "Guidelines for the Selection and Employment of Consultants by World Bank Borrowers" dated January 1997. Consulting firms would be selected by "Quality- and Cost-based Selection" procedures. Short lists for small assignments costing less than US$100,000 may consist entirely of national consulting firms. NGOs to assist with R&R and WUA formation would: (a) have to meet the NGO selection criteria in Annex 13; and (b) NGO services costing less than US$100,000 may be procured on a single source selection basis when (i) an assignment is small, and (ii) the NGO has local experience and/or is exceptionally qualified. Individual national or foreign consultants may be contracted as per the Guidelines. *An assurance* was obtained from GOAP at negotiations that it would select NGOs in accordance with criteria agreed with the Bank/IDA (Annex 13).

3.11 **R&R Program and Recurrent Costs** (US$4.90 million). These expenditures comprise of: (a) incremental staff salaries, allowances and operating expenditures for PPMU (US$2.20 million); (b) vehicle hire charges (US$2.10 million); and (c) R&R administration (US$0.60 million). No disbursements would be made for incremental salaries and operating costs of the agricultural and environmental management plan components valued at US$4.80 million equivalent.

3.12 **Review of Contract Award.** Prior Bank/IDA review will be required for procurement actions of: (a) all contracts for civil works valued at US$300,000 and above; (b) goods and equipment and vehicles valued at US$200,000 and above; (c) all consultancy contracts valued at US$100,000 and above (US$50,000 for individual consultants); and (d) all single source consultancy contracts over US$100,000 equivalent. All other contracts would be subject to random post review in the field by visiting missions. This would result in over 75% of the project procurement being subject to prior review. Both GOAP and ICADD have had recent prior experience with Bank/IDA procurement procedures.

3.13 **Procurement Summary.** The procurement arrangements and amounts for each expenditure category are summarized in Table 3.3.

Table 3.3 Procurement Arrangements (US$ Million)

Expenditure Category	ICB	NCB	National Shopping, Direct Contract	Unit Rate, Piece Work or Force Account	Other Method[a/]	NBF[b/]	Total Costs
1. Land Acquisition	-	-	-	-	-	13.90	13.90
						(0.0)	(0.0)
2. Engineering and Administration	-	-	-	-	-	34.33	34.33
						(0.0)	(0.0)
3. Civil Works:							
- Irrigation	-	333.70	-	-	-	-	333.70
		(253.62)					(253.62)
- O&M Costs	-	3.51	-	4.23	-	-	7.74
		(1.49)		(1.94)			(3.43)
- On-Farm Development	-	-	-	17.12	-	-	17.12
				(13.01)			(13.01)
- Feeder Roads	-	9.67	-	-	-	-	9.67
		(7.35)					(7.35)
- Buildings	-	3.21	0.18	-	-	-	3.39
		(2.44)	(0.14)				(2.58)
4. Forest Plantation	-	-	20.07	-	-	-	20.07
			(19.06)				(19.06)
5. Equipment and Furniture	7.40	3.31	1.02	-	-	-	11.73
	(5.55)	(2.48)	(0.77)				(8.80)
6. Vehicles	-	0.81	-	-	-	-	0.81
		(0.64)					(0.64)
7. Training	-	-	-	-	4.15	-	4.15
					(3.94)		(3.94)
8. Consultant Services	-	-	-	-	4.91	-	4.91
					(4.67)		(4.67)
9. Studies	-	-	-	-	2.19	-	2.19
					(2.08)		(2.08)
10. R&R Assistance	-	-	-	-	4.03	-	4.03
					(3.22)		(3.22)
11. Recurrent Costs	-	-	-	-	4.90	4.80	9.70
					(2.76)	(0.0)	(2.76)
Total Expenditure	7.40	354.21	21.27	21.35	20.18	53.03	477.43
	(5.55)	(268.02)	(19.97)	(14.95)	(16.67)	(0.0)	(325.16)

Note: Figures in parenthesis are the respective amounts to be financed by the Bank/IDA.
a/ Applies to NGO contracts and incremental staff and operating costs. b/ NBF-Non-Bank Financed.

3.14 **Procurement Procedure**. To ensure efficient procurement, the following *understandings* were recorded at negotiations:

(a) As a minimum, all bid invitations would be advertised in newspaper with national circulation and shall contain the key post-qualification requirements in summary form. Bid documents shall be provided promptly upon request, upon payment of the prescribed fee, and shall be sent by mail upon request.

(b) During pre-bid conferences, bidders would be advised about: (i) Conditions of Contract related to "Technical Expert" adjudicator for large civil works, default provisions, post-qualification requirements, etc.; (ii) streamlined processing to elicit competitive bidding; and (iii) the high likelihood of being declared unresponsive if all qualification data and securities are not provided in bid documentation.

(c) Bids shall be evaluated within 30 days of bid opening and recommendations for contract award should be forwarded to the Bank/IDA for review where necessary (prior review) within 60 days thereof, and all contracts would be conveyed to the successful bidder within the bid validity period of 90 days. Any justifications for extension of bid validity shall be cleared with the Bank/IDA to preclude forfeit of financing for bids not awarded within a reasonable time.

3.15 **Procurement Management**. The procurement process would be coordinated by the Project Preparation and Monitoring Unit (para. 4.14). Bids would be evaluated by the concerned Chief Engineer of SRBC or SRSP and a Bid Evaluation Report would be forwarded to the State Commissionerate of Tenders (COT) chaired by the ICADD Chief Engineer for clearance. The PPMU would ensure that suitably qualified individual(s) are designated to prepare a signed and dated Bid Evaluation Report following a format and content acceptable to the Bank/IDA. COT procedures and efficacy would be monitored by the Project Empowered Committee (para. 4.12) and if found wanting, the Project Empowered Committee would undertake procurement management. ICADD's semi-annual reports (para. 4.38) would contain summarized procurement data for each contract, the dates of bid invitation, receipt, evaluation, approval and signing, and the names of contractors bidding, offer prices, and firm awarded the contract.

Retroactive Financing

3.16 **Amount and Eligibility Period**. Implementation of civil works contracts in the two sub-project areas procured under AP II according to Bank/IDA Guidelines has continued since the project's closure on June 30, 1994 (para. 1.19). These works have been monitored by the Bank during project preparation and have been subject to an independent construction quality audit in June 1996. The audit team certified that the works were of a high standard, and that the project quality assurance procedures and controls (para. 2. 28) were sustainably implemented. Thus, to reimburse GOAP for part of these expenditures, the Bank/IDA has approved retroactive financing of 13% of the loan/credit amount for up to SDR30.5 million (US$42.25 million equivalent) for eligible expenditures incurred by GOAP after February 28, 1995.

3.17 **Escrow Account**. It was agreed during appraisal that GOAP would deposit 50 percent of the payment on account of retroactive financing of civil works in an escrow account to be used exclusively for financing of GOAP's contribution to project financing. Not only would this dedicated account serve to reduce the fiscal burden on GOAP during its proposed fiscal adjustment program, but it would ensure that temporary delays in payments to suppliers and contractors would

not arise due to delays which could occur in GOI fund transfer to GOAP or to delay in GOAP transfer of funds to ICADD. At Negotiations, *assurances* were obtained that GOAP would: (i) establish a project escrow account for 50 percent of the payments received on account of retroactive financing of eligible expenditures incurred prior to the date of the Development Credit and Loan Agreements; and (ii) ensure that such such amounts are used as counterpart funds for financing project activities prior to the Closing Date of the project.

Disbursement

3.18 The proposed IDA Credit of SDR 108.10 million (US$150.0 million equivalent) and IBRD Loan of US$175.0 million would finance about 77 percent of the total project costs net of taxes and duties. The proceeds of the Loan/Credit (Annex 7) would be disbursed against:

(a) 76% of expenditures on civil works;

(b) 100% of foreign expenditures or 100% of local ex-factory cost or 80% of other local costs of goods, equipment, furniture and vehicles;

(c) 95% of expenditures on national consultancy services, studies, training, and 100% of foreign consultant services;

(d) 95 % of expenditures on afforestation and canal plantation; and

(e) on a declining basis for recurrent expenditures on canal O&M during construction, vehicle hire charges, PPMU and R&R administration and incremental staff--90% during FY96 and FY97; 80% during FY98 and FY99; 55% during FY2000 and FY2001; and 25% thereafter.

3.19 Disbursements against civil works and forestry plantation contracts exceeding US$300,000 equivalent, vehicle and equipment contracts exceeding US$200,000 equivalent, and consultancy and training contracts exceeding US$100,000, would be fully documented (for individual consultants, the limit would be US$50,000 equivalent). For all other expenditures, disbursement could be against Statements of Expenditures (SOEs). Supporting documents for SOEs would not be submitted to the Bank/IDA, but would be retained by GOAP and made available to Bank staff during supervision. Disbursements would exclude expenditures on land acquisition, survey and investigation and engineering and administration for the irrigation sub-projects, R&R and operation costs of the environmental management plans, which would be funded by GOAP. The estimated Schedule of Disbursements is presented in Annex 7.

3.20 **Special Account.** To facilitate project implementation and to reduce the risk of shortage of GOAP's counterpart funding as well as to reduce the volume of withdrawal of application, a Special Account in US dollars would be established in the Reserve Bank of India with an authorized allocation of up to US$15 million equivalent, equal to the anticipated average four monthly disbursement. This deposit is based on estimates of the project's financing needs and projected Bank/IDA disbursements (Annex 7). The special account that would be maintained by the Department of Economic Affairs would show all withdrawal requests disbursed, amounts advanced and reimbursed by the Bank/IDA, and the balance at the end of each accounting period. Auditor's reports would reflect the certification of the balance held by the Reserve Bank of India.

3.21 **Disbursement Procedure**. In line with the agreements of the Fourth Country Portfolio Performance Review, GOI would ensure that, at the beginning of each fiscal year, an amount equal to 25% of project's expenditure budget--as determined by the project Annual Action Plan and Budget (para. 4.38)--would be made available to GOAP as Advance Central Assistance for transfer to the project implementing agency. A*n assurance was obtained* at negotiations that GOI and GOAP would implement a system satisfactory to the Bank/IDA for channeling the funds required for the project to the project entities. *An understanding* was reached at Negotiations that GOI would release 25% of anticipated project expenditures in advance to GOAP in accordance with the amounts established in the project's Annual Action Plans and that, upon receipt of funds from GOI, GOAP would transfer such funds, together with its quarterly counterpart contributions, immediately to the project accounts of ICADD. In addition, *an understanding* was recorded at Negotiations that on April 1 of each year, commencing on April 1, 1998 and thereafter by April 1 of each year, GOAP would inform the Bank/IDA of the annual budgetary allocations made for meeting the financial needs of project implementation during the forthcoming fiscal year.

Accounts and Audit

3.22 **Project Budget Unit**. A Program Budget and Accounts (PB&A) sub-unit in the PPMU would establish, maintain, and administer the financial management systems including program, budget and cost allocation/accounting systems. This unit will be supported with adequate and qualified staff on a full time basis. The system would be used to develop annual budgets by consolidating budget requests from all ICADD organizational units and to ensure that the final budget request is consistent with the policies and instructions from GOAP. Each management or operational unit would be responsible for providing PB&A with required information and estimates. PB&A would use this data to produce management reports that would track program progress. *An assurance* was obtained at negotiations that a fully staffed Program Budget and Accounts sub-unit headed by a qualified accountant would be established in the Project Preparation and Monitoring Unit by October 1, 1997.

3.23 **Project Accounts**. A separate project account maintained by the PPMU in ICADD which, with supporting documentation, would identify all project transactions on an ongoing basis including contributions from GOAP, GOI and the loan/credit and provide a comprehensive record of project financing and expenditures. The majority of project expenditure will be incurred at the main component SRBC and SRSP sub-project sites. Payments will be made by Pay and Account Officers who will compile and submit monthly accounts to Directors of Accounts stationed at SRBC and SRSP. The monthly accounts will be consolidated by the PPMU in accordance with the accounting standards of the Comptroller and Auditor General of India, which are acceptable to the Bank. The consolidated audited project accounts, including the special account and SOEs, and the auditor's reports, which would include a separate statement on the SOEs and their certified copies, would be submitted to the Bank/IDA annually no later than six months after the close of the fiscal year. The audit report on SOEs would specifically comment on their usage and the controls established to ensure their accuracy. Previous Bank-supported irrigation projects implemented by the ICADD maintained satisfactory accounting systems and records and also complied with their audit covenants.

3.24 The project accounts would show : (a) details of expenditures by investment items together with their funding sources; and (b) expenditures at (a) classified by project components. The general format of such accounts are exhibited in Annex 7. Project accounts would summarize expenditures showing: (i) actual versus planned expenditures for each quarter and accumulated to date; and (ii)

financing source for the quarter, and accumulated. The summaries, which would provide information for the SOEs would form part of the project account, including those expenditures for which reimbursement is claimed with full documentation. The project accounts would be supported by a listing with the withdrawal applications submitted for the period. *Assurances* were obtained from GOI and GOAP at negotiations that: (i) project accounts, including the Special Account and Escrow Account, would be maintained and audited annually in accordance with sound auditing standards consistently applied by independent and qualified auditors acceptable to the Bank/IDA; and (ii) certified copies of the annual financial statements and SOEs together with the auditors report, which would comment separately on the SOEs, would be submitted to the Bank/IDA not later than six months after the close of each GOAP fiscal year (April 1 to March 31).

IV. ORGANIZATION, MANAGEMENT AND IMPLEMENTATION

A. Organizational Reforms

Participatory Irrigation Management

4.01 **State PIM Policy**. A GOAP Government Order (G.O.) issued on July 19, 1995 adopted a policy to promote participatory irrigation management (PIM) whereby the management of irrigation networks below the minor canal level would be handed over to WUAs. A subsequent G.O. for a statewide framework for WUA formation and implementation based on the SRSP pilot experience was issued in February 1997. Expansion of the pilot program to cover the whole of the SRSP and SRBC areas under the project is intended to serve as a prototype for the other public irrigation schemes in the state. The objectives of the PIM Policy are to improve agricultural productivity by: (a) improving water deliveries through more effective O&M and thus improve distribution equity and reliability; (b) ensuring physical sustainability through a division of labor whereby ICADD would focus its resources on maintenance of the headworks, main canals and reliable agreed water supplies to WUAs; and (c) promoting partnership, communication and cooperation between ICADD and farmers.

4.02 The salient features of GOAP's PIM policy are: (a) farmers in the command area of major, medium and minor irrigation projects will be encouraged to form WUAs to operate and manage irrigation systems in their respective areas; (b) a WUA would manage a hydraulically contiguous unit composed of a minor canal (or part of a distributary) serving 400-750 ha within the area of one "Revenue Village" under a Memorandum of Understanding between its members and ICADD; (c) the WUAs would be legally registered and democratically autonomous bodies subject to professional audit and function according to principles determined by bye-laws to be framed under the IU & CAD Act; (d) the WUA will have the powers to regulate distribution of water within its jurisdiction on a volumetric or any other basis and levy and collect penalties fixed by it for violation of water its internal distribution arrangements; (e) WUAs may sell water saved through improved irrigation available to their members; (f) the IU & CAD Act would be amended to recognize WUAs, provide incentives for their promotion including powers to initiate action against irrigators interfering with water distribution; and (g) ICADD will promote maximization of WUA responsibilities by (i) providing a reliable water supply at the minor canal head, (ii) undertaking rehabilitation of irrigation networks wherever WUAs are formed, and (iii) facilitate fixation and collection of water user charges by WUAs.

Reorganization of Command Area Development

4.03 **State Command Area Development Council.** GOAP issued a G.O. on June 13, 1996 implementing GOI recommendations for state CAD Councils and CADAs. The reconstituted State CAD Council will be responsible for taking policy decisions on developmental activities in all the public gravity irrigation commands in the state. The new State CAD Council will contain non-governmental members representative of the state's command areas. Such members include Members of Parliament (MPs) , Members of the Legislative Assembly (MLAs), farmer's representatives from WUAs and NGOs. The Council will meet at least twice a year and its decisions are to be implemented without further examination by a concerned department.

4.04 **Command Area Development Boards.** The reconstituted CADA Boards in AP will approve programs, review CAD activities, and take implementation decisions subject to the guidelines issued by the State CAD Council. New functions of the CAD Boards include: (a) acting as a catalyst for formation of Farmer's Associations, WUAs and Distributary Committees; (b) technical assistance to farmer organizations and WUAs, monitoring of their activities and advice in selection and introduction of suitable cropping patterns; (c) assistance in developing groundwater to supplement surface irrigation; and (d) assistance in development of post-harvest services and organization of fairs, workshops, etc. to motivate farmers. Up to 60% of a reconstituted CAD Board will be non-official members such as MPs and MLAs, heads of local government institutions, NGO representatives, and Distributary Committee representatives from all reaches of a canal network. Each CAD Board will be chaired by the Minister-in-Charge CAD Program and official members will include concerned government Departments officials, District Revenue Collectors and the CADA's Administrator-cum-Chief Engineer. GOAP and GOI program funds for WUA and CAD activities will be released directly to CAD Boards so that they may function independently.

4.05 GOAP will constitute an Executive Committee for each CAD Board headed by the CADA Administrator-cum-Chief Engineer. The CADA Executive Committee will be responsible for the detailed working of each command's programs, take important administrative decisions and decide matters according to the general directions of the CADA Board. The Executive Committee's membership will have a 5 year tenure and include: (a) district officials from various involved GOAP departments; and (b) the presidents of WUAs and/or Farmer's Associations at canal minor and distributary level at the rate of two from the head, middle and tail reaches of the system. All Department Heads of the various GOAP departments working in the command will be responsible to the CADA Administrator in all matters related to the CAD activities and transfers of officers of the Departments concerned are only to be made with the prior concurrence of the Administrator.

4.06 **SRSP CADA Restructuring.** The SRSP CADA would be restructured and serve as a pilot for evaluation of GOAP's CADA reorganization program. The following modifications would be implemented to improve the performance of the SRSP CADA:

- The ICADD Chief Engineer (SRSP) would only be responsible only for construction activities while all O&M activity would be the responsibility of the SRSP CADA Administrator. The functions of O&M and CAD are to be integrated at the Division level to facilitate an assured water delivery to WUAs.

- The CADA would be organized into two command area O&M Divisions (one for the above LMD command and one for the area below LMD) and a separate Division for the Sriramasagar

Dam and headworks (Annex 8). The Administrator would be assisted by a Deputy Chief Engineer and three Superintending Engineers each responsible for a Division. Groundwater and Agricultural extension staff working in the command would report to him on their CAD-related activities. Assistant Agriculture Officers would have an agricultural engineering background for the tasks of implementing the canal Rotational Water Supply regime and technical assistance to WUAs.

- Gate operators ("Laskars") at the lowest level in the CADA organization are proposed to be brought under the administrative control of WUAs in order to assist them in day-to-day water management.

- WUAs will be encouraged to take over the management of water distribution and canal maintenance below minors and for this purpose, the entire SRSP command will be reorganized into WUAs. Thus, with ultimate turnover of the tertiary network to WUAs, CADA water management responsibilities would cease at the offtakes to WUA jurisdictions.

- SRSP CADA Administrators would be appointed with a minimum tenure of two years. The first such appointment was made prior to project negotiations.

4.07 The organograms of the restructured CADA are given in Annex 8. When SRBC nears completion, a SRBC CADA will be organized along similar lines to that of SRSP and incorporating the experience gained in SRSP. *Assurances* were obtained from GOAP at Negotiations that by October 1, 1997: (i) arrangements for a reconstituted SRSP CADA Board would be in place; and (ii) proposed SRSP CADA restructuring appointments, including that of Assistant Agricultural Officers with agricultural engineering training, will have been completed..

4.08 **SRSP CADA O&M Framework**. The SRSP CADA restructuring is predicated on a transfer of works from the construction wing of ICADD to the SRSP CADA organization as laid down in a July 28, 1995 Government Order [G.O.Ms.117I&CAD(PW-SRSP.II(2))]. A detailed procedure for the transfer has been developed and is given in the SRSP Plan of Operations & Maintenance (POM) document which includes O&M functions and several other technical and administrative responsibilities. The POM also sets forth a framework for: (a) the O&M and management duties of all O&M staff; and (b) the maintenance planning and budget estimation procedures. The reorganization and transfer process is expected to take about two years (inclusive of staff training and system operation hand-over). During the project, joint O&M management of the tertiary networks are expected to result in gradual hand-over of minor canal maintenance to established WUAs. The experience gained with the restructured CADA O&M framework would be applied for SRBC also.

Cost Recovery Arrangements

4.09 **Irrigation Water Charge Increase** (Annex 11, para. 11). During project preparation, the Bank had expressed increasing concern about public irrigation investment sustainability caused by the low allocation of funding for O&M works and the low level of irrigation water charges (para.5.19). As part of a fiscal reform program, GOAP has gazetted an Ordinance on January 3, 1997 raising irrigation water charges to: (a) Rs.200 per acre for monsoon wet crops, and Rs.150 per acre for dry season wet crops; and (b) a uniform rate of Rs.100 per acre for dry crops irrespective the season of their cultivation. This ordinance has subsequently been confirmed by the AP State Assembly.

4.10 **Revenue Sharing**. In view of the large rate increase and as an incentive to WUAs, GOAP has proposed that, in the case of major and medium schemes, only 50% of the collected irrigation revenue from the enhanced water charge would be retained by the government: 40% would be given to WUAs for O&M works and 10% to Gram Panchayats (local government councils). In the case of minor irrigation schemes, 100% of the collected revenue would be given to WUAs.

4.11 **Water Charges Review Committee**. To ensure the efficacy of GOAP's increased irrigation water charges, revenue sharing and RWS policies in for upland schemes, water charge assessment procedures and revenue collection performance need to be regularly monitored and reviewed. GOAP is in the process of establishing a standing state-level Water Charges Review Committee (WCRC) with terms of reference satisfactory to the Bank/IDA. The WCRC would also review data on actual O&M budget allocation needs for those portions of schemes under ICADD control, water charge levels and their affordability, and the impact of WUA promotion on revenue-sharing formulae. The WCRC would consist, inter alia, of the Secretaries of Agriculture, Finance, Irrigation and Revenue of GOAP and meet annually for consideration of adjustments to O&M budget allocations, water charge assessment and collection policies and procedures. In preparation for such meetings, GOAP would engage consultants to collect and compile data on water charge assessment, revenue-sharing and collection performance, and trends in O&M costs. *Assurances* were obtained at negotiations that GOAP would: (i) constitute a Water Charges Review Committee (WCRC) with composition and terms of reference satisfactory to the Bank/IDA by October 1, 1997; and (ii) engage consultants to prepare a report on water charge assessment, collection and revenue sharing for consideration by the WCRC and for submission to the Bank/IDA for information not later than December 31, 1998.

B. Project Management

Management Organization

4.12 **Project Empowered Committee**. For overall project oversight, control and coordination, GOAP issued a G.O. on June 26, 1996 establishing an Empowered Committee chaired by the GOAP Chief Secretary with Principal Secretary (Finance), Secretary (Law), Principal Secretary (ICADD), and ICADD Secretary (Projects) as members. The Empowered Committee's functions are: (a) ensuring timely release of funds to ICADD for the project; (b) dealing with senior personnel management appointment matters; (c) monitoring of overall project progress; (d) ensuring coordination and implementation performance of all government agencies and entities involved in the project, and in particular, those involved in the EMP component; and (e) resolving procurement issues and meeting of project procurement arrangements. The Empowered Committee would meet twice a year following the issue of semi-annual project status reports (para.4.41) and may also be convened by the Secretary (Projects) to deal with project management contingencies.

4.13 **Overall Management**. The project will be implemented by ICADD under the Principal Secretary (ICADD). Direct project management responsibility will be vested in the Secretary (Projects) who will supervise: (a) the Chief Engineers of SRBC and SRSP responsible for ICADD line staff units engaged in design and construction supervision under the irrigation and dam safety components; (b) the Special Officer with Chief Engineer rank in charge of the Project Preparation and Management Unit (PPMU) responsible for procurement coordination, budgeting, reimbursement and accounting, reporting, monitoring and evaluation, supervision of R&R implementation and general coordination and supervision of training programs, research and agricultural extension; (c)

the work of the Forest Development Corporation undertaking the afforestation under the EMP component and coordination of other participating agencies involved in the EMP; and (d) the SRSP O&M works and WUA establishment undertaken by the SRSP CADA Administrator-cum-Chief Engineer working under the direction of the ICADD's CAD Commissioner. Feeder road works will be executed by the Roads & Buildings Department (RBD).

4.14 **Project Preparation and Management Unit**. The existing PPMU line responsibilities will be reorganized by: (a) designating one EE as a deputy chief engineer responsible for a cell monitoring all procurement, civil works and administration; and (b) designating an EE as deputy chief engineer responsible for a cell monitoring all R&R, environmental and groundwater utilization activities. An Accounts Officer will be responsible for an accounting and reimbursement cell and Project Accounts (para. 3.23), while a Deputy Director of agriculture will monitor the Agricultural Support Services component's research, extension and training activities. An WUA Advisor for the PIM program (para. 2.36) will be assigned to the PPMU. An organogram of the PPMU is given in Annex 8.

Works Quality Assurance and Supervision

4.15 **Staffing**. The management of the irrigation construction wings of SRBC and SRSP will each be headed by a Chief Engineer (Annex 8). For SRSP, 137 additional supervision engineers will have to be appointed. Quality assurance in each of these projects is currently undertaken by a sub-project Quality Control Division (QCD) headed by an independent Supervisory Engineer under each Chief Engineer. Given the large increase in construction activity, the number of quality control divisions will be increased in both sub-projects. In SRSP alone, the number of QCD engineers would be increased from 43 to 120 (Annex 8). The *Action Plan for Quality Control Organization* prepared by ICADD defines the duties and responsibilities of all staff levels of the QCDs on-site and in the field laboratories. It also defines the nature of coordination between the QCD and site construction supervision staff and their duties with respect to reporting to the QCD. The Action Plan empowers an EE of a QCD to order stoppage of work if serious construction flaws are identified although arranging for their remediation remains the responsibility of the construction wing EE. *An assurance* was obtained from GOAP at negotiations that, by October 1, 1997, additional staff would be posted to SRBC and SRSP Construction Circles and Quality Control Divisions as per the staffing schedule submitted by GOAP to the Bank/IDA on December 20, 1996.

4.16 **Supervision Procedures**. In addition to the extant AP II Quality Control Manual, Quality Audit Guidelines and an 'OK Card' system for irrigation works have been successfully introduced during project preparation as found during the construction quality audit of on-going works (para. 2.28). These procedures will be maintained during the project and serve to reduce spurious financial claims while recording proper supervision procedure. For road quality assurance, RBD will second experienced staff to the ICADD QCU divisions in the areas that road works are being constructed.

Dam Safety Assurance

4.17 ICADD's Dam Safety Cell (DSC) operates under the control of the Chief Engineer (Central Designs Organization). Its functions consist of post-construction monitoring, data compilation and collection, review of dam safety inspection reports of ICADD dams. GOAP has decided to strengthen the DSC to cater for all aspects of dam safety in the state and ICADD has prepared a *Dam Safety Assurance and Rehabilitation Identification Report* outlining the proposed program to monitor the safety of the state's 180 large dams and tanks. Reorganization of dam safety activity will be

based on appointment of a State Level Dam Safety Committee chaired by the ICADD Engineer-in-Chief. The Committee would meet at least twice a year to: (a) review the activities and reports of the DSC; (b) establish priorities for works needing remedial safety works; (c) assign responsibilities for execution of non-departmental works and determine the need for independent experts. The DSC's expanded duties will include preparation of a Dam Safety Manual for each major dam beginning with Sriramasagar, Srisailam and Lower Mannair dams. An independent project Dam Safety Review Panel (DSRP)--originally constituted under AP II--will continue to review and guide implementation of the project's dam safety component including construction of major structures in SRBC. The staff assigned to dam safety works in SRBC will be increased to supervise Srisailam spillway repairs.

Krishna River Basin Reservoir Management

4.18 GOAP issued a Government Order on June 15, 1996 which institutionalizes operating rules based on fixed delivery priorities according to available storage. A subsequent G.O. was issued on August 1, 1996 to reconstitute the Inter-Agency Committee for Integrated Operation of the Srisailam and Nagarjunasagar Reservoirs established in 1989 into a standing "Committee for Integrated Operation of Krishna and Pennar Basin Schemes" (CIOKRIP) which is to meet seasonally to consider water releases for multi-purpose uses for all schemes dependent on the Krishna River. Under these G.O.s: (a) GOAP scheme water allocation priorities are preserved and non-firm hydroelectric power generation at Srisailam is kept subservient to SRBC irrigation requirements; (b), specific uniform multi-purpose operating tables are to be derived for Srisailam Reservoir's power and irrigation operation staff; (c) CIOKRIP would plan meeting seasonal water requirements in the AP portion of the river basin, review the efficacy of monthly allocations and multi-reservoir storage regulation; and (d) monitor day to day release requirements during drought periods.

Resettlement and Rehabilitation

4.19 The Economic Rehabilitation Action Plans (ERAPs) for SRBC and SRSP (para. 2.45) envisage a four tier R&R implementation and monitoring organization. This consists of the a State R&R Committee, the R&R Cell of the PPMU, District R&R Committees, sub-project Rehabilitation Units under a Special Collector and Village R&R Committees assisted by NGOs. An organogram showing the overall management and implementation organization with the members of each management unit is given in Annex 8.

4.20 **State R&R Committee and PPMU R&R Cell.** A multi-agency State R&R Committee has been established under the chairmanship of the Principal Secretary (ICADD) to guide the R&R activities under the project. Meetings of this committee would be convened by the Secretary (Projects). The State R&R Committee will review overall R&R progress, make R&R policy decisions, and coordinate among concerned departments. The PPMU will have a R&R Cell headed by an EE of Deputy Chief Engineer rank to monitor day-to-day R&R performance and report to the State R&R Committee. The PPMU R&R Cell would be responsible for R&R implementation in ICADD and its functions include planning, supervision, monitoring and coordination of all R&R activities. It would also be responsible for contracting NGOs according to the criteria in Annex 13 to implement the assist in facilitating community income-generating activities.

4.21 **District Level Organization.** The District R&R Committee--chaired by the District Collector and consisting of NGO representatives and officials from government agencies--is the R&R coordinating and implementing agency at the district level. Full-time Special Collectors have been appointed to SRSP and SRBC to implement land acquisition and rehabilitation program of the

sub-project ERAPs. The Special Collectors would convene meetings of their respective District Committee. The Special Collectors' office would be composed of a Land Acquisition Unit and a Rehabilitation Unit, headed respectively by a Revenue Department Land Acquisition Officer and a Rehabilitation Officer from the cadre of Joint Registrar of Cooperative Societies who would coordinate implementation with the various line departments.

4.22 Each Rehabilitation Unit would be staffed with the following additional officers: (a) Assistant Rehabilitation Officer (Women & Child Welfare) responsible for liaison with the District Rural Development Agency and Child Welfare Department to promote formation of women's thrift groups, income generating schemes for women, and child and maternity care; (b) Project Economist responsible for formulating Village Rehabilitation Plans (para. 2.46) and monitoring their implementation, and for progress reporting to project authorities; (c) Computer Programmer responsible for creating a data base for land acquisition and R&R works, maintenance of accounts and computerization of all routine data and functions; and (d) Executive Engineer (Infrastructure) in charge R&R civil works. *An assurance* was obtained at negotiations from GOAP that all government staff positions required for the R&R implementation organization would be filled by October 1, 1997.

4.23 **Village Rehabilitation Committees**. R&R Officers and NGOs will assist PAPs living in the affected villages to form Village Rehabilitation Committees (VRC). The VRC will include women and members from each recognized community group and caste. Working closely with NGOs and R&R officers, the VRCs would participate in formulating Village Rehabilitation Action Plans (VAP), PAP consultation, implementation of the VAPs and monitoring of R&R progress.

4.24 **Non-Governmental Organizations**. NGOs experienced in rural development and community mobilization would be engaged for R&R implementation. NGOs would be engaged by the PPMU and work under the supervision of the Special Collectors and Rehabilitation Officers to implement the ERAPs in cooperation with R&R officers in the district Rehabilitation Unit and other line departments. NGOs would: (a) participate in all R&R committee meetings at different levels; (b) organize VRCs and consultation of PAPs; (c) prepare VAPs with VRCs and R&R officers; (d) assist Special Collectors in land acquisition, assessment of land value and payment of compensation; (e) coordinate PAP-specific income generating schemes with VRCs and organize women's thrift groups; (f) facilitate vocational training programs; and (g) monitoring income generating activities. Terms of Reference are given in Annex 5 for NGOs involved in the R&R program.

4.25 **Settlement of PAP Grievances**. The VRCs and NGOs will be mainly responsible for collecting complaints and grievances from PAPs regarding land valuation, entitlements, entitlement delivery and R&R activities etc. These grievances will be brought to R&R officers for attention. The District R&R Committee (para. 4.23) is the second level of grievance redress mechanism. If any grievances cannot be redressed, they would be brought to the PPMU R&R Cell and the State R&R Committee (Annex 5). Grievances, raised and disposed, will be recorded as part of the R&R internal monitoring system (para. 2.28).

4.26 **R&R Monitoring Arrangements**. Both internal and external monitoring would be conducted concurrently to determine the implementation progress of the R&R component throughout the project period. The monitoring entities would report to the State R&R Committee and the PPMU's R&R Cell, who would review and evaluate the R&R progress and determine any necessary measures to correct any identified problems. The PPMU will be responsible for the monitoring of R&R implementation through the District Committees, NGOs and VRCs. The NGOs and the

Rehabilitation Unit under the Special Collector will monitor R&R progress and present quarterly R&R progress reports to the District R&R Committees, who will, in turn, furnish the progress reports to the PPMU. The PPMU R&R Cell would set up a computerized monitoring system and develop monitoring forms.

4.27 Independent monitoring of R&R progress would be carried out by a qualified NGO engaged for monitoring and evaluation of all R&R activities according to an agreed terms of reference (Annex 5). The NGO multi-disciplinary team will be community-based and will have field offices. The monitoring NGO would submit quarterly monitoring reports to the Special Collectors. At the end of each year, the monitoring NGO would submit annual monitoring and evaluation reports with suggestions for modifications and improvements for the coming year. The independent monitoring report would be submitted to the Bank. *An assurance* was obtained from GOAP at negotiations that it would recruit a suitably qualified NGO R&R monitoring consultant satisfactory to the Bank/IDA by March 1, 1998 and that its annual monitoring reports would be submitted to the Bank/IDA.

Irrigation Agronomy and Farmer Training Program

4.28 **Agricultural Research.** The research sub-component would be carried out under the supervision of an agronomist from the AP Agricultural University (APAU) and officers from various participating government departments redeployed for its execution. The work would be monitored by WALAMTARI and the scientists of the three Regional Agricultural Research Stations (RARS) in the SRSP project area and the RARS Nandyal in SRBC. An inter-disciplinary Coordination Committee would be established for both SRSP and SRBC to ensure inter-departmental coordination and its membership would include a progressive farmer from each research site. A State Level Steering Committee will review and monitor the on-farm operational research programs through regular contact with each Coordination Committee. The Steering Committee would contain senior officials from ICADD, APAU, WALAMTARI, the Agriculture and Horticulture Departments and farmers' representatives.

4.29 **Agricultural Extension.** While there are an adequate number of Village Extension Officers (VEOs) in SRBC and in SRSP above LMD for the proposed extension program, the number of VEOs in the Warangal district below LMD needs to be increased. Based on past experience, it is proposed that the shortage of 35 VEOs could be filled by temporary recruitment (for 5 years) of 35 agricultural graduates as agricultural development apprentices (ADAs) under the supervision of 5 Agricultural Officers (AOs). The AOs would be incremental staff that need to be appointed. *An assurance* was obtained at Negotiations that sufficient numbers of agricultural graduate VEOs and Agricultural Officers would be posted by October 1, 1997

4.30 The various extension programs set up in a phased manner would be monitored in SRSP and SRBC by Extension Program Steering Committees who would guide the personnel involved in extension and training. The performance of ADAs, AOs and VEOs would be evaluated by these committees. The membership of each Extension Program Steering Committee would be chaired by the Associate Director of Research of an RARS and include: (a) Joint Director of Agriculture (b) SRSP CADA Administrator/Superintendent Engineer SRBC; and (c) WUA representatives.

4.31 **WALAMTARI Training Programs.** The existing WALAMTARI training organization established for AP II would be expanded under the leadership of the WALAMTARI Director-General (Annex 8). A Director (Training & WUAs) would be responsible for the conduct of project training courses at WALAMTARI headquarters for the officers of ICADD and the Agriculture

Department. He would be assisted by one EE and one Deputy Director of Agriculture (DDA) for carrying out the training programs, and by a Institutional Specialist (rural sociologist of Associate Professor rank) for promotion of WUAs (Annex 8). The Director (Field Training) would be responsible for the conduct of training at the eight field training centers. He would be assisted one DDA at headquarters and by an EE placed in each of the two project commands (at LMD in SRSP and Nandyal in SRBC) to guide training and coordinate the activities at various field training centers. The DDA would guide and assist agricultural training and oversee the maintenance of demonstration farms at field training centers. Both Directors should be of SE/JDA rank. *An assurance* was obtained from GOAP that the Director of WALAMTARI field training programs would be posted by October 1, 1997.

Environmental Management Plan Responsibilities

4.32 GOAP desires that a professional agency assume the responsibility of implementing the EMP in a systematic manner. Thus GOAP has entrusted the Andhra Pradesh State Forest Development Corporation (SFDC), a GOAP parastatal agency, with implementation of the afforestation components. Monitoring of the EMP activities of the SFDC and all other participating departments and agencies would be carried out by the Environmental cell of the PPMU (para. 4.14). SFDC would directly implement compensatory afforestation, canal bank plantation, catchment area treatment plans and soil conservation measures. The SFDC has the requisite infrastructure for implementation of the activities entrusted to it, including soil conservation works. The agency obtains its technical forestry staff on secondment from the State Forest Department who have the requisite experience. The other agencies involved in the EMP are Agriculture, Environment & Forests, Groundwater, Fisheries and State Health Directorate. Sub-components relating to wildlife preservation would be entrusted to the Wildlife Wing of the Forest Department. Site restoration and muck stabilization would be the responsibility of ICADD through its supervision of construction contracts. Although the head of each participating department is responsible for execution of his agency's involvement in the EMP, each agency would designate a nodal officer for coordinating its activities. Overall implementation will be monitored by the State Level and Project Environmental Management Committees established by G.O. in February 1993.

C. Implementation Monitoring

Implementation Schedule

4.33 Project monitoring and physical and financial planning are related to the GOAP fiscal year (April 1 to March 31 of the following year). A Master Implementation Schedule for each project sub-component within the SRBC and SRSP sub-project areas has been prepared by ICADD. The Master Schedule notes all key procurement events and records the periods of canal closure in SRSP during which work can take place. A summary implementation schedule is exhibited in Annex 12; a detailed implementation schedule for the R&R component is given in Annex 5.

4.34 The master schedules are based on the following principles: (a) all land acquisition for SRBC works is to be completed prior to the estimated date of award of any new civil works contract; (b) on-farm irrigation and drainage works in SRBC are scheduled to commence at least 9 months before completion of the tertiary network of their respective irrigation blocks so that they could be ready on time for initiation of irrigation (para. 2.15); (c) whereas six of the sixteen irrigation block packages of SRBC would only be awarded in PY3, all network rehabilitation contracts for SRSP would be awarded in PY1 and PY2; and (d) scheduling of SRSP main canal and main distributary

works is based on closure of Kakatiya Canal from March 15 to June 15 of each year while rehabilitation of small distributaries and minors is to be undertaken sequentially from December 15 to June 15 by missing a Rabi irrigation season as necessary. The need for seasonal canal closure in SRSP has been conveyed to irrigators during public consultations and included in bid documents.

Project Performance Monitoring Framework

4.35 **Project Performance Indicators** The PPMU would be responsible for assembling and reporting all project performance indicators from field units and participating agencies according to an agreed framework. The physical and financial progress data for each construction contract and irrigation performance would be obtained from the Management Information System database to be established in the office of the SRBC and SRSP Chief Engineers respectively. A framework of key Performance Monitoring Indicators relating to achievement of project objectives, outputs and component input implementation progress has been prepared and is shown in Annex 12. The PPMU's would arrange for a Baseline Survey (Terms of Reference in Annex 12) to record present socio-economic and production conditions in the sub-project areas for the purposes of comparison with a similar survey to be conducted prior to project closure. The survey--to be completed by the end of the first project year--would cover agricultural data (average cropping patterns, yields, input use etc.), household income and socio-economic data, current sources of irrigation and areas irrigated. *At negotiations*, the Baseline Survey terms of reference and Performance Monitoring Indicators were confirmed by GOAP and an *understanding* was recorded that GOAP would establish a data collection system to facilitate regular reporting of the project output and implementation progress indicators in project status reports. *An assurance* was obtained at negotiations that the Baseline Survey would be completed not later than December 31, 1998.

4.36 **Water Charge Collection Monitoring.** The assessment and collection of water charges is the responsibility of the Revenue Department (RD). Water charge assessment requires accurate verification of areas actually irrigated. Detailed records of water charge assessments are maintained by the Village Revenue Office describing the performance of the irrigation system below the irrigation outlet. A provisional assessment is made for every field receiving irrigation (source-wise) during October/November of each year and is finalized in May/June of the following year. Revenue Village assessments are then aggregated by revenue jurisdictions for the entire state. Assessment of water charges and the exchange of information between the RD and ICADD needs to be improved. The reason why every potentially irrigable field is not irrigated or receives inadequate service is recorded and used to deal with applications for remission of the water charge. However, water charge remission information is not communicated to ICADD nor is it consulted information exchange between ICADD and RD is infrequent and limited. ICADD does not provide RD with irrigation maps nor does RD inform ICADD about irrigated areas entered in village records: thus information that could serve to improve system performance is not used. Exacerbated by lack of field staff in RD, this lack of communication enables farmers to conceal irrigated areas, evade payments and misuse water.

4.37 During its implementation, the proposed project would serve as a model for establishment of a service quality and increased water charge linkage in SRSP and SRBC. To achieve this, it would be necessary to maintain separate accounts for each sub-project reflecting both water charge amounts collected by RD and O&M expenditures by the ICADD and the WUAs. Unfortunately, water charge collection accounts are not kept in a manner that allows full reconciliation over the entire command: the units are village areas which almost always include non-irrigated areas and other irrigation sources such as wells and village tanks. *Assurances* were obtained at negotiations that, for the SRSP

sub-project, GOAP would: (i) arrange for separate village irrigation revenue records to be kept by the Revenue Department for canal irrigated areas based on distribution network maps supplied by ICADD; (ii) require ICADD to keep records of the volume and duration of water supply made available to each tertiary area and WUA; (iii) require that ICADD canal flow records and Revenue Village canal scheme irrigation records be systematically analyzed and reconciled each year for monitoring of WUA efficacy in field water distribution, bulk water supply service, and water charge assessment and collection efficiency; and (iv) cause ICADD to submit the above analysis results to the Water Charges Review Committee and the Bank/IDA for information not later than December 31 of each year starting 1998.

Reporting and Project Review

4.38 **Reporting**. An action-oriented review, planning and budgeting reporting process would be a key feature of project management and implementation monitoring. This would take the form of: (a) a semi-annual Project Status Report (which would include, inter alia, data on construction progress, quality assurance and contract management prepared by the Chief Engineers of SRBC and SRSP respectively; and (b) a comprehensive Annual Review, Action Plan and Budget (ARAPB) Report (para. 4.39). All reports would be compiled and prepared by the PPMU. The semi-annual Project Status Reports would be produced in standard format and would track the implementation progress of each project component, including physical and financial progress, procurement, disbursement and key output and implementation performance indicators. The semi-annual status reports and ARAPB report would be submitted to the Principal Secretary (ICADD) and Secretary (Projects), and copied to the Empowered Committee, relevant GOAP officials, GOI and the Bank/IDA. The project reporting arrangements were confirmed at negotiations. *Assurances* were obtained from GOAP at negotiations that: (i) it would prepare and submit a draft Annual Review, Action Plan and Budget Report for the forthcoming GOAP fiscal year to the Bank/IDA for review and comment by January 15 of each year, commencing January 15, 1998; and (ii) not later than April 15 of each year, the agreed Action Plan would be implemented taking account of Bank/IDA comments in accordance with the agreed budget.

4.39 **Annual Project Implementation Review**. Preparation of the ARAPB Report would be the main vehicle for annual GOAP review of project performance and future needs, for adjusting ICADD's program as needed, for budgeting by GOAP of ICADD's expenditures, for assessing progress and determining follow-on actions regarding WUA formation policies, and for major review and supervision by GOI and the Bank/IDA. For ICADD, it would provide annual opportunity to assess the overall project program, to propose adjustments as needed and to present its consolidated plan and justification for financing needs for the forthcoming year. The ARAPB Report would review the past year's achievements for each component and responsible unit and/or agency in terms of development indicators, physical targets and expenditure, and would propose a revised work program and expenditure budget for the forthcoming fiscal year.

4.40 The ARAPB Report's content would include: (a) description of each year's works, schedule of activities, staffing requirements and distribution of responsibilities; (b) proposed expenditures for the next fiscal year compared with the past year's actual expenditures and the budgeted and expected expenditures of the current year; (c) details on major civil works contracts exceeding US$300,000, and equipment and vehicle contracts exceeding US $200,000; (d) review of implementation progress related to the improved canal and water management program in SRSP (and for SRBC when irrigation begins); (e) detailed review of project maintenance needs; (f) progress with the project farmer participation and turnover program; and (g) progress with the various staff and farmer

training programs. The ARAPB Report would quantify and compare progress with an updated Master Implementation Schedule and the previous ARAPB, and would highlight key issues and constraints. An overview with summarized data and a listing of decisions taken or recommended, based on each unit's submission, would be prepared by the PPMU. This would include commentary on the status of decisions and actions outstanding from the previous semi-annual status report, and review of decisions/actions still required related to recommendations of the Project Empowered Committee, GOI or Bank/IDA supervision missions.

4.41 **Mid-Term Review**. Prior to project mid-term, a Mid-Term Review Report would be prepared by the PPMU according to a terms of reference to be agreed with a prior Bank/IDA supervision mission. The mid-term review report would include an assessment of: (a) procurement, implementation and disbursement progress of each project component; (b) progress in participatory irrigation management, water delivery improvement and collection of irrigation water charges in the SRSP command; (c) reorganization and improvement of SRSP CADA performance; (d) the likelihood of completion by project closure of all components in general and irrigation works in particular; and (e) any project design changes or component restructuring needed to achieve project objectives prior to closure. *Assurances* were obtained at negotiations that GOAP would: (i) submit a detailed Mid-Term Review Report of the project to the Bank/IDA by October 31, 1999; and (ii) not later than April 30, 2000, review with the Bank/IDA any possible need for adjustments to the design of project components and its implementation arrangements and thereafter implement the mid-term review's recommendations.

Supervision Plan

4.42 Bank/IDA supervision would be initiated by a Project Launch/First Supervision Mission mounted as soon as possible after the project is declared effective. The mission would assist ICADD in ensuring that: (a) procurement, accounting and disbursement arrangements meet Bank guidelines and project covenants; (b) implementation and procurement schedules and benchmarks are updated; (c) adequate arrangements are made to collect and process data for performance monitoring indicators; (d) project reporting formats are satisfactory; (e) finalize terms of reference for technical assistance and studies. The first mission will also review arrangements for: project staffing and SRSP CADA reorganization, inter-agency coordination, contract management and quality assurance, initiation of staff and farmer training programs, WUA formation and improved canal management in SRSP. Subsequent Bank/IDA supervision missions would comprise a main annual supervision mission at the time of ARAPB review (para. 4.39), supplemented by shorter field visit. A Supervision Plan is given in Annex 12. A separate mission would be mounted for Bank/IDA participation in the mid-term review to be conducted by GOAP.

V. BENEFITS, JUSTIFICATION AND RISKS

A. Project Benefits

Productivity, Employment and Income (Annex 10)

5.01 **Farm Production and Economic Benefits**. Assistance to GOAP for rehabilitation and completion of the SRSP 253,000 ha command area and completion of the 65,000 ha SRBC project begun under the AP II project would add 153,000 ha to the surface irrigation commands in AP. The agricultural objective of these works is to promote the production of high value cash crops in upland

irrigation schemes by improved water delivery, applied farming systems research, irrigation agronomy extension and farmer training. These inputs would result in significant incremental agricultural production consisting of cereals and pulses, oilseeds, cotton and other cash crops. Project agricultural output would generate an annual Value Added to the local economy estimated at Rs.5.03 billion (about US$140 million) in 1995 prices. These project outputs would be sustained by investment to ensure the safety and economic life of the Srisailam and Sriramasagar dams which, in turn, would ensure sustained irrigated and hydroelectric power production within the Krishna and Godavari river basins outside the project areas. Completion of the command area feeder road program would promote farm produce marketing and provide quantifiable economic benefits in travel time and vehicle operating cost savings valued at about Rs.60 million per annum.

5.02 **Afforestation Products and Environmental Conservation.** The Environmental Management Plan component would also generate several benefits, including: (a) soil conservation and reduced reservoir sedimentation due to catchment area treatment and reservoir green belt plantation; (b) generation of forest products by compensatory afforestation, canal bank and the green belt plantations; and (c) water-borne disease control under the environmental health program. Natural resources and wildlife conservation in protected areas would be improved, while conservation benefits are not readily quantifiable, canal bank and reservoir green belt plantation would produce saleable fuelwood, pulpwood, faggotwood in the future (para. 5.07).

5.03 **Employment.** The number of directly benefiting farm families is estimated at about 447,700 (about 2.24 million people). At full development, the increased demand for farm labor would amount to about 31.6 million man-days per annum (equivalent to about 105,450 full-time jobs). About one half of the manpower demand would be supplied by hired labor, the majority of which consists of landless workers. The increased agricultural production would generate off-farm employment (over 26,000 transport, marketing and processing jobs) in project area Districts. Construction of civil works would generate a temporary increase in employment opportunities.

5.04 **Farm Income Enhancement.** The project would result in a significant increase in farm income for primarily marginal and small farmers owning less than 2 ha (the average farm holding is 1.8 ha and 1.1 ha in SRBC and SRSP, respectively), and comprise 70% to 80% of the total holdings in the two sub-projects. The annual net income increments for average farms are estimated at 360% in SRBC, 104% in SRSP's rehabilitated command above LMD, and 197% in partially completed SRSP command below LMD (Annex 10). The net income of the average farms in both sub-projects is currently at or below the AP absolute rural poverty threshold of Rs.11,000/family. Since the estimated net income increment for average SRSP farms ranges from Rs.12,000 to Rs.18,000, the project would raise most land-owning farm families above the poverty threshold. The project R&R component would benefit families impoverished by land acquisition under previous projects within the command area.

Irrigation Management Reform Benefits

5.05 Having served as a catalyst for GOAP irrigation sector management and fiscal reform, the project would be a pilot to test management reform modalities for statewide adoption. The benefits include determination of an effective process for: (a) empowerment of irrigators to take over the operation and maintenance of minor canal networks by voluntary establishment of autonomous WUAs; (b) involvement of irrigators in joint management of major canal schemes through representation on Command Area Development Boards or Scheme Committees; and (c) transfer of a part of the financial and management burden of canal network O&M funding and enforcement of

water delivery discipline to irrigation scheme beneficiaries with the objective of improving ICADD irrigation services. An important benefit of the project would be the piloting of: (i) modalities to realize GOAP's water rationing strategy for increasing the potential of upland canal commands having scarce water resources; and (ii) ensuring reliable and adequate water supply to WUAs by ICADD scheme organizations having main system O&M and water management as their primary function. Thus, success of the twin pronged approach of PIM and improved irrigation service under the project would lay the foundation for improvement of irrigation efficiency in upland areas and improve the ability of irrigation schemes to compete with the growing water demand of other sectors. Improvement of ICADD implementation capacity in the area of construction quality assurance, R&R implementation and monitoring of large externally aided projects would also be a beneficial outcome of the project.

B. Economic Justification

Economic Analysis Assumptions (Annex 10)

5.06 **Assessment Scope**. The economic analysis focuses on quantifying the net benefits of irrigation on agricultural production and feeder road investments and on road users. The costs of the agricultural support services program were included as necessary to achieve crop yields and the diversified cropping pattern. The benefits were reduced by: (a) reduction in cultivated area due to land required for civil works; and (b) the opportunity cost of hydroelectric power generation foregone due to diversion of irrigation water to SRBC from the Srisailam multi-purpose reservoir. The economic rates of return (ERRs) and Net Present Values (NPVs) have been calculated separately for: (i) the three irrigation commands of the sub-project areas (SRBC, above LMD and below LMD in SRSP); (ii) SRSP as a whole; and (iii) the overall project.

5.07 The R&R costs related to the SRSP sub-project were excluded from the economic analysis since they are not related to the benefits of irrigation scheme rehabilitation. The proposed SRSP expenditures would address the impoverishment of people affected by irrigation works under the AP II project outside the rehabilitated command area (para. 1.28) and are therefore not relevant to irrigation investment decisions. Investment to ensure the safety of the Srisailam Dam spillway was also excluded from the analysis because its benefits are largely attributable to the protection of the dam's hydroelectric plants and major downstream facilities in the river basin. The costs and benefits of the Environment Management Plan were excluded because most of the benefits are related to regional environmental conservation and are difficult to quantify in economic terms.

5.08 **Benefit Assumptions**. The quantified benefits are mainly incremental agricultural production due to assumed cropping pattern and productivity changes in each command, supplemented by the estimated economic benefits attributed to feeder road investments (e.g. economic savings in vehicle operating costs and travel time). In SRSP, the agricultural benefits are expected to come mainly from significant shifts from low value to higher value crops as a result of rehabilitation of the existing irrigation network and expansion of reliable canal irrigation to the whole command. For SRBC, project benefits are derived from the change from rainfed to irrigated production in the form of higher crop yields, an increase in cropping intensity and shift to higher value crops. The build-up rate of benefited areas was derived from the projected command area contract completion schedule. The maturation rate of irrigation benefits has been assumed over three years at a constant rate in already irrigated areas and over five years in areas where large scale surface irrigation would be newly introduced. Benefits were reduced by the agricultural production foregone due to project land acquisition and by the hydroelectric power generation foregone at Srisailam Dam due to SRBC.

5.09 The "Without Project" (WOP) and With Project (WP) cropping patterns were based on available data and Participatory Rural Appraisals to elicit farmer preferences under a reliable irrigation water delivery hypothesis. The resulting cropping patterns assume a cropping intensity of 160% and 150% for SRBC and SRSP respectively. Achievement of these cropping intensities is very likely because : (a) major canal schemes in AP have an average cropping intensity of 125-130%; and (b) SRSP's above LMD command has a current cropping intensity of 147%. Crop yields were estimated on the basis of available data and the considered opinion of GOAP and FAO agronomists with reference to existing yields and the impact of irrigation. For example, yield increments in SRBC are high because less than 10% of the area is irrigated at present, while crop yield increments for SRSP's above LMD command are lower as yields already reflect partial irrigation coverage .

5.10 Given the uncertainties of private sector investment in wells after scheme rehabilitation, the analysis postulates that the private development of groundwater would continue at the same level in both the WP and WOP scenarios: accordingly their costs and benefits are excluded. It is therefore assumed that in SRSP the additional wells installed by rice cultivators to cope with the rotational water supply regime in the WP case would equal the number that would be installed as a response to inadequate canal irrigation coverage under the WOP scenario. For SRBC, it is unlikely that groundwater development will expand significantly beyond its present level as the geology of 70% of the command does not lend itself to viable well development.

5.11 **Analysis Parameters, Prices and Costs**. All costs and benefits have been expressed in 1995 constant prices and are net of identifiable taxes. The analysis uses a project life of 30 years and an opportunity cost of capital of 12%. The prices of all tradable commodities and imports are based on world reference prices adjusted to site or farm-gate values. All local costs, including unskilled labor wages and non-traded goods, were converted to economic costs and values by using a Standard Conversion Factor (SCF) of 0.90. Based on an analysis of taxes, duties, foreign exchange components, local materials and labor charges of seven ongoing construction contracts, a conversion factor of 0.79 was used for valuation of irrigation works. Annual irrigation O&M costs were assumed to be Rs.494/ha and adjusted to economic values by using an SCF of 0.9 as inputs consist mostly of salaries, local materials and unskilled labor. Hydroelectric power generation foregone by the project was valued at Rs.1.6/kwh (based on AP State Electricity Board estimates of the long-run marginal cost of electricity). Based on local traffic surveys and rural road vehicle operating cost savings studies, the annual economic benefits of feeder roads in SRSP and SRBC were estimated at Rs.227,465 and Rs.207,130 respectively.

Economic and Risk Analysis Findings (Annex 10)

5.12 **Economic Evaluation Results**. Based on the above assumptions, the economic evaluation results for a base case scenario are summarized in Table 5.1 below.

Table 5.1: Base Case Economic Analysis Summary

Economic Evaluation Criterion	Above LMD	Below LMD	Combined SRSP	SRBC	Whole Project
Base Case ERR (%)	36	31	34	14	24
ERR with AP II Sunk Costs (%)	35	28	31	9	19
Present Value of Net Benefits(Rs. M)	7,228.0	4,272.0	11,501.0	780.0	12,280.0

The economic rate of return (ERR) of the whole project is estimated at 24% and the ERRs of sub-projects are all favorable and higher than the 12% opportunity cost of capital. The present value of net benefits (NPV) computed at the discount rate of 12% is positive for the whole project and the individual commands. Although not relevant to the investment decision, the impact of sunk costs incurred under the AP II project was evaluated. Expressed in constant 1995 prices, these expenditures amounted to about Rs.4,405 million and of which SRBC sunk costs comprised 87%. Except for SRBC whose ERR dropped to about 9%, the ERRs for SRSP and the whole project remained very favorable. These results indicate that the project is justified, and not merely because its sunk costs have been excluded.

5.13 **Sensitivity Analysis**. "Switching values" were computed to determine the effect of deviations from the main assumptions on the economic viability of the project: i.e. the value of the variable tested which would reduce the present value of the project's net incremental benefits to zero when discounted at a capital opportunity cost of 12%. The results indicate that, except for SRBC, ERRs of the above and below LMD commands of SRSP are not very sensitive to substantial increases in the total costs, particularly the construction costs, nor to substantial decreases in incremental benefits. The analysis results are summarized in Table 5.2 below:

Table 5.2: Switching Values at 12% Discount Rate (Rs. millions)

Command Area	Net Incremental Benefits			Total Costs		
	Base Value	Switching Value	Percentage Change	Base Value	Switching Value	Percentage Change
Above LMD	9,832.9	2,605.7	-73.5%	2,604.8	8,530.7	+277.5%
Below LMD	5,655.5	1,379.9	-75.6%	1,383.1	5,658.3	+309.1%
All SRSP	15,488.4	3,996.0	-74.2%	3,987.9	15,465.1	+287.8%
SRBC	4,824.5	4,042.9	-16.2%	4,044.6	4,825.2	+19.3%
Whole Project	20,312.9	7,800.2	-61.6%	8,032.5	20,892.5	+160.1%

5.14 **Economic Risk Analysis**. The sensitivity of the economic analysis to planning assumptions, as well as implementation risks, was analyzed. Fiscal and financial risks were analyzed separately (paras. 5.16-5.32). The resulting ERR values are, for the most part, above 12% and indicate that economic risks would not cause net benefits to drop below their switching value. The risk analysis indicates that the project is robust, in economic terms, to deviations from appraisal assumptions. This assessment is based on consideration of the following economic risks:

- Impact of Implementation Delays. In the event of plausible increases in the construction costs (+20%) or delay in the project's expected benefits, ERRs would still be acceptable for individual commands, the combined SRSP command and the whole project. The ERR of SRBC is relatively more sensitive to delayed benefits than to increased construction costs. A combination of both contingencies would cause the SRBC ERR to fall below the ERR cut-off rate although the project ERR would remain acceptable. Cost overruns in excess of 20% are somewhat unlikely since: (a) civil works costs based on the official "Schedule of Rates" are adjusted upward to reflect recent tender rates; and (b) irrigation contracts consist of simple canal works except for SRBC Owk Reservoir and Tunnel contracts which comprise less than 10% of SRBC civil works costs.

- Impact of Rice Cultivation. If planning assumptions are not realized with respect to the projected cash crop cropping patterns, investment in all sub-project commands--including SRBC--remains economically attractive. To assess the risk that rice cultivation would expand despite rotational water supply, the analysis assumed an increase of 50% in rice area. As the water requirement for paddy is about twice that of upland crops, any increment in rice area would result in reduction of the dry crop area and a lower cropping intensity. Thus the reduction in cropping intensity is significant at about 47% at above LMD, marginal at about 13% for below LMD and only 3% at SRBC. However, since the farmgate *economic* returns from rice are about 80% higher than most cash crops (except cotton), the reduced cropping intensity is offset by the higher value of rice and ERRs do not drop significantly .

- Seasonal Water Supply Deficits. The water deficit risks were based on computation of an expected value of net benefits using water supply probabilities derived from river basin mathematical simulation models of each sub-project. Seasonal water deficits do affect sub-project ERRs but do not cause them to fall below the 12% threshold, albeit that seasonal water deficits reduced expected net benefits by 11% for SRBC, and by 10% and 16% for SRSP above and below LMD commands respectively. The benefit reduction for SRSP's below LMD command is the largest as simulation studies indicated that its water supply reliability was very sensitive to hydrological risk in the rabi (post-monsoon) irrigation season. Consequently, the analysis assumed its water supply to be zero in the rabi season during deficit years, whereas for the other two project commands, irrigation was assumed to be curtailed by 50% in deficit years.

- Lower Crop Yields. For the yield reduction analysis, a 25% decrease was assumed for rice and 10% for other crops (Annex 10, para. 46). Except for the above LMD command, reduction in rice yield did not have a major effect on ERRs because of its relatively small role in the cropping pattern. However, when combined with yield shortfalls for all other crops, a significant reduction of ERR ensues albeit not to critical levels (except for SRBC).

5.15 The economic risk analysis results are summarized in Table 5.3 below.

Table 5.3: Sensitivity of ERR Values to Planning Assumptions and Risks

Risk Categories	Above LMD	Below LMD	Combined SRSP	SRBC	Whole Project
Base Case	36	31	34	14	24
Investment Costs (+20%)	32	28	30	12	22
Benefits Lagged 1 Year	30	27	29	12	21
Benefits Lagged 2 Years	26	24	25	11	19
Investment Costs (+20%) and Benefits Lagged 2 Years	23	22	23	10	17
Seasonal Water Supply Deficits [a/]	29	25	28	12	20
Paddy Area Increased by 50%	23	31	27	14	21
Paddy Rice Yield 25% Lower	30	30	30	14	22
Lower Yields for all Crops [b/]	25	26	25	12	19

a/ Weighted seasonal supply probabilities cause reduction of expected net benefits by 10% in the above LMD command, 16% in the below LMD command and 11% in SRBC.
b/ Paddy yield 25% lower and all other crops 10% lower.

C. Financial and Fiscal Analysis

Analysis Background and Scope (Annex 11)

5.16 **Sector Debt Service Expenditure.** Public irrigation has been given the highest priority in the State's capital budget and amounted to 20% of the total GOAP public investment and is now about 1.2% of SGDP. Irrigation is the third largest sector in terms of total budgetary allocations after welfare programs and education. The State's annual interest payments to GOI for irrigation debt are substantial and increased from Rs.4 billion in FY93/94 to Rs.7.22 billion in FY95/96. In FY95/96, debt service payments amounted to about 85% of irrigation sector's total revenue expenditure account and comprised about 38% of the State's total debt service payments.

5.17 **Sector O&M Expenditure.** The most pressing financial problem faced by the AP public irrigation sector is chronic under-funding of O&M works has led to a decline of the net canal command area from 2.8 million ha in FY90/91 to 2.3 million ha in FY94/95. The actual O&M allocation in real terms was kept at only about 24% of the actual funds needed for adequate upkeep of the existing irrigation network. The average sector O&M allocation in FY94/95 was Rs.300/ha of which 30% was spent on salaries and ICADD overhead, 66% for repairing the ravages of deferred maintenance and only 4% on normal maintenance. The inadequate O&M allocation causes the "deferred maintenance culture" currently practiced in the irrigation sector and inadequate cost recovery has been the cause of under-funding of O&M.

5.18 **Sector Revenues.** Because of the high share of irrigation expenditures in the total State expenditures, inefficiency in the public irrigation sector generates an adverse multiplier effect on

overall efficiency and growth in the economy. Prior to the recent increase in irrigation water charges and agricultural power tariffs, surface and groundwater irrigation subsidies have reached 260% of the total budgetary allocations to the irrigation sector and comprised about 6% of the state revenue deficit. Direct cost recovery through water charges has been about 0.5% of agricultural value added. Revenue from irrigation water charges in FY94/95 accounted for less than 1% of total GSDP. Despite their low levels, water charges are generally perceived by farmers as taxes and not as user charges for public irrigation services. FY94/95 water charge revenue collection amounted to 78% of the water charge assessment: Compared to previous years, FY94/95 represents a drastic decline in collection efficiency per gross irrigated ha which had attained 97% in FY93/94.

5.19 **Requisite Analysis Scope**. The current Andhra Pradesh fiscal crisis (para. 1.07) and sector fiscal management thus gives rise to sector financial sustainability questions that need to be assessed in addition to the conventional financial assessment of the project's direct and indirect cost recovery potential and farmers' ability to pay irrigation water charges. These questions relate to: (a) the incremental impact of project debt service needs on irrigation sector revenue expenditure; (b) the impact of increased water charges and indirect project cost recovery revenue generated by incremental agricultural sales taxes; (c) the state's fiscal capacity to meet project debt service payments and O&M funding needs; (d) the minimal irrigation water charge and indirect cost recovery collection efficiency required to ensure adequate coverage of project debt service and O&M funding requirements; (e) the impact of statewide partial management turnover to WUAs on the sector and project O&M funding burden.

5.20 The above considerations all have a bearing on the question of whether adequate funding of project O&M can be sustained after cessation of Bank assistance. The sector fiscal health and project debt service capacity issue arises out of the grant and loan arrangement by which the proposed credit/loan of US$325 million would be on-lent to GOAP as additional central assistance. The project IDA/IBRD credit/loan is made to GOI under standard terms and conditions and GOI assumes the foreign exchange and variable interest rate risks. However, the 30% of this amount is made available to AP as a GOI grant while the remaining 70% is on-lent under GOI's standard terms and conditions[3] at an interest rate of 13%. Thus the loan's impact on sector debt service repayment needs to be kept in view when state finances are under stress.

Financial Analysis (Annex 11)

5.21 **Water Charge and O&M Funding Assumptions**. Firstly, the irrigation water charge rates used in the analysis are those expected to be in effect by July 1, 1997. (Annex 11, para. 11). Since rotational (intermittent) water supply would be the mode of water delivery for each command after its de-localization to ID status (paras. 1.15-1.16), it is assumed the wet crop (rice) cultivators would be charged a flat rate of Rs.247/ha. Secondly, it is expected that, given the increased water charges, GOAP will provide for a statewide increase in irrigation O&M expenditures under its fiscal adjustment program. Because the predominant crop grown on existing canal schemes in AP is rice, it is tentatively assumed for the purposes of this analysis that the O&M allocation would be raised in future from Rs.300/ha/year to Rs.494/ha/year (Annex 11, para. 14). This increase would also facilitate essential scheme rehabilitation to overcome the ravages of deferred maintenance (para. 5.17) and enable turnover

---

3 The loan is divided equally into two parts: the first half is recovered at an interest rate of 13% per annum over 10 years without a grace period; the second half is also recovered at an interest rate of 13% but over 15 years after a grace period of 5 years.

of tertiary networks to WUAs. Thirdly, based on ICADD data for the SRSP scheme, it is assumed that where WUAs manage minor canals in their jurisdiction, only half of the GOAP maintenance budget would be required by ICADD for the main network. When WUAs are fully established and responsible for their minor network under a MOU with ICADD (paras. 2.32-2.36), actual O&M expenses for the minor canal network would be provided by WUA members in cash and kind, and from a 40% rebate on water charges under a proposed revenue sharing scheme (para. 4.10).

5.22 **Indirect Cost Recovery via Agricultural Sales Taxes.** Indirect taxation accounts for about 72% of total state tax revenues of which the most important was the sales tax on agricultural products which averages 4% of gross output. Given that irrigated areas have a higher crop yield than rainfed areas, the incremental sales tax on their incremental output may be regarded as an indirect cost recovery mechanism which contributes to general state revenue. Accordingly, since the project's output would generate incremental agricultural sales tax revenues, these were included in the analysis as an indirect source of cost recovery. Using the project farm models, the per ha incremental sales tax revenue for SRBC is estimated at over 600% (because of the change from rainfed to irrigated production), while that of SRSP ranges from 200-300%. The total incremental agricultural sales tax revenue is estimated at Rs.485.6 million (Annex 11, para. 18 and Table 5).

5.23 **Project Rent Recovery Index.** For the assessment of the project's farmers ability to pay the increased water charge, the Project Rent--defined as the incremental net benefit per ha due to the project after deduction of appropriate allowances for management and risk--has been estimated for each sub-project using the representative farm models (para SS). Using the incremental water charges and estimated average farm budgets under the WOP and WP scenarios, the Project Rent for an average project farm would be substantial. The rent could vary from about Rs.9,807/ha to Rs.15,290/ha in SRSP's above and below LMD areas respectively and attain Rs.23,783/ha in the SRBC area. Whereas project rent constitutes about 91% of the present value of incremental project net income, the project rent recovery index[4] is only 10% (i.e. only 10% of the rent is recovered through water charges and agricultural sales taxes). The project rent recovery index considering only water charge revenue is about 8%. The rent recovery indices indicate that, if the project net benefits would materialize, there could be scope to increase cost recovery further if necessary by raising water charges, or at least maintaining a high collection efficiency.

5.24 **Project Cost Recovery Index.** For the assessment of the ability of the increased water charge as a revenue generation mechanism for recovery for project costs, the project cost recovery indices[5] were computed. The cost recovery index of assumed O&M costs by potential water charge revenues is 66%. However, a O&M requirement of Rs.494/ha is rather high for rehabilitated or new schemes and it is likely that ICADD would allocate a lower unit O&M budget to the project commands (at least in its early years). Since current SRSP staff costs are about Rs.160/ha, this would leave Rs.324/ha for normal O&M. It may be expected that actual O&M requirements would be much lower and that the increased water charges would be adequate to cover O&M costs for the project. This would remain true even if

---

4 The Rent Recovery Index is the percentage ratio between the incremental per ha tax and water charge revenues and the unit Project Rent. All amounts are expressed in present values discounted at 12% over 30 years in constant 1995 prices.

5 The Cost Recovery Index is the percentage ratio between the per ha cost recovery revenues (incremental water charges and agricultural sales tax revenues) and incremental unit irrigation capital and O&M costs. All amounts are expressed in present values discounted at 12% over 30 years in constant 1995 prices.

water charge revenues are shared with WUAs in return for assuming the O&M burden of the minor canal systems of SRSP and SRSP.

5.25 Considering the contribution of incremental sales taxes, the project cost recovery index in terms of O&M costs alone is 285% while the cost recovery index for both capital and O&M costs is 19%. After deducting full recovery of estimated O&M costs, incremental sales tax revenues are able to recover about 13-14% of project capital costs during the project's economic life of 30 years. Given the reliance of GOAP on indirect taxation, the effective rate of cost recovery is probably understated as increased agricultural income would generate growth in other sectors of the economy and thus additional revenue through other tax measures.

Fiscal Analysis (Annex 11)

5.26 **Project Fiscal Impact Assumptions**. Assuming constant 1995/96 prices, the proposed project as a whole would incur average annual expenditures of Rs.2.86 billion of which GOAP's annual average counterpart contribution would be Rs.0.91 billion with the remainder being financed by additional central assistance facilitated by Bank/IDA financing. Assuming that, with fiscal reform to reduce the state's current fiscal deficit, GOAP could maintain its FY95/96 level of sector capital expenditures (Rs.6.83 billion), the project's annual counterpart capital outlay would comprise about 13% of irrigation capital expenditures. Thus if the sector capital budget is not increased, expenditure on other ongoing projects may have to be curtailed. In terms of debt service obligations to GOI, standard on-lending conditions would entail an average annual project debt service of about Rs.0.801 billion and increase the current sector average annual debt service amount by 11%. Assuming that, with fiscal reform, the total sector revenue expenditure can be maintained at the FY95/96 level of Rs.8.54 billion, the project's annual debt service would comprise about 9.4% of total sector revenue expenditure.

5.27 Annual revenue expenditure for project O&M a few years after completion of SRBC construction and SRSP rehabilitation is estimated at Rs.157.1 million if the full O&M burden remains with GOAP, or Rs.94 million if ICADD only bears 60% and the remainder is borne by WUAs[6]. Sector revenue expenditure for O&M at Rs.494/ha (para. 5.21) is estimated at Rs.1,212 million after project completion. Thus project O&M costs would comprise about 13% and 8% sector O&M revenue expenditure without and with WUA burden sharing respectively. The project share of O&M expenditure may be smaller in the initial years as the works would be new. However, for the purposes of a sectoral analysis, project O&M costs are assumed to increase after several years and equal those of other projects.

5.28 **Project Debt Service Deficit**. Under the revised water charge structure, the project could generate a total annual potential revenue of Rs.603.4 million annual consisting water charge assessment of Rs.117.8 million[7] and potential agricultural sales tax revenues of about Rs.485.6 million (para. 5.22). This revenue would cover only 63% of the total annual average expenditure of Rs.958.1 million consisting of the estimated project O&M requirement (para. 5.27) and annual average debt service (para. 5.26), while the potential water charge revenue would cover 75% of the assumed O&M cost. These findings are similar to those of the cost recovery index calculation (para. 5.24). The cost

---

6 Based on a command area of 318,000 ha for both sub-projects and an estimated O&M budget of Rs.494/ha. If revenue sharing is instituted whereby 40% of the water charge is returned to WUAs and 10% to Gram Panchayats, it is assumed that GOAP will only budget Rs.247/ha for O&M.

7 Based on a uniform water charge of only Rs.247/ha (para. 5.21).

recovery revenue deficit of Rs.354.7 million could be regarded as reducing the cost recovery efficacy of agricultural sales taxes from the agricultural production of other irrigation projects whose potential annual sales tax revenue is estimated at Rs.1,101 million. To maintain the irrigation sector's fiscal status quo, the project debt service deficit would have to be made up by increased state revenue generated by other fiscal reforms and adjustments currently being actively pursued by GOAP in consultation with the Bank.

5.29 **Impact of Revenue Collection Efficiency**. The foregoing analysis may be regarded as theoretical as it compares project costs with potential revenues in the form of projected water charge and agricultural sales tax revenue assessments that ostensibly could be made by the state government's Revenue Department that collects both water charges and sales taxes. Given shortfalls in water charge collection such as those of FY94/95 (Annex 11, para. 9), overall cost recovery would be lower and depend on the Revenue Department's collection efficiency of both water charge assessments and sales taxes. In the absence of data on actual sales tax collection efficiency within the irrigation commands of AP it is assumed--for the purposes of analysis--that the collection efficiencies of both revenue sources are identical.

5.30 Assuming that existing public canal schemes and minor irrigation tanks totaling 2.135 million ha (excluding SRSP) achieve the present average cropping intensities of 125% and 115% respectively, and that about 90% of the gross cropped area consists of wet crops, a potential water charge revenue assessment of Rs.1.35 billion could be expected under the new water charge rate structure (Annex 11). This amount is about 330% larger than the sector water charge assessment made by the Revenue Department in FY94/95 under the previous rate structure. An analysis was thus made of the ability of sector water charge revenues and project agricultural sales tax revenues to recover sector O&M costs and project debt service under different revenue collection efficiencies. The analysis was repeated for a scenario which assumes that the all canal schemes are organized under WUAs and a revenue sharing arrangement. The results are summarized as shown in Table 5.4 below.

Table 5.4: Revenue Expenditure Recovery Collection Efficiency

Sector Expenditure Category	Revenue Collection Efficiency			
	100%	90%	80%	75%
Without WUAs and Revenue Sharing				
% O&M Expenditures for existing and project commands recovered by sector water charge revenues only	111	100	89	84
% [O&M Expenditure + Project Debt Service] recovered by sector water charges and project agricultural sales tax revenues	91	81	73	68
% Agricultural Sales Tax Revenue of existing irrigation schemes required to cover [O&M Exp. + Proj. Debt Service]	16	38	62	77
With WUAs and Revenue Sharing				
% O&M Expenditures for existing and project commands recovered by water charge revenues only	111	100	89	84
% [O&M Expenditure + Project Debt Service] recovered by water charges and project agricultural sales tax revenues	82	74	66	62
% Agricultural Sales Tax Revenue of existing irrigation schemes required to cover [O&M Exp. + Proj. Debt Service]	22	37	54	65

5.31 It is seen that there is only a marginal difference in project debt service recovery between with and without WUA/revenue sharing scenarios. In both cases, sector water charge revenues substantially recover O&M expenditure except that with WUAs only about half the O&M burden is carried by the state. When revenue collection efficiency drops to 75%, the unrecovered O&M expenditure and project debt burden is equivalent to about two thirds of the estimated agricultural sales revenue generated by all existing public irrigation schemes; with WUAs this amount increases to about three quarters. Thus in order to maintain the fiscal and operational advantages of WUAs without compromising capital cost recovery, it is essential that every effort be made to maintain water charge efficiency at a level of 90% or more.

5.32 **Overall Project Fiscal Viability Assessment**. The analysis indicates that the significant fiscal burden of the project may be offset provided efforts are made to maintain a revised water charge and agricultural sales tax collection efficiency of at least 75%. Joint management of irrigation schemes by establishment of WUAs would significantly reduce GOAP's O&M burden expenditure burden albeit that a significant rebate of water charges is contemplated. The project design has considered fiscal risks by requiring the establishment of a Water Charge Review Committee which would periodically review water charge assessment and charge collection efficiency and advise government of the adjustments required to maintain the financial viability of the public irrigation sector.

D. Project Risks

5.33 **Government Commitment.** Waning GOAP commitment is a risk. However, all indications point to very strong GOAP commitment to ensure that project implementation does not fail in the manner of AP II and that its irrigation management reform piloting aspects will succeed. Firstly, GOAP is engaged in fiscal adjustment dialogue with the Bank as part of a very large assistance program for FY98/99 and, despite its fiscal difficulties, has agreed to an exclusive escrow account for funds received as retroactive finance (para. 3.18). It published a White Paper irrigation financial difficulties and undertook statewide public consultations prior to the politically risky major increase of irrigation water charges. Secondly, success of the project is vital for the sustainability of the AP public irrigation sector in general and, in particular, for satisfying the local political and inter-state water sharing imperatives motivating the development of upcoming upland irrigation projects. GOAP has undertaken a series of frank political and beneficiary consultations about the SRSP canal operation policy which caused problems under AP II before issuing Orders for the final de-localization of the SRSP command. Thirdly, its commitment to a publicly announced joint irrigation management policy and beneficiary empowerment under WUAs extends beyond the project and receives support from the government's highest levels. GOAP is now in the process of establishing WUAs in all its major irrigation schemes without Bank support or pre-conditions. Fourth, GOAP supports the agreed project R&R Policy despite its precedent setting financial implications for other ongoing and future irrigation projects. However, notwithstanding GOAP's commitment, there are several ubiquitous project risks to be contained as described below.

5.34 **Implementation Agency Motivation Risks**. The enunciated GOAP commitment to improved irrigation service and beneficiary empowerment may not be enthusiastically shared by an agency such as ICADD whose staff motivation traditionally lies in executing civil works. This risk has been addressed in project design. Firstly, NGOs will play a major role as Social Organizers in establishing WUAs and in assisting GOAP revenue and rural agencies in R&R implementation. Secondly, project preparation has led to strengthening the role of CAD by appointment of an CAD Commissioner of Joint Secretary rank, while project design requires: (a) transfer of SRSP O&M functions to its CADA under a CADA Administrator with two year tenure; (b) establishment of a

CADA Agricultural Engineering Wing using agriculture staff; (c) significant beneficiary representation on the CADA Board; and (d) placement of minor canal gate operators under WUA control. Thirdly, the agronomy and extension component and the Environmental Management Plan will be respectively implemented by WALAMTARI and SFDC, i.e. by agencies seeking to expand their role and therefore with an incentive to perform. Difficult project staffing issues are to be resolved by the Empowered Committee while general problems of redundant ICADD staff are being addressed by GOAP.

5.35 **Implementation Capacity and Delay Risks**. The economic analysis has indicated sensitivity to delayed benefits which would arise from delay in completion of irrigation works. The principal sources of this implementation risk are delayed civil works procurement (including excessive bid values in relation project estimates), delayed transfer of funds to implementation units and construction contract management disputes. There is also a risk that poor construction quality could shorten the economic lifetime of canal structures and thus curtail the area irrigated. Aside of GOAP desire not to let implementation delays reoccur by using an Empowered Committee to monitor implementation and resolve issues causing delay, these risks are mitigated in the project design. The safeguards include: (a) the escrow account which provides an initial buffer against delays in resource transfer from GOI and within GOAP and the proposed Annual Review, Action Plan and Budget process for monitoring and control of project implementation; (b) completion of bid documents prior to project start-up; (c) use of a tender premium in base cost estimates, rigorous post-qualification where possible to minimize bidder collusion and ensure selection of competent contractors; (d) specification of canal rehabilitation "construction windows" in bid documents to elicit competitive bidding; (e) bid validity and evaluation time limitations; (f) continuation of the job-specific daily OK Card system for monitoring supervision and contractor performance; and (f) use of an independent adjudicator for initial contract dispute resolution. ICADD has already proved its ability to deliver good construction quality and this would be strengthened by expansion of the training component of the construction quality assurance program and quality monitoring organization.

5.36 **Beneficiary Response Risks**. The risks that farmer production response may not coincide with project plans have been assessed by the economic analysis and have been found not to be overly critical in economic efficiency terms. However, there are other irrigator response risks which may arise during project implementation which could be more critical in reducing project benefits. Firstly, control of wasteful irrigation in SRSP's above LMD command may not be fully achieved despite rotational water supply and WUA management of farm water deliveries. Thus, the water supply to the below LMD command would be less reliable than forecast by the sub-project simulation model. Secondly, the irrigation agronomy extension program may not be effective in training farmers in improved water management. The project design has tried to mitigate the risks of wasteful irrigation by placing irrigators served by direct outlets from large canals within the jurisdiction of WUAs and it is expected that the proposed partial devolution of ICADD's disciplinary powers to WUAs will enable enforcement of discipline. It is also assumed that rehabilitation of this command will create a political lobby that would be brought to bear on water wastage and excessive water consumption by farmers in the above LMD command.

5.37 **Financial Sustainability Risks**. There is a risk that water charge and agricultural sales tax collection efficiency may be lower than anticipated due to the higher charge levels and other GOAP fiscal reform measures to increase revenue by taxation. As this could affect project cost recovery, a provision has been made to monitor water charge assessment and collection in the SRSP sub-project (para. 4.37). The monitoring results would also serve as an input to the GOAP Water Charge Review

Committee which is to monitor statewide water charge revenue collection (para. 4.11). The risk of inadequate O&M budgeting would arise if water charge collection efficiency is low. It is assumed that the O&M burden would be reduced by turn-over of the minor canal system to WUAs and by the statewide water charge revenue sharing proposal for water charge rebates to WUAs to promote their assumption of the canal maintenance burden. Nevertheless, there remains a risk that—in the future--fiscal pressures and completion of other large projects may result in erosion of the ICADD's O&M budget for those works it remains responsible for.

5.38 **Water Availability Risks.** There is some risk that future irrigation development by upstream riparian states could reduce water availability to the project commands and that reservoir sedimentation may reduce water supply reliability. These risks have been assessed by simulation models (Annex 1) and are deemed unlikely because: (a) the SRSP command area supported by the project has been limited to the existing potential created; (b) SRBC water supply reliability has been assessed on the assumption of full future development of the Krishna river basin; and (c) the models were run assuming expected reservoir capacity levels after 50 and 75 years of sedimentation.

VI. AGREEMENTS AND RECOMMENDATIONS

6.01 **Assurances.** At Negotiations, assurances were obtained from GOAP that:

(a) all micro irrigation network designs for each water course command in a SRBC irrigation block would be completed by consultants at least 15 months prior to completion of the irrigation block works contract, and that these designs would be reviewed and accepted by the beneficiary farmers prior to initiation of the micro-network works (para. 2.15);

(b) by October 1, 1997, and thereafter by April 1 of every year, GOAP would submit to the Bank/IDA for review: (i) plans for the extent of the sub-project road reserves to be acquired for development in the following or subsequent construction season; and (ii) detailed designs, cost estimates and bid documents satisfactory to the Bank for the roads to be newly constructed (para. 2.20);

(c) prior to the award of any SRSP contract for rehabilitation of the irrigation network, the beneficiary farmers would be consulted on the modifications to the tertiary network designs with respect to relocation of irrigation outlets to farm watercourses or farm block watercourses, and shall take into account the views of beneficiaries (para. 2.36);

(d) the R&R program would be implemented according to the provisions of paras. 2.40-2.48 and the R&R Targets and Actions matrix in Annex 5 (para 2.48);

(e) NGOs participating in the project would be selected in accordance with criteria agreed with the Bank/IDA (para. 3.10).

(f) GOAP would: (i) establish a project escrow account for 50 percent of the payments received on account of retroactive financing of eligible expenditures incurred prior to the date of the Development Credit and Loan Agreements; and (ii) ensure that such such amounts are used as counterpart funds for financing project activities prior to the Closing Date of the project (para. 3.17);

(g) a fully staffed Program Budget and Accounts sub-unit headed by a qualified accountant would be established in the PPMU by October 1, 1997 (para. 3.22);

(h) by October 1, 1997: (i) arrangements for a reconstituted SRSP CADA Board would be in place, and (ii) proposed SRSP CADA restructuring appointments, including that of Assistant Agricultural Officers with agricultural engineering training, will have been completed. (para. 4.07);

(i) GOAP would: (i) constitute a Water Charges Review Committee (WCRC) with composition and terms of reference satisfactory to the Bank/IDA by October 1, 1997, and (ii) engage consultants to prepare a report on water charge assessment, collection and revenue sharing for consideration of the WCRC and for submission to the Bank/IDA for information not later than December 31, 1998 (para. 4.11);

(j) by October 1, 1997, additional staff would be posted to SRBC and SRSP Construction Circles and Quality Control Divisions as per the staffing schedule submitted by GOAP to the Bank/IDA on December 20, 1996 (para. 4.15);

(k) all government staff positions required for the R&R implementation organization of each sub-project would be filled by October 1, 1997 (para. 4.22);

(l) a suitably qualified NGO R&R monitoring consultant satisfactory to the Bank/IDA would be recruited by March 1, 1998 and that its annual monitoring reports would be submitted to the Bank/IDA (para. 4.27);

(m) that sufficient numbers of agricultural graduate VEOs and Agricultural Officers would be posted by October 1, 1997 (para. 4.29);

(n) the Director of the WALAMTARI field training programs would be posted by October 1, 1997 (para. 4.31);

(o) the Baseline Survey would be completed not later than December 31, 1998 (para. 4.35);

(p) for the SRSP sub-project, GOAP would (i) arrange for separate village irrigation revenue records to be kept by the Revenue Department for canal irrigated areas based on distribution network maps supplied by ICADD, (ii) require ICADD to keep records of the volume and duration of water supply made available to each tertiary area and WUA, (iii) require that ICADD canal flow records and Revenue Village canal scheme irrigation records be systematically analyzed and reconciled each year for monitoring of WUA efficacy in field water distribution, bulk water supply service, and water charge assessment and collection efficiency, and (iv) cause ICADD to submit the above analysis results to the Water Charges Review Committee and the Bank/IDA for information not later than December 31 of each year starting 1998 (para. 4.37);

(q) GOAP would undertake to (i) prepare and submit a draft annual action plan for the forthcoming GOAP fiscal year to the Bank/IDA for review and comment by January 15 of each year, commencing January 15, 1998; and (ii) not later than April 15 of each year,

the agreed Action Plan would be implemented taking account of Bank/IDA comments in accordance with the agreed budget (para. 4.38); and

(r) GOAP would submit a detailed Mid-Term Review Report of the project to the Bank/IDA by October 31, 1999; and (ii) not later than April 30, 2000, review with the Bank/IDA any possible need for adjustments to the design of project components and its implementation arrangements and, thereafter implement the mid-term review's recommendations (para. 4.41).

6.02 At Negotiations, assurances were obtained from GOI and GOAP that:

(a) GOI and GOAP would implement a system satisfactory to the Bank/IDA for channeling the funds required for the project to the project entities (para 3.21); and

(b) project accounts, including the Special Account and Escrow Account, would be maintained and audited annually in accordance with sound auditing standards consistently applied by independent and qualified auditors acceptable to the Bank/IDA, and certified copies of the annual financial statements and SOEs together with the auditors report, which would comment separately on the SOEs, would be submitted to the Bank/IDA not later than six months after the close of each GOAP fiscal year (para. 3.24).

6.03 **Understandings**. At Negotiations, the following understandings were reached with GOAP with respect to procurement of civil works contracts (para. 3.14):

(a) As a minimum, all bid invitations would be advertised in newspaper with national circulation and shall contain the key post-qualification requirements in summary form. Bid documents shall be provided promptly upon request, upon payment of the prescribed fee, and shall be sent by mail upon request.

(b) During pre-bid conferences, bidders should be clearly advised about: (i) Conditions of Contract ("Technical Expert" adjudicator for large civil works, default provisions, post-qualification requirements, etc.); (ii) streamlined processing to elicit competitive bidding; and (iii) the high likelihood of being declared unresponsive if all qualification data and securities are not provided in bid documentation.

(c) Bids shall be evaluated within 30 days of bid opening and recommendations for contract award should be forwarded to the Bank/IDA for review where necessary (prior review) within 60 days thereof, and all contracts signed within the bid validity period of 90 days. Any justifications for extension of bid validity shall be cleared with the Bank/IDA to preclude forfeit of financing for bids not awarded within a reasonable time.

6.04 At Negotiations, GOAP confirmed that:

(a) the OK Card quality assurance system will be maintained for all SRBC and SRSP civil works (para. 2.28);

(b) it accepted the Baseline Survey terms of reference and Project Performance Monitoring Indicators, and a data collection and processing system would be established to facilitate regular reporting of the project output and implementation progress indicators in project status reports (para. 4.35); and

(c) it would submit semi-annual Status Reports and Annual Review, Action Plan and Budget Reports to the Bank/IDA (para. 4.35).

6.05 Understandings were reached with GOI and GOAP that (para. 3.21):

(a) GOI would release 25% of anticipated project expenditures in advance to GOAP in accordance with the amounts established in the project's Annual Action Plans and that, upon receipt of funds from GOI, GOAP would transfer such funds, together with its quarterly counterpart contributions, immediately to the project accounts of ICADD; and

(b) on April 1 of each year, commencing on April 1, 1998 and thereafter by April 1 of each year, GOAP would inform the Bank/IDA of the annual budgetary allocations made for meeting the financial needs of project implementation during the forthcoming fiscal year.

Recommendation

6.06 With the above assurances and understandings , the proposed project would be suitable for an IDA Credit to India of SDR108.10 million (US$150 million equivalent) on standard IDA terms with 35 years maturity and a single currency Bank Loan to India of US$175 million for 20 years, including five years grace at the Bank's variable interest rate.

WATER SUPPLY RELIABILITY ANALYSIS

Table of Contents

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

WATER SUPPLY RELIABILITY ANALYSIS

A. Overview of Water Availability Issues

Interstate Rivers

1. **The Interstate Water Disputes Act**. Water is a State subject under the Indian Constitution. Riparian disputes about the sharing and development of the waters of an interstate river are resolved and regulated by the Union Government by means of The Interstate Water Disputes Act passed in 1956. The Act provides for setting up a Tribunal to adjudicate in case of a dispute about water of an interstate river or river basin. The Act is set into motion on a complaint made by a state party to the central government, who constitutes a Tribunal at its discretion for resolution of the dispute. The Tribunal may apportion flow to downstream riparian states and also among existing schemes, future projects and beneficial uses (e.g. hydro-power) brought before the Tribunal by the riparian states.

2. **Project Interstate Rivers**. The proposed project (AP III) would support further development and management of the waters of the Krishna and Godavari rivers for irrigation within Andhra Pradesh (AP). The Krishna River Basin drains 258,848 km^2 of catchment from its headwaters to the Bay of Bengal and its river network flows through the states of Maharashtra, Karnataka and AP. The Godavari River drains a catchment of 309,760 km^2 covering the states of Madhya Pradesh, Maharashtra and AP. The project includes: (a) completion of the 65,000 ha Srisailam Right Branch Canal (SRBC) sub-project which is to receive its water supply from the Srisailam Reservoir on the Krishna River; and (b) rehabilitation the 253,000 ha Sriramasagar Project (SRSP) which receives the bulk of its water supplies from the Sriramasagar Reservoir on the Godavari River and supplementary supplies from the Lower Mannair Dam (LMD) located on the Mannair River (a small tributary of the Godavari river within AP). Since interstate water disputes had arisen on both the Krishna and Godavari rivers, riparian state water sharing is based on allocations determined by the Awards made by two Tribunals under the 1956 Act.

The Srisailam Right Branch Canal Project

3. **Srisailam Reservoir**. The idea of utilizing Krishna River waters to irrigate the drought-prone upper Pennar river basin in the Rayalaseema region is more than 100 years old. The first attempt was the Kurnool-Cuddapah (KC) Canal scheme (IBRD Map **BBB**), begun in 1872 which, by diversion from the Krishna river and through a system of multiple pick-ups from the Kundu river (a tributary of the Pennar River), enabled progressive utilization of return flows to irrigate about 88,814 ha on the east bank of the Kundu River . The area of the SRBC project on the right bank of the Kundu, about 130 km long and 5-10 km wide, and having a cultivable command area (CCA) of 77,000 ha, became potentially irrigable only after completion of the Srisailam Reservoir (IBRD Map **BBB**) on the Krishna River in the late 1970s.

4. **The Krishna Water Disputes Tribunal Award**. In 1973, the Krishna Water Disputes Tribunal (KWDT) allocated 2060 thousand million cubic feet (TMC) or 58,333 million cubic metres (Mm^3) of the Krishna River's estimated 75% dependable annual water yield (para BB) between the three riparian States involved. The Award is distributed as follows:

Andhra Pradesh	800 TMC (22,654 Mm^3)
Maharastra	560 TMC (15,857 Mm^3)
Karnataka	700 TMC (19,822 Mm^3).

The water utilization of existing projects in all three co-basin states as of September 1960 was protected within the KWDT allocations. The Award further confines planned irrigation development by the two upstream riparian states in the Krishna basin to be consistent with the above allocations. The KWDT Award covered existing (at the time) uses and all future allocations and is therefore quite specific. Review in the year 2000 AD is dependent on any one riparian State requesting it.

5. A further 70 TMC (1982 Mm^3) of estimated irrigation return flow (regeneration) within the basin was allocated to the states by the KWDT. Since AP had already fully utilised its KWDT allocation for existing projects, its allocation was augmented by the KWDT to 811 TMC (22,965 Mm^3), i.e. to include 11 TMC (311 Mm^3) of the regeneration flow amount. According to a subsequent KWDT Order issued in 1976, AP is permitted to use any surplus waters in excess of 800 TMC reaching its border up to the year 2000 AD without conferring a future right to these flows.

6. **Interstate Agreements**. During the 1970s, it became clear that Madras City in Tamil Nadu (TN) requires water from the Krishna to ensure its municipal and industrial requirements, the three Krishna basin states each allocated 5 TMC of their KWDT share, i.e. totaling 15 TMC (425 Mm^3), to TN for Madras City. Thus it became necessary to skim water from the Srisailam reservoir without passing it through the turbines, and convey it by canal through a number of balancing reservoirs to the AP/TN border via a canal financed by TN. The so-called Telegu Ganga Canal (TGC) would divert 15 TMC of surplus Krishna flows over a period of 3-4 monsoon months and deliver 12 TMC (allowing for losses) to storage facilities in TN for Madras's use over an eight month period. Once the cost of water transfer via the TGC from the Srisailam Reservoir to the Pennar basin would be thus covered, AP conceived three new irrigation projects to utilize its return flow award and the sanction to use surplus waters for irrigation of its poorest and drought-prone Rayalaseema region. Tamil Nadu agreed that TGC could serve the Telegu Ganga Project (TGP) which would be based on diversion of 29 TMC (821 Mm^3) of Krishna surplus flows from Srisailam Reservoir into the TGC to irrigate about 117,000 ha. GOAP has also planned another project to utilize 30 TMC of its surplus Krishna water called the Srisailam Left Branch Canal Project (SLBC).

7. **SRBC Water Allocation**. The third new project, SRBC, was not specifically given an allocation by the KWDT. However the scheme's 19 TMC (538 Mm^3) planned water requirement was originally cleared by the GOI Planning Commission on May 16, 1981. Since then, the 11 TMC (311 Mm^3) regeneration amount awarded by the KWDT to AP has been allocated to SRBC by Government Order (GO-Ms No. 154 dated June 6, 1994). The same Order included a statement of intent for obtaining the remaining 8 TMC (227 Mm^3) by "..modernisation of KC Canal system or any other system.". GOAP has since concluded an Agreement with the Japanese Overseas Economic Cooperation Fund for grant financing of KC Canal relining and modernization works. It is assumed that the water savings obtained by this project would facilitate greater irrigation efficiency in the KC Canal scheme and enable water to be made available for SRBC consumptive use.

8. **SRBC Water Supply**. SRBC's water supply is obtained by an off-take from the TGC at a distance of 19.4 km from Srisailam Reservoir. Accordingly, the main canal leaving the reservoir was designed for a capacity of 315.7 m^3 per second (cumec) to cater for both SRBC, TGP and Madras needs on the assumption of diversion of surplus Krishna waters from Srisailam Reservoir during a 3 to 4 month monsoon period. The SRBC main canal was planned to carry a maximum discharge of

140.5 cumec for a distance of about 50 km to the command area. This capacity was selected on the assumption that at least 12.82 TMC would also be diverted during the monsoon months for storage in two balancing reservoirs: Gorakullu Reservoir with a live storage of 10.73 TMC at km 50 of the SRBC main canal, and Owk Reservoir with a live storage of 2.09 TMC at km 116 of the SRBC main canal. Construction of the SRBC main canal began under the Bank-assisted Second Andhra Pradesh Irrigation Project (AP II).

9. **AP II Water Availability Issues.** The AP II project appraisal mission determined that a reliable water supply was possible without construction of the Gorakullu and Owk Reservoirs as proposed by GOAP. By elimination of these reservoirs, the SRBC scheme's operation was to be based on continuous abstraction from Srisailam Reservoir for 9-10 months during the irrigation season instead of reliance on off-channel reservoirs filled in 3-4 months during the monsoon season only. It therefore became important to operate Srisailam Reservoir in such a manner that it could supply SRBC's irrigation needs throughout the irrigation season. Nevertheless, during AP II implementation and despite a GOAP assurance that 19 TMC would always be allocated to SRBC, water availability for SRBC and operation of Srisailam Reservoir became an issue between the Bank and GOAP. Thus when the preparation of the proposed AP III project began, GOAP claimed that the two off-channel reservoirs (Gorakullu and Owk) having a combined gross storage capacity of 17.92 TMC were necessary to ensure a water supply reliability of 75% for SRBC as per Indian planning standards. Accordingly, GOAP also proposed to extend the SRBC cultivable command area (CCA) from 65,000 ha to 77,000 ha as originally envisaged when the project was approved by GOI in 1981.

10. **SRBC Project Preparation Issues.** The project preparation mission found that: (a) no design studies and investigations had been undertaken for the enlarged command; (b) the proposed Srisailam Reservoir operating rules resulted in a higher supply reliability for the proposed TGP and SLBC schemes than for SRBC (which had an identifiable water allocation derived from the KWDT Award and was already under construction); (c) aside of requiring relocation of a large village, the Gorakullu Reservoir site was located over karstic limestone outcrops and that its viability could not be ascertained without extensive and time-consuming investigations; (d) the SRBC main canal excavation had progressed to about km 100 and its alignment could not be practically changed to eliminate the Owk Tunnel and Reservoir; and (e) the Owk Reservoir's gross capacity would have to be reduced from 4.86 TMC to 1.86 TMC (live storage 0.84 TMC) by lowering its level by 7 m so as not to relocate a village and to prevent possible water leakage through karstic limestone outcrops at the higher elevations.

11. Given these findings, the Bank requested GOAP to review its project simulation studies to determine SRBC water supply reliability without the Gorakullu Reservoir. The cardinal assumptions of this review were: (a) use of the agreed hydrological series developed by the KWDT in determining water allocations to the riparian states; and (b) that proposed projects such as TGP and SLBC would be included in the simulation so as to determine SRBC supply reliability under full development within AP. The review was to investigate alternative operating rules for the Srisailam Reservoir which would ensure supply reliability to SRBC without Gorakullu Reservoir and with an Owk Reservoir of reduced capacity. These studies were also to allow for the need to augment the water supply to Hyderabad. In parallel, GOAP was also to begin investigation of the sedimentation rates of Srisailam Reservoir as only one reservoir survey had been conducted in the 1980s. Thus it became relevant to also investigate water reliability sensitivity to long term reservoir storage reduction.

12. The outcome of these studies--described herein--resulted in a reformulation of the SRBC project design, namely, that the Gorakullu Reservoir would not be necessary for irrigation of 65,000 ha and that a reduced capacity Owk Reservoir would be included in the project. A pumping station would

be installed at Owk Reservoir in order to utilise 0.64 TMC of dead storage for supply augmentation. Since the SRBC main canal had already been excavated to its original capacity as a flood flow canal under AP II, the present design leaves GOAP the option of possibly building Gorakullu Reservoir and expanding the Owk reservoir to full capacity in the post-project period if economical solutions to the potential reservoir leakage problems could be found.

The Sriramasagar Sub-Project

13. **Sriramasagar Reservoir and Lower Mannair Dam**. For a few hundred years, irrigation in AP's drought-prone Telangana Region had existed in small areas served by locally constructed village tanks. During 1951, the erstwhile Government of Hyderabad submitted a scheme to the GOI Planning Commission based on a dam at Pochampad on the Godavari River and dams on its tributaries, the Kaddam and Mannair rivers. The Pochampad site was located a little below the entry point of the Godavari River into AP territory. However, only the Kaddam Dam was built. The final Pochampad Project proposals were cleared for GOAP in 1964 and were based on utilization of 66 TMC of Godavari waters stored in a 112 TMC gross capacity Pochampad Dam (82.1 TMC live storage) to irrigate 231,000 ha via a 113 km long Kakatiya Canal (KKC). The dam was also to include a hydroelectric generating plant with a 36 MW installed capacity. Bank involvement began in 1971 with assistance to GOAP for completing the Pochmapad Dam--later renamed Sriramasagar Reservoir (SRSR)--and extension of the existing 17,000 ha command area to 100,000 ha. When detailed localization surveys revealed that a CCA of 0.231 M ha was not available up to km 113 of KKC, plans were made to: (a) extend KKC another 33 km up to the Mannair River; (b) construct the 13.4 TMC capacity Lower Mannair Dam (LMD) as a balancing reservoir; and (c) extend the command area beyond KKC's proposed km 146.

14. **Command Area Development**. The Pochampad Project became known as SRSP when it was reformulated in 1982-1984 to increase the command area from 0.231 M ha to 0.392 M ha by: (a) extending KKC to km 284 to create a 343,000 ha command, and supplying water to Warangal town at KKC's km 234; and (b) including two new canals from SSR: Saraswathi Canal to potentially serve 17,000 ha and linking SRSR to Kaddam reservoir; and Laxmi Canal to serve 6,400 ha (see Figure 2). KKC was also to be lined to reduce losses and GOAP adopted a water management and system design policy based on Rotational Water Supply and de-localization of the whole area for ID irrigation only. The extension of KKC to km 146 LMD and the new Laxmi and Saraswathi canals were funded by GOAP, while command area development of 33,500 ha was to be undertaken under the bank-supported AP I project. AP I had implementation problems, and after restructuring, all field channels and on farm works were eliminated.

15. Thus by 1985, prior to the AP II appraisal, only about 120,000 ha of the main network out of total CCA of 164,800 ha above LMD had been completed (except for channel lining) but the minor network was not completed. Nevertheless, GOAP began to extend KKC below LMD until km 234. Under AP II, the KKC works up to km 234 were to be completed and extended to km 284 to create a command of 163,000 ha below LMD. Thus the total area served by KKC was expected to be 328,000 ha and serve over 651 villages. Rehabilitation of the existing command area above LMD was an important AP II project component. In 1985/86 the net area irrigated by KKC was only 31,564 ha as the minor network was incomplete. During AP II, the net area irrigated rose to a maximum of 73,447 ha in 1990/91 (inclusive of an extension of about 8000 ha below LMD complete by 1989), and declined to 63,345 ha in 1992/93. This negative trend indicates that only a small part of the minor canal networks were ever completed, and then deteriorated rapidly within a few years after completion due to inadequate maintenance funding (about 85 to 90% of the O&M budget is

spent on establishment costs and salaries). By the closure of AP II in June 1994, no existing command above or below LMD was rehabilitated nor were any of the new command areas completed except for some of the distributary and branch canals.

16. **Godavari Water Disputes Tribunal.** The Godavari Water Disputes Tribunal (GWDT) made a water allocation to each riparian state after an analysis of the hydrology of the entire Godavari River Basin. The 75% dependable yield of the Godavari River Basin at the Dowleshwaram gauging station on the lower Godavari River was assessed by the GWDT to be 3,000 TMC (84,951 Mm^3) of which 1,172 TMC (33,168 Mm^3) was allocated to AP. Although specific GWDT allocations are made for each basin there is not the same degree of project definition that occurs in the KWDT Award. As per GWDT, AP is entitled to use all water reaching its territory including that reaching SRSR. Upstream of SRSR, the following provisions of the GWDT agreements apply:

- Three existing dams upstream of SRSR (Jaikwadi and Sidheswar in Maharashtra and Nizamsagar within AP) are able to trap all flows of the catchment upstream of them, leaving an effective catchment of 40,415 km^2 for the SRS reservoir.
- Agreements (as stated by GWDT) provide for 98 TMC (2775 Mm^3) to be allocated to schemes in the upstream effective catchment area.
- There is no specific water allocation for SRSP except that the project will get any water left over after upstream utilisation of 98 TMC (2775 Mm^3) (i.e. any determination of the amount of water available to SRSP must be reduced by 98 TMC to allow for future development).

GOAP entered into a bilateral agreement with the state of Maharashtra in 1975 and filed a document which became part of the GWDT Award. According to this document, a quantity of 200 TMC (5,660 Mm^3) is accepted as available at the Maharashtra border for flow into SRSR and served as the basis of GOAP planning of SRSP in 1982/84 (para.16). In contrast to the KWDT provisions, no expiry date was set for the GWDT Award.

17. **SRSP Water Availability Estimates** The AP II Staff Appraisal Report (SAR) estimated the 75% dependable inflow to SRSR to be 160 TMC according toCWC computations. Adding an estimated 13.4 TMC as the 75% dependable inflow into LMD, the total 75% water availability for the SRSP scheme was regarded by the Bank to be 177.4 TMC. The SAR assumed that the requirements of Laxmi, Saraswathi and KKC (up to km 284) commands would be 121.6 TMC and the balance amount of 56 TMC was therefore assumed to be available for irrigation beyond km 284 of KKC. *The AP II SAR based its assessment on a canal irrigation efficiency of 50%, but noted that, if irrigation efficiency was realistically only 37%, scheme expansion below KKC's km 284 would not be possible.* In 1992, the CWC re-estimated the 75% dependable inflow to SRSR to be 196.1 TMC (after subtraction of 98 TMC for future developments upstream). Accordingly, GOAP undertook a water supply reliability simulation study of the SRSP scheme and published a report in 1993 to expand the scope of the KKC command by 198,300 ha beyond the 328,000 ha envisaged under AP II. The overall scheme irrigation efficiency assumed in these GOAP studies was 70%.

18. **SRSP Project Preparation Issues.** When project preparation began in May 1994, GOAP expected that the AP II program of rehabilitation and extension of 328,000 ha of SRSP would be completed, and that the command area beyond km 284 of KKC would be extended by 34,300 ha. The initial Bank preparation missions were concerned that these plans were optimistic because: (a) estimates of the Godavari River inflow to SRSR seemed uncertain; (b) there were indications that sedimentation rates of SRSR were higher than originally assumed; (c) improvement of the project's low irrigation efficiency would be a difficult social engineering task; and (d) planning based on canal irrigation

efficiencies of over 40% was unrealistic. The Bank therefore indicated that it would only support scheme rehabilitation up to km 234 of KKC and not support completion of the works to expand the SRSP command beyond km 234 as it feared that water supply reliability beyond this point would be low because of the above reasons. In order to resolve the issue of supply reliability, it was agreed that GOAP would therefore review both the hydrology of inflows into SRSP and its SRSP simulation model to (i) study water supply reliability below LMD, and (ii) determine the system's sensitivity to key planning assumptions and parameters including Godavari River flow estimates. The outcome of GOAP's simulation studies--described herein--confirmed the Bank's concerns: consequently, the proposed project only supports rehabilitation of the existing command up to km 234 of KKC. The project does however support an economic rehabilitation program for families affected by land acquisition for the SRSP extension works undertaken under AP II.

B. Hydrological Series Used for Simulation Studies

Krishna River Basin

19. **Inflow into Srisailam Reservoir**. The KWDT established and published a Krishna River flow series for the period 1894/95 to 1971/72 consisting of the annual mean flows at the Vijayawada gauging station near Prakasam Barrage in the Coastal Region of AP (see Figure 1). To this was added the yearly estimate of water use upstream of Vijayawada obtained by consensus from the three Riparian States (Maharastra, Karnataka and Andhra Pradesh). The resultant annual flows can be considered as a best estimate of the 'natural' or 'virgin' flow record of the Krishna from its origin to the coast. The 75% dependable annual flow of 2060 TMC upon which the KWDT Award is based was derived from this data series. For reasons of data integrity, only data for 1900/01 to 1971/72 was used in the project simulation study. In order to derive a hydrological series representing the gross water yield at the Srisailam Reservoir for use in the simulation study, the flows at the downstream Vijayawada gauging station (Figure 1) were multiplied by a factor of 0.9123 derived from gauging station and catchment area correlation. The net inflow series at Srisailam Reservoir was obtained by first deducting upstream water allocations made by KWDT, and then by adding 11 TMC (311 Mm^3) regeneration flow and the water saving of 8 TMC (227 Mm^3) expected from the KC Canal rehabilitation program (para. 7).

20. **Free Catchment Inflows**. The simulation model undertakes a fortnightly routing of the series of modelled inflows into Srisailam Reservoir. According to the reservoir's operating rules, computed releases through the power plant and spillway are routed downstream to the Nagarjunasagar Reservoir (NSR). The yield of the free catchment between the two reservoirs is considered while carrying out the reservoir operation of NSR to meet its water demand. Simulated releases from NSR flow down the Krishna to Prakasam Barrage (PB) and is augmented by yield of the free catchment between the two structures. This yield estimate is computed by a procedure proposed by CWC in 1986. From this yield, the inflow of the upper interim catchment (para. 19) is deducted along with the utilisation of all schemes between NSR and PB to give the gross yield of the lower catchment. The net annual flow series is then computed by deducting the water allocations of all schemes between NSR and PB

Godavari River Basin

21. **Generation of the SRSR Inflow Series.** Prediction of water supply reliability for SRSP under alternative development scenarios requires the derivation of a net monthly inflow series that reflects development of the whole upper catchment of the Godavari River according to the provisions of the GWDT. Because of very large inflows downstream of the SRSR, it is not easy to correlate the short record of SRSR inflows and the long record of downstream flows at the Dowleshwaram gauging station

in the Coastal Region of AP. For this reason, the methodology of derivation of a reliable hydrological series comparable to that of Krishna Basin was not possible. Instead an inflow data series for SRSR from 1971/72 to 1986/87 was used by GOAP and extended by means of rainfall-runoff data correlation as per a procedure developed by CWC in 1992 (para SS). Estimated utilisation for the 40515 km^2 free (effective) catchment, for each year were added to the SRSR inflow series to get gross flow. This record was correlated with the monsoon period weighted average rainfall downstream of the three dams which capture all the water above SRSR (Nizamsagar in AP, Jaikwadi and Sidheswar in Maharashtra). The resulting regression equation was then used to extend the flow series back to 1950/51 based on rainfall data. The next step was to deduct spill flows from the Nizamsagar Dam. To derive total annual flows for the extended record based on rainfall data, it was assumed that the monsoon period flow amount could be multiplied by 10%. Calculations have been made on the basis that the Jaikwadi and Siddeswar dams did not spill in the 1971/72 to 1986/87 period. The gross 755 dependable yield was computed to be 284.68 TMC. Committed and contemplated utilisation of 98 TMC (2,775 Mm^3) was deducted (para.18) from the extended gross annual yield series series to obtain the net annual inflow series to Sriramasagar Reservoir for the period 1950-1987 which was to be used in the simulation model. The 75% dependable net SRSR inflow worked out as 196.1 TMC (5,553 Mm^3).

22. **Alternative SRSR Inflow Series**. The Bank missions determined that there were uncertainties in the rainfall-runoff correlation used to extend the 1971-1987 SRSR inflow data record. It also found that there were apparently non-random trends in the data used in GOAP's correlation studies. GOAP were therefore asked to consider the alternatives to its flow generation methodology. The various estimates of the net 75% dependable inflow into SRSR that emerged from the alternative methodologies is shown in Table 1 below.

Table 1: Alternative 75% Dependable Annual Inflow Assessments for SRSR

	GOAP Estimates [a/]			Bank/FAO Estimates	
	GOAP Standard Flow Series (1)	Gauged Flows (Basar, Mancherial, Yelli) (2)	Correlation based on Nizamsagar Inflows (3)	Daily Inflow Data Computations(4)	Correlation based on Nizamsagar Inflows (5)
SRSR Inflow	196.1 TMC (5553)	207.7 TMC (5881)	180 TMC (5097)	148 TMC (4191)	168 TMC (4757)
SRSR and LMD Inflows	208.5 TMC (5890)	220.1 TMC (6233)	192 TMC (5437)	160 TMC (4530)	180 TMC (5097)

a/ Figures in parentheses are Mm^3

The alternatives considered were: (a) use of data from upstream CWC gauging stations (Basar, Mancharial,Yelli) in the 'free' catchment above SRSR to produce an inflow series; (b) extend the derived 1950-1987 inflow series to 1994 using available SRSR data; and (c) compile an alternative series for SRSP based on Nizamsagar Dam inflows for the period 1950-51 to 1989-90. The purpose of these alternative computations was to determine whether the streamflow generation procedure used by GOAP was robust. The Bank's consultant hydrologist (FAO) also undertook an independent evaluation by using: (i) 28 years of daily streamflow data of upstream gauging stations and correlation with SRSR inflows; and (ii) correlation with Nizamsagar dam inflows.

23. GOAP prefers its standard inflow series giving a 75% dependable SRSR inflow estimate of 196.1 TMC (Table 1, column 1) and regard the other alternatives (Table 1, columns 2 & 3) as upper and lower limits within the range of statistical error. Thus the standard 1950-1987 series is used in GOAP simulation studies . The inflow series preferred by the Bank/FAO is the Nizamsagar Dam series (Table 1, column 5). This series has been used in some simulation modelling runs to provide an alternative estimate of scheme reliability (Table 6).

24. **Total Surface Water Availability**. Water for the Kakatiya Canal is obtained from the Lower Mannair Dam (LMD) as well as SRSR. No processed discharge data (aside of a 4 year record) exists for LMD: thus flows have been derived by correlation with actual records for the nearby Kaddam Reservoir using rainfall-runoff relationships and the free catchment area between Upper and Lower Mannair dams on the Mannair River. The 75% dependable annual inflow to LMD is calculated by GOAP as 12.4 TMC (351 Mm^3). The 75% dependable water availability for the overall scheme is shown in Table 1 for alternative SRSR inflow estimates and a constant average monthly series is used for LMD inflow in the SRSP simulation model.

C. Simulation Framework

Srisailam Reservoir Operation Model

25. **Simulation Model Components**. The simulation model to determine how the 65,000 ha SRBC command will succeed in competition with existing and future irrigation, hydroelectric and water supply schemes, entailed definition of detailed reservoir and scheme operating rules, and scheme water requirements. Thus, ongoing schemes (SRBC and TGP) and future projects (SLBC and Hyderabad water supply augmentation) are regarded as being commissioned. The schemes included in the model are shown in Figure 1. Upstream of Srisailam Reservoir, water is diverted to the Jurala and KC Canal irrigation schemes. Water would be supplied from Srisailam Reservoir to the two power stations, three new irrigation schemes (SRBC, TGP and SLBC) and the downstream existing irrigation schemes. Tributary rivers below Srisailam Reservoir contribute water to the existing and proposed downstream water demands. In addition to water and power, water supply for Madras is to be diverted from the Srisailam Reservoir according to interstate agreements (para. 6), while Hyderabad supplies are to be abstracted from the Nagarjunasagar Reservoir.

26. **Krishna Model Characteristics**. A detailed simulation model was developed by ICADD that took account of seasonal crop water demand, estimated reservoir evaporation losses, hydropower flow requirements, reservoir operating rules and scheme supply priorities according to GOAP policy. Fortnightly steps were used to obtain the basic scheme performance data used to for evaluation of model performance. GOAP's priorities for water release at the Srisailam Reservoir were based on ensuring urban water supply first, then meeting demand of existing schemes and firm power generation commitments, followed by SRBC's allocation and lastly, new surplus water irrigation schemes. The priorities are therefore: (i) Madras Water Supply; (ii) Nagarjunasagar and Prakasam Barrage irrigation together with Hyderabad water supply augmentation and firm power commitments of Srisailam Reservoir; (iii) SRBC irrigation; (iv) filling of Owk Reservoir; (v) Telegu Ganga Project; and (vi) SLBC Project. The model's scheme and reservoir operating rules based on the above priorities are quite complex and are related to reservoir storage levels. These rules are fully detailed in ICADD's simulation study report[1]. Detailed crop water demands that vary with seasonal climatic conditions are

[1] Irrigation & Command Area Development Department: *Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under Third AP Irrigation Project*; April 1995.

modelled. Estimates of total fortnightly reservoir evaporation losses are deducted from all reservoirs in the model.

27. **Analysis of Development Options and Scheme Performance**. The principal development options analysed to assess SRBC water supply reliability included: (a) inclusion or exclusion of the Gorakullu Reservoir; (b) a reduced capacity Owk Reservoir; (c) impact of non-realisation of 8 TMC per year water savings from rehabilitation of the KC Canal scheme; and (d) development of the SRBC command area to 77,000 ha instead of 65,000 ha as proposed under AP II and AP III. Supply reliability of each scheme was expressed as a percentage of the number of modelled years that modelled supply fell short of its fortnightly water demand in any period. For irrigation projects, an the definition of success included acceptance of cumulative annual shortfalls of 0.3-0.4 TMC. The total annual power output for each hydroelectric plant was also computed to determine shortfalls created by alternative development options.

28. **Reservoir Operating Levels**. In particular, the system performance sensitivity to an alternative Srisailam MDDL was modelled given the current tendency to draw down the reservoir in the dry season in order to maximize power output. When the reservoir becomes a multi-purpose facility in the future, such drawdown could cause late filling of the reservoir and delay or affect diversions for Madras, SRBC and TGP.

29. **Reservoir Sedimentation Scenarios**. Various reservoir sedimentation scenarios were modelled to determine the sensitivity of supply reliability and sustainability to loss of reservoir live storage. The base case assumes reservoir live storage decreased by 50 years of sedimentation. Since the Srisailam and Nagarjunasagar reservoirs were completed in the late 1970s, this modelling assumption simulates available storage during the economic lifetime of SRBC (i.e. the next 30 years). Considerable analytical effort was devoted to establishing reservoir sedimentation volumes after 50 years of operation as only one reservoir survey undertaken in the early 1980s is available. Calculations are based on upstream river sediment gauging station data and on actual sedimentation rates for the upstream Tungabadhra Reservoir (in Karnataka) over a 30 year period. As a result of the focus A series of cross sections have been established at the Srisailam Reservoir so that sedimentation can be systematically monitored once every five years as required by national guideleines.

30. **Irrigation Efficiency Planning Assumptions**. A sensitivity test based on a range of irrigation efficiencies from 56% to 40% have been modelled to determine water supply reliability to this key parameter. ICADD optimistically selected a 56% irrigation efficiency in its SRBC planning studies whereas Bank missions consider 40% to be a reasonable planning assumption.

31. **Sensitivity to Hydrological Series Length**. The KWDT Krishna River flow series used enables simulation of 87 years of scheme performance. Actual Srisailam inflows for the period 1972 to 1993 were added to this series in order to extend the modelling period and test sensitivity to series length. However, this comparison is only an indicative one as data on actual abstractions by upstream riparian states are not available to AP for post-KWDT period. Accordingly, natural inflow is approximated by adding KWDT sanctioned water allocations to existing upstream riparian schemes.

The Sriramasagar Project Model

32. **Model Components**. The details of the SRSP model given in Table 2 and in Figure 2.

Table 2: Sriramasagar Project Area Components and Water Demands

Water Use or Scheme	Capacity/Water Utilisation	Command Area Size	Part of AP III Project	Remarks
Sriramasagar Reservoir	Capacity 112 TMC (3171 Mm^3)	-	no	Dam Safety Only
Pochampad Power Station	27 MW (36 MW in future)	-	no	Power is incidental
Saraswathi Canal	6.32 TMC (179 Mm^3) includes Laxmi demand	17000 ha or 14151 ha	no	
Kaddam Reservoir	-	-	no	Not relevant
Laxmi Canal	see Sarawathi Canal	8849 ha	no	
SRS Irrigation (above LMD)	42.8 TMC (1212 Mm^3)	165000 ha	yes	
Lower Mannair Dam Reservoir	Capacity 24 TMC (680 Mm^3)	-	no	Dam Safety Only
LMD Irrigation below LMD	49.5 TMC (1402 Mm^3) to km 284 of KKC	204000 ha (to km 284 of KKC)	yes (up to km 234)	Command area size was varied.
Water Supply to Warangal and Karimnagar towns	4.0 TMC (113 Mm^3)	-	no	Included in model
Water Supply to NTPC Power station	7.9 TMC (224 Mm^3)	-	no	Included in model
Reservoir Evaporation	24.1 TMC (682.Mm^3)		-	SRSR + LMD (modelled)

The SRSP simulation model includes two reservoirs (SRSR, LMD) and four irrigation commands. These commands are Laxmi Canal, Saraswathi Canal, SRS irrigation (Kakatiya Canal above LMD up to km 146) and LMD irrigation (Kakatiya Canal from LMD up to km 234 or up to km 284). The model also considers the impact of the proposed Korutla Flood Flow Scheme to divert monsoon flood flows from SRSR into a detention reservoir at Korutla via a canal instead of discharging floods downstream. This scheme would operate once the SRSR water level reaches the reservoir Flood Release Level (FRL) at elevation 1,091 feet.

33. **Water Delivery Priorities**. Water delivery priorities are placed within the context of integrated operating rules for a range of water levels in each reservoir. These priorities are:

(i) Water supply to the NTPC thermal power station from SRSR and urban water supply from to LMD to Warangal and Karamnigar ;
(ii) Irrigation requirements for above LMD (from SRSR);
(iii) Augmentation of to LMD storage from SRSR; and
(iv) Irrigation below LMD from LMD storage.

Hydroelectric power is generated only when water is released into KKC from SRSR.

34. **Variation of Reservoir Operating Levels.** The design operating levels for the two project reservoirs are:

Sriramasagar Reservior	
FRL (flood release level)	332.54 m (1,091 ft)
MDDL (minimum drawdown level)	322.48 m (1,058 ft)
Lower Mannair Dam	
FRL (flood release level)	280.42 m (920.00 ft)
MDDL (minimum drawdown level)	275.85 m (905.00 ft)

The sensitivity of water supply performance to the SRSR MDDL was considered by running the model with a SRSR MDDL of 1,034 ft (i.e. running the risk of a delay in filling the reservoir in the subsequent monsoon season and thus possibly delaying the initiation of irrigation above LMD).

35. **LMD Storage Management Procedure.** Provision was made to review the balancing capacity of LMD as a storage facility for surplus Godavari River inflow into SRSR and seasonal irrigation below LMD. Under normal model conditions, LMD's reservoir is maintained at or near FRL by releasing water from SRSR and conveying it to LMD provided all irrigation demands of KKC above LMD can be met and canal conveyance capacity is adequate (para.41). Thus a series of simulation runs were made whereby water is only released to LMD from SRSR when LMD levels are below its FRL reservoir capacity.

36. **KKC Conveyance Capacity.** The Kakatiya Canal's original design capacity up to km 146 was 8,500 cusecs (240.7 cumecs) but its current capacity is about 5,000 cusecs because of bed siltation and broken lining. The project would increase the KKC cross-section to a capacity to 9,000 cusecs in order to improve delivery of Godavari floodwater (which would otherwise spill from SRSR) to LMD for seasonal storage. The simulation model uses existing and proposed KKC conveyance capacity to determine the impact of the proposed capacity increase on SRSP water supply reliability and to model its current restricted operational status.

37. **Sensitivity to Planning Uncertainties.** Planning parameters were varied as in the Krishna Basin model. Variations used in the model sensitivity analysis runs included: (a) higher than planned water use in the command above LMD (b) water demand estimates computed by an alternative method; (c) smaller water diversions in upstream riparian states; (d) use of the less bountiful SRSR inflow series derived by FAO; and (e) alternative canal irrigation efficiency estimates.

38. **Sensitivity to Canal Irrigation Efficiency Estimates.** The canal irrigation efficiency of SRSP is low. The net area of 63,645 ha irrigated in 1992/93 (mainly for rice) utilized about 95 TMC (i.e. about 85% of the project water allocation of 113 TMC planned to be used on 328,000 ha) with a cropping intensity of about 112% (the project area cropping intensity is higher due to well and tank irrigation). The 1992/93 gross water use is equivalent to an annual gross water application of about 3,773 mm of water per ha or about 6.6 times the GOAP's planned water duty of 572 mm/year/ha for SRSP as a whole. The large apparent water use means that irrigation consisted of continuous flow through rice paddies, with about one third of the residual flowing into village irrigation tanks to supplement their rice cultivation, and about two thirds flowing into watercourses discharging into the Godavari River and recharging the aquifer (and partly recycled by well irrigation to increase the

overall irrigation efficiency of the command). Part of the problem stems from: (a) allowing rice farmers to use water indiscriminately in the early years of project development; (b) the deficient design of SRSP whereby--in many instances--water is directly supplied from a large canal to small irrigation blocks through oversized outlets. Although design deficiencies are to be corrected under the project, water supply to the below LMD command is dependent of the irrigation efficiency achieved above LMD.

39. **Sensitivity to SRSR Sedimentation Rates**. In order to derive a conservative estimate of supply reliability, the simulation model was run using SRSR and LMD storage capacity reductions equivalent to 50 years of sedimentation at a design catchment erosion rate of 1.2 acre-feet/sq. mile/year. Accordingly, based on computations and revision of the reservoir area-capacity curve, the modelled storage capacity for SRSR after 50 years of sedimentation was taken as 77 TMC at its FRL elevation (instead of its initial capacity of 112 TMC). The sensitivity of scheme water supply reliability was also tested by running the model using a SRSR capacity of 60 TMC, i.e. a forecast of residual storage after 75 years of sedimentation. The need for this sensitivity analysis arose out of the Bank's concern that the design sedimentation rate may be too low when compared to the rate implied by analysis of the only available 1984 reservoir hydrographic survey (i.e. at the time the SRSR spillway gates were installed). Hence, particular importance was given to the issue of model sensitivity to reservoir sedimentation in that it could affect water supply reliability in the later years of the project's economic life. Since GOAP claimed that there were errors in its 1984 survey because too few reservoir cross-sections were used, it commissioned the AP Engineering Research Laboratory to undertake an additional hydrographic survey in 1994.

40. The 1994 reservoir survey report concluded that SRSR storage capacity had reduced from 112 TMC to 90.3 TMC over a 24 year period, and its analysis implied an average annual sedimentation rate of 1.0 acre-feet/sq. mile of free catchment/year. However, at appraisal in 1996, GOAP informed the Bank that the original topographic survey used to derive SRSR's initial storage capacity of 112 TMC, was found to be erroneous. Revised calculations indicated that the reservoir's initial volume was most likely about 98.8 TMC. This meant that SRSR's 50 year volume was recomputed as 81 TMC. Since this result is similar to the volume of 77 TMC used in modelling studies, GOAP saw no need to undertake further model sensitivity tests. However, an independent analysis by the appraisal mission hydrologist indicated that extrapolation of the 1994 survey results and the smaller initial capacity of SRSR that the 50 year SRSR capacity could be as low as 67 TMC, i.e. almost the 75 year residual storage value used by GOAP in its model. Thus particular attention is given to SRSR sedimentation in the interpretation of model results and to execution of the SRSR catchment treatment plan included in the proposed project's Environmental Management Plan component.

D. Krishna River Basin Model Results

Performance of Krishna River Basin Schemes

41. **Basin Performance**. The success of the SRBC project in achieving 75% dependable water supply (scheme success) was evaluated using the simulation model for the Krishna Basin. The standard simulation case results indicate that--under full development without Gorakullu Reservoir--all schemes modelled succeeded in achieving an acceptable requisite water supply reliability or power output (see Table 3 below). Acceptability was defined as a reliability of 75% for irrigation schemes and over 95-98% for urban water supply.

Table 3: Krishna Basin Projects - Simulation Results for Standard Scenario

Standard Conditions
- Without Gorakullu Reservoir; - Reduced Owk Reservoir; - TGP and SLBC are accorded less priority than SRBC; - Use of KWDT flow series; - Failures of 0.3TMC for SRBC and 0.4 TMC for SLBC regarded as success; - Srisailam MDDL of 834 feet; - Srisailam capacity reduced by 50 years of sedimentation.

Project	% Success
SRBC Irrigation	77.5
TGP Irrigation	78.9
Madras Water Supply	98.6
SLBC Irrigation	77.5
Energy Generation at Srisailam	97.2
Nagajunasar Reservoir Irrigation	78.9
Prakasam Barrage Irrigation	88.7
Water Supply Hyderabad	95.8
Pumped Storage Energy	100
Nagarjunasagar Reservoir Energy	94.4
Average Power Output	2390 GWH

42. SRBC is too small to affect existing schemes within the AP portion of the Krisha Basin. If SRBC were not included in the basin development program, then average power output increases from 2390 GWh to 2435 GWh.: i.e., an additional 45 Million KWh of power is generated each year (1.9% more). Model runs for the case without the SBRC scheme are not available, but a study that considered the effect of not supplying the 8 TMC KC canal leakage water suggests that success rates would increase in the order of 1% to about 5% for other schemes and uses.

43. **Implementation of Srisailam Reservoir Operating Rules**. There is a risk that reservoir operating rules will be breached in times of power shortages to the disadvantage of SRBC. For this reason--and based on simulation model results--a Government Order has been issued which establishes the reservoir MDDL at 834 feet and institutionalises the successful operating rules simulated in the model. A Government Order has also been issued to reconstitute the Inter-Agency Committee for Integrated Operation of the Srisailam and Nagarjunasagar Reservoirs into a standing "Committee for Integrated Operation of Krishna and Pennar Basin Schemes" which is to meet seasonally to consider water releases for multi-purpose uses for all schemes dependent on the Krishna River. Under these Orders, (i) GOAP scheme water allocation priorities are preserved and non-firm hydroelectric power generation at Srisailam is kept subservient to SRBC irrigation requirements and (ii), specific uniform multi-purpose operating tables are to be derived for Srisailam Reservoir's power and irrigation operation staff.

SRBC Water Supply Reliability Sensitivity Analysis

44. **Base Case Scenario**. The SRBC success rate of 77.5% (Table 3) is 2.5% more than required although it should be noted that this result is based on considering an delivery shortfall of 0.3 TMC (i.e. less than 2% of crop demand) as a success. The base case modelled by GOAP is based on the following key parameters: Srisailam Reservoir MDDL of 834 feet and reservoir capacity after 50 years of sedimentation, irrigation efficiency of 56%, a 77,000 ha SRBC command area and no Gorakullu Reservoir. The sensitivity analysis examined the impact of these key planning parameters.

45. **SRBC Sensitivity Analysis**. Sedimentation of the Srisailam Reservoir does not seem to present a problem. Reducing the command area from almost 77,000 ha to 65,000 ha as planned for the proposed project improved success by about 3% while adding the Gorakallu off-channel reservoir improves scheme reliability by only 6%. In contrast, changing the MDDL to 796 feet (242.62 m)

instead of limiting drawdown to the design MDDL of 834 feet (254.20 m) produces an unacceptable result in that the supply reliability drops to about 40-45%. If the reservoir is drawn down to an elevation of 796 feet regularly (as it is at present for hydroelectric power generation) and not kept above 834 feet, then not only does the scheme fail year by year but the onset of the irrigation season would sometimes be delayed. With only a small amount of off river storage at Owk Resevoir, there is total reliance on the Srisailam reservoir for early supply. The Gorakallu Reservoir could provide some seasonal flexibility but its cost-effectiveness is very much in doubt.

46. Rabi season irrigation reliability is not seen as a problem provided the scheme is operated according to the modelled water allocations. Using a realistic 40% scheme irrigation efficiency reduces supply reliability to about 73% for the base case: however this is not of major concern because of the command area has been reduced to 65,000 ha in the project design.

47. Adherence to supply priorities according to the Srisailam Reservoir's proposed operating rules is important because of the relatively high level of the SRBC canal intake level of 854 feet (260.30 m). Priority of supply over TGP and SLBC is important to SRBC as shown by the model. If SLBC or TGP get priority over SRBC outside their limited reservoir operating range (875 to 885 feet), then it is likely that such a practice would not only affect SRBC performance but it would cause a delay in initiating SRBC's irrigation season. If model scenarios and operating rules are adhered to, then the absence of KC Canal water savings (8 TMC) is not a significant factor.

Appraisal Mission Assessment

48. The findings of the GOAP Krishna Basin simulation model are sufficiently convincing that water availability and supply reliability should not present unacceptable planning and operational risks that could compromise the viability of the SRBC project design during its economic life. The model evaluated scheme performance under conditions of full river basin development as sanctioned by the KWDT, more realistic irrigation efficiency assumptions and allows for reduction in Srisailam Reservoir's flow regulation capacity due to unavoidable sedimentation. The project design to be completed under the proposed AP III project in itself includes: (a) a smaller command area to be served by the original water allocation; (b) an a priori decision to ration water by Rotational Water Supply under an "Irrigated Dry" localization; (c) some off-channel storage in the form of Owk Reservoir; and (d) specific operating rules and formalized management arrangements for Srisailam Reservoir which preserve SRBC and other irrigation interests.

49. According to a formalized GOAP water allocation policy, SRBC is accorded a higher supply priority than TGP (currently in the early stages of construction) and SLBC (whose construction has hardly begun). Thus, if AP's surplus monsoon water use sanction is revoked by reconvening the KWDT in the near future in favor of greater development by upstream riparian states, AP may still adjust the water allocation to its uncompleted projects to meet SRBC needs.

E. Sriramasagar Project Model Results

GOAP Standard Scenario Outcome

50. **Irrigation**. The water supply reliability of SRSP was evaluated by simulation in the same manner as SRBC. GOAP's standard simulation scenario was based on the following key parameters: a flow series having a 75% dependable flow of 196 TMC; a SRSR MDDL of 858 feet and a storage capacity reduced to 77 TMC after 50 years of sedimentation; an assumed scheme irrigation efficiency

of 56%; irrigation below LMD up to km 284 of Kakatiya Canal; and a KKC capacity above LMD of 9,700 cusecs. The standard case gave a reliability of 85.4% for water delivery to the command above LMD and 87.8% for the command below LMD: i.e., 10% to 12% more than the 75% reliability required.

51. Increasing the capacity of Kakatiya Canal is critical. If the Kakatiya canal is limited to 5000 cusecs and not 9,700 cusecs then none of the 41 years modelled meets irrigation demand below LMD (0% success). It is clear that increasing KKC capacity as proposed is necessary to fill LMD reservoir and maintain 75% dependable flow below LMD. It was also found that if KKC is not used to divert water from SRSR whenever LMD falls to below 90% of its capacity, irrigation below LMD is badly affected due to the limited storage capacity of LMD. Thus, upgrading the conveyance capacity of KKC is essential to scheme success and is an integral part of the proposed project.

52. A summary of the above results are given in Table 4 below.

Table 4: SRSP Sensitivity to Various Design Features and Planning Assumptions

Comparison of standard GOAP flow series with flow series based on FAO correlation methodology (HJF Niz).	= 3% less success with "HJF Niz" for SRS = 3% less success with "HJF Niz" for LMD = 7% less success with "HJF Niz" for LMD and SRS [Last case is with SRSR MDDL at 314.55 m (1032 ft)]
Sedimentation 0 yrs compared to 50 yrs Sedimentation 0 yrs compared to 50 yrs Sedimentation 50 yrs compared to 75 yrs Sedimentation 50 yrs compared to 75 yrs	= 7% more success with 0 yrs for SRS = 8% more success with 0 yrs for LMD = 12% less success with 75 yrs for SRS = 0% less/more success with 75 yrs for LMD
MDDL at 1058 ft compared to 1032 ft MDDL at 1058 ft compared to 1032 ft	= 10% more success with 1032 ft for SRS = 13% more success with 1032 ft for LMD
Command to 284 km compared to 234 km Command to 284 km compared to 234 km	= 5% more success with 234 km for SRS = 3% more success with 234 km for LMD
Scheme efficiency of 56% compared to 40% ditto Scheme efficiency of 56% compared to 45% ditto	= 25% less success with 40% efficiency for SRS = 85% less success with 40% efficiency for LMD = 17% less success with 45% efficiency for SRS = 31% less success with 455 efficiency for LMD
Increased demand above LMD compared to Design Increased demand below LMD compared to Design	= 12% less success with 20% increased demand for SRS = 10% less success with 20% increased demand for LMD
FAO 46 Crop Wat compared to Design FAO 46 Crop Wat compared to Design	= 8% more success with FAO 46 for SRS = 7% more success with FAO 46 for LMD

Note *All the individual comparisons are the same in all aspects apart from the model component being subjected to a sensitivity test.*

53. **Power Generation.** Power generation at SRSR is incidental to irrigation as a matter of GOAP policy: hence GOAP will not issue an Government Order to maintain the MDDL of SRSR at 1,058 feet. In recent times when the SRS reservoir has been drawn down to 1,032 feet (314.55 m), there has been considerable delay in releasing water for the first irrigation. One of the factors in the delay appears to

be that of trying as much as possible to release water via the power station which can only occur above 1058 feet.

General Sensitivity Analysis

54. **Planning Parameters**. Reducing the command area to km 234 and the use of the latest FAO methodology for crop water demand estimates increases scheme success under the standard scenario by about 3-5% and 7-8% respectively. On the other hand, a higher water demand reduces success by about 10-12%. Assuming a canal irrigation efficiency of 56%, FAO undertook a separate analysis of crop water demand specifically allowing for: (a) irrigation scheduling using a Rotational Water Supply system as per the project's proposed operating modalities; and (b) supplemental irrigation only in the monsoon season. It was found that water demand could be up to 38% lower than assumed by GOAP for the model. It is therefore estimated that if canal irrigation efficiency were reduced to 40% in FAO computations, overestimation of water demand may only be about 20%. This could somewhat mitigate the model's poor result when a canal irrigation efficiency assumption of 40% is used.

55. **Operational Parameters**. Operating the SRSR Reservoir to MDDL 1034 feet increases success by about 10% although initiation of irrigation on June 1 will usually be delayed, often through into August. The model's performance was notably insensitive to the use of the Bank/FAO flow series which only reduced standard scenario success by 3%. The SRSR capacity capacity to regulate inflows is somewhat sensitive to storage reductions due to sedimentation, particularly for the SRS command above LMD; however, the 75 year sedimentation scenario which is assumed to reduce storage to 60 TMC did not reduce supply reliability below 75%. The Korutla Scheme reduced success of the standard scenario by 6%; however, if canal irrigation efficiency is less than 56%, this scheme would have an adverse impact on SRSP performance.

Canal and Scheme Irrigation Efficiency Impact

56. **Canal Irrigation Efficiency**. The SRSP project was found to be very sensitive to canal irrigation efficiency assumptions, particularly if the command below LMD is extended to km 284 of KKC. An efficiency level below 45% implies an unreliable supply below 75% if the command is extended below km 234: at 40% efficiency, the reliability of supply below LMD up to km 284 was only 2%. Modification of the project design to rehabilitate the command below LMD up to km 234 only resulted in a water supply reliability of about 60% and 54% above and below LMD respectively. This result does not take account of: (a) the higher overall scheme irrigation efficiency achieved at present and in the future by conjunctive use of groundwater and recycling of canal seepage losses; and (b) possible water savings by reducing water deliveries in the monsoon season to supplemental irrigation only.

57. **Impact of Groundwater Conjunctive Use on Scheme Efficiency**. The simulation model does not include allowance for groundwater recharge from canal seepage and its conjunctive use. There are about 15,000 shallow wells with pump-sets above LMD and about 13,200 below LMD up to km 234. In addition there are about 14,200 bullock powered wells (mhotes) above LMD and about 4,950 below LMD. Pumped wells irrigate about 1 ha of rice in the monsoon season and about 0.45 ha of rice or dry crop in the Rabi season; mhotes irrigate about 0.33 ha of rice in the monsoon season only. Studies by the AP Groundwater Department suggest that recharge up to KKC's km 234 would be about 80 Mm^3 year which is about 3% of the canal fed water.

58. Analysis of groundwater potential for the post-project situation indicate that--with energization of mhote wells and additional pumped wells--the increment in utilisable groundwater resources above and below LMD (up to km 234) are about 223 Mm^3 and 97 Mm^3 respectively. This corresponds to about 23,000 additional wells above LMD and about 9,000 wells below LMD, or a total number of wells above and below LMD equal to about 42,400 and 22,000 respectively. Thus about 20-25% of each command could be served by groundwater to make up for deficiencies in supply and cater for supplementation of water supply to rice cultivators when rotational water supply is introduced. Accordingly, even if canal irrigation efficiency would only be 40%, overall scheme irrigation efficiency would be close to 75% (under the conditions assumed in the simulation model.

Appraisal Mission Assessment

59. GOAP's simulation model results indicate that the AP II investment in extension of the command beyond km 234 of KKC was not warranted as water supply would be extremely unreliable. Accordingly, the Bank will not support further investment in the area except for redressal of the adverse impacts of land acquisition under AP II. Since reduction of SRSR storage capacity from about 90 TMC at present to 77 TMC (the 50 year sedimentation value) would take at least twenty years, a canal irrigation efficiency of 40% would be mitigated by reservoir capacity and groundwater conjunctive use to keep overall scheme efficiency at a 75% level. Thus, investment in rehabilitation of the command below LMD up to km 234 is regarded as a reasonable project risk by the appraisal mission.

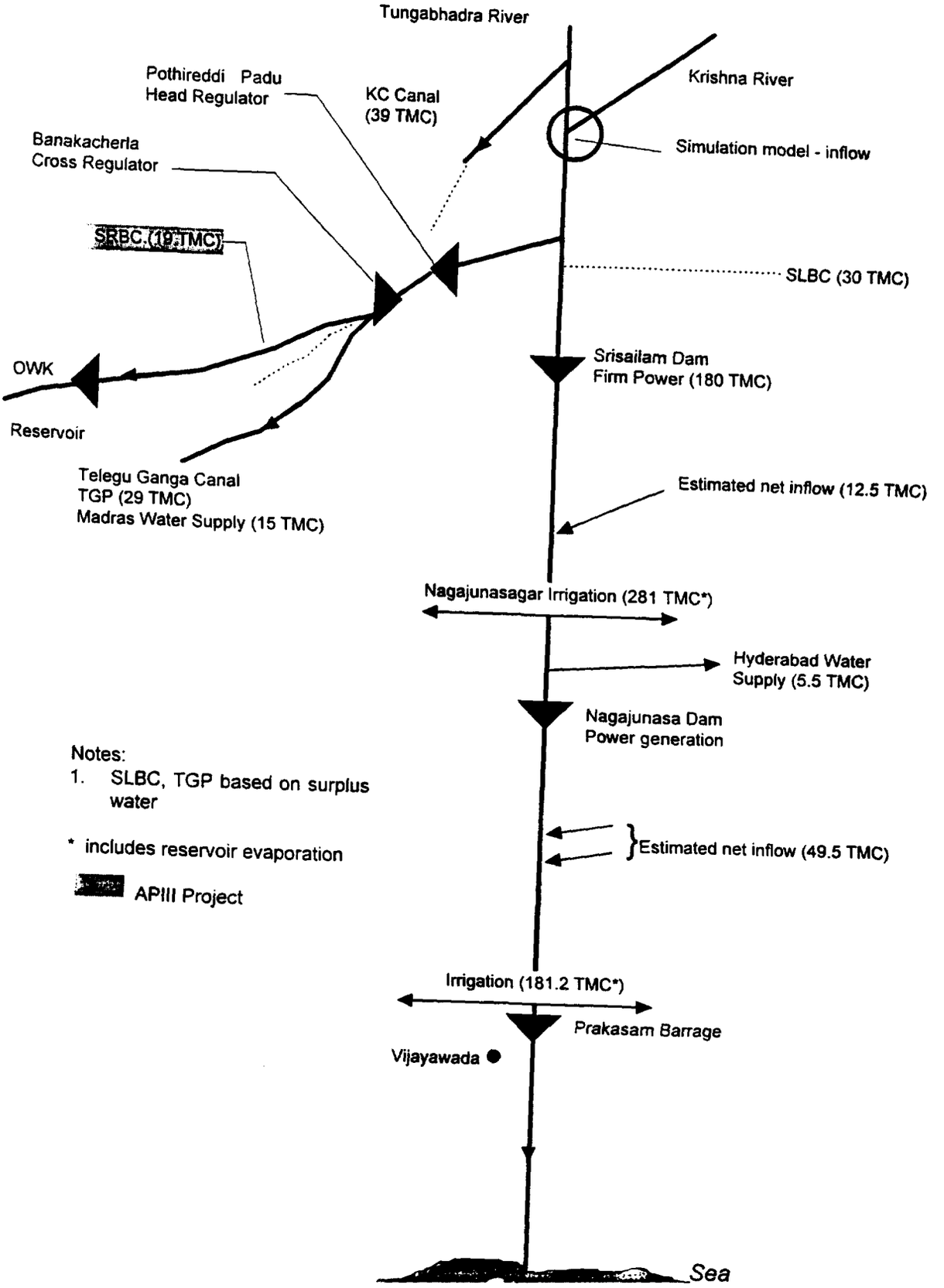


Figure 1: Krishna River Model - Structures, Water Allocations and Requirements

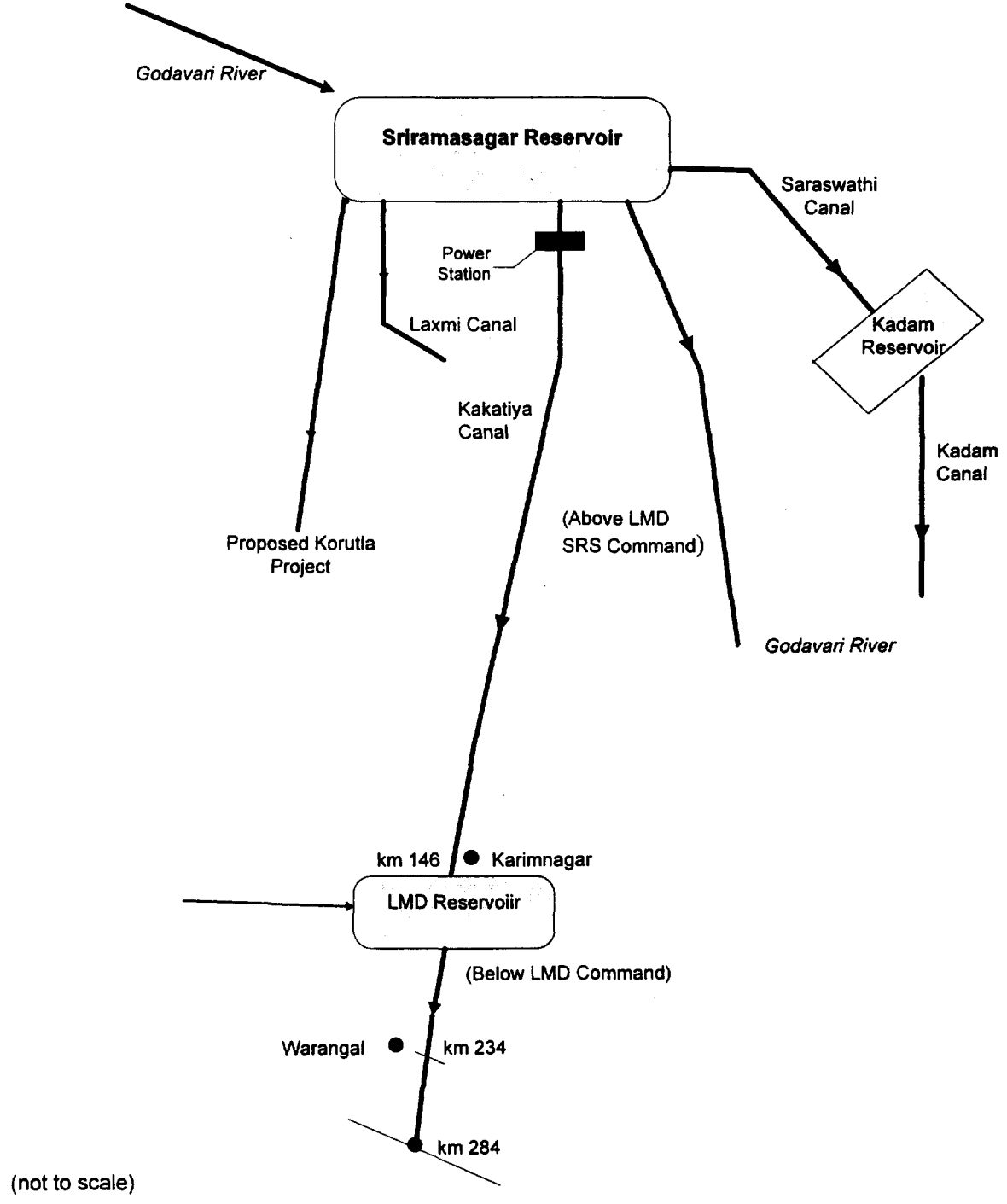


Figure 2: Sriramasagar Project Model

ENVIRONMENTAL IMPACT ANALYSIS AND MANAGEMENT PLAN

Table of Contents

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

ENVIRONMENTAL IMPACT ANALYSIS AND MANAGEMENT PLAN

A. Overview

1. **Environmental Assessment Procedure**. Under India's Environmental Protection Act of 1986 administered by the GOI Ministry of Environment and Forests (MOEF), the potential adverse environmental impacts of any public investment project need to be analyzed and if found to be significant in an Environmental Impact Assessment (EIA), they need to be addressed in an Environmental Management Plan (EMP). The review process includes a separate GOI Ministry of Social Welfare review of potential adverse social impacts caused by population displacement in general and adverse impacts on members of Scheduled Castes and tribes in particular. Albeit that a State investment project may be cleared by the GOI Planning Commission as technically and economically viable, capital expenditure may only begin if and when MOEF issues a general letter of clearance of the EIA and EMP. A state government is to make the necessary budget provision to carry out the EMP and its implementation is monitored by MOEF.

2. **Potential Environmental Impacts**. Five principal types of environmental impact are potentially of concern in the development of SRBC and rehabilitation of SRSP. These impacts are: (a) the potential for soil waterlogging and secondary salinization due to rise of the groundwater table as a result of canal irrigation; (b) loss of reservoir storage through sedimentation caused by watershed degradation; (c) increase in malaria and waterborne diseases; (d) loss of forest land due to reservoir and canal construction; and (d) adverse impact on flora and fauna as a result of construction of irrigation canals. Separate EIA studies analyzing the above potential impacts for SRBC and SRSP were compiled by consultants and submitted to the Bank in May 1994 as part of the initial project feasibility study. These studies were based on existing and new surveys of soils, land use, flora and fauna, and on specialized groundwater monitoring investigations and analysis undertaken by GOAP's Groundwater Department.

3. **Environmental Clearances**. In order to receive national environmental clearance for the project, GOAP prepared a *Environmental Impact Assessment and Environmental Management Plan* for both SRBC and SRSP according to national guidelines in February/March 1995. The EMPs included normal construction impact mitigation and monitoring irrigation impact required of any well planned irrigation scheme. Prior to according its clearance, MOEF required that the EMPs include several natural resource and nature conservation sub-components which would benefit the sub-project districts. These interventions are not attributable to any adverse impact caused by irrigation per se. Details of the proposed R&R Action Plan were also required. The EMPs were cleared by MOEF in March 1996.

4. No irreversible, diverse or complex adverse impacts were found by the MOEF review committee in either of the sub-project command areas which would change the project's 'B' environmental category rating accorded by the Bank. Given GOAP's obligation to carry out the regional EMPs, they have been included as a monitorable investment under the project. A detailed description of the project's EMP features are given below after a description of the project area and a summary of groundwater and drainage analyses.

B. Geographical Features of the Project Areas

The Srisailam Right Branch Canal Sub-Project (SRBC)

5. **Location**. The SRBC command area is located in the Kurnool District of AP's Rayalaseema Region within the Krishna River Basin and is situated along the west bank of the Kundu River, a Krishna tributary (Map IBRD &&&). The command area is about 130 km long and 5-10 km wide, with a cultivable command area (CCA) of 77,000 ha (Figure 1). The area became potentially irrigable only after completion of the Srisailam Reservoir (IBRD Map 18843) on the Krishna River in the late 1970s. This reservoir [live storage of 250 thousand million cubic feet (TMC)] was originally designed for power generation.

6. **Climate, Drainage and Soils**. Climate is temperate with hot summers and mild winters. The average annual rainfall is 761 mm with nearly 71% falling from July to September and the remainder between October and December. During 1901-1993, rainfall varied between 280 mm (in 1920) to 1,070 mm (in 1970) and droughts during the monsoon are common. The command has a flat gradient of about 1:1,000 towards the Kundu river and is drained by numerous small streams. About 80% of the command area consists of deep Black Cotton soils with 83% of the soils falling into Land Irrigability Class II.

7. **Demography**. The area has a total population of about 286,000 living in 95 villages. The average household size is 5 people. Scheduled Castes (SC) and Scheduled Tribes (ST) comprise about 28% and 2% of the total population respectively, while the majority belong to the Backward Caste (artisans, servants and laborers) and Other Caste (landed) groups. Landowners comprise about 24% of the population.

8. **Land Tenure**. The average farm size is 1.8 ha whereas 2 ha of rainfed land is regarded as a "minimum economic holding" in AP. Land holdings are unequally distributed (Table 1). Marginal farmers and small farmers having an average holding of 0.53 ha and 1.44 ha respectively, comprise 68% of the landowners but own only 26% of the land area. The medium and large farmers comprising only 32% of landowners, own 74% of the land and have a average farm holding of 4.85 ha. Thus the predominant cropping pattern is determined by mainly by medium and large farmers.

9. **Agricultural Development**. Rainfed crops predominate in the proposed command area with the most important cash crops being sorghum, groundnut, tobacco, sunflower, coriander, cotton and pulses. Because they are grown under rainfed conditions, average yields are low. There are about 2,650 wells irrigating about 3,650 ha during the monsoon (kharif) season and about 2,600 ha in the post-monsoon (rabi) season. About 2,800 ha is irrigated by 14 irrigation tanks. In contrast, within the Kurnool District there are about 150,000 ha irrigated by the Kurnool-Cuddapah (KC) Canal Scheme on the east bank of the Kundu, wells and tanks. Seed, fertilizer and pesticide depots are within a reasonable distance (less than 16 km) for about two thirds of the villages. Oil mills, rice mills and other market and processing facilities are adequate and within reasonable distance of the command area. About 32 villages are near (less than 16 km) veterinary hospitals and livestock service units. Agricultural credit institutions such as Scheduled Banks, Grameena Banks and Cooperative Credit Societies are plentiful in the area.

10. **Infrastructure**. The population is relatively well served by social infrastructure. There are: 19 hospitals, dispensaries and primary health care centers; and 77 primary schools and 14 high schools. Only 18 villages have tubewells while all other villages obtain potable water from open

wells. All villages are electrified. The area is served by good road, bus and rail links to the rest of the state and 72 villages are served by all weather feeder roads. There are post offices in 66 villages although only 28 have telephones.

The Sriramasagar Sub-Project (SRSP)

11. **Location and Scope.** The SRSP command is located in the Telengana Region of AP and covers part of the Nizamsagar, Karimnagar and Warangal Districts (Map IBRD 18842). It is served by the Sriramasagar Reservoir (SRSR) on the Godavari River near the Maharashtra State border. The upper portion of the command (about 100,000 ha) served by the Kakatiya Canal (KKC) was originally developed up to KKC's km 113 under the Bank-supported Pochampad Project. During the late 1970s and early 1980s, GOAP extended the KKC up to km 234 near the town of Warangal to create an irrigation potential of 323,000 ha (Figure 2). The works included construction of the Lower Mannair Dam (LMD) across the Mannair River (a tributary of the Godavari River) at KKC's km 146 near the town of Karimnagar. LMD augments SRSP water supply by capturing the runoff from the Mannair River's free catchment and serve as a balancing reservoir for SRSR (i.e. to prevent spillage of monsoon floodwaters at SRSR). The KKC and irrigation works below LMD were not completed by GOAP when the SRSP sub-project AP II was appraised. Under the Second Andhra Pradesh Irrigation Project, the KKC was to be completed to km 284 and its command extended by an additional 34,000 ha.

12. **Climate Drainage and Soils.** The climate is tropical with hot summers and dry winters. The average rainfall varies from about 1,170 mm near SRSR to about 878 mm at Warangal (km 234 of KKC). There is marked inter-annual variation in rainfall and several consecutive years of drought are not uncommon. The topography of the gross command area comprises of a series of valleys with flat bottom lands which are separated by steep ridges and bare rock domes. The net to gross command area ratio is therefore only about 50%. Drainage density is high and is generally northeast to the Godavari River and streams have perennial base flows maintained by effluent discharge from groundwater. About 60% of the command area consists of Black Cotton soils (Vertisols) while the remainder are red Alfisols. A high clay content and relatively poor drainage is found only where black soils overly sedimentary formations such as limestone. About 67% of the cultivable command area is classified under Land Irrigability Class II while about 13% is classified as Class III.

13. **Population and Land Tenure.** The potential project area (587,000 ha) has a total population is about 4.05 M, of which about 1.83 M live in the SRSP command area up to KKC's km 234. The farming population constitutes about 70%. The average holding size is 1.1 ha. Marginal farmers and small farmers having an average holding of 0.44 ha and 1.40 ha respectively, comprise about 83% of the landowners but own 47% of the land area. The medium and large farmers comprising 17% of landowners with an average holding of 3.8 ha.

14. **Agricultural Development.** In the early 1990s, the net area irrigated by KKC was about 70,000 ha, while that irrigated by tanks and groundwater up to km 284 was about 30,000-40,000 ha and about 90,000 ha respectively. During the *kharif* season, paddy is the preferred crop while pulses are grown extensively. In the upper reaches of the command (above LMD) maize is an important crop, while groundnut is preferred below LMD. Amongst the two-seasonal crops, large areas of cotton and chilies are grown below LMD, while tumeric is favored above LMD. During the *rabi* season, paddy followed by maize and groundnut are preferred above LMD; however, since there is limited canal irrigation below LMD, groundnut is an important crop. The yields of irrigated crops are above the state averages. Agricultural processing facilities for rice oil seeds and cotton are

adequate. Agricultural extension is provided by the Agriculture Department as well as private fertilizer and pesticide suppliers.

15. **Industry and Infrastructure**. The region is not industrially developed and there few industries in the command area. There are some factories based on mining and forest products. The main mineral resource is coal the Karimnagar District and hence two thermal power stations of 62 MW and 2,100 MW installed capacity each are located there. Aside of the 27 MW hydro capacity at SRSR, some mini-hydro plants are being built on SRSP's larger canals. All important towns and district headquarters are connected by good all-weather roads. Under the AP II project, 45 feeder roads with a total length of 485 km were built connecting 112 villages to state roads.

C. Groundwater Build-Up Potential

SRBC Irrigation Development Impact

16. **Groundwater Development Potential**. The SRBC command is underlain by semi-consolidated rocks of sedimentary origin such as quartzite, shale and limestone. They have a non-uniform fracture porosity extending about 70 m deep and groundwater is utilized by about 1,890 dug wells and tubewells irrigating only about 3,500 ha. Their yield is highly variable depending on local geohydrological conditions and vary from that required to irrigate 0.5 ha/well to those capable of irrigation about 4 ha/well. The Groundwater Department has undertaken intensive groundwater monitoring since 1991 when a network of 137 observation wells was established. Water levels are measured during fixed 10-day periods in January, April, June, August and October, and water quality samples are taken in April and October. Under current conditions, water levels below the ground surface are, for most of the area, deeper than 3 m--even in the post-monsoon period. The average water table depth in the 1993 pre-monsoon period varied from 5.6 m below ground level (b.g.l.) in block VII to 13.0 m b.g.l. in block IV. During the post-monsoon, water table depths b.g.l. reached 3.6 m in block IV and 9.83 m in block VII. The Kundu River serves a groundwater drainage recipient for the area.

17. Groundwater development is not financially feasible in about 70% of the gross command area, even with large diameter hand dug wells which are pumped intermittently because of low well yields. Thus, even allowing for additional recharge from canal seepage, the additional full groundwater development possible in the 65,000 ha SRBC command area is only about 5,000 ha served by about 2,500 additional wells each abstracting about 12,000 m^3/year (gross). Thus the overall area irrigated by conjunctive use of groundwater could at the very most be about 8,500 ha or about 13% of the net command area.

18. **Potential for Groundwater Build-up**. A forecast of future groundwater build-up with and without groundwater development was made by the Groundwater Department on the basis of increased recharge from irrigation and canal seepage. The groundwater rise over the 16 irrigation blocks as a consequence of estimated incremental recharge varies from about 1.8 m to 4.9 m. The post-monsoon water levels in the SRBC command are projected to be shallow (0.0 m to 1.9 m b.g.l.) in blocks VI, VII, XII, XIII and XVI and deep in blocks III, IV and IX. With full groundwater development, post-monsoon water levels would be 1.38 m to 8.8 m b.g.l. so that all groundwater levels would be below 2 m except in blocks VI and VII. This static analysis is however regarded by Bank missions as inaccurate or overly pessimistic as it does not consider increased drainage to the Kundu River and adjacent lower groundwater as a result of the increased groundwater gradients caused by water table rise.

19. Although all canals are lined and the scheme is based on a rotational water supply and irrigation, prevention measures such under-drainage of canals in some of the problematic blocks has been included in the detailed designs. While water logged pockets could occur over time, they would not preclude rice cultivation. The nearby Mylavaram and Kurnool-Cuddapah (K.C.) Canal schemes located in areas with similar hydrogeological, pedological and geomorphological characteristics were analyzed as indicators of waterlogging development. In both schemes, groundwater build-up has not been a problem. In particular, the K.C. Canal command can be regarded as a surrogate for SRBC command area when the latter is irrigated. The K.C. Canal command lies on the east bank of the Kundu River and is virtually a geomorphological mirror image of SRBC except that it has been irrigated for over one hundred years. The pre-monsoon water depths are in the range 3-9 m b.g.l. while post-monsoon water level depths range from 1.3 m to more than 5.0 m b.g.l. and the area of water table depths <2 m b.g.l. is small. There are no reports of secondary soil salinization and crop yields are high (e.g. 5 tons/ha for paddy). Thus, the K.C. Canal scheme indicates that serious groundwater drainage problems are not to be anticipated in SRBC.

20. **Groundwater Quality and Salinization Potential**. An Electrical Conductivity (EC) map of the SRBC command shows that most of the areas zoned for potential groundwater development have groundwater with EC <2,250 umhos/cm and some have EC <750 umhos/cm. While the upper end of this conductivity range is fairly high, farmers using groundwater do not report water quality as a problem for cropping. Areas proposed for development around Owk Reservoir have EC values >2,250 umhos/cm. Here some farmers report problems with cultivating paddy nurseries with poor quality groundwater, but have no problems with the transplanted crop. Leaching requirement is estimated at 17% and can be met from field application losses. It is therefore considered that, in general, groundwater quality is not a serious constraint in SRBC command, particularly when it can be used conjunctively with high quality Krishna water which has an EC of less than 500 umhos/cm. Furthermore, as in the nearby Mylavaram scheme, recharge will tend to improve groundwater quality. Alkaline hazard is also not anticipated as the Sodium Adsorption Ratio of both surface and groundwater is generally less than 4.

SRSP Irrigation Development Impact

21. **Hydrogeology and Well Yields.** Groundwater generally occurs under water-table conditions. Large diameter dug-wells are the most common means of its abstraction although dug-cum-tubewells are also found. The potential of the aquifers is generally limited. The yield of dug-wells varies from 40-150 m^3/day in consolidated rocks, 25-100 m^3/hour with a 1.5-30 m drawdown in semi-consolidated rocks, and about 90-180 m^3/hour in alluvium along the Godavari river. Whereas the latter are capable of continuous pumping, dugwells generally sustain pumping for more than 2-4 hours/day: thus most dug-wells generally irrigate only 1-2 ha. The average net area provided with supplementary groundwater irrigation during the monsoon is about 1.4 ha. Smaller wells powered by bullocks to lift a large bucket device ("mhotes") can provide supplementary irrigation to about 0.3 ha of monsoon paddy.

22. Detailed hydrogeological surveys of the area immediately below LMD (down to distributary D13) indicates that well yields are 30-50 m^3/day in the rabi season and 50-100 m^3/day in the monsoon season. The Groundwater Department estimates that the rabi season well yields can be expected to improve when canal irrigation becomes widespread and regular as a result of the rehabilitation works to be undertaken by the project. Above LMD, there are about 19,500 pumped wells and about 14,220 mhotes; below LMD up to km 234 of KKC, there are about 13,200 pumped

wells and about 4,950 mhotes. Thus the net project area irrigated above and below LMD is about 31,560 ha and 19,965 ha respectively. The current groundwater potential of the whole command area (up to km 284) is about 24 TMC; this could increase by about 10% if the whole are were to be irrigated. Water balance computations indicate that, with conversion of mhotes to pumped wells, a pumped well increment of about 23,000 and 9,000 pumped wells can be installed above LMD and below LMD respectively.

23. **Potential for Groundwater Drainage Problems**. Intensive groundwater monitoring is undertaken by the Groundwater Department. In the command above LMD there are 365 observation wells monitoring a net area of about 294,000 ha; below LMD there are 239 observation wells of which 115 monitor the command up to km 234 of KKC while the remainder monitor the area up to km 284. Water levels are monitored five times a year while water samples are taken twice in April and October. In the command above LMD, the pre-monsoon water table build-up has averaged 0.22-0.27 m/year with a higher rise in canal head reaches because of their excessive water use. Currently, above LMD, the gross area with a water table within 3 m of the ground during April is about 37,000 ha; about half of this area (less than 10% of the gross area) has pockets with a water table between 0-2 m b.g.l.

24. The Groundwater Department prepared a forecast[1] the potential for waterlogging due to a rise in the groundwater table as a result of increased recharge due to rehabilitation of the command to km 234 of KKC. Assuming a uniform spread of the additional recharge and its retention in aquifer storage, water table maps were prepared. The post-monsoon (October) map forecasts only small pockets with water tables at less than 2 m b.g.l. The methodology was similar to that used for SRBC and is therefore unconvincing because of the neglect of natural drainage to the Godavari River as it is unreal to assume that all, or even a large proportion of incremental recharge will be retained in storage. The Bank mission assessment is that significant problems of groundwater drainage and adverse waterlogging will not develop in the project area even if groundwater development proves to be lower than that assumed at full development. The natural groundwater drainage conditions will prevent major long-term increases in permanent groundwater storage. The development of of significant areas of shallow water tables will be confined to the valley bottoms and will not be detrimental to the paddy crop which occupies most of such areas now and will most likely continue to do so in the future.

25. **Groundwater Quality and Secondary Salinization**. The EC maps of April 1993 show that more than 90% of the area in the gross command area down to LMD is underlain with groundwater with EC<1,500 umhos/cm and most is EC<750 umhos/cm. The small areas with EC>1,500 umhos/cm roughly correlate with shallow water table areas in the same month, implying that there may be a relationship between salt concentration and depth below the water table. This situation persists into the post-monsoon of October 1993. However, the areas underlain by water with EC<3,000 umhos/cm are very small. They could well be related to pockets of constrained drainage coupled with shallow water tables. They do not have significance in an area which has been irrigated for up to 20 years. The command area below LMD shows a similar groundwater quality pattern with small pockets of EC<2,250 umhos/cm which, in general, relate to relatively shallow water table areas. It is noteworthy that this area has received little or no canal irrigation and that they are situated in valley bottoms occupied by the commands of very old tanks. It is concluded that secondary salinization is very unlikely and that leaching by rains and irrigation will prevent a

[1] AP Groundwater Department: *Report on Intensified Groundwater Development Action Plan in Sriramasagar Project Command in the 0-234 km Reach of Kakatiya Canal*; July 1995.

progressive build-up of salinity in the soil, albeit that a very slow decline of groundwater quality may occur.

D. Irrigation of Black Cotton Soils

Crop Root Zone Drainage Analysis

26. **The Problem**. Despite the small likelihood of major regional water table rise in SRBC and SRSP, there could be concern about the natural drainage of Black Cotton Soils having low permeability at a depth of 150-180 cm b.g.l. and the likelihood of crop yield reduction due to seasonal perched water tables above this semi-impermeable layer. An early pedological survey of the SRBC command found some signs of such a layer in Black Cotton soils. They could also exist in some of the Black Cotton soils of SRSP which have a limestone parent material. Consequently, FAO experts considered it important to assess whether the proposed RWS irrigation regime could give rise to seasonal perched water tables and even salinization of the crop root zone.

27. **Drainage Simulation Models**. One of the major difficulties in estimation of water (and salt) drainage out of the root zone (up to 2 m b.g.l.) is allowance for water drawn into the atmosphere by crop transpiration and direct evaporation. A mathematical model that simulates water flow, salt transport, plant water uptake and crop yield was used by FAO to evaluate transpiration, evaporation, drainage and water table depth as a function of crop type, soil hydraulic properties and potential evapotranspiration demand. The key parameter of this model is the soil's unsaturated hydraulic conductivity as a function of soil moisture content. This function was determined in the field for SRBC and SRSP black and red soils using a simple and quick method. The simulation studies used average monthly precipitation and Class A evaporation data. The crops simulated were corn, sunflower and groundnut. The time for germination and time to reach full crop canopy were used to differentiate between potential evaporation and actual transpiration at different crop growth stages.

28. The study concluded that under normal rates of groundwater drainage prevalent in the SRBC command (about 6 mm/day) and for water tables at 6 m b.g.l. or more, no annual accumulation of aquifer storage and waterlogging of the root zone would occur under the proposed irrigation regime. Similarly, no salinity problems are expected. However where an impervious layer exists with a permeability of about 2 mm/day, it was found that waterlogging could develop in 8 to 15 years. It is therefore important to monitor water tables, especially where subsurface drainage may be slow so that appropriate measures may be taken if pockets of waterlogging develop. Large areas of perched water table are not expected because of the self-mulching attributes of black soils.

Local Irrigation Practices

29. The above findings induced FAO experts to look carefully at irrigation practices on Black Cotton (Vertisol) soils in the K.C. Canal command adjacent to the proposed SRBC command area. Field observations and discussions with farmers and agricultural department staff showed conclusively that farmers understand and use furrow irrigation for cash crops (e.g. cotton and chillies) and are also conversant with the practice of irrigation scheduling (i.e. appreciate the need to supply water to crops as and when needed). The soils allow farmers in many places to grow rice alongside and surrounded by "dry" crops; however there is an increase in the amount of rice grown in low-lying lands. It was concluded that farmers in the area have a good understanding of irrigation of clay soils; it is clear from their observations that they understand the problems caused by over-irrigation and schedule their irrigation to avoid ponding of water and crop damage. To a great

extent, the Black Cotton soils provide a suitable environment for irrigation since their uptake of water can easily be observed and guide farmers' irrigation practices.

E. Environmental Management Plan

Compensatory Afforestation

30. This EMP component is required in order to complete mandatory replacement of government forest land areas utilized for the construction of canals prior to the proposed project. For *SRSP*, this envisages completion of afforestation of 289 ha of degraded lands in the foreshore of the Sriramasagar reservoir. In SRBC, an area of 885 ha will be reforested in the Kurnool district even though only 149 ha of forest land would have been diverted for the sub-project at its current scope. About 736 ha of forest land may be diverted in future if the Gorakullu Reservoir is constructed. However, since clearance of this compensatory afforestation was requested and cleared for immediate transfer to the State Forest Department in 1994, it would be undertaken under the project since the rehabilitated lands are to serve as a source of timber, fuel and fodder for local villages and alleviate the pressure on dwindling forest resources. The already identified degraded areas are to be planted with suitable tree species and protected with cost-effective structural and non-structural soil and water conservation measures. Various planting models were initially identified by the State Forest Department and provision made for implementation infrastructure, nurseries etc. These models have been modified for implementation by the Forest Development Corporation (FDC).

SRBC Eco-Restoration and Degraded Forest Improvement Program

31. **Development Impact.** A detailed investigation of the flora and fauna along the alignment of the main canal and within the command area of SRBC was undertaken by the State Forest Department, the Zoological Survey of India and Society for Conservation and Management of Natural Resources. It was found that the SRBC main canal would serve as a natural protective barrier for the mammalian wild fauna in the reserve forests and hilly areas to its west and thus facilitate their conservation. The provision of cross-drainage structures at all streams and springs prevent any disruption of natural runoff in the command area and thus its fauna and flora are not affected. At Rollapadu, the canal passes within 3 km of the Great Indian Bustard (*Choriotis nigriceps*) bird sanctuary but would not have an adverse impact: in fact, its water would benefit all terrestrial and aquatic birds. Within the command area, it is anticipated that irrigation would change the dryland habitat, increase the cultivated area and, over time with increasing population, create some pressure on forest resources.

32. **Mitigation Measures.** In order to ensure protect wildlife and forest resources from developmental pressures, the following mitigation measures would be supported under the project:

(a) *Degraded Area Development in Reserve Forests.* In order to improve barren degraded areas of thorny dry scrub species totaling 800 ha in five reserve forests near the command area, several treatment models have been proposed involving gap planting, nursery pasture plots, agave plantation, vegetative strips and soil and water conservation measures. The latter works will include 100 percolation tanks within these and other reserve forests. The selected treatment mix would depend on soil, slope and canopy cover of the treated area. In addition, another 300 ha of degraded area outside the forest reserves would be planted with local species. A joint forestry management approach was not been adopted for the treatment models as the treated areas are on

remote government land far from villages, and are to be managed and harvested by the FDC to gain revenue for project maintenance.

(b) *Canal Bank Plantation.* In selected stretches totaling 35 km along the main canal near reserve forests, a double row of trees and will be planted to consolidate canal banks and serve as a partial barrier to wildlife access. About 50% of the trees would be harvestable varieties such a Neem, fruits etc. while the rest would be large canopy shade trees.

(c) *Environmental Education Centers.* Two well-equipped environmental education centers based on the theme of water resources development and conservation are proposed near the command area for public education purposes. The existing education center at the Rollapadu Bird Sanctuary is also to be upgraded with models, exhibits, a library and four tourist suites. This improvement would be part of an environmental awareness campaign related to grassland ecology and endangered species such as the Great Indian Bustard.

(d) *Nutritive Fodder Plots and Animal Watering.* In order to reduce pressure on the pasture grass in the reserve forests, 20 fodder plots of 2 ha each for wild herbivores will be developed with irrigation water facilities for the dry season. In the degraded areas and on the fringes of reserve forests near high priority villages, 100 ha of nutritive fodder plots will be developed to reduce competition between cattle and wild herbivores. Saucer pits and check dam water holes will be built in gullies and eroded depressions of the degraded areas for wildlife watering. In the priority villages on the forest reserve fringes, breached tanks will be repaired and cattle watering facilities provided.

(e) *Environmental Monitoring and Anti-Poaching Units.* A fully equipped monitoring and research unit is to be established at the Rollapadu environmental education center to monitor the efficacy of the environmental program. Three motorized anti-poaching vigilance squads are to be established to protect forest wildlife.

SRSP Eco-Restoration Program

33. **Possible Impact.** A detailed investigation of the flora and fauna along the alignment of the main canal and within the command area of SRBC was undertaken by the State Forest Department, the Zoological Survey of India and Society for Conservation and Management of Natural Resources. The resultant program concentrates on district eco-restoration activities and safeguards in the area below LMD inclusive of the new command below km 234 of KKC. The new command is not funded under the project and borders on the Pakhal Wildlife Sanctuary which contains a population of about 11 tigers.

The mitigation program components include:

(a) *Degraded Forest Rehabilitation.* Degraded areas totaling 1000 ha within 9 blocks of the 21,135 ha forest reserve area will be improved along the same lines as in SRBC.

(b) *Canal Bank Plantation.* This would be similar to SRBC for a length of 150 km.

(c) *Development of LMD Bird Sanctuary.* The 17 sq.km reservoir and foreshore vegetation area would be declared a bird sanctuary in view of the many species of local aquatic and winter migratory birds now supported by the water body. Investments required include: (i) demarcation

surveys, biological inventory survey and preparation of a sanctuary management plan; (ii) planting of 50 ha of Babul and Barringtonia saplings; (iii) construction of viewing towers, shelters and staff buildings; (iv) equipment and staff. Two flora and fauna vigilance parties would be established and equipped. Artisanal reservoir fishing is controlled by issue of Fisheries Department licenses and would not interfere with the bird sanctuary situated on islands and the foreshore. The existing fish seed farm would be expanded to include 20 nursery ponds, breeder pond, seed parking hall and Chinese hatchery.

(d) *Development of LMD Deer Park and Environmental Education Center.* A recreational garden, playground, aviary, water fowl pond and moated deer park would be established at LMD to cater to the population of Karimnagar town. The park would contain a landscaped Environmental Education Center building housing a library, auditorium and museum The center would be equipped for educational exhibits, audio-visual and interactive displays.

(e) *Pakhal Wildlife Sanctuary Improvement.* In order to monitor and control the pressure on the sanctuary area, two vigilance parties would be established and provided with buildings, transport and communication equipment. Habitat improvement works would be built such as: (i) boundary demarcation barricades, cattle-proof trenches, etc.; (ii) repairs and improvements of animal water and fodder sources; and (iii) soil and water conservation works in degraded areas. To reduce pressure on the sanctuary, a *village eco-development program* would be supported in four selected villages. This program includes: livestock improvement and development of fodder plots and watering facilities; provision of alternative energy sources; and income generation schemes. The details of this program, including the process of beneficiary involvement in its formulation, are not yet available.

(f) *Monitoring and Research.* Incremental staff will be hired for a scientific unit to monitor the eco-restoration program and will be provided with facilities and equipment in Karimnagar.

Catchment Area Treatment Program

34. The AP Remote Sensing Applications Center has prepared catchment area treatment plans (CATPs) based on collateral remote sensing data to reduce sediment inflow into the Srisailam and Owk reservoirs serving SRBC and for the Sriramasagar and LMD reservoirs in SRSP. The land use and cover of the watersheds comprising the free catchment (i.e. below upstream reservoirs) of each reservoir has been analyzed to compute their sediment yield index and determine their treatment priority. The CATPs include vegetative and structural soil conservation measures for all watersheds having a high priority for soil erosion reduction. These measures include: (a) land protection using afforestation, silvipasture and agroforestry treatment models for various categories of land type with emphasis on degraded areas; (b) gully control works (rockfill and check dams) with vegetative measures to arrest silt flow; and (c) greenbelt plantation with commercially viable trees along reservoir foreshores, together with vegetative barriers and soil conservation structures where necessary. The limited area treatment of the Sriramasagar reservoir catchment (1,104 ha and 129 silt arresting tanks) derives from it being a supplement to ongoing government programs which have already treated about 18,000 ha out of 45,000 ha.

The overall program of catchment treatment to be funded under the project is is summarized in the table below:

Catchment Area Treatment Program Summary

Treatment	Reservoir			
	Srisailam	Owk	Sriramasagar	Lower Mannair
Tree Planting				
Degraded Areas (ha)	10,510	14,940	1.104	21,757
Reservoir Foreshore (ha)	4,130	23	2,208	430
Sub-Total(ha)	14,640	14,963	3,312	22,187
Structural Measures				
Rockfill Dams (No.)	0	118	0	808
Check Dams (No.)	0	14	0	97

Agroforestry Extension

35. MOEF has stipulated that the command areas should have a mobile extension unit to disseminate agroforestry techniques. A distribution target of 100,000 teak stumps and 20,000 assorted fruit tree seedlings every year for five years in SRBC and SRSP has been set for this program. The seedlings will be distributed by mobile extension units established for this purpose.

Environmental Health Program

36. A baseline survey of health care delivery capacity was conducted by the State Health Directorate in 120 villages of the new command area of SRBC. The project will support a limited environmental health program against water-borne and other diseases in each sub-project. This includes: (a) immunization of 13,600 susceptible children against Japanese Encephalitis; (b) distribution of chlorine tablets for pot chlorination and bleaching powder for protection of village water supplies; (c) anti-malaria spraying in villages; (d) additional stores of drugs, disinfectants, nutrients and X-ray film for primary health care clinics and hospitals in the command areas in order to cope with the additional load of the project's transient laborers and workers during the construction period; (e) a fully equipped mobile medical team and vehicle-cum-ambulance to visit labor camps and provide treatment of minor ailments; and (f) establishment of a dispensary in SRSP.

Restoration after Construction

37. Restoration of construction sites is included in the technical specifications of all construction contracts as a contractual responsibility: hence a special financial provision is not required. This includes treatment of borrow areas, muck stabilization during canal construction etc. For Owk Tunnel in SRBC, the design provides for suitable disposal and stabilization of tunnel spoil.

Groundwater Development Program

38. **SRBC Groundwater Monitoring Studies**. Provision has been made in the EMP for 8 professional Groundwater Department staff to monitor groundwater levels and quality and to plan the promotion of conjunctive use to mitigate any waterlogging tendencies that may arise. This effort would continue for the duration of the project.

39. **SRSP Groundwater Development Program**. In addition to continuation of the ongoing groundwater monitoring program, the EMP has made provision for GOAP assistance to promote construction of 12,610 new wells and energization of 19,173 mhotes over a five year period. This program would not only mitigate local waterlogging if it occurs, but also facilitate adjustment of rice cultivators to RWS by enabling supplementation of intermittent canal flows from well supplies. The total cost of over Rs,1,514 million would be covered as follows: a 25% GOAP subsidy, a 15% equity contribution from farmers, and 60% as credit from financial institutions such as NARBARD, Scheduled Caste Corporation, District Rural Development Authority and banks. GOAP has issued instructions to all District Collectors to extend all facilities to farmers available through normal district well programs. The AP State Electricity Board is taking steps to improve power supplies. The Bank/IDA does not provide any support for this well construction program under the project as agricultural power tariffs are below national guideline norms of Rs.0.5 per kwh.

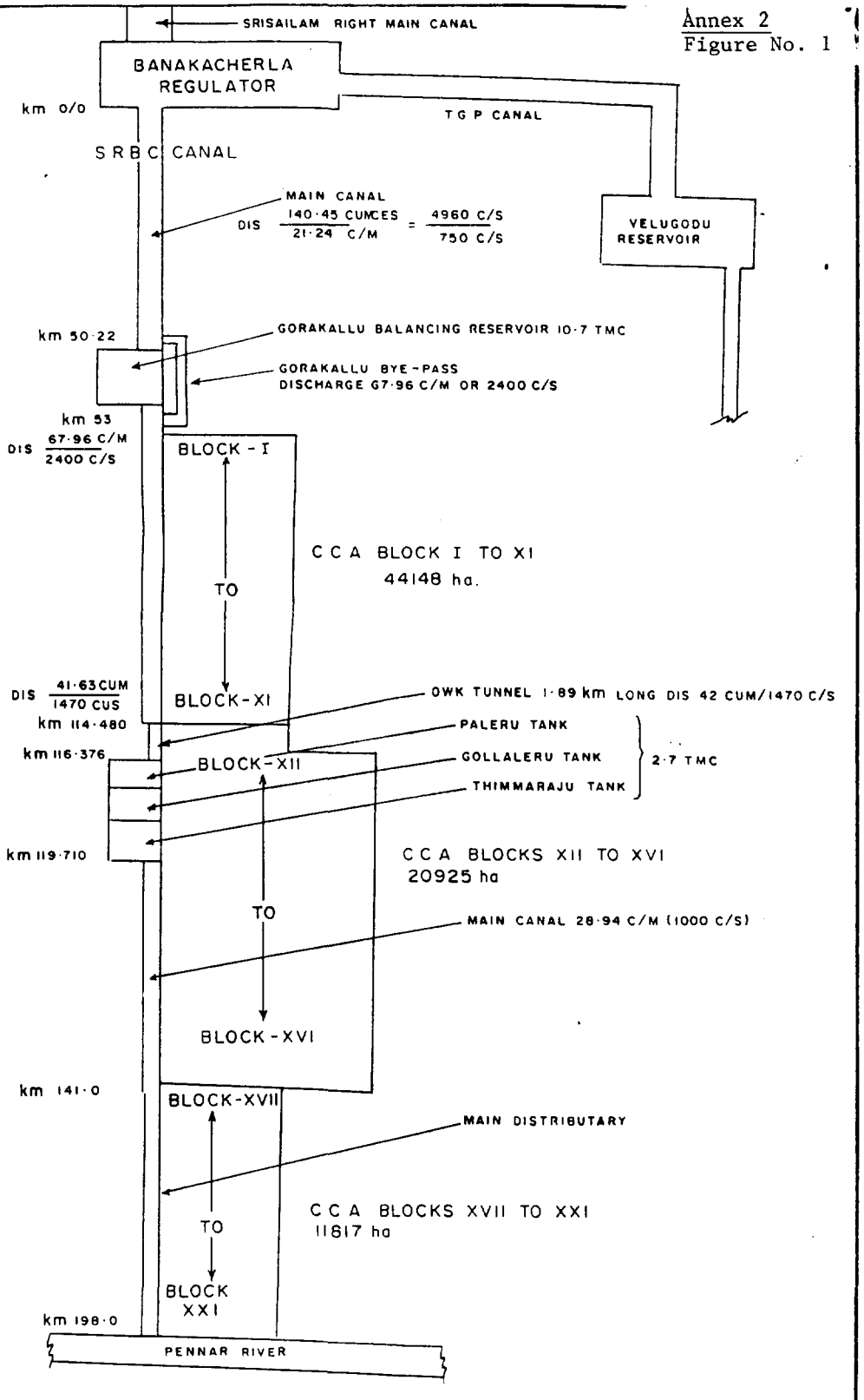
SRSP Environmental Monitoring Program

40. An environmental monitoring program will be carried out in the SRSP command as follows:

- Water Quality. Surface and groundwater quality twice a year by the Groundwater Department.
- Soils. Soil characteristics such as conductivity, pH, salinity and texture will be sampled once every three years; in areas prone to waterlogging, sampling will be carried out annually. The implementing agency will be the soil conservation units of the Agriculture Department.
- Land Use. Post-construction monitoring will indicate status of borrow pits, temporary camp sites, landfill sites, waste dumps. etc. The change in land use pattern will be monitored once every five years using satellite imagery. The implementing agency will be the AP State Remote Sensing Application Center.
- Erosion and Siltation. The Agriculture Department will monitor water sediment load, effectiveness of soil conservation measures and erosion of canal bank spoil. In addition, ICADD will undertake a reservoir sedimentation survey of Sriramasagar and Lower Mannair reservoirs as part of the Dam Safety Component.
- Spread of Aquatic Weeds. The Agriculture Department will monitor the density and problem areas of aquatic weeds and the effectiveness of weed control measures.
- Trends in Incidence of Water-Related Diseases. The Medical & Health Department will monitor trends in water-borne and related diseases and the adequacy of local curative and vector control measures.

The above program will be monitored by an Environmental Cell in the PPMU. Progress will be reviewed by project-level and state-level environmental committees constituted by Government Order in February 1993.

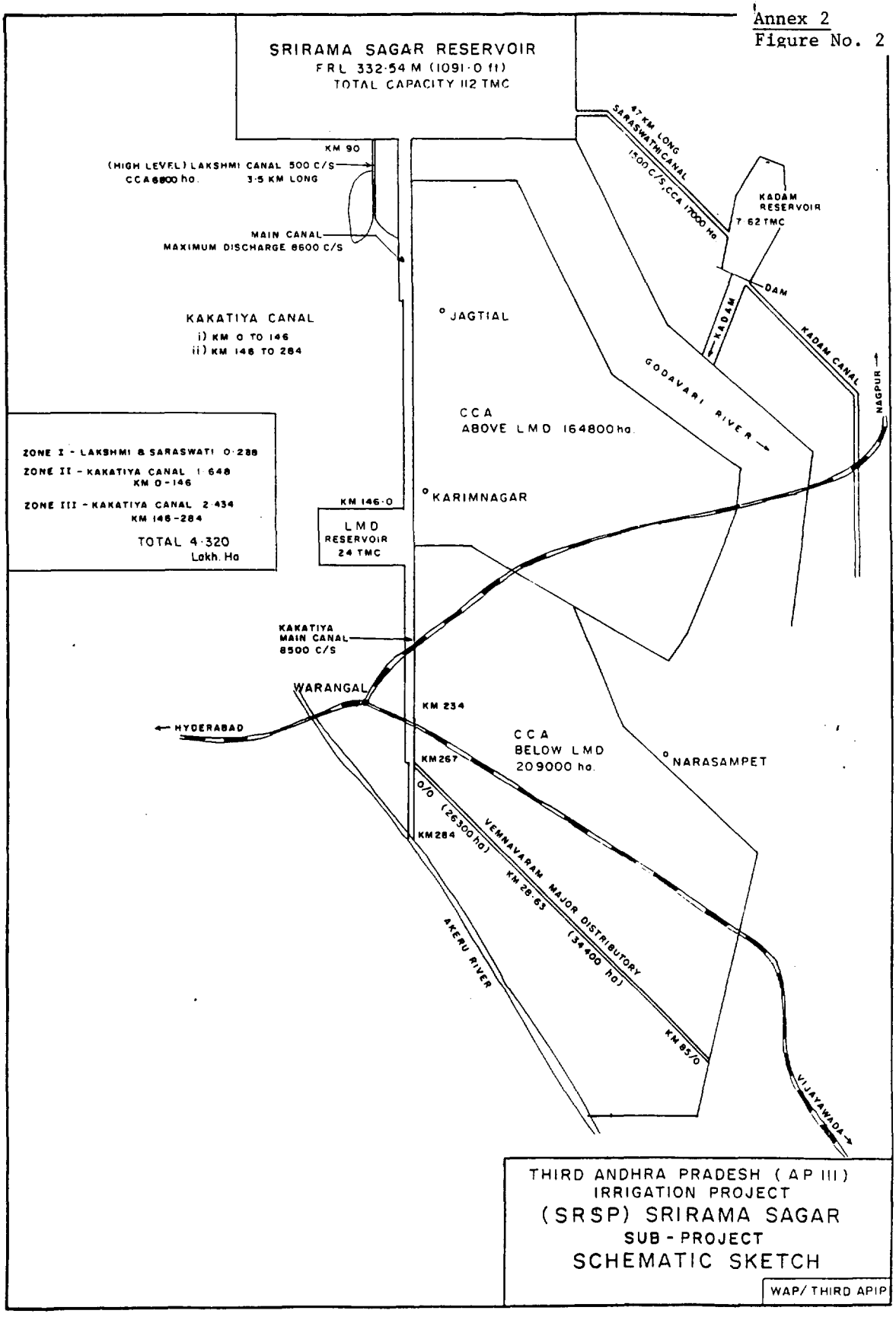
Annex 2
Figure No. 1



THIRD ANDHRA PRADESH
IRRIGATION PROJECT
SCHEMATIC SKETCH
S R B C SUB-PROJECT
C C A 76890 ha

WAP/THIRD APIP

Annex 2
Figure No. 2



WATER USER ASSOCIATIONS

Table of Contents

POLICY ON FARMERS' PARTICIPATION IN IRRIGATION MANAGEMENT

* * *

The State of Andhra Pradesh has invested large amounts of its scarce financial resources to creat surface irrigation schemes. The net Irrigation potential created thus far is 6.4 M ha. Inspite of this large effort, statistics show that only about 4.3 M ha or 67% of the potential created is utilized thus leaving a gap of about 2.1 M ha. or 33% unutilized. Some of the main reasons for this gap are the non-complaince of farmers to the designed cropping pattern, the poor conditions of the irrigation systems, and the lack of operational plans. In addition to this gap, water distribution within the command areas is often neither reliable nor equitable with large differences in water availability between the head and tail end of irrigation canals.

Irrigation & CAD Dept., has attempted to remedy this situation through various measures among which are the rehabilitation of the distribution networks, the introduction of rotational water supply based on structured systems and the promulgation of the AP Irrigation Utilization and Command Area Development Act, 1984 authorizing the creation of Command Area Development Authorities (CAD) and the formation of Pipe Committees. Though some improvements were noted, much of the disorders noted previously continue and none of these initiatives have really proved to be fully sustainable. The failure is mostly due to a top-down approach to irrigation planning and management without adequate consultation with farmers.

In view of the above difficulties, the Irrigation & CAD has initailed a pilot program involving farmers participation in irrigation management at the minor level. This program was carried out with some success with the assistance of an NGO In D64 of SRSP. Based on field observations, the IU & CAD Act legalizing farmers organisations, and the experience of the pilt program, the GOAP would like to develop a new approach to water management. The new approach would be based on participatory irrigation management through the creation of Farmers Organisations. It is proposed to implement this new approach first under the proposed AP.III Project in the SRBC and SRSP commands. THe salient features of the management policy are as follows:

1. The farmers in the command of the projects will be encouraged to form Water Users' Associations to operate and manage irrigation systems in their respective area;
2. Irrigation system upto minor level consisting normally of an ayacut of 400 to 750 ha. will be placed under the management of the respective Water Users' Association under a memorandum of understanding with the Department. The endeavour shall be to have preferably not more than one WUA in a Revenue village.

3. The Water Users' Associations will be autonomous bodies which will function on democratic principles and their affairs will be subject to audit by professionals. The WUA will be governed under bye-laws to be framed under the IU & CAD Act;
4. The endeavour of the Department will be to give increasing responsibility of managing irrigation systems to WUAs and for the purpose it will:
   i) make available assured and reliable water at the head of minor;
   ii) Undertake rehabilitation and modernisation of the internal water distribution system wherever WUAs are formed;
   iii) facilitate fixation and collection of operation and maintenance charges from water users.
5. The WUA will be at liberty to regulate distribution of water to the water users on volumetric or any other basis and to leavy and collect panalities if any, Fixed by it for violation of the water distribution scheme finalised for the irrigation system under its administrative supervision;
6. By improving efficiency of the irrigation system the WUAs will be at liberty to save water and make the water so saved available to users on payment;
7. The IU&CAD Act will be suitably amended to provide for the formation of WUAs and to give suitable incentives for thier promotion;

Government of A...
Irrigation & Command Area Department

Memo No. 07206/CAD IV/97 Date: 15 February, 1997

Sub: participatory irrigation Management in Irrigation projects - formation of Water User Associations - Delineation of jurisdictions - instructions issued - Reg.

Ref: 1. G.O. Ms. No. 120 CAD IV I & CAD Dept. Dated 27th. August 1996.
2. Minutes of the meeting on PIM on 13-2-97.

Government have decided to introduce participatory irrigation management in irrigation projects of the state. A draft bill for the same is under preparation and shortly to be introduced in the current assembly session.

All the Chief Engineers of the I&CAD Department are requested to immediately ensure that the following actions are taken and a detailed report submitted by March 10, 1997 without fail.

1. Depending on the size of the Irrigation Project there may be one or more tiers of farmers organisation as follows:

Tier of Association.	Minor Irrigation Projects	Medium Irrigation Project	Major Irrigation Project
Water User Association	yes.	yes	yes
Distributory Committee	----	----	yes
Project Level Committee	----	yes	yes

2. Each WUA to be delineated on a hydraulic basis, which is viable administratively and economically may range from 2000 Acres (MI tank) to 8,000 Acres (major or medium Irrigation Project.)

3. In delineating a WUA the following guidelines to be borne in mind:
   A. WUA to be on an hydraulic basis.
   B. As far as possible the boundaries of WUA's may be in line with village/Natural boundaries.
   C. Mandal boundaries should in as far as possible be kept intact as the Mandal forms the basis of administration.

D. Different tiers shall be administratively and functionally viable be tied up with the Irrigation set up and the locally elected bodies such as gram Panchayats, Mandal parishads and zilla parishads.

4. A distributory or a group of distributories shall constitute a Distributory Committee (DC). The Presidents of all the WUA's within the jurisdiction of the DC shall be its members. A Project Level Committee (PLC) is to be constituted at the project level. The presidents of all the DC shall be the members of the PLC

5. All the ayacutdars within the jurisdiction of a WUA shall be the members of the WUA & constitute the general body of the WUA.

6. Each of the WUA is to be divided into 9 viable territorial constituencies. The ayacutdars is each of constituency shall elect one member each. Which will form the executive committee of the WUA i.e., President, Secretary, Treasurer and six members.

7. A command area of the Distributory Committee shall be divided into 9 territorial constituency The President of the WUA's in each of the territorial constituency shall elect one member to be represented on the Managing Committee the Distributory.

8. The Managing Committee of the DC shall have 9 to 16 members.

9. A Project Level Committee is to be formed at the project level. All the Presidents of the DC shall be its members.

10. A Managing Committee at the project level will have comprising of 9 to 12 members who shall be elected out of its members.

11. All the concerned CE's/SE's/EE's must immediately undertake the following actions

1. Delineation of jurisdiction of WUA, DC, PLC depending on the type of the irrigation project.

2. Prepare the Maps showing the territorial constituencies in each of the associations.

3. Voters list of ayacutdars (Category 'A' & 'B') will be prepared by the Revenue department in consultation with the Irrigation departments after the maps of the associations are prepared. Category A ayacutdars will consist of registered land holders in the localised area and category B ayacutdar will be other landholders outside the localised ayacut.

Government have also appointed consultants for evolving a structural framework on PIM in irrigation projects. With a view to give appropriate guidance the following consultants shall work in close co-ordination with the Chief engineers to ensure that the delineation of the various associations is completed by 10th march 1997.

Sri. K. Rami Reddy	NSRC, NSLC, Penner Delta, TGP Srikalahasthi.
Sri. Dronacharyulu	Krishna Delta, KC Canal, TBP HLC, LLC, TGP Cuddapah.
Sri. Satyanaryanamurthy	Godavari Delta, Vamshadhara & Yeleru Projects.
Sri. Maruthi	Medium, Minor, PJP, RDS, Nizam Sagar Sriramsagar Projects

The Chief Engineers/ Supdt. Engineers shall work in close co-ordination with the consultants and ensure that adequate instruction are given to all the field staff & executive engineers and ensure that the delineation work is completed within the time frame.

C.S.RAO
PRINCIPAL SECRETARY TO GOVERNMENT.

To
The Engineer-in-Chief,(IW)Erramanzil, Hyderabad.
The Commissioner, CAD, Hyderabad.
All Chief Engineers of Irrgn & CAD Dept.
All District Collectors of the District concerned.
All Supervisor Officers concerned.
All the Consultants of the Irrgn. & CAD Dept.
The Finance & Planning (FW)Dept.
The Accountant General, A.P.Hyd.
The Pay and Accounts Officer, Hyderabad.
The Deputy Pay & Accounts Officer, Hyd.
The Director of Treasuries & Accounts,Hyderabad.
All the District Treasury Officers.

Copy to:-
P.S to Minister, Major & Medium Irrigation.
It Secy to CM

P.S.to Principal Secretary,Fin.&Plg.(W&P)Dept.
P.S. to Principal Secretary,Irrgn.& CAD Dept.
P.S. to Secretary (Irrigation)
P.S. to Secretary (Projects)
Chairman of CADA boards
P.A. to Jt.Secy.(CAD).

FORWARDED BY ORDER

SECTION OFFICER

CADA COUNCIL AT THE STATE LEVEL.

As per the revised instructions of the government of India, the *CADA Council at the state level* will be responsible for the various developmental activities in the command in the entire state. the decisions taken by the council shall be implemented without further examination. the Council shall meet twice in a year or as and when necessary.

	CADA COUNCIL AT STATE LEVEL AS ON DATE	
1	Chief Minister --	Chairman
2.	Minister (Fin) --	Member
3.	Minster (Agri) --	Do
4.	Minister (Med. Irrgn. & Drainage)	Do
5	Minister (Rev)	Do
6	Minister (Co-opera.)	Do
7	Minister (PR)	Do
8	Minister (PWD R&B)	Do
9	Minister (Min. Irrgn)	Do
10	Minister (Excise & Agro Ind Corpn)	Do
11	Minister (Marketing)	Do
12	Minister (Fisheries)	Do
	Minister (Animal Husbandry Dairy	Do
14	Chief Secretary to Govt.	Do
15	Member , Board of Rev (Incharge of Ayacut Development)	Do
16	Second Secretary to Govt & Agrl Production ction Commr.)	Do Commr.
17	Member, Board of Rev (Incharge of irrign)	Do
18	Secretary, (F&RD)	
19	Secretary , Fin & Plng Dept.	Do
20	Secretary (PR)	Do
21	Secretary (Rev)	Do
22	Secretary (F&A) Dept	Do
23	Secretary (PWD & Projects Wing)	Do
24	Secretary (CAD)	Member Secretary.

	CADA COUNCIL AT STATE LEVEL AS PROPOSED BY GOVT. OF INDIA.	
1.	Minister-in-Charge CAD Programme	chairman.
2.	Prl Secy./Secy CAD	Member
3.	Commissioner CAD	"
4.	Commissioner Agriculture	"
5.	Registrar of Co-op Societies	"
6.	C.E., (R&B) Ayacut Roads	"
7	M.Ps in the Command	"
8	MLAs in the Command	"
9	Farmers' representatives	"
10	Dir of Animal Husbandry, Mar.	"
11	Commissioner , Fisheries	"
12	Vice Chancellor, APAU	"
13	Dir. General WALAMTARI	"
14.	Active N.G.O's in the Command.	"

COMMAND AREA DEVELOPMENT BOARD

(AT THE COMMAND LEVEL).

There shall be a Command Area Development Board assisted by an executive committee at each command. The Board should be constituted by legislation. Chairman of the Board should be the Minister-in-charge of CAD Programme. The farmers' representatives should be elected by Farmers' Associations/Societies. Till all the Farmers' Associations/Societies are formed, the representatives should be nominated by the State Government. Care should be taken that head, middle and tail reaches get proper representation.

DUTIES OF CADA

1. *Conversion into CAD Board with more than 50 per cent participation of farmers, non-officials and academicians. Necessary legislation has to be passed*
   Assuming responsibility for formation of Farmers Associations.
2. *Disbursement of fund to Farmers Associations as received from State and Union Governments*
3. *Providing technical assistance to Farmers Associations.*
4. *Maintenance of the accounts.*
5. *Maintenance of register of all agreements entered into between ID and Farmers Associations*
6. *Training of farmers to form Associations/Societies.*
7. *Giving utilisation certificate of grants received from Uunion/State Government.*

CAD AUTHORITY AS EXISTING

1.	**A Minister to be nominated by the CM**	**Chairman.**
2.	Agriculture Prodn. Commissioner	Vice chairman
3.	All M.P's, M.L.A's in Command	Members
4.	Chairman Z.P.	"
5.	Secretary to Govt. CAD	"
6.	Director Agriculture	"
7.	Registrar of Coop Societies	"
8	Chief Engineer Project Concerned	
9.	Collectors of the Concerned District.	"
10.	Director of Animal Husbandry	"
11.	Director of Fisheries	"
12.	Director Marketing.	"
13.	MD, Agro Industries Corpn.	"
14.	MD, APCOB	"
15.	Rep of GOI Min Of Agrl.	"
16	Special Invitees.	"
17	Administrator of the project CAD Authority	

CAD AUTHORITY AS PROPOSED.

1.	**Minister - in - Charge of CAD programme**	**Chairman.**
2.	Members of Parliament in command	Member.
3.	Members of Legislative Assembly	"
4.	Elected Heads of P.R. institutions	"
5	Representatives of Farmers in Head, Middle & Tail end	"
6	Repr. of Govt. of India	"
7	N.G.O's in the command	"
8.	Officials of Agriculture, Co-operation Animal Husbandry, Ayacut Rds, Fisheries , Horticulture at Dt Level	"
9	Administrator - cum - Chief Engnr	"
10.	Collectors of concerned Districts	

.....contd.

FUNCTIONS OF THE CADA BOARD.

The CAD board will supplant the existing CADA Authorities in the state. The functions of the board shall be as follows:

1.To Lay down policy guidelines for the implementation of CAD programme.

2.To disburse the central assistance and the State Governments Share to Farmers Association/Societies.

3. To provide technical assistance and guidance to the Farmers' Associations/Societies.

4. To co-ordinate the activities of different departments involved in the implementation of CAD Programme.

5. To maintain the accounts of amounts disbursed and to give utilisation certificate to the State Governments and the Union Government.

6. To monitor the work of Farmers' Associations/Societies.

7. To develop ground water to supplement surface irrigation.

8. To help the Farmers' Associations/Societies in selection and introduction of suitable cropping pattern.

9. Carry out soil survey and prepare Geographical Information System.

10.To develop marketing and processing facilities and communications.

11.To organise annual agricultural fairs, seminars and workshops and exhibitions etc. to motivates the farmers.

12. To carryout assessment and reclamation of waterlogged areas.

13. To act as a catalyst for formation of Farmers' Associations/Societies.

EXECUTIVE COMMITTEE

(AT THE PROJECT LEVEL)

Vide G.O.Ms No 10 CADA Dept Dt 2-11-1974 , Government have constituted the CAD Authorities and the Project Working committee. Each CAD Authority shall an executive Agency called he Project working committee which shall be responsible for the detailed working of the programmes in the project areas and shall lay down all the details and decide matters according to the general directions of the Government and CAD Authority Board.

As per the Govt. Of India Guidelines the CADA Board shall have an Executive Committee to take important decisions as suggested in the D.O. letters of Ministry of Water Resources.

- *Chief Executive of the board will be appointed by the State Govt.*
- *there should be an executive committee from out of the Board to take important administrative decisions.*
- *The life of the Executive would be Five Years.*
  At least 60 % of the members of the Board and the executive Committee should be non officials.

PROJECT WORKING COMMITTEE

Secretary, CAD & Addl. Agrl. Production Secretary, **Chairman**

Commissioner, CAD and Additional Administrator of the Concerned Project CAD Authority. **Members**

The **Chief Engineer of the concerned. Project.**

The **Collectors of the Districts** concerned. **Members**

The Dy. Agriculture Production Commr and **Sr. Field Level Officers** of Irrgn/Agriculture/Co-operation /P.R/Animal Husbandry /Fisheries /S.>S>&L.
Marketing /Warehousing /Rural Roads and other concerned depts.
Representatives of the Executive and Financing Agencies such as Agro Industries Corporation/A.P. Co-op Central Land Mortgage Bank/State

EXECUTIVE COMMITTEE AS PROPOSED

1) **Chief Executive who shall be Administrator-cum-Chief Engineer of the command.**

2) **Officials of Irrigation, Agriculture, Co-operation , Animal Husbandry, Fisheries Horticulture, R&B, Ayacut Roads** representing the Districts in the Command.

3) **Presidents of Farmers' Associations** at Minor level/Distributor level at the rate of two from Head reach, Middle reach and tail reach.

The life of the Committee would be five years with 60% representations to non officials.

FARMERS ASSOCIATIONS.

One of the major causes for the inefficient management of water resources is that there is very little or no involvement of farmers in the management of the irrigation system. As a result the supply of water to farmers is often unreliable , at variance with their needs, inequities unsustainable and inefficient.

The situation is sought to be remedied substantially if farmers are actively involved in the management of the irrigation system. the Ministry of Water Resources had urged the state governments to set up farmers associations and issued guidelines as early as 1987.

Government of India have now decided to channel the plan allocations for CAD Programme directly through the CAD Boards to the Farmers Associations to make them responsive and accountable. In Andhra Pradesh a number of Farmers Associations (Pipe Committees) were formed in 1980's. However there has been slackening of pace in the 1990's. Moreover , Some of the committees formed earlier have now become defunct. therefore the GOI have felt that there is a need to form Farmers Associations in the State.

In His Letter, Minister of Water Resources , has conveyed that hereafter the Union Government and the State Government should release funds to be utilised by Farmers Associations directly by the CAD Boards. He has also requested that the State Government should immediately initiate steps to constitute Farmers Associations, CAD Boards and CAD Council.

The ***Various Steps involved in the formation of the Farmers Associations*** is listed below:

1. Identify the Hydraulic Unit for which the FA is to be formed(Outlet, Minor, Branch). *It could be preferably be the minor, because of homogeneity and financial viability.*

2. Motivate the farmer in order to, *decide who should be Incharge of this crucial work & involve NGO's and WALMI's.*

3. Reach Agreement among a minimum of fifty-one percent of land holders of land in the command for formation of FA.

4. Decide the Act under which to register the Association/Society(*Co-operative/ Registn of Societies Act/Companies Act.)*

5. Draft bye-laws of Association. Bye-laws should be in accordance with the objective of Participatory Irrigation Management.

6. Undertake Joint Inspection of the system by FA's, Irrigation Department and CADA

contd.....

DUTIES RESPONSIBILITIES AND RIGHTS OF FARMERS ASSOCIATIONS.

1. *Establishment and updating register of members.*
2. *Preparation of Cropping Plan at the beginning of irrigation season.*
3. *Receiving water in bulk on volumetric basis from ID*
4. *Payment of water fees to ID*
5. *Delivering water to the registered members.*
6. *Arranging supply of water to non-members at differential rate.*
7. *Taking the execution of OFD Works and maintenance of accounts and submission of accounts to CADA Boards regularly.*
8. *Operation and maintenance of the infrastructure transferred to them.*
9. *Maintenance of water accounts.*
10. *Recovering of water rates.*
11. *Educating farmers in applying new technology.*

In this connection it may be stated that there has a significant impact in the pilot project is SRSP for the formation of the Farmers Association. There is now a need for extending in all the entire Project especially in the context of completion of works in Warangal District.

COMMAND AREA DEVELOPMENT PROGRAMME.

The command Area Development Programme was started in 1972 solely with the aim of a systematic development of the command areas by making provision for field channels, equitable distribution of water to farmers, land levelling and shaping, field drains along with scientific crop planning, streamlining of supply of other inputs like high yielding variety seeds, fertilisers, herbicides including short term credit, extension service support and other infrastructures like roads, market, storage etc.

the components of the Command Area Development Programme are as follows:

1. **On Farm Development.**
   a. *Development of field channels and field drains within the command of each outlet.*
   b. *Land levelling, on an outlet command basis.*
   c. *Realignment of field boundaries, wherever necessary.*
   d. *Enforcement of a proper system of warabandi and fair distribution of water to individual fields.*
   e. *Supply of all input and services, including credit and*
   f. *Strengthening of extension services.*

2. **Selection and introduction of suitable cropping patterns.**
3. **Development of ground water to supplement cropping patterns.**
4. **Development and maintenance of the main and intermedeate drainage system(irrigation sector).**
5. **Modernisation, maintenance and efficient operation of the irrigation system upto the outlet of one cusec capacity(irrigation sector).**

The **financing of the CAD activities** comes from the following three sources namely:

i) *State Outlays.*
ii) ***Central Assistance on matching basis for certain identified activities.(detailed in Annexure).***
iii) *Institutional finance.*

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

BYE-LAWS OF FARMERS ORGANIZATIONS - (A MODEL)

1. Name of the Organization:

2. Headquarters:

3. Date of Formation:

4. Jurisdiction--All the area under the command of the operational unit.

5. Formation of Farmers' Organization:

   a. All the farmers within the command of the operational unit will be eligible to become members.

   b. A member will have only one vote.

   c. All members will be members of General Body of the Farmers Organization.

   d. In the first General Body Meeting, Executive Body (EB) consisting of a President, a Secretary, and members will be elected. The number of members, the pattern of representation for the entire command area and details of functioning of EB will be decided by the general body.

   e. The EB will issue a letter of intent to the Executive Engineer, regarding the formation and plan of function, and work.

   f. The General Body will determine the amount of share capital, to be collected from each member. It will also decide upon the pattern of collection of share capital.

   g. The EB will open a Bank Account.

   h. At least 51% of the farmers in terms of numbers and land holdings in the command should be enrolled as members before registration.

   i. Chak level or Outlet Committee (OC) shall be formed by the farmers within the chak. A chak level committee shall consist of three members including one leader. These will collaborate with EB in the water distribution.

   j. For amending the by-laws, there should be at least a two-thirds majority.

   k. In the first General Body Meeting after registration, the members of the Executive Body will be elected. The Executive Body will consist of all the chak level leaders.

l. Executive Body will elect the office bearers of the council such as Chairman, Vice Chairman, Secretary, and Treasurer. The General Body will authorize the Executive Body to sign the Memorandum of understanding with CADA.

6. The Objectives of the Farmers' Organizations (FO)

a. To obtain agreed quantity of water in the system prepare O&M plan for the supply of water and monitoring the same.

b. To introduce a schedule of water supply among outlets for equitable distribution of water proportionate to the area.

c. To settle the irrigation disputes of the farmers.

d. To organize maintenance and repairs of the distributor, to ensure full supply of water to distributaries and channels.

e. To help the farmers to adopt modern crop techniques for increasing the yield.

f. To educate and guide the farmers for economic and efficient use of available water.

g. To make suggestions regarding operation plan of the scheme to the CADA.

h. To tap other sources of water within the command and distribute it among farmers on a cost-sharing basis.

i. Any other item as considered necessary for promoting the functioning of FO.

j. To maintain the accounts of the management cost and O&M costs separately and get them audited every year by the Chartered Accountant appointed by the Executive Body of the council.

k. To prepare Annual Report on the water received and water utilized area irrigated under different crops.

l. To take appropriate action for misbehavior or any offenses in respect of any member (farmer) in water distribution.

7. Farmers' Organization Business

a. The financial year for the FO shall be from April 1 to March 31 of the next year.

b. The General Body will have two meetings every year before starting crop season.

c. The Executive Body shall meet at least once in a month. They can have more meetings whenever required.

d. The tenure of office bearers shall be three years and thereafter, a fresh election will take place.

f. Collect the share capital as decided by the General Body and to deposit the amount in the bank.

g. The Executive Body will decide about immediate maintenance and repairs of the minor/distributary, field channels and repairs to structures which will fall under the area of the organization. This shall be carried out from the amount collected from the members and/or the interest on the share capital amount deposited in the bank.

h. It shall deal with all matters, to further the cause of improving the performance of the irrigation system under its charge and helping in sharing the water resources by all equitably.

i. It will be eligible to receive grants from the Government.

j. The Executive Body may appoint staff to conduct various activities. Their terms and conditions shall be decided by the Executive Body/General Body.

k. If there be any legal disputes , the Chairman will handle such cases on behalf of the Farmers Organizations.

l. For conducting the general Body Meeting a quorum of 33 1/3% of members shall be necessary. If such quorum is lacking the meeting will be postponed for some time. Even if on postponed time, the quorum is not obtained, meeting shall be conducted by the members present.

The resolution should be passed in the General Body Meeting as per the majority (51%) of the members present. Voting should be conducted to pass the resolution. In case of an equal vote being polled, for or against the particular resolution, the Chairman shall exercise his casting vote.

m. The FO may diversify its activities to increasing crop production and thereby increasing the benefits to its members.

n. The FO will cooperate with the Distributary Committee and the CAD Board at the project level.

Some of the important rights and duties proposed for the Farmers Organization are listed below:

Rights:

i. Right to have the prescribed/agreed quantity of water made available at the point, below which the farmers organization is to function.

ii. Right to have complete information on the availability of water in the system.

iii. Right to get the agreed supply at the agreed time and for the agreed period.

iv. Right to enter with the irrigation department a MOU (at the head) inter alia specified quantity of water.

v. Right to manage the system and oversee the maintenance and other operation.

vi. Right to fix up priorities in the maintenance work in the system and oversee its utilization.

Duties:

i. Proper maintenance of the system.

ii. Develop an operation plan for equitable distribution of water.

iii. Ensure the farmers to adhere to the water distribution schedule.

iv. Prevention of damage to the structures.

v. Prevention of unauthorized tapping of water.

vi. Take prompt action to punish the erring farmer.

vii. Collect operation and maintenance charges from farmers.

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

MEMORANDUM OF UNDERSTANDING (MOU) - (A MODEL)

1. Draft of Agreement to be executed between (1) the Chairman on behalf of the _____Farmers' Organization of Distributary/Minor_____taking off from_____left/right canal of_____Project in_____Mandal_____Division of the ID on behalf of the Government of Andhra Pradesh on the other side.

Objective:

2. The objective of this MOU is to provide a written agreement between the Farmers' Organization and the ID on the activities, rights and responsibilities of the two organizations during the phase of joint management and turnover of the irrigation system below the distributary, to ensure farmers participation in water management, with a right to get the agreed quantity of water, so as to optimize the use of available water and raise agricultural productivity in the command.

Definitions:

3. The FO refers to the association of farmers as defined in the by-laws of the FO. Apex refers to the federation of all the FO in the command of the scheme. The ID refers to the I & CAD Department of the Government of Andhra Pradesh. Joint Management refers to Operation and Maintenance (O&M) carried out jointly by the FO and the ID. Turnover defines the point in time when the FO assumes full responsibility for the O&M of the distributary and system below.

Part I: Joint Management

4. The Joint Management phase will begin when (1) the FO has been formed, thereby implying that informal sluice committees are in place; (2) Office bearers of the FO have been elected.

5. The Joint Management phase will include close collaboration between the ID and the FO through information exchange and transfer of skills.

6. The ID will prepare an operation plan for the entire scheme showing the water availability, allocation made for irrigation, drinking water, industrial and other uses. The ID will also prepare the method of distributing water to various distributaries, i.e., opening/closing of canal and ON/OFF periods for all the distributaries and for the distributary of the concerned FO. The FO will prepare the operation plan for the distributary or the minor under its jurisdiction. The respective operation plans will be discussed and modified as required.

7. The office bearers of the FO, its representatives or staff will accompany the ID staff during the operation of the gate and head regulator observing the reading gauges, accounting for water, working out actual duty and depth of water.

8. The ID will conduct hydraulic tests of the distributary or minor to check the capacities at different points with the design. Similarly, tests for measurements of actual seepage losses will be carried out by the inflow-outflow method. The methodology involved in such tests will be explained by the ID to the FO.

9. The FO will identify any shortage in fall of levels in water supply and communicate to the ID for follow-up action immediately.

10. A measuring device like automatic stage level recorder or any other device will be provided downstream of the head regulator of the distributary or minor for record of water flows.

11. The distributary will be jointly inspected by the ID and FO before the season to identify the status of maintenance and to list items. Silt removal and weed clearance repairs to earth work, raising of bund, and repair to structure will be included in this. The ID will prepare an estimate of such works and discuss the list and related funding needs with the FO. The FO may suggest items to be added. The FO will indicate its contributions of work particularly silt clearance and weed removal. Contributions can in cash or kind, ID will do the other.

12. Rights and Responsibilities: ID will reserve the right to operate the headworks and the main system while jointly managing the distributary/minor with the FO. Ownership of the system and related works will vest with the Government. Normally, water supply to the distributary/minor will be in accordance will be in accordance with the distributary operation plan prepared, discussed, and agreed to by the ID and the FO. However, supplies may be increased or reduced in proportion to its share in case of short supply of water in the system. To carry out its responsibilities, the ID will deploy necessary field staff. The ID will share with the FO relevant data in respect of designs/actual capabilities and discharge; water levels at different sluices; water allocation; design details of APMS/OFMs where applicable; seepage and operation losses. The ID will also maintain the main canal, branches and distributaries to ensure designed discharge at the head regulator. It will undertake repairs arising due to natural calamities such as earthquake, heavy rains or other unforeseen events. The ID authorizes the FO to take/initiate penal action against any member/non-member within the jurisdiction of the FO for misbehavior/offenses in water distribution and protection of the structures.

13. The FO will be responsible for equitable distribution of water among the outlets. In the joint management phase, the FO will prepare itself for taking over the O&M responsibilities at the distributary level. To this end, it will collect all relevant data, prepare and implement O&M plans together with the ID and ensure collection of adequate service charges for maintenance. It will also demonstrate capacity to conduct the affairs of the FO in an organized and satisfactory manner with full attention to records and accounts.

14. Upon satisfactory completion of the joint management phase (normally for six months), the ID and the FO representatives will sign at the place provided at the end of this document to demonstrate their willingness, to proceed to the turnover.

Part - III: Handing Over

15. The management of the distributary and systems below it will be handed over by the ID and taken over by the FO as per the procedures laid down.

16. The ID will prepare an inventory of the works showing length of lined and unlined sections, structures, crossing, sluices, outlets and lands acquired for the same.

17. The works will be jointly inspected by the ID and FO to identify deficiencies, omissions, substandard or incomplete works.

18. On completion of these works, the ID will organize hydraulic testing of the distributary to ensure that the designed discharge can pass to the tail outlet. The ID will prepare a statement showing the capacity of the distributary or minor at different sluice off-takes and the designed and actual water depths.

19. The ID will also prepare complete records of all the works; the land plans; gauge discharge curves; and a map showing the command of the distributary or minor and of the sluice in the command.

20. As part of the turnover, the ID will hand over system management along with the documents mentioned above to the FO. The ID and the FO will indicate the turnover has occurred by signing this document at the appropriate place.

21. Rights and Responsibilities. The ID will operate the head regulator of the distributary or minor. It can suggest improvements for O&M below this. The ID also has the right to inspect the position of water supplies, irrigation works in the command, structures under the jurisdiction of the FO to verify whether the Agreement is implemented satisfactorily. The right of ownership of the distributary or minor including all structures, land acquired by the Government and all other works executed in the FO area remains with the Government.

22. The FO will assume entire responsibility for O&M from the data of turnover. The maintenance and repairs shall include: weed removal; silt removal; earthwork to restore banks; repairs to lining; painting, plastering; replacing damaged portions; repairs to masonry and other structures; oiling and painting of gates and shutters where needed. The FO shall protect the distributary and masonry and other structures thereon from any damage. The FO will also undertake/suggest measures for improved water management at the level of the distributary. It will also organize better improved water management methods at the farm level. It can ask for and obtain from the ID, information on planned O&M activities in the entire system including at the concerned distributary. It can utilize lands acquired for the distributary for growing trees, fodder and timber or for beautification and utilize the products of such works for FO's general welfare with due care for the protection of assets and the environment. The FO will notify ID promptly if there is any damage due to unforeseen natural calamities like earthquake, heavy rains, etc.

23. Disputes. All disputes in respect of various provisions made under this agreement will be resolved by a committee comprising one nominee from the FO and the Executive Engineer. If the FO violates any of the provisions contained in the MOU with regard to water management or maintenance, the Executive Engineer will issue notice to the FO to take corrective action within a specified period. In case no improvement is made by the FO, the Executive Engineer may decide to take back the management and maintenance responsibilities from the FO.

GOVERNMENT OF ANDHRA PRADESH
ABSTRACT

Sriramasagar Project - Water management policies for equitable and optimum Utilization of Water by introducing Rotational Water Supply - formation of Water Users Associations - Orders - ISSUED.

==========

IRRIGATION & CAD (PW-SRSP.I) DEPARTMENT

G.O.MS.NO. Dated: 1996.

Read the following:-

1. G.O.Ms.No.37, Irrigation & CAD Department, dt.28.02.1991.
2. G.O.Ms.No.101, Irrigation & CAD Department, dt.19.07.1995.
3. G.O.Ms.No.105, Irrigation & CAD Department, dt.21.07.1995.

* * * * *

O R D E R

Sriramasagar Project (SRSP) was originally conceived and constructed for developing backward Telangana area. In SRSP one third area in the command was planned for paddy (wet) during Kharif and about two thirds area for ID during Rabi. This has led to unequal allocation and haphazard distribution of canal waters.

During operation of the system in the last two decades, the farmers particularly in head reaches of the distributories and minors drew continuous water supply and grew wet crops in areas localized for ID depriving the tail enders of their legitimate share of water. Consequently even though irrigation potential created in SRSP is 2.5 lakh ha in Stage-I, the area actually irrigated is reported to be 1.2 to 1.3 lakh ha i.e. only about 50 per cent of potential created. It is also reported that full quantum of water meant to serve the entire ayacut is drawn from the system although the area utilizing water is only one third of the total command of 3.92 lakh ha under Stage-I. The problem of non-availability of water would be much more accute when additional ayacut of 2.56 lakh ha of Stage-II of the project is to be served.

To remedy the situation Government of Andhra Pradesh while implementing Second AP Irrigation Project comprising Sriramasagar Right Bank Canal and Sriramsagar Sub-Projects

with World Bank assistance, decided to regulate water supplies to meet only ID requirements and issued orders in G.O.Ms.No.37 Irrigation & Command Area Development (Projects wing: SRSP.I) Department dated 28.02.1991. The following is stipulated in the order:

i. Water release to an extent of 62,000 ha. of existing irrigated wet areas, in the reach from Km.0/0 to Km.146 above LMD should be on rotational water supply system to meet the requirement of ID crops only. Government have no objection to the farmers raising wet crops by supplementation of water supply from their own resources like wells etc. or restricting their wet crops areas in accordance with the quantities of water made available to them on ID pattern of Rotational Water Supply

ii. Accorded permission for rephasing the conversion of the IW areas above LMD to ID pattern by June 1992 to June 1994, keeping in view the programme for remodelling of distributory system under the different packages

iii. District Collectors of Nizamabad and Karimnagar were directed to publish necessary notification restricting the water releases from Kakatiya Canal above LMD i.e., from Km.0/0 to Km.146 on ID pattern in phased manner

iv. The District Collectors were also directed for relocalizing irrigated wet areas below LMD i.e. Km.146.00 to Km.234.00 as irrigated dry areas in accordance with the provisions of the project report for revised stage.I of Sriramasagar Project, in terms of clauses 24 to 26 of AP Irrigation & CAD Act 1984 and rules made thereunder.

2. An operation and maintenance plan was also developed through the assistance of a consultancy group, for regulating the water supplies to meet ID requirement. However, the process of regulation of water to meet the ID crop demands could not be fully achieved, as the required modification in the system to

regulate flow could not be done as required GOAP posed third AP Irrigation Project to World Bank for financial assistance to complete the spill over and other works of second AP Irrigation Project so as to achieve the objectives of water regulation as originally contemplated.

3. To strengthen the process of rehabilitation of SRSP system for proper water regulation and to provide ID irrigation in the entire command, and as part of the process for approval of the Third AP Irrigation Project, Government of AP decided to do the following:

i. Public consultation regarding GOAPs Water Management policy

ii. The acceptability of SRSP Water and Canal Management Policy for equitable and optimum utilization of water in the entire command of SRSP.

iii. Preparing farmers for acceptance of canal closure schedule for rehabilitation during Project Implementation. This is to be confirmed through resolution of farmers bodies and local irrigation bodies

iv. Issue of the GO containing the delocalization schedule for all areas above and below LMD in Sriramasagar Project.

4. In pursuance of the above the Commissioner, CAD initiated the public consultation programmes on Third AP Irrigation Project and have successfully conducted workshops of farmers in the command area, in different reaches in the Sriramasagar Project Command at Warangal, Huzurabad, Peddapally, Metpally and at the CADA Board Meeting held at Jagtial.

Government of AP also appointed a consultant to have a detailed consultations with farmers along with district administration to elaborate on the proposed programme to obtain the approval of farmers.

Government of AP decided to promote participatory irrigation management through formation of water user's associations on well delineated hydraulic unit, for self management and sanctioned a pilot project for promotion of WUAs.

Government, on pilot basis have engaged two NGOs viz., IRDAS and SONAR to motivate the farmers in establishing water users association in 16,000 Ha., covering six distributories of Sriramasagar Project vide G.O.Ms.No.316, Irrigation & CAD Department, dated 03.12.1994.

5. Government after careful examination of the out come of public consultation and experience gained so far decided to implement the following Water Management Policy in Sriramasagar Project Command to achieve the objectives stipulated.

i. The District Collectors Nizamabad, Adilabad and Karimanagar have already published notifications relocalizing the wet areas of Kakatiya Canal above LMD into ID. To relocalize the wet areas under Kakatiya Canal below LMD from Km.146.00 to Km.234.00 into ID, the District Collects, Karimnagar and Warangal shall issue notification

ii. The policy of State Government shall be to allocate a uniform quantity of water to all localized lands both in Kharif and Rabi season based on the overall allocation of water under the project. This allocation will be essentially to provide intermittent irrigation regardless of previous irrigation practices and permit the farmers to grow crops of their choice with the water allocated, supplementing it if necessary, by ground water and by improved technology at their initiative. During drought years, water available would be shared equitably by all farmers in proportion to the lands owned by them

iii. To ensure equitable distribution of water to entire command area, rotational water supply system comprising of a canal roaster up to out let level and warabandi system below out let shall be implemented

iv. Government have as a policy decided to encourage farmers of Sriramasagar Project to form into water users association to operate and manage irrigation system in their respective areas. It has been proposed to hand over the system below the distributory level taking into consideration the viabilities for management and hydraulic boundaries of the system. Part of the money collected towards water tax would be transferred to these associations for the management of the system. A consultant has been specially appointed to assist in this activity

v. Government decided to extend the formation of water users associations in other project of AP and has appointed separate consultant to develop a programme for promoting WUA for improving water distribution and regulation

vi. Modernization of the system is programmed to be taken up from 1996-97 onwards (annexure - 1, schedule for modernization). The main canal and major distributories shall be closed for a minimum period of 3 months i.e., from March 15th to June 15th to facilitate construction activities

vii. An amount of Rs.21.76 crores has been sanctioned vide G.O.Ms.No.105, Irrigation & CAD Department, dated 21.07.1995 for deferred and emergent O&M works of the canal system during the project period as enhancement of O&M Budget

viii When package works are taken up in distributories/minors RABI holidays shall be declared in such areas

ix. During kharif the entire area, in the command shall be supplied with water from 16th June or from a later date depending upon the reservoir position, and would be supplied based on the availability in the reservoir and on equity principle

x. The water supply in kharif and rabi shall be on ID pattern irrespective of the crops grown.

xi. The detailed procedure for rotation water supply shall be decided by the project level committee in consultation with WUA. During RABI, area of cultivation shall be based on the availability of water in the reservoir at the end of kharif.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

PRINCIPAL SECRETARY TO GOVERNMENT.

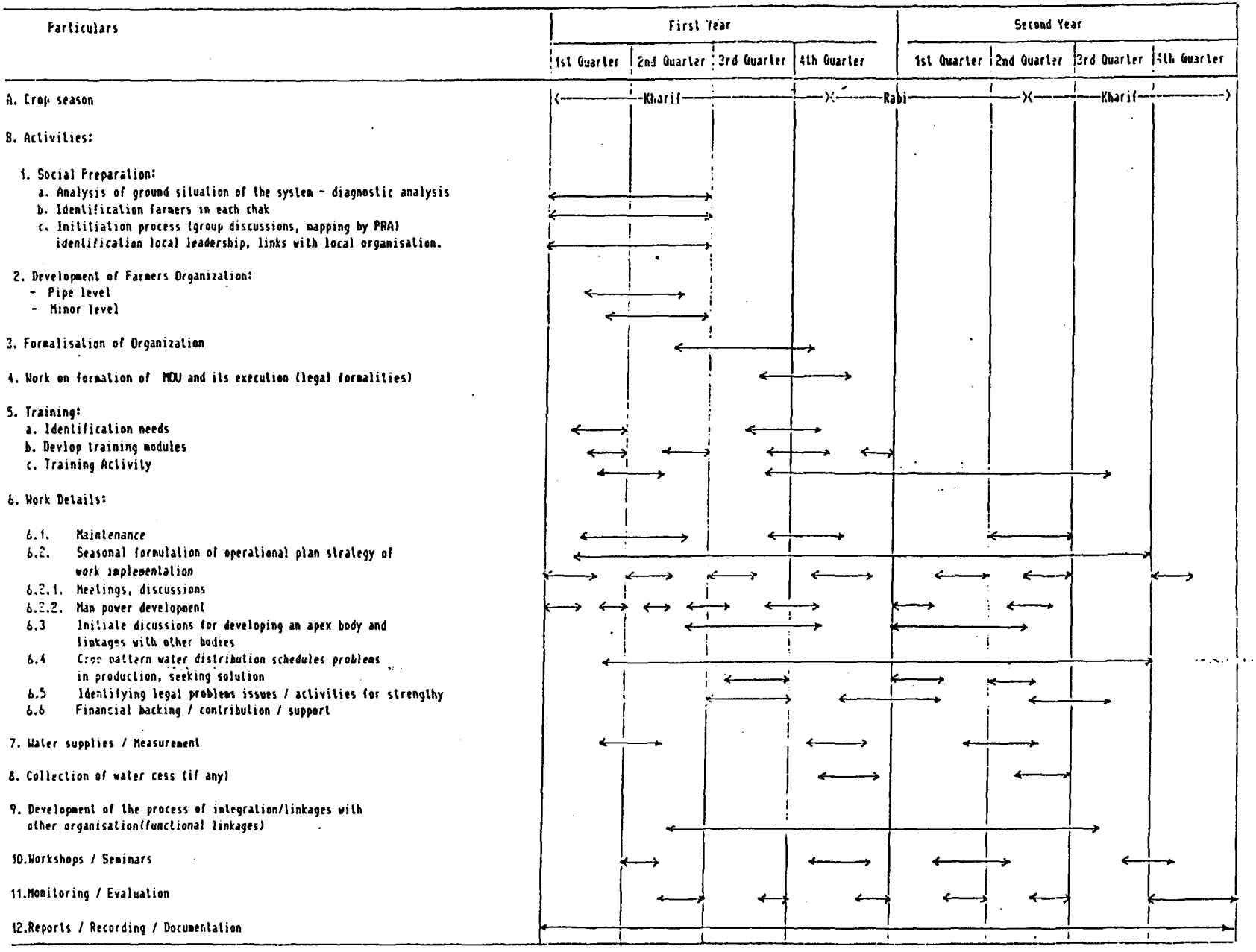
To

The Chief Engineer, Sriramasagar Project, Hyderabad.
The Commissioner, CAD, Himayatnagar, Hyderabad.
The Administrator-cum-Chief Engineer, Sriramasagar Project, CAD, Jagtial, Karimnagar District.
The Collector, Nizamabad.
The Collector, Karimnagar.
The Collector, Warangal.

Srirangam - Kakatiya Canal
Year-wise Programme of Rehabilitation
(Improvement to existing channel system)

Year	Name of Distributory	Ayacut (in ha.)
1996-97 (Target: 50,000 ha.)	D/51 and D/61	3147
	D/61 1153 D/64 5760 D/63 2963	
	D/89 and D/90 281	3770
	D/6 to D/29	10800
	D/30 to D/61 except D/51, D/53, D/54 and D/61	6800
	D/62 to D/81 except D/63 and D/64	4545
	D/63-A	5000
	Total:	50911
1997-98 (Target: 50,000 ha.)	Part of D/53 and excluding D/63	8430
	D/53 (part)	8800
	D/53 (part)	8650
	D/63-A (excl. D/63-A)	5700
	D/84 to D/94 excl. D/86, D/89 and D/90	5340
	DBM.6	10600
	DBM.7	3328
	Total:	50756
1998-99 (Target: 60,000 ha.)	D/86	2350
	D/86	7900
	D/86	12200
	D/86	11200
	DBM.31	21800
	DBM.28	3600
	DBM.22	591
	Total:	59641
1999-2000 (Target: 60,000 ha.)	D/83	49817
	DBM.15	5451
	DBM.20	4365
	Total:	59623
2000-2001 (Target: 36,800 ha.)	DBM.73 to DBM.30 excl. DBM.15, 20, 22 and 28	40000

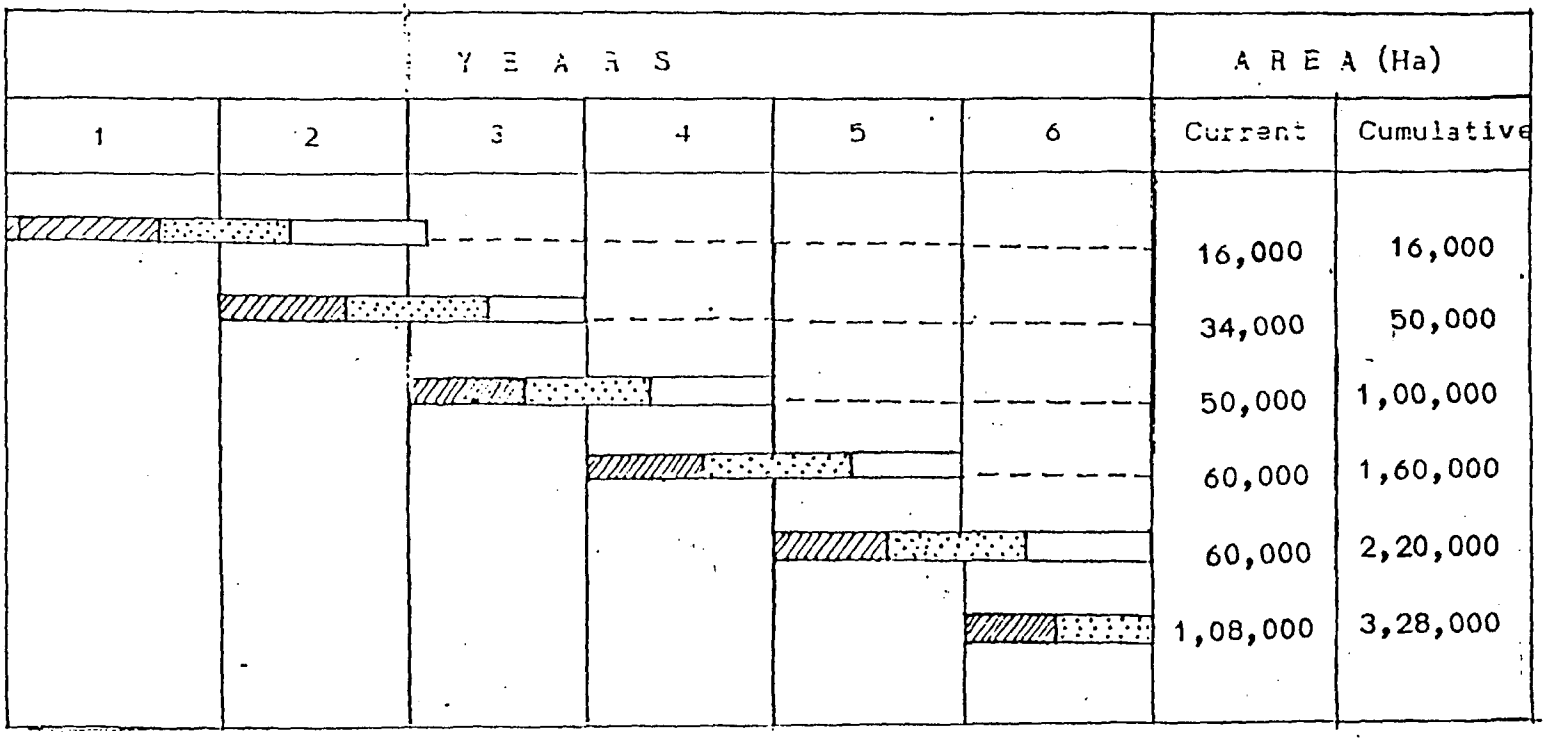
PROGRAMME OF WORK - WATER USERS ASSOCIATION



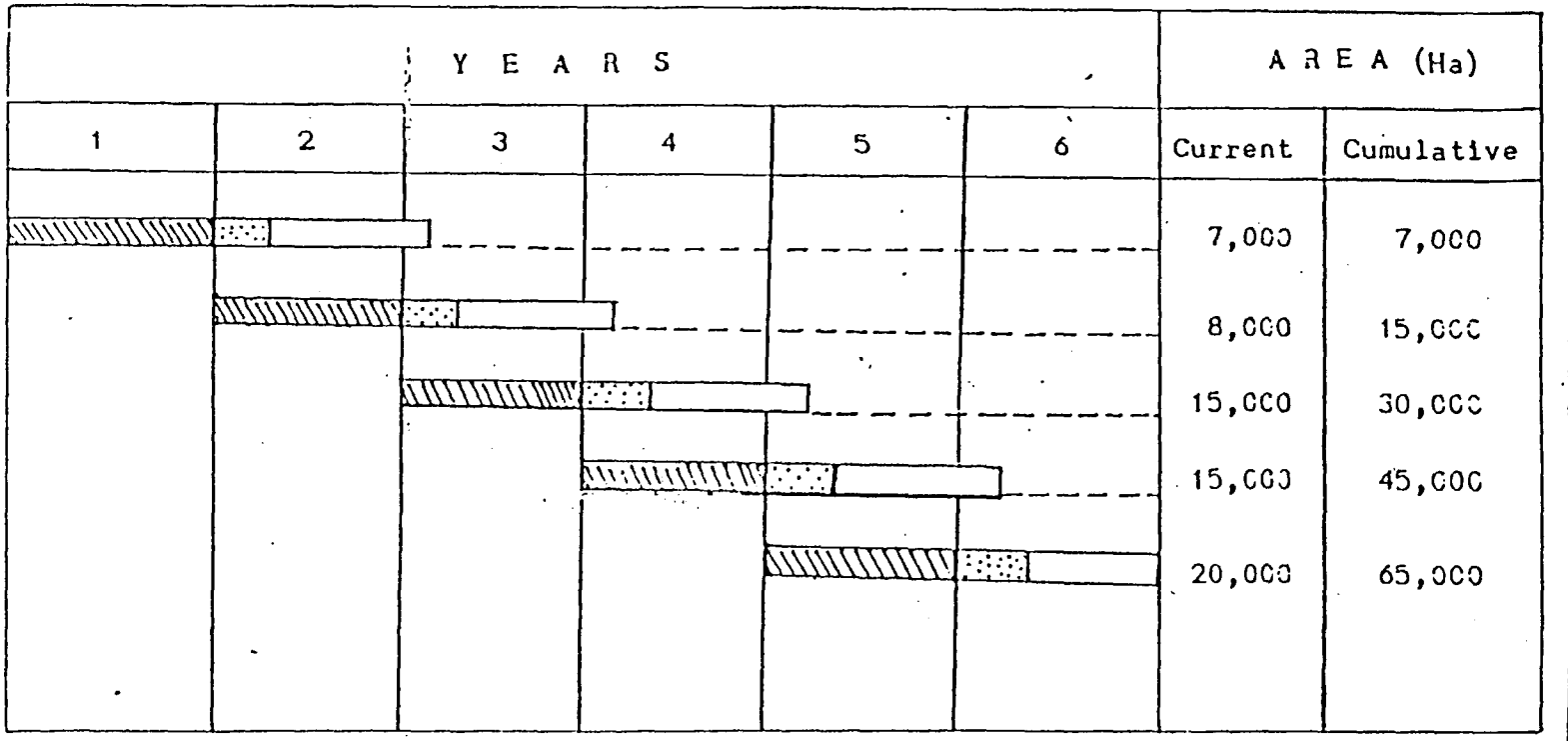
TENTATIVE PROGRAM OFSRSP WATER USER ASSOCIATION FORMATION (Ha.)

Contract Package No.	Total Area of Package	Annual Implementation					
		1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
L6-14	21,000	5,000	3,000	5,000	6,000	2,000	
N4-11/A	16,500			3,000	3,000	4,000	6,500
N4-11/B	11,000	1,000	1,000	1,500	2,000	2,800	2,700
N4-11/C	9,900	4,000	1,000	1,000	2,000	1,900	
N4-12/A	11,400	3,000	1,000	2,000	2,000	2,000	1,400
N4-12/B	8,800		1,000	1,000	1,500	2,000	3,300
N4-12/C	6,800		1,000	1,000	1,000	1,500	2,300
L6-13/A	8,700		1,000	2,000	2,000	2,000	1,700
L6-13/B	11,700		1,000	2,000	3,000	3,000	2,700
L6-15/A	7,300		1,000	1,500	1,500	1,500	1,800
L6-15/B	8,800		500	1,500	2,000	2,000	2,800
L1-16/A	11,800	2,400	500	1,500	2,000	2,000	3,400
L1-16/B	7,900		500	1,000	1,500	1,500	3,400
L1-17/A	12,200		500	1,500	2,500	2,500	5,200
L1-17/B	11,200		500	1,500	2,500	2,500	4,200
J4-02	51,500		500	3,000	4,000	5,000	39,000
C5-03	21,800		500	1,970	2,500	4,000	12,830
H2-06	3,600			500	1,000	2,100	
W6-09	14,000		3,000	1,500	2,000	3,000	4,500
C6-10	26,000		4,500	4,000	4,000	5,000	8,500
H1-18	600	600					
L3-01	13,800		4,000	4,000	4,000	1,800	
H1-05	6,900		2,000	2,000	2,000	900	
W5-08	14,000		3,000	3,000	3,000	3,000	1,000
W4-21	5,000		1,000	1,000	2,000	1,000	
W3-20	4,000		1,000	1,000	1,000	1,000	
W6-26	1,300		500	800			
H5-19	730		500	230			
Annual Total	328,230	16,000	34,000	50,000	60,000	60,000	108,230
Cumulative Total		16,000	50,000	100,000	160,000	220,000	328,230

SRSP - Programme for Water Users Association (WUA)



SRBC - Programme for Water Users Association (WUA)



TRAINING PROGRAMS

Table of Contents

TRAINING PROGRAMMES PROPOSED UNDER A.P. III PROJECT

Sl. No.	Description of Training	Duration	Target group
	A. AT WALAMTARI		
1.	Orientation course on Agricultural Practices and Irrigation Management	4 weeks	AEEs/AEs
2.	Quality Control and Quality Assurance	3 days	SEs, EEs
3.	Contract Administration and Contract law and its Implications	3 days	SEs, EEs
4.	Workshop on water management for Senior Level Officers	3 days	SEs, CEs; JDAs
5.	Water users Association's Formation, responsibilities and duties	3 days	SEs,CEs,JDAs
	B. AT FIELD TRAINING CENTRES OF SRSP & SRBC COMMANDS		
1.	Training for Lascars & Canal Inspectors in Water Management	1 week	Lascars, W.I. and Canal Inspectors
2.	Training for Water users Association members & Contact Farmers in Management of WUA.	4 days	Water users Assocation members, Contact Farmers
3.	Maintenance of Irrigation systems	4 days	Dy EEs, AEEs
4.	Preparation and implemention of operation plan at minor level	One week	Dy EEs, AEEs ADAs, AOs
5.	Monitoring of systems (MIS)	4 days	-do-
6.	Farmers' participation	3 days	-do-
7.	Conjunctive use of Surface & Groundwater	3 days	-do-
8.	Public relations development	3 days	-do-

CURRICULUM DETAILS FOR
TRAINING PROGRAMMES PROPOSED UNDER A.P. III PROJECT

Sl. No.	Description of course	Topics included
1	2	3
1.	Orientation Course	Irrigation Engineering, Investigation of Projects, Design of CM & CD works, Earth dams, Design of systems, mix design, specification of materials, construction management, design of gates, gantries, hoists and maintenance, operation, III A.P.Irrigation project, soil identification, bearing capacity, investigation of conveyance system, canal lining, tunneling problems. Infiltration test, agreements, tenders, quality control, computer application, Irrigation Sociology, production economics, agronomic measures for soil moisture conservation, water management in rice and I.D. crops, management of saline alkaline soils, soil plant water relationship, estimation of ETO etc. Operation Planning its implementation,monitoring and feed back,conjunctive use of ground water with surface water, Computers and management in formation systems, HRD: Duties and responsibilities human relations inter personnel relations, effective communication, goal management.

		Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
2.	Contract Administration Contract Law and its implications	Third A.P.Irrigation project procurement procedures, Adjudication of disputes, contract law and contract Administration, contract management
3.	Quality Control and Quality Assurance	Specification for materials, Cement, Aggregates, water etc, Quality control techniques stone masonry, earth work; Quality control and quality assurance.
4.	Workshop for Senior level officers on water management	Cropping Pattern, operation, maintenance, monitoring & evaluation, Farmers organisation, water laws/ rights. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
5.	Workshop on water users Associations	Water users Associations, Duties and responsibilities, CAD Act. Water budgeting, canal maintenance etc. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.

AT FIELD TRAINING CENTRES

1.	Maintenance of irrigation systems	Maintenance of canals & Structures, calibration of flow measuring devices. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
2.	Preparation and implementation of operation plan at minor level	Preparation of operation plan, operation rules, implementation of operation plan, review and updating. Water budgeting. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
3.	Monitoring of systems (Operation and Maintenance)	Monitoring of Maintenance plan, Monitoring of Flow measuring devices, Monitoring of weather data, Monitoring of operation plan implementation. Computers, management information systems. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
4.	Farmers participation	Participatory management, farmers organisation and their role and water distribution and system maintenance. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.

5.	Conjunctive use of surface availability,	Water Budgeting, Surface water and groundwater, groundwater development and conjunctive use and its advantages. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
6.	Public relation development	Rural sociology and cultural practices, Irrigation laws & Acts, Management skills, Duties and responsibilities, Public relations, effective communication, inter personal relations, goal management. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.
7.	Training for Water Users Association Members and Contact Farmers	Project details ie., construction, operation and maintenance, systematic land development for soil and water management, soil plant water relationship, critical stages of crop, water management in Rice, I.D.Crops and Horticultural crops, Irrigation methods, soil testing and role of plant nutrients, A.P. CAD Act, water users association and its role, social aspects in irrigation utilisation etc. Operation of 1) ungated structurs 2) Volumetric release of water 3) Water User's Associations duties and responsibilities at each level.

8. Canal Inspectors, Work Inspectors and Canal Lascars.

Responsibilities of canal Inspectors, Irrigation methods, Irrigation scheduling within outlet and minor, canal commands, flow rates, irrigation intervals, study of crop-soil-water relationship. On farm irrigation practices, traditional and improved field layout and methods of irrigation, water losses in field and in conveyance. System operation and rotational water supplies-canal operation and water allocation principles, water measuring devices, control structures - locations, nature, conditions, accuracy, maintenance policy, maintenance of canals, control, drop and other structures, importance, need and methods, weed-control. Record keeping, Reporting, Relations with water users, legal aspects command area development act etc.
Duties and responsibilities of lascars, basic principles of crop, soil and water relation ship principles and proce dures, On farm development and land shaping, methods of irrigation, water deliveries to outlet from where the chak starts, role of farmers organ isation, communication with farmers etc.

Operation of

1) ungated structurs
2) Volumetric release of water
3) Water User's Associations duties and responsibilities at each level.

YEAR WISE TRAINING PROGRAMMES PROPOSED UNDER AP III PROJECT

Sl. No.	Description of Training	Duration	Target group	No. of participants			1995-96		1996-97		1997-98		1998-99		1999-2000		Grand total	
				Engg.	Agrl.	Total	No.of courses	Total officers to be covered	No.of courses	Total officers to be covered	No.of courses	Total officers to be covered	No.of courses	Total officers to be covered	No.of courses	Total officers to be covered	No.of courses	Total officers to be covered
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	AT WALAMTARI																	
1.	Orientation course for field engineers	4 weeks	AEEs, AEs	30	-	30	1	30	2	60	2	60	2	60	1	30	8	240
2.	Qaulity control and quality assurance	3 days	SEs, EEs	20	-	20	2	40	4	80	4	80	4	80	2	40	16	320
3.	Contract law and Administration	3 days	SEs, EEs	20	-	20	2	40	4	80	4	80	4	80	2	40	16	320
4.	Workshop for senior officers	3 days	SEs, CEs & JDAs	10	10	20	2	40	4	80	4	80	4	80	2	40	16	320
5.	Water users Associations	3 days	SEs,CEs & JDAs	15	15	30	2	60	4	120	4	120	4	120	2	60	16	480
			Total				9	210	18	420	18	420	18	420	9	210	72	1680

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	AT FIELD TRAINING CENTRES																	
A)	S R S P Command - 5 Nos. (SRSP Dam site, Chelgal, LMD Colony, Huzurabad & Chintagattu)																	
1.	Maintenance of Irrigation Systems	4 days	Dy.EEs, AEEs	30	-	30	3	90	6	180	6	180	6	180	3	90	24	720
2.	Preparation and Implementation of Operation Plan	1 week	Dy.EEs, AEEs/ ADAs, AO	20	10	30	3	90	6	180	6	180	6	180	3	90	24	720
3.	Monitoring of Systems (Operation and Maintenance)	4 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	3	90	6	180	6	180	6	180	3	90	24	720
4.	Farmers participation	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	3	90	6	180	6	180	6	180	3	90	24	720
5.	Conjunctive use of surface and Groundwater	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	3	90	6	180	6	180	6	180	3	90	24	720
6.	Public Relations Development	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	3	90	6	180	6	180	6	180	3	90	24	720
7.	Training for lascars, W.I and Canal Inspectors	1 week	Lascars, W.I. & Canal Inspectors	30	-	30	4	120	8	240	8	240	8	240	4	120	32	960
8.	Training for Farmers, Water Users Association Members (for 5 centres)	4 days	Contact farmers, WUA members			30	75	2250	150	4500	150	4500	150	4500	75	2250	600	18000
			Total				97	2910	194	5820	194	5820	194	5820	97	2910	756	23280

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
B)	S R B C Command - 3 Nos. (Koilkuntla, Nandyal and Banaganapalli)																	
1.	Maintenance of Irrigation Systems	4 days	Dy.EEs, AEEs	30	-	30	1	30	2	60	2	60	2	60	1	30	8	240
2.	Preparation and Implementation of Operation Plan	1 week	Dy.EEs, AEEs/ ADAs, AO	20	10	30	1	30	2	60	2	60	2	60	1	30	8	240
3.	Monitoring of Systems (Operation and Maintenance)	4 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	1	30	2	60	2	60	2	60	1	30	8	240
4.	Farmers participation	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	1	30	2	60	2	60	2	60	1	30	8	240
5.	Conjunctive use of surface and Groundwater	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	1	30	2	60	2	60	2	60	1	30	8	240
6.	Public relations Development	3 days	Dy.EEs, AEEs/ ADAs, AO	20	10	30	1	30	2	60	2	60	2	60	1	30	8	240
7.	Training for lascars, W.I and Canal Inspectors	1 week	Lascars, W.I. & Canal Inspectors	30	-	30	1	30	2	60	2	60	2	60	1	30	8	240
8.	Training for Farmers, Water Users Association Members (for 3 centres)	4 days	Contact farmers, WUA members			30	45	1350	90	2700	90	2700	90	2700	45	1350	360	10800
			Total				52	1560	104	3120	104	3120	104	3120	52	1560	416	12480

ABSTRACT

	8	9	10	11	12	13	14	15	16	17	18	19
At WALAMTARI	9	210	18	420	18	420	18	420	9	210	72	1680
AT FIELD TRAINING CENTRES (A)	97	2910	194	5820	194	5820	194	5820	97	2910	756	23280
AT FIELD TRAINING CENTRES (B)	52	1560	104	3120	104	3120	104	3120	52	1560	416	12480
Grand Total	158	4680	316	9360	316	9360	316	9360	158	4680	1264	37440

STATEMENT SHOWING CATEGORY-WISE STRENGTH OF STAFF PROPOSED TO BE TRAINED UNDER THE PROJECT.

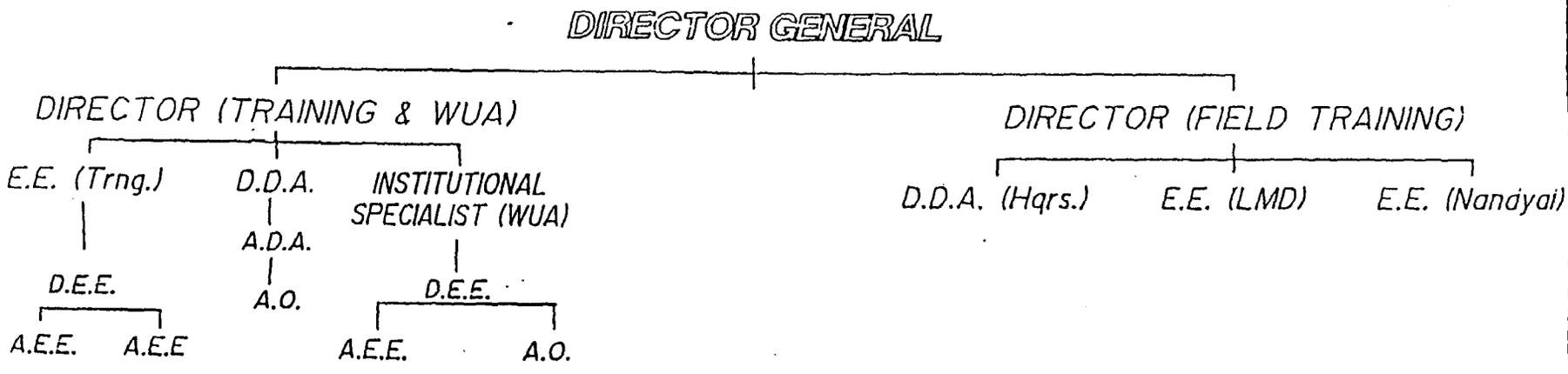
Sl.No.	Name of Project/District	Category of Staff			Total
		ADA	AO	VEO	
I.	SRSP				
	1. Karimnagar	7	34	223	264
	2. Warangal	1	12	47	60
II.	SRBC				
	1. Kurnool	2	8	30	40
		10	54	300	364

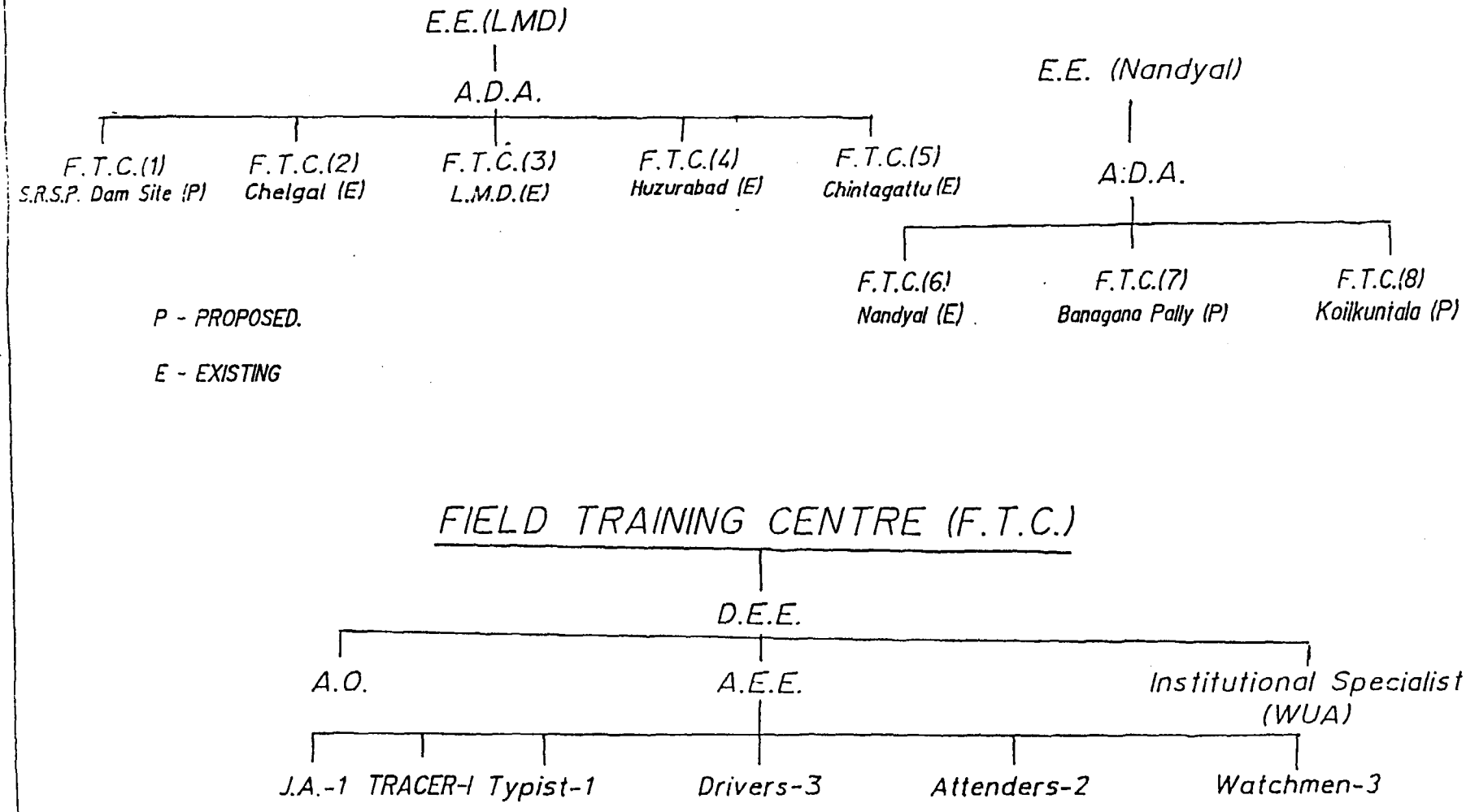
STATEMENT SHOWING STAFF TRAINING PHYSICAL TARGETS PROPOSED UNDER THE PROJECT

Sl.No.	Name of Project/District	1st Yr.		2nd Yr.		3rd Yr.		4th Yr.		5th Yr.		Total	
		NC	NT	NC	NT	NC	NT	NC	NT	NC	NT	NC	NT
I.	S.R.S.P												
1.	Karimnagar		264		66		66		66		66		528
		11		2		2		2		2		19	
2.	Warangal		60		15		15		15		15		120
II.	S.R.B.C.												
1.	Kurnool	1	40	1	10	1	10	1	10	1	10	5	80
		12	64	3	91	3	91	3	91	3	91	24	728

NC : NO. of Courses. , NT: Number of Trainees

ORGANOGRAM FOR THIRD A.P. IRRIGATION PROJECT AT WALAMTARI





FIELD TRAINING CENTRE (F.T.C.)

Annex 4

Annex 5

RESETTLEMENT AND REHABILITATION

Table of Contents

Third Andhra Pradesh Irrigation Project

Resettlement And Rehabilitation Action Plan

R&R Targets & Action Points

General Objective & Targets

The objective of R&R program is to ensure that the living standard of the affected people are improved or at least restored to their pre-project level. This objective is to be materialized through achieving specific targets of: (i) establishing a complete and competent institutional structure in the project affected areas to be responsible for land acquisition, resettlement and rehabilitation of the affected people; (ii) development of a R&R policy to provide entitlements of the affected people; and (iii) preparation and implementation of the resettlement and rehabilitation action plans. Specific targets and actions are listed below:

No.	R&R Targets	Planned Actions
A	**Establish the organizational structure for managing land acquisition, resettlement and rehabilitation.**	A four-tier organization structure has been proposed and is in the process of being set up. This comprises the State R&R Committee, the project Preparation and Monitoring Cell within the Department of I&CAD, District R&R Committees, Resettlement and Rehabilitation Units under Special Collectors, Village R&R Committees with assistance from NGOs for RAP implementation. 1. The State R&R Committee, composed of representatives from relevant state government departments, will be the leading group for formulating R&R policies, periodically reviewing R&R progress and coordination among concerned departments in the implementation of the RAPs. 2. The Project Preparation And Monitoring Unit is headed by a Special Officer of Chief Engineer Rank, who will be assisted by a senior Executive Engineer and other supporting staff. The Project Preparation and Monitoring Cell is responsible for planning, supervision, monitoring and coordination of all R&R activities under AP III. It will also be responsible for contracting non-government organizations for facilitating community income-generating activities. 3. The District R&R Committees are the coordinating and implementing agency at district level. They will be chaired by district collectors and consist of officials from relevant government agencies, representatives from non-government organizations and PAPs. It will be responsible for R&R coordination and implementation at the district level. Special Collectors will be appointed to SRSP and SRBC Components to work full time in R&R implementation. Two special

No.	R&R Targets	Planned Actions
		units will be created under the Special Collectors, the Land Acquisition Unit and Rehabilitation Unit to be headed respectively by the Land Acquisition Officers and Rehabilitation Officers. The Rehabilitation Unit will be staffed with full-time R&R officers. NGOs will be engaged on a long-term basis to assist R&R officers in the Land Acquisition Unit and the Rehabilitation Unit to implement the RAPs in the field. The GOAP issued Negotiations Committee Rules in 1992, stipulating the constitution of Negotiation Committees and procedures for negotiated compensation with the affected persons. 4. Village R&R Committees (VRC) will be formed in the affected villages with the help of NGOs and R&R officers in an effort to promote PAPs participation in R&R activities implementation. The VRC will be represented by members from each caste community i.e. scheduled caste, scheduled tribe, backward caste, other castes and women. in each revenue village. The VRCs will be actively involved and fully participate in formulating Village Rehabilitation Action Plans (VAP), facilitating PAPs participation and consultation, implementation of the VAPs and monitoring of R&R progress. They will work closely with NGOs and R&R officers.
B	**Project Socioeconomic Survey**	Detailed baseline socioeconomic surveys have been conducted for the project by experienced consultants. The surveys covered the full inventories of PAPs, tenants, sharecroppers and their socioeconomic profile, household characteristics, full resources bases, impact of land loss on incomes. The surveys have also identified the functionally landless PAPs and have brought up grievances of PAPs due to the completed land acquisition, such as bifurcation of land, uneconomic status of remaining holdings etc. The surveys involved active participation of PAPs and community leaders.
	C Legal Framework and R&R Policy	Government of Andhra Pradesh (GOAP) takes the Land Acquisition Act of 1894, as amended in 1984, as the basis for determining land compensation. Since early 1995, GOAP started to work on an AP III resettlement and rehabilitation policy consistent with the Bank's Operation Directive on involuntary resettlement. The agreed policy with the Bank has been translated into local language and disseminated among PAPs. The policy provides a legal framework for defining project affected persons, their rights and entitlements, involvement of non-government organizations and affected people, project R&R structure, grievance procedures.
D	**R& R Action Plan Preparation**	GOAP prepared, on the basis of the socioeconomic surveys and the agreed R&R Policy for AP III, RAPs for SRS Component, SRBC Component, Srisailam Retrofit and Lower Manair Retrofit.

No.	R&R Targets	Planned Actions
E	**Compensation for Lost Assets**	Land compensation is conducted in line with the Land Acquisition Act (LAA) of 1894, amended in 1984. Under the LAA, the GOAP pays compensation at prevailing market value for the land acquired, provides 30% solatium for the involuntary nature and 12% of additional market value prevailing from the date of Notification till the date of Award. The Land Acquisition Act (Section 11 (2) also provides the land owning PAPs the option to request negotiated settlement with the District Negotiation Committee. The GOAP issued Negotiations Committee Rules in 1992, stipulating the constitution of Negotiation Committees and procedures for negotiated compensation with the affected persons. If the negotiations fail to result in consent awards, the affected could resort to the legal proceedings under LAA.
F	**Rehabilitation Assistance**	In addition to compensation, the AP III R&R Policy provides the following six packages for rehabilitation to all PAPs, including the landless tenants, sharecroppers, agriculture laborers and encroachers: **Package 1** Productive Assets of either option. Provision of government or ceiling surplus land of equivalent quality to the extent of loss or upto a limit of 2 hectares of dry land or 1 hectare of wet land. This option is to be strictly applied to the ST PAPs. In land allocation, preference will be given to the weaker section. Alternatively, provision of the following productive asset grants at the preference of PAPs or in the case of unavailability of government land in the local villages. • Rs.8,000 to all PAPs that have obtained judicial or consent awards and for all major children of all PAPs at the time of socioeconomic survey; • Rs.13,000 for PAPs that have not obtained judicial or consent award; • Rs.16,000 for those losing land to the project and rendered landless or functionally landless **Package 2** Assistance to Women Thrift Group. Women groups will be organized through NGOs and R&R officers for income generation activities. Financial assistance will be provided to each group of 15 women at Rs.15,000. **Package 3** Vocational Training. Each PAP will be provided Rs.3,000 for vocational training linked with relevant economic activities. **Package 4** Homestead Land & House Construction Allowance. Each PDP family will be provided 5 cents of developed land for homestead land free of cost and Rs.14,000 for house construction with provision of free transport facility to the new site.

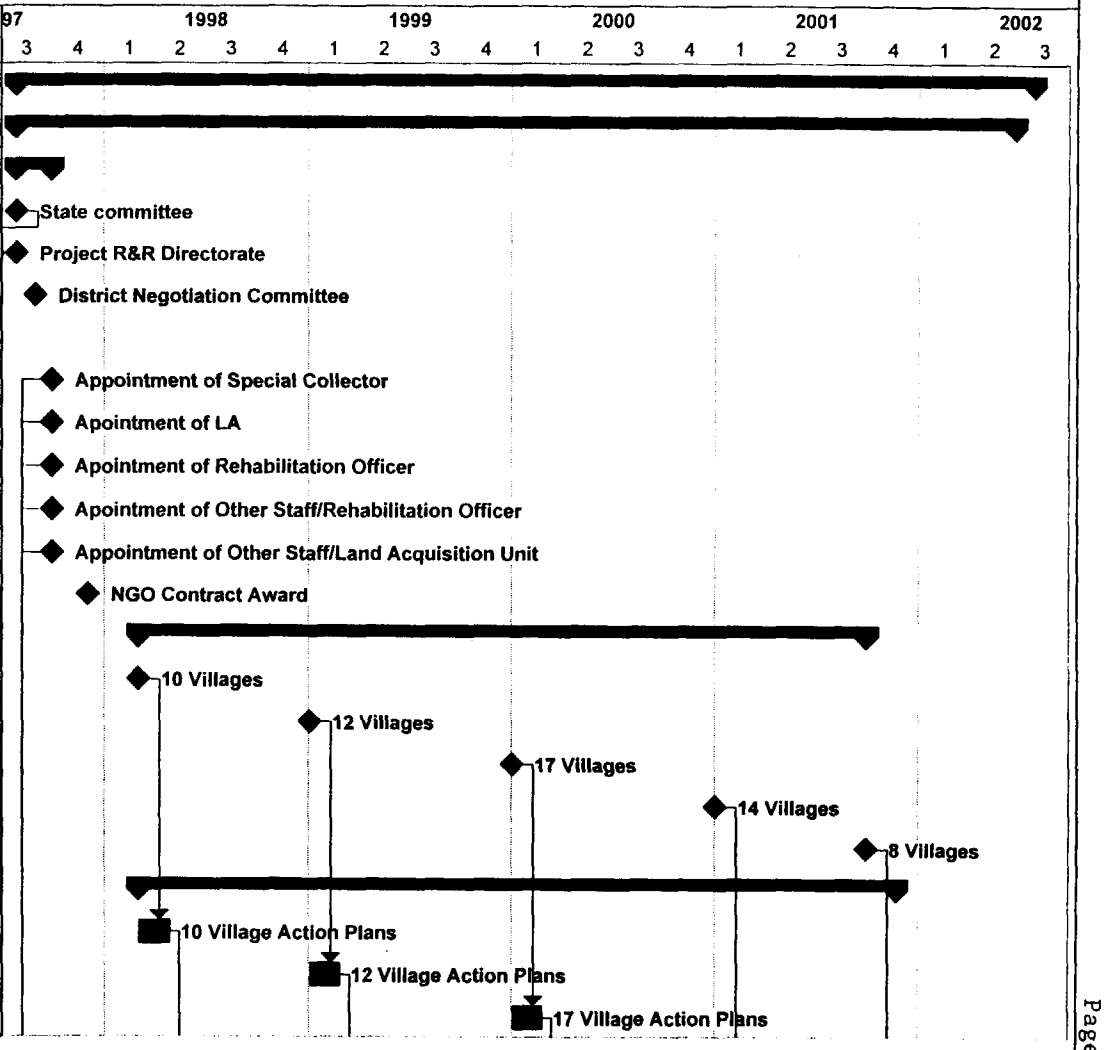
No.	R&R Targets	Planned Actions
		Package 5 Maintenance Allowance. Each PAP will be provided the following maintenance allowances: • Rs.500 per month for subsistence for a period of nine months • Rs.200 per month for cattle for a period of 6 months • A smokeless Chulla free of cost. **Package 6** Training. Intensive training has been planned and budgeted as part of the R&R program. Training will be provided to the PAPs in the form of lectures, seminars, discussions, visits to nearby sites etc. Most of the training would be conducted in the nearby training centers. Detailed vocational training programs, trades and schedules would be provided in the Village Action Plans. PAP training would cover the objective and entitlements under the State R&R policy, technical skills for different trades, purchase and maintenance of productive assets etc.
G	**Staff Training.**	A detailed training program has been drawn up and the cost has been fully budgeted in the RAP. The training of Rehabilitation Officers and NGOs is aimed at upgrading their skills, familiarizing them with R&R planning, R&R strategy, community mobilization, income restoration and would cover R&R policies and entitlements, community mobilization techniques, income generation schemes in various sectors, identification and verification of all developmental schemes, organization of women thrift groups, disbursement of maintenance and cattle allowances through Bank account, identification of training programs for youths, risk analysis of various economic schemes and possible measure to prevent and correct them, R&R monitoring arrangements.
H	**AP II Retrofit**	The consultant carried out the survey in the resettlements and, on the basis of the survey, prepared action plans for the retrofit. The survey has identified and the RAP has planned to provide for outstanding facilities, improvements of existing facilities and requirements of new facilities in the resettlements. The survey has also identified 2,231 homeless people in both reservoir areas and the RAP plans to provide each homeless family with 5 cents of developed homestead land free of cost. The consultant has also determined that about 778 PAPs have not received their income generation schemes under AP II. The Retrofit is to provide Rs.8,000 per PAP (Below Poverty Line) for income generation assets.

No.	R&R Targets	Planned Actions
I	**Community Participation & Consultation**	PAPs have been closely involved in the preparation of the socio-economic surveys and RAPs. Census surveys were conducted through personal contacts and interviews with individuals or families, including women, landless tenants, sharecroppers, government land assignees. Detailed discussions were held with individual PAPs for their input on assets lost, compensation paid or to be paid, court cases, impact on living standards, economic rehabilitation activities and income generation schemes and remaining problems. Community participation and consultation is designed into the implementation mechanism. Village R&R Committees are to be set up to ensure the full participation of the PAPs in the village-level R&R planning and its implementation. Village Committees, as representatives of the PAPs, could help to improve the village RAPs with constant feedback from the PAPs. NGOs will be engaged to facilitate PAP participation. PAP and NGO representatives are on the District R&R Committees to further enhance PAP participation in their development.
L	**Implementation Mechanism**	GOAP has worked out detailed, PAP-specific compensation and rehabilitation programs by village, phased out over a period of 5 years. Detailed implementation schedules have been prepared for all R&R activities under the project (See Attachment 8 for the master schedule). As an effort to further enhance PAP participation during implementation, Village R&R Committees are to be organized to fully represent PAPs' opinions in implementation jointly with NGOs and R&R officers. As part of the detailed and final planning effort, Village Committees, NGOs and R&R officers will reconfirm and finalize all details of PAP-specific rehabilitation activities in each Village R&R Action Plan. To ensure the success of the income generation schemes, a lot of efforts have gone into training planning. A detailed training program has been drawn up.
M.	**Monitoring & Evaluation of Resettlement Progress**	Both internal and external monitoring will be conducted concurrently throughout the project implementation.. The monitoring bodies will ultimately report to the State R&R Committee, who will review and evaluate the R&R progress and make decisions on necessary measures to improve R&R performance. Internal monitoring. The Project Monitoring Unit will supervise and monitor R&R implementation through the District Committees, NGOs and VRCs. The NGOs and the Rehabilitation Unit under the Special Collector will monitor R&R progress and present quarterly progress reports to the District R&R Committees, who will, in turn, furnish the

No.	R&R Targets	Planned Actions
		progress reports to the Project Preparation & Monitoring Cell. The Cell will set up a computerized monitoring system for this purpose. Independent external monitoring of R&R progress shall be carried out by a NGO. The NGO will submit quarterly and annual monitoring and evaluation reports to the Special Collector. As part of the project completion report, the NGO should conduct a final evaluation on the performance of R&R program.Tentative indicators have been developed for effective and comprehensive monitoring and evaluation.

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
1	**1 Andhra Pradesh Third Irrigation Project**
2	**1.1 SRSP Component**
3	**1.1.1 Institution Set-up**
4	1.1.1.1 State committee
5	1.1.1.2 Project R&R Directorate
6	1.1.1.3 District Negotiation Committee
7	**1.1.1.4 District R&R Committee**
8	1.1.1.4.1 Appointment of Special Collector
9	1.1.1.4.2 Apointment of LA
10	1.1.1.4.3 Apointment of Rehabilitation Officer
11	1.1.1.4.4 Apointment of Other Staff/Rehabilitation Off
12	1.1.1.4.5 Appointment of Other Staff/Land Acquisitio
13	1.1.2 NGO Contract Award
14	**1.1.3 Establishment of Village Committees**
15	1.1.3.1 10 Villages
16	1.1.3.2 12 Villages
17	1.1.3.3 17 Villages
18	1.1.3.4 14 Villages
19	1.1.3.5 8 Villages
20	**1.1.4 Preparation of Village Action Plan**
21	1.1.4.1 10 Village Action Plans
22	1.1.4.2 12 Village Action Plans
23	1.1.4.3 17 Village Action Plans

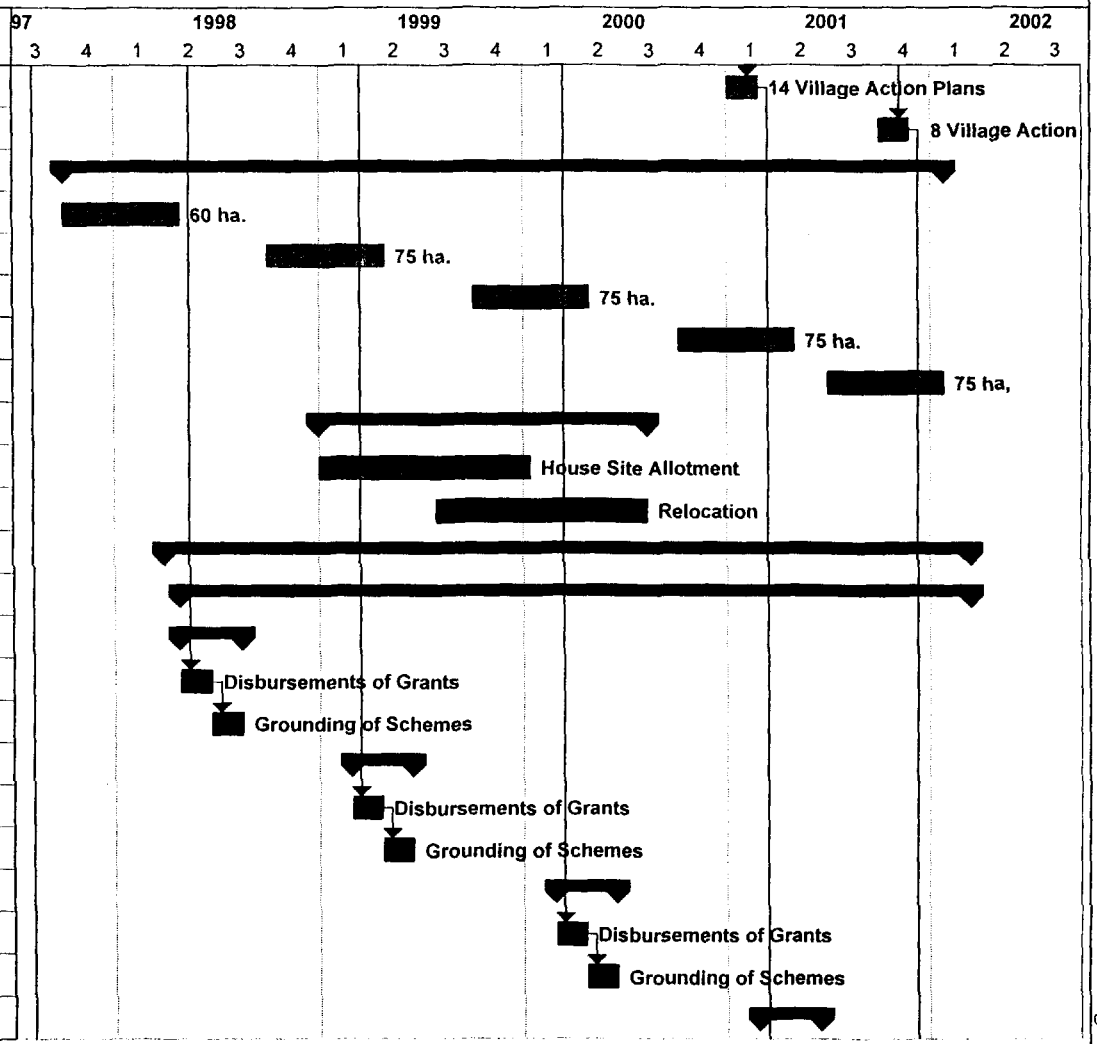


Project: AP III Irrigation Project
Date: 2/28/97

Task | Summary | Rolled Up Progress
Progress | Rolled Up Task
Milestone | Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
24	1.1.4.4 14 Village Action Plans
25	1.1.4.5 8 Village Action Plans
26	**1.1.5 Land Acquisition**
27	1.1.5.1 60 ha.
28	1.1.5.2 75 ha.
29	1.1.5.3 75 ha.
30	1.1.5.4 75 ha.
31	1.1.5.5 75 ha,
32	**1.1.6 Resettlement**
33	1.1.6.1 House Site Allotment
34	1.1.6.2 Relocation
35	**1.1.7 Rehabilitation Activities**
36	**1.1.7.1 Income Generation Activities**
37	**1.1.7.1.1 313 PAPs**
38	1.1.7.1.1.1 Disbursements of Grants
39	1.1.7.1.1.2 Grounding of Schemes
40	**1.1.7.1.2 557 PAPs**
41	1.1.7.1.2.1 Disbursements of Grants
42	1.1.7.1.2.2 Grounding of Schemes
43	**1.1.7.1.3 536 PAPs**
44	1.1.7.1.3.1 Disbursements of Grants
45	1.1.7.1.3.2 Grounding of Schemes
46	**1.1.7.1.4 453 PAPs**

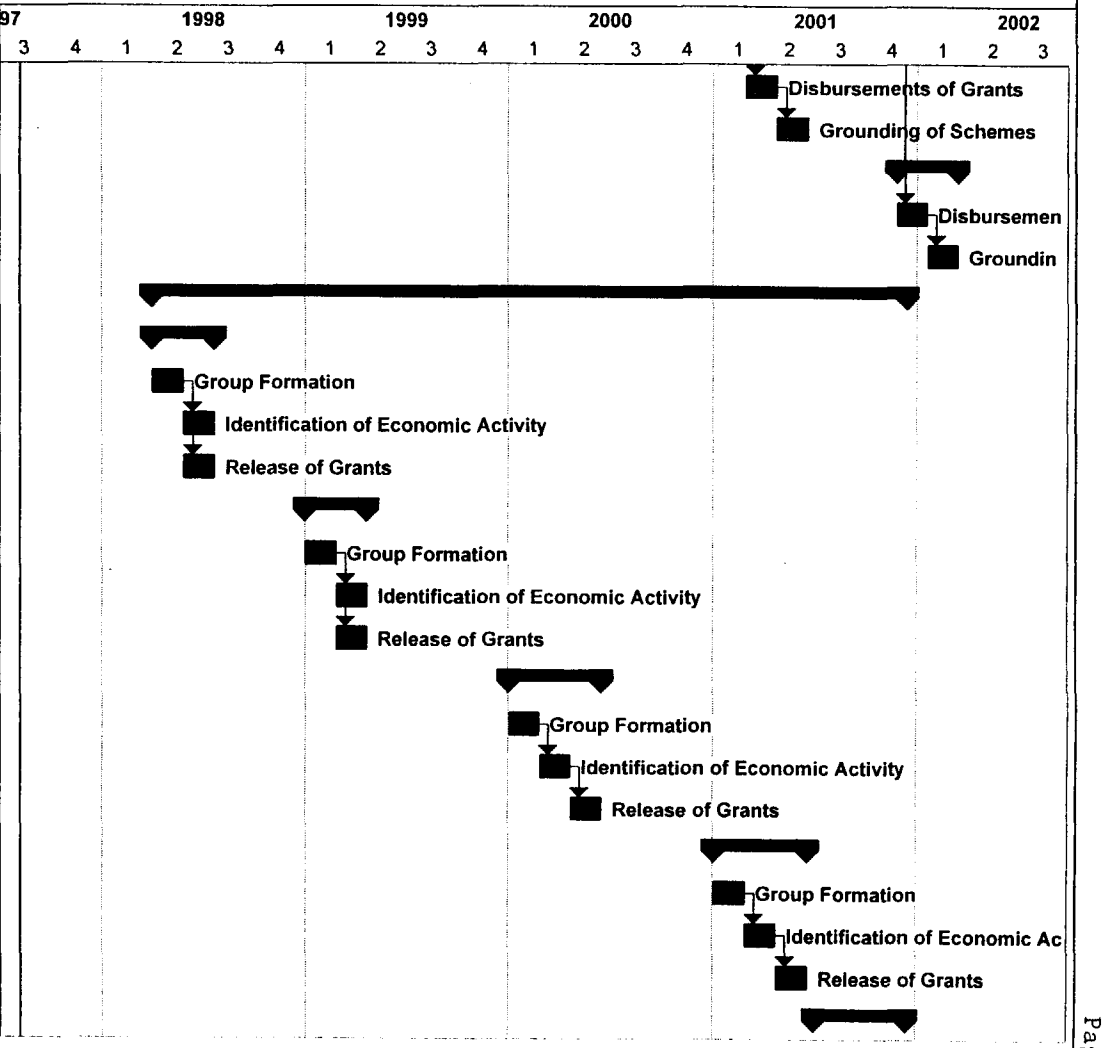


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
47	1.1.7.1.4.1 Disbursements of Grants
48	1.1.7.1.4.2 Grounding of Schemes
49	**1.1.7.1.5 178 PAPs**
50	1.1.7.1.5.1 Disbursements of Grants
51	1.1.7.1.5.2 Grounding of Schemes
52	**1.1.7.2 Thrift Group Activity for Women**
53	**1.1.7.2.1 353 Women**
54	1.1.7.2.1.1 Group Formation
55	1.1.7.2.1.2 Identification of Economic Activity
56	1.1.7.2.1.3 Release of Grants
57	**1.1.7.2.2 781 Women**
58	1.1.7.2.2.1 Group Formation
59	1.1.7.2.2.2 Identification of Economic Activity
60	1.1.7.2.2.3 Release of Grants
61	**1.1.7.2.3 746 Women**
62	1.1.7.2.3.1 Group Formation
63	1.1.7.2.3.2 Identification of Economic Activity
64	1.1.7.2.3.3 Release of Grants
65	**1.1.7.2.4 636 Women**
66	1.1.7.2.4.1 Group Formation
67	1.1.7.2.4.2 Identification of Economic Activity
68	1.1.7.2.4.3 Release of Grants
69	**1.1.7.2.5 282 Women**

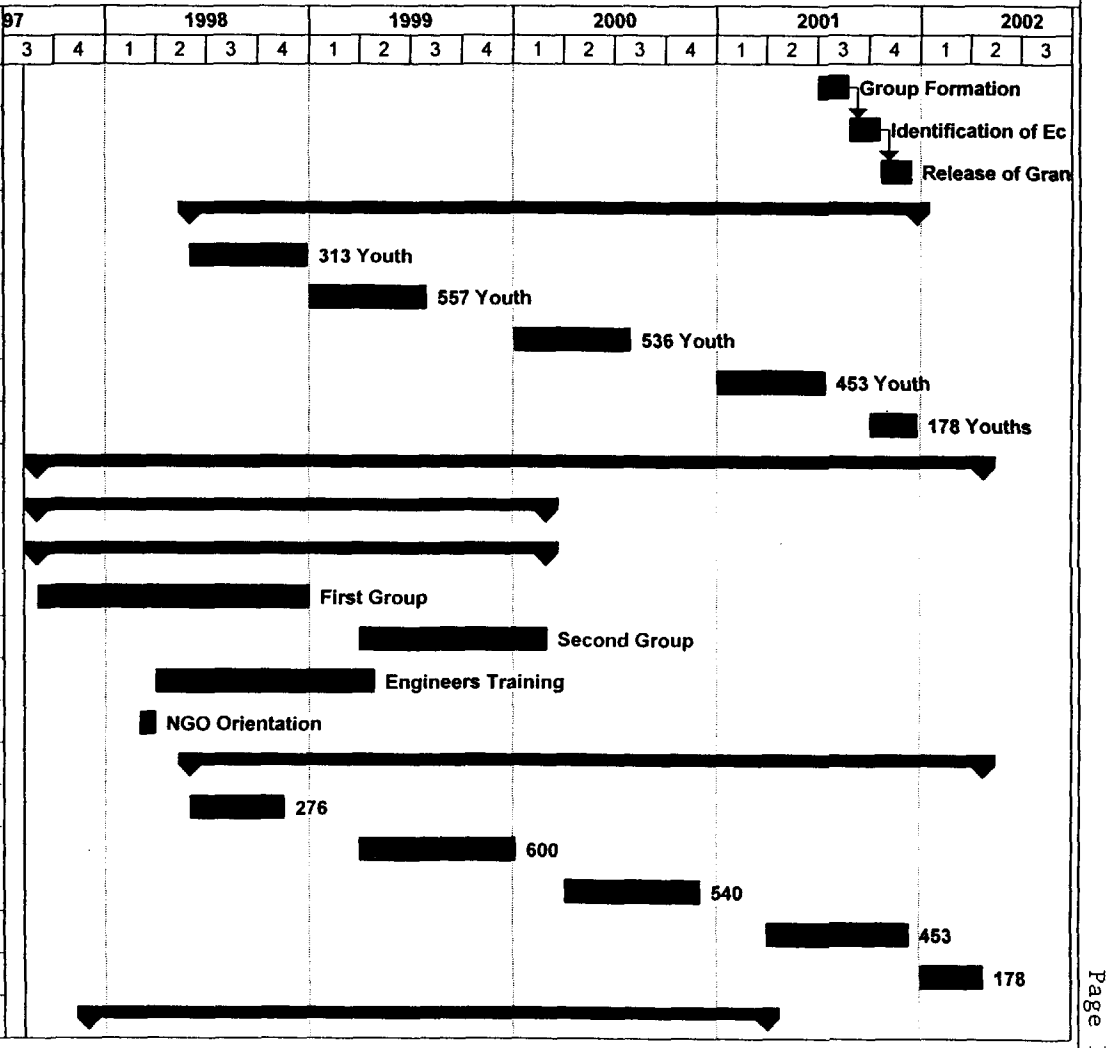


Project: AP III Irrigation Project
Date: 2/28/97

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
70	1.1.7.2.5.1 Group Formation
71	1.1.7.2.5.2 Identification of Economic Activity
72	1.1.7.2.5.3 Release of Grants
73	**1.1.7.3 Vocational Training for Youth**
74	1.1.7.3.1 313 Youth
75	1.1.7.3.2 557 Youth
76	1.1.7.3.3 536 Youth
77	1.1.7.3.4 453 Youth
78	1.1.7.3.5 178 Youths
79	**1.1.8 Training**
80	**1.1.8.1 Staff Training**
81	**1.1.8.1.1 R&R STaff Training**
82	1.1.8.1.1.1 First Group
83	1.1.8.1.1.2 Second Group
84	1.1.8.1.2 Engineers Training
85	1.1.8.1.3 NGO Orientation
86	**1.1.8.2 Training of PAPs**
87	1.1.8.2.1 276
88	1.1.8.2.2 600
89	1.1.8.2.3 540
90	1.1.8.2.4 453
91	1.1.8.2.5 178
92	**1.1.9 AP II Retrofit**

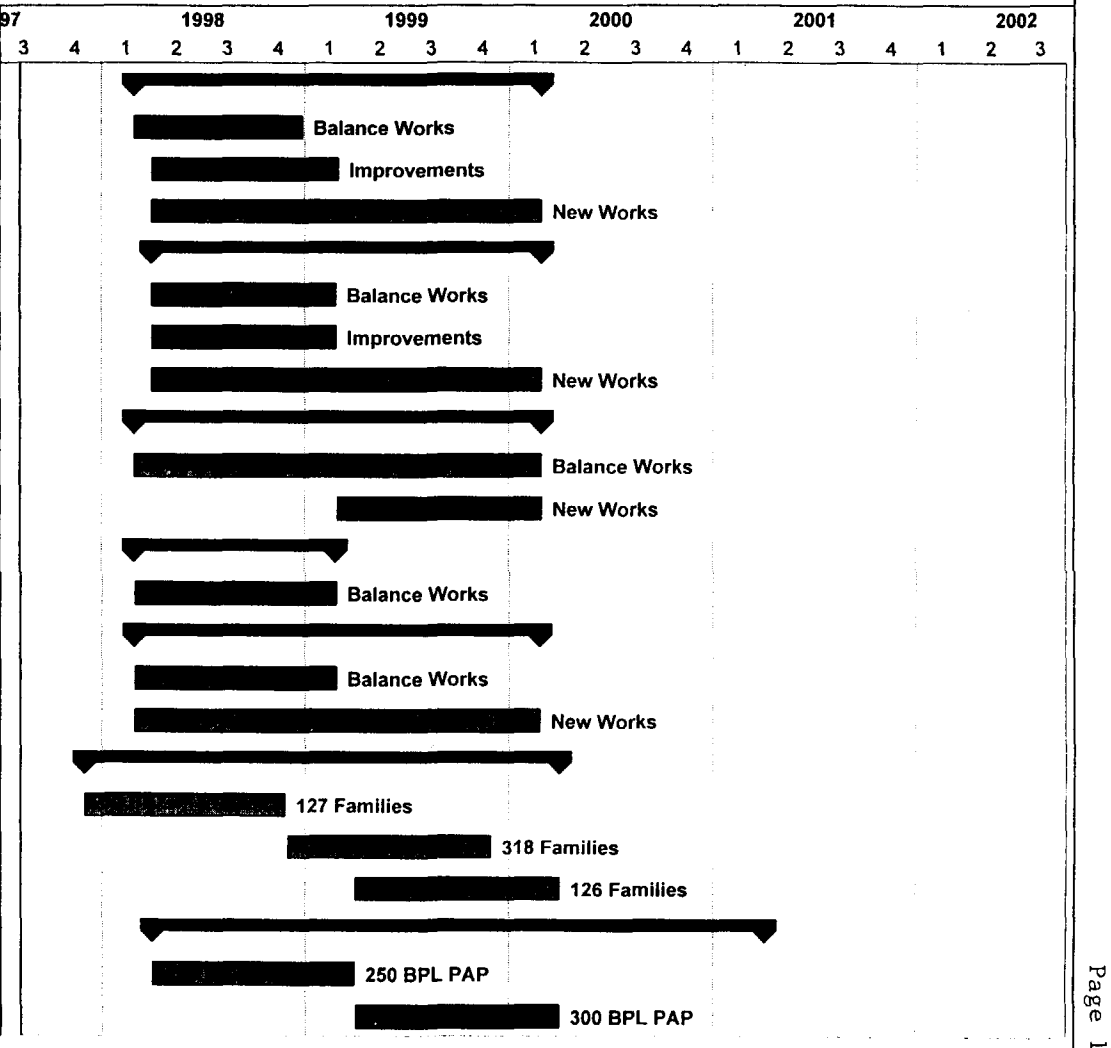


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
93	**1.1.9.1 Roads**
94	1.1.9.1.1 Balance Works
95	1.1.9.1.2 Improvements
96	1.1.9.1.3 New Works
97	**1.1.9.2 Drinking Water**
98	1.1.9.2.1 Balance Works
99	1.1.9.2.2 Improvements
100	1.1.9.2.3 New Works
101	**1.1.9.3 Education Facilities**
102	1.1.9.3.1 Balance Works
103	1.1.9.3.2 New Works
104	**1.1.9.4 Medical & Veterinary Facilities**
105	1.1.9.4.1 Balance Works
106	**1.1.9.5 Other Communities**
107	1.1.9.5.1 Balance Works
108	1.1.9.5.2 New Works
109	**1.1.9.6 House Plots**
110	1.1.9.6.1 127 Families
111	1.1.9.6.2 318 Families
112	1.1.9.6.3 126 Families
113	**1.1.9.7 Income Generation Schemes**
114	1.1.9.7.1 250 BPL PAP
115	1.1.9.7.2 300 BPL PAP

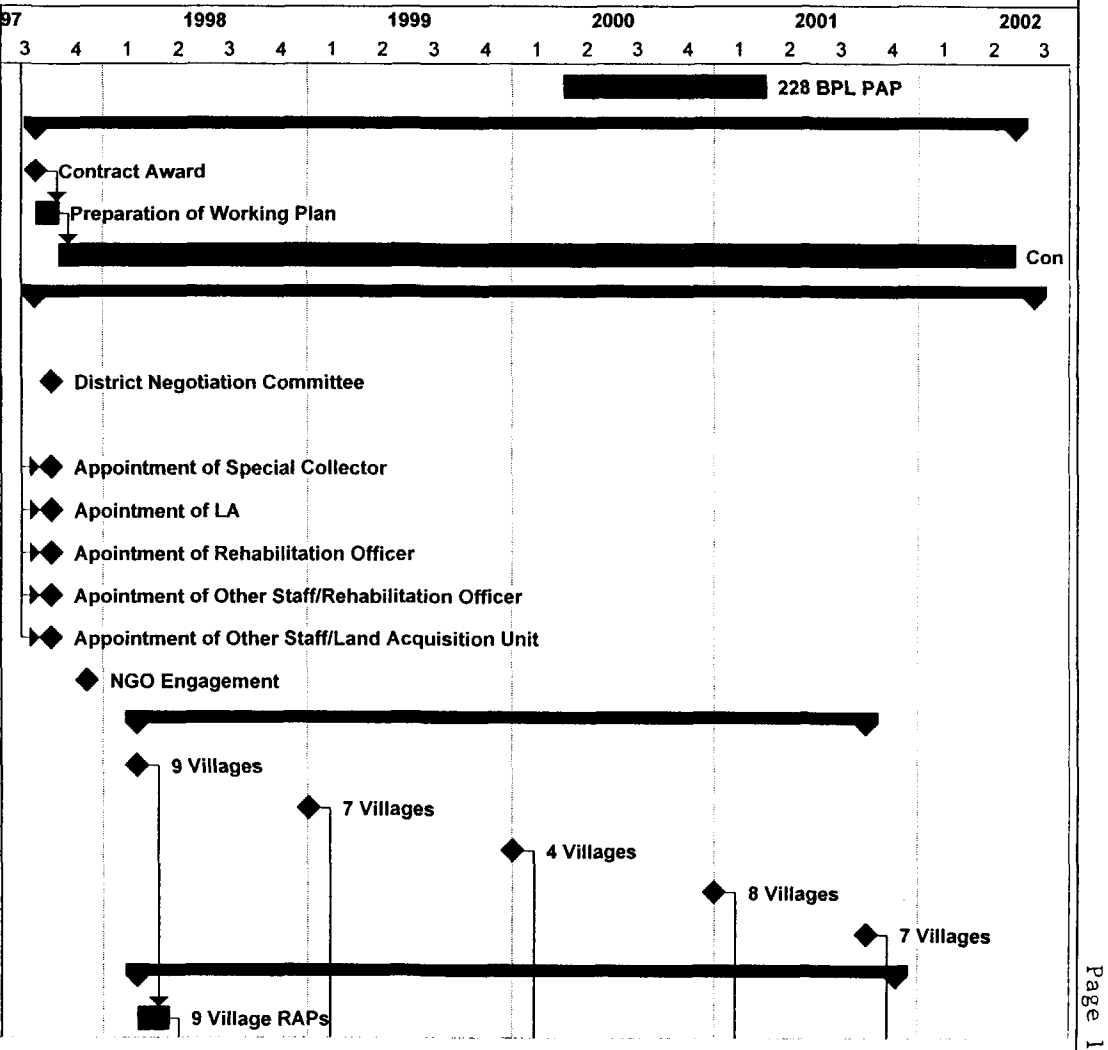


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
116	1.1.9.7.3 228 BPL PAP
117	**1.1.10 Monitoring Evaluation**
118	1.1.10.1 Contract Award
119	1.1.10.2 Preparation of Working Plan
120	1.1.10.3 Concurrent Monitoring
121	**1.2 SRBC Component**
122	**1.2.1 Institution Set-up**
123	1.2.1.1 District Negotiation Committee
124	**1.2.1.2 District R&R Committee**
125	1.2.1.2.1 Appointment of Special Collector
126	1.2.1.2.2 Apointment of LA
127	1.2.1.2.3 Apointment of Rehabilitation Officer
128	1.2.1.2.4 Apointment of Other Staff/Rehabilitation Off
129	1.2.1.2.5 Appointment of Other Staff/Land Acquisitio
130	1.2.2 NGO Engagement
131	**1.2.3 Establishment of Village Committees**
132	1.2.3.1 9 Villages
133	1.2.3.2 7 Villages
134	1.2.3.3 4 Villages
135	1.2.3.4 8 Villages
136	1.2.3.5 7 Villages
137	**1.2.4 Preparation of Village Action Plan**
138	1.2.4.1 9 Village RAPs

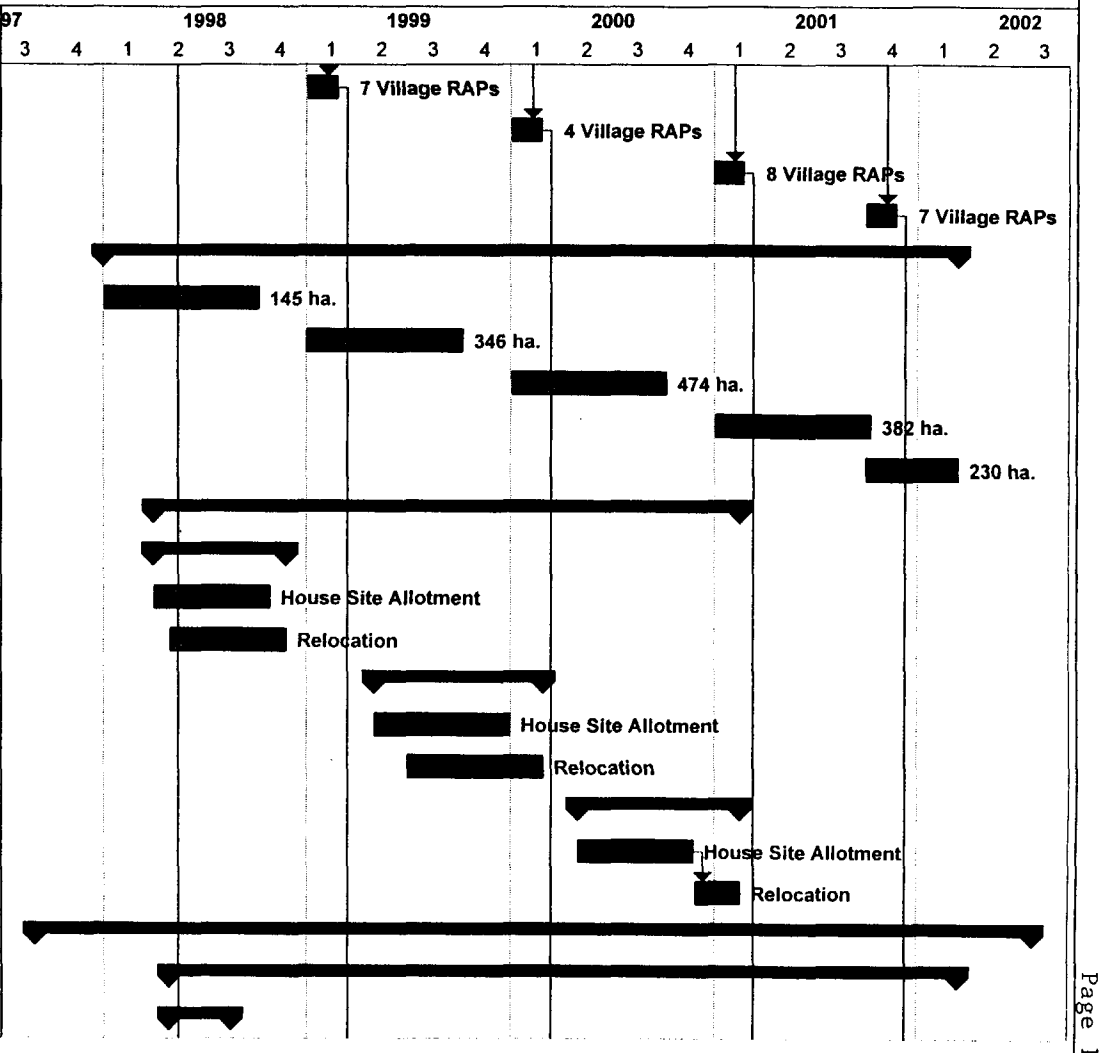


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
139	1.2.4.2 7 Village RAPs
140	1.2.4.3 4 Village RAPs
141	1.2.4.4 8 Village RAPs
142	1.2.4.5 7 Village RAPs
143	**1.2.5 Land Acquisition**
144	1.2.5.1 145 ha.
145	1.2.5.2 346 ha.
146	1.2.5.3 474 ha.
147	1.2.5.4 382 ha.
148	1.2.5.5 230 ha.
149	**1.2.6 Resettlement**
150	**1.2.6.1 122 Displaced Families**
151	1.2.6.1.1 House Site Allotment
152	1.2.6.1.2 Relocation
153	**1.2.6.2 92 Displaced Families**
154	1.2.6.2.1 House Site Allotment
155	1.2.6.2.2 Relocation
156	**1.2.6.3 19 Displaced Families**
157	1.2.6.3.1 House Site Allotment
158	1.2.6.3.2 Relocation
159	**1.2.7 Rehabilitation Activities**
160	**1.2.7.1 Income Generation Activities**
161	**1.2.7.1.1 363 PAPs**

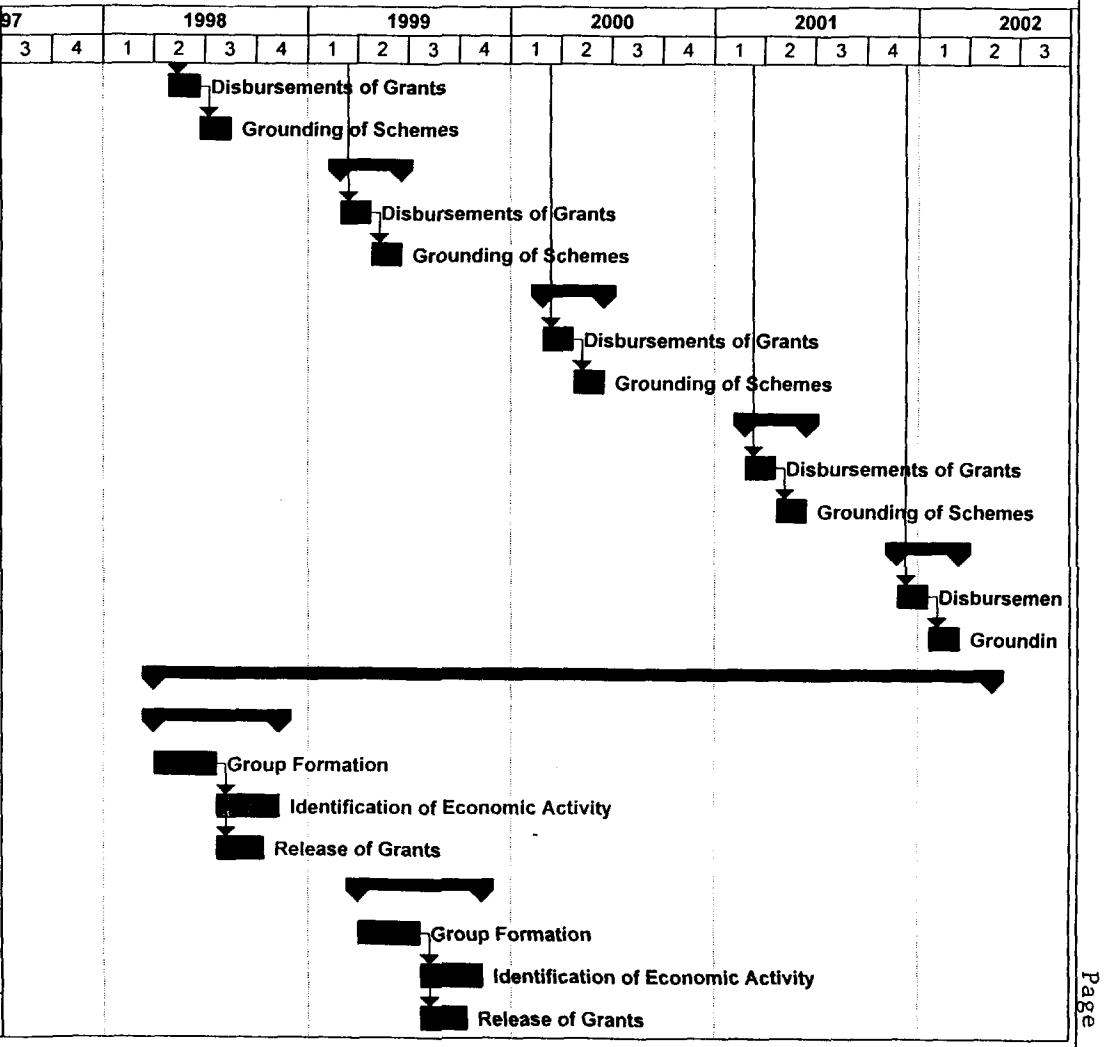


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
162	1.2.7.1.1.1 Disbursements of Grants
163	1.2.7.1.1.2 Grounding of Schemes
164	**1.2.7.1.2 333 PAPs**
165	1.2.7.1.2.1 Disbursements of Grants
166	1.2.7.1.2.2 Grounding of Schemes
167	**1.2.7.1.3 316 PAPs**
168	1.2.7.1.3.1 Disbursements of Grants
169	1.2.7.1.3.2 Grounding of Schemes
170	**1.2.7.1.4 323 PAPs**
171	1.2.7.1.4.1 Disbursements of Grants
172	1.2.7.1.4.2 Grounding of Schemes
173	**1.2.7.1.5 340 PAPs**
174	1.2.7.1.5.1 Disbursements of Grants
175	1.2.7.1.5.2 Grounding of Schemes
176	**1.2.7.2 Thrift Group Activity for Women**
177	**1.2.7.2.1 532 Women**
178	1.2.7.2.1.1 Group Formation
179	1.2.7.2.1.2 Identification of Economic Activity
180	1.2.7.2.1.3 Release of Grants
181	**1.2.7.2.2 497 Women**
182	1.2.7.2.2.1 Group Formation
183	1.2.7.2.2.2 Identification of Economic Activity
184	1.2.7.2.2.3 Release of Grants

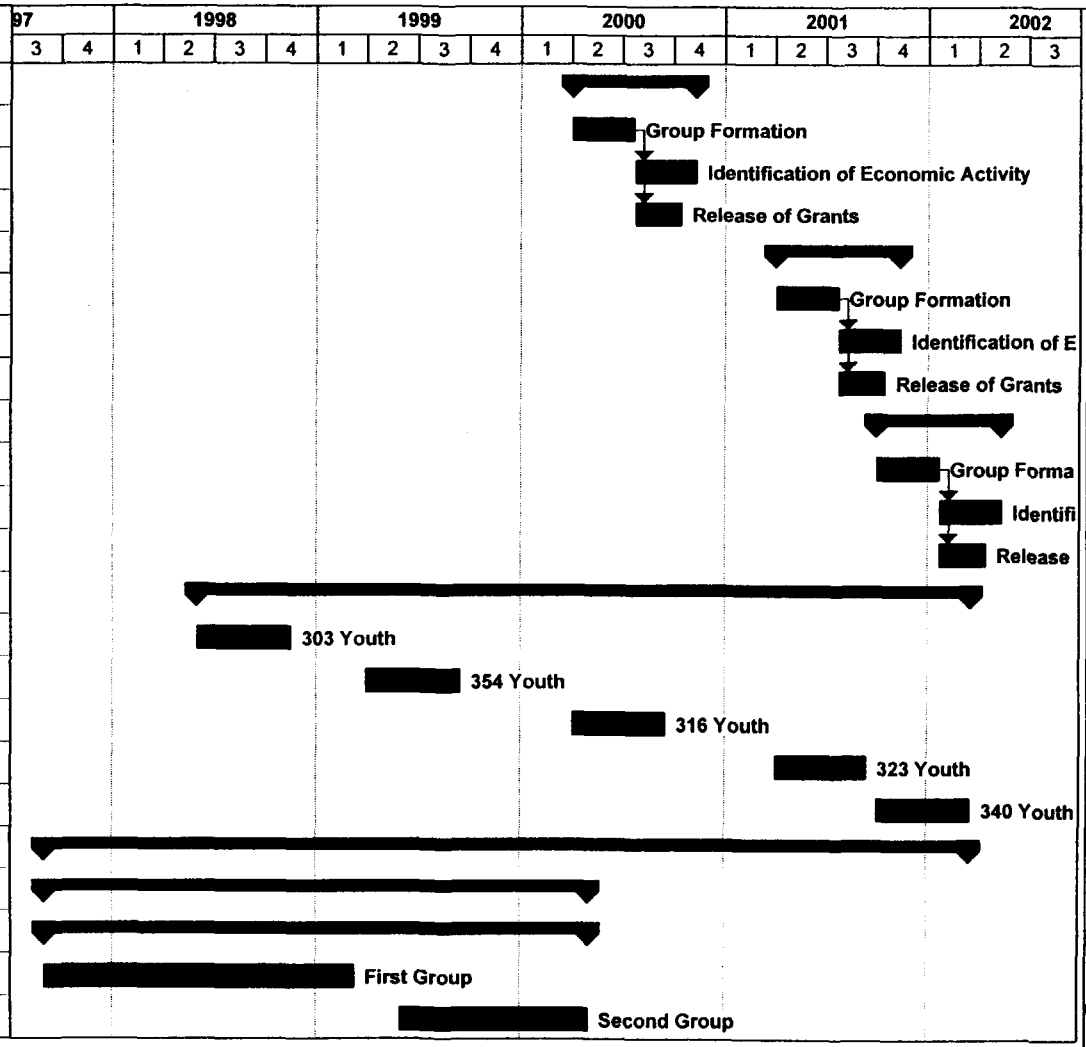


Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
185	**1.2.7.2.3 532 Women**
186	1.2.7.2.3.1 Group Formation
187	1.2.7.2.3.2 Identification of Economic Activity
188	1.2.7.2.3.3 Release of Grants
189	**1.2.7.2.4 484 Women**
190	1.2.7.2.4.1 Group Formation
191	1.2.7.2.4.2 Identification of Economic Activity
192	1.2.7.2.4.3 Release of Grants
193	**1.2.7.2.5 473 Women**
194	1.2.7.2.5.1 Group Formation
195	1.2.7.2.5.2 Identification of Economic Activity
196	1.2.7.2.5.3 Release of Grants
197	**1.2.7.3 Vocational Training for Youth**
198	1.2.7.3.1 303 Youth
199	1.2.7.3.2 354 Youth
200	1.2.7.3.3 316 Youth
201	1.2.7.3.4 323 Youth
202	1.2.7.3.5 340 Youths
203	**1.2.7.4 R&R Training**
204	**1.2.7.4.1 Staff Training**
205	**1.2.7.4.1.1 R&R STaff Training**
206	1.2.7.4.1.1.1 First Group
207	1.2.7.4.1.1.2 Second Group

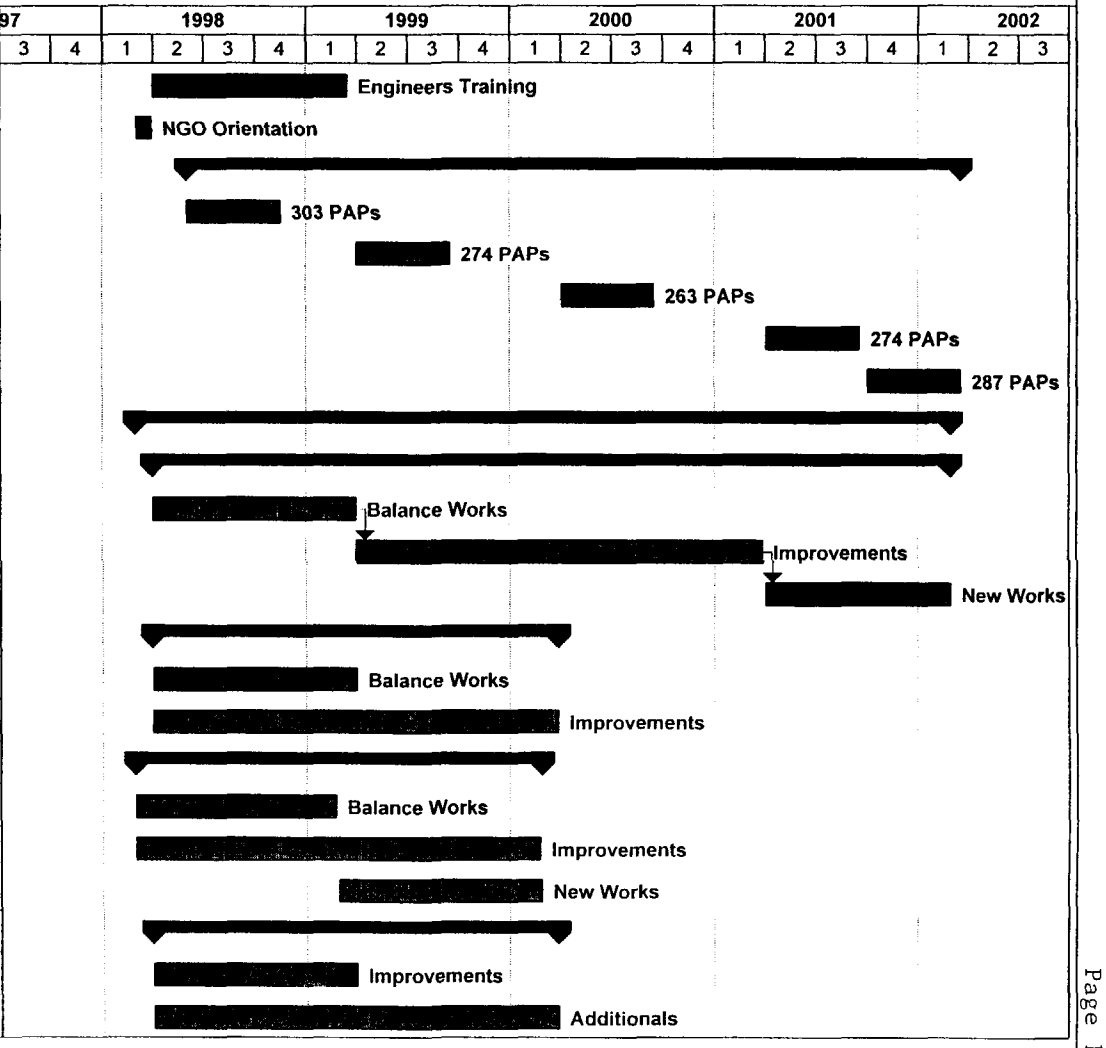


Project: AP III Irrigation Project
Date: 2/28/97

Task | Summary | Rolled Up Progress
Progress | Rolled Up Task
Milestone | Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
208	1.2.7.4.1.2 Engineers Training
209	1.2.7.4.1.3 NGO Orientation
210	**1.2.7.4.2 Training of PAPs**
211	1.2.7.4.2.1 303 PAPs
212	1.2.7.4.2.2 274 PAPs
213	1.2.7.4.2.3 263 PAPs
214	1.2.7.4.2.4 274 PAPs
215	1.2.7.4.2.5 287 PAPs
216	**1.2.7.5 AP II Retrofit**
217	**1.2.7.5.1 Roads**
218	1.2.7.5.1.1 Balance Works
219	1.2.7.5.1.2 Improvements
220	1.2.7.5.1.3 New Works
221	**1.2.7.5.2 Drinking Water**
222	1.2.7.5.2.1 Balance Works
223	1.2.7.5.2.2 Improvements
224	**1.2.7.5.3 Education Facilities**
225	1.2.7.5.3.1 Balance Works
226	1.2.7.5.3.2 Improvements
227	1.2.7.5.3.3 New Works
228	**1.2.7.5.4 Electrification**
229	1.2.7.5.4.1 Improvements
230	1.2.7.5.4.2 Additionals

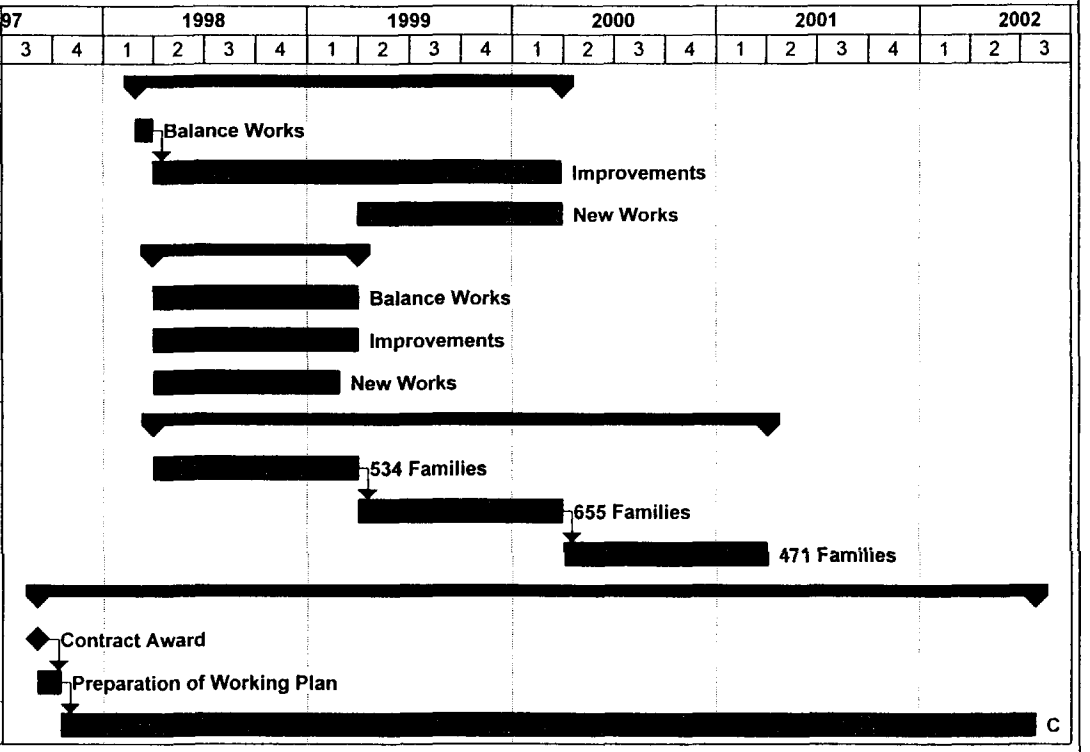


Project: AP III Irrigation Project
Date: 2/28/97

Task | Summary | Rolled Up Progress
Progress | Rolled Up Task
Milestone | Rolled Up Milestone

Resettlement & Rehabilitation Schedule of Third Andhra Pradesh Irrigation Project

ID	Task Name
231	**1.2.7.5.5 Medical & Veterinary Facilities**
232	1.2.7.5.5.1 Balance Works
233	1.2.7.5.5.2 Improvements
234	1.2.7.5.5.3 New Works
235	**1.2.7.5.6 Other Communities**
236	1.2.7.5.6.1 Balance Works
237	1.2.7.5.6.2 Improvements
238	1.2.7.5.6.3 New Works
239	**1.2.7.5.7 House Plots**
240	1.2.7.5.7.1 534 Families
241	1.2.7.5.7.2 655 Families
242	1.2.7.5.7.3 471 Families
243	**1.2.7.6 Monitoring Evaluation**
244	1.2.7.6.1 Contract Award
245	1.2.7.6.2 Preparation of Working Plan
246	1.2.7.6.3 Concurrent Monitoring



Project: AP III Irrigation Project
Date: 2/28/97

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone

**Involvement of Non-Government Organizations (NGO)
in Implementing
Project Affected Persons Economic Rehabilitation Program (PAPERP)**

TERMS OF REFERENCE

Introduction

1. The Government of Andhra Pradesh GOAP is implementing the Third Andhra Pradesh Irrigation Project (AP III) with World Bank assistance. A.P.I.P-III comprises two sub-projects namely (i) Srisailam Right Branch Canal (SRBC) in Kurnool district and (ii) Sri Rama Sagar Project (SRSP) in the Karimnagar and Warangal districts. Resettlement and Rehabilitation (R & R) is small but significant and essential component of the project. The displaced persons under the Srisailam Reservoir and Lower Manair Reservoir have been covered for Resettlement and Rehabilitation under three Action Plans under the Second Andhra Pradesh Irrigation Project (AP II). The R & R Component under AP III envisages economic rehabilitation of the persons affected by the canal system, roads network, etc., together with retrospective completion of the AP II program.

2 GOAP has formulated an R & R Policy indicating aims and objectives for the Economic Rehabilitation. GOAP further conducted socioeconomic surveys, findings of which form the base line for the PAPERP designed for the Economic Rehabilitation. The Project Affected Persons Economic Rehabilitation Plan (PAPERP) is proposed to be implemented over a period from 1997- 98 to 2001-2002. The policy stipulates involvement of NGOs and its role in the PAPERP implementation. The Special Collector SRBC Kurnool and Special Collector SRSP Hyderabad are responsible for the planning, implementation and monitoring of the PAPERP in the respective districts that have been prepared for each sub-project. In order to enable them to implement PAPERP through such a process, the GOAP is appointing a NGO to work with Special Collector, Land Acquisition.

The Aim

3. The aim of the assignment is to help the Special Collector, Land Acquisition to initiate and sustain a process of participatory PAPERP by mobilizing and organizing the affected communities in implementing the PAPERP so that they could all be fully involved in the restoration and improvement of their livelihood.

4 In order to achieve this aim, assignment will have the following specific objectives:

(a) Translation of the PAPERP into reality with the involvement of beneficiaries, through PRA exercises; and

(b) Restoration or improvement of living standard in the affected communities.

B. Criteria For Selection of NGOs

5 In order to achieve the above objectives, the following criteria have been set out for selection of NGOs:

- The NGO should be a registered society that has been registered under A.P. Societies Registration Act or any other relevant Act and should fulfill the mandatory regulations of such Acts, including the annual audit of the accounts.

- The NGO should have an understanding and appreciation of the social and economic impacts of not only land acquisition but also the benefits of the AP III to the project areas.

- The NGO should have appropriate professional skills and experience in community and rural development, restoration of livelihood for sustainable income through , among others, water resources management, community organization and mobilization, training for skills improvement, sustainable livelihood for economic rehabilitation, non-formal education and leadership.

- The NGO should have a clear understanding of gender and poverty relations within the community of project affected families, and the project beneficiaries in order to focus on the development of women and poverty alleviation.

- The NGO should have an interest and the capacity to organize community groups, including Development of Women and Children in Rural Areas (DWCRA) type activities that are applicable to a particular sub-project of AP III.

The Role of NGOs

6. The NGOs selected on the basis of these criteria will also be part of the institutional arrangements that have been constituted for the implementation of PAPERP. These arrangements include the Negotiation Committee and the Economic Rehabilitation & Grievance Committee at district, project and state level. The NGOs will provide the interface between the Special Collector, Land Acquisition and other Rehabilitation Officer and his staff at the sub-project level and the affected community under the sub-project of the A.P.I.P-III so that they could all be involved in the process of livelihood Restoration and sustainable development. In order to do this, the NGOs will have the following roles to play:

- to enable Special Collector, Land Acquisition and his staff speed up the process of land acquisition and help with assessment of land value and the payment of compensation;

- to identify and strengthen existing social organizations and/or community groups, or organize such groups where necessary and provide necessary support for their

capacity and leadership building so that they could participate in the process of sustainable development;

- to enable the community of project affected persons, their groups, the Negotiation Committee and the Economic & Rehabilitation and Grievance Committee in the sub-project to identify "land for land" on the basis of "willing seller and willing buyer";

- to enable the community of project affected persons to make effective use of Productive Asset Grant and Maintenance allowance for PAPs and their cattle by linking them wherever possible and necessary with other sources of funds such as Integrated Rural Development Program, NABARD, Training of Women in Agriculture and any other such projects (including the Bank-sponsored projects such as the Agricultural Development Projects, the National Sericulture and the Second National Dairy Project for dairy cooperatives financed by NDDB), and to release the funds through joint accounts only for the purchase of productive assets;

- to ensure that the grievances of the community of project affected persons regarding land acquisition, payment of compensation, PAG, MA/CMA and other issues related to PAPERP are redressed in a participatory manner through the Negotiation Committee and the Economic Rehabilitation and Grievance Committee;

- to strengthen the role and the status of women in the family and in the community through organization of DWCRA type groups as are applicable in a particular sub-project and their capacity building through non-formal education and training for skills and leadership improvement for microenterprise;

- to organize village committees of PAPs to enable them to become aware of the definition of PAPs, entitlements as stipulated in the R & R policy and as provided in the PAPERP, codification of entitlements, rights and responsibilities, collection and payment of bank loans, management, and conflict resolution so that a participatory model for implementation of PAPERP could be developed and replicated;

- to help Special Collector Land Acquisition and his representative to plan, implement and monitor the process of PAPERP in a participatory manner so that the project affected persons could have sustainable livelihood; and

- to work very closely with the other Non-Governmental Organization meant for independent monitoring and evaluation in all aspects related to PAPERP.

7. It is essential for the NGOs to have a clear understanding of AP III, its R & R Policy, the PAPERP and A.P-II Remedial Action Plan. It is also essential for them to understand the role of the Special Collector, Land Acquisition and his staff and the need to complement their role. It is important, therefore, for the NGOs to participate in any training program, workshops and seminars which the Special Collector, Land Acquisition, and the other Non-Government Organization for monitoring and evaluation, may organize from time to time.

C. Scope of Work

8. The assignment covers villages where minimum 30 PAPs areare located. The NGO should work closely with Special Collector, Land Acquisition and his staff at the sub-projects and participate in the R&R committees at project, district and state level.

9 The NGO will organize Village Rehabilitation Committees (VRC) as recommended in the PAPERP and facilitate PAP participation and consultation in all R&R activities. The NGO will help VRCs to define it function and operations.

10 The NGO will work with VRCs and R&R officers to reconfirm all PAP-specific economic activities and develop village-wise R&R action plans,

11 The NGO will, working with VRCs, R&R officers and district line departments, coordinate PAP-specific income generation schemes with government development programs and facilitate vocational training programs for PAPs..

12 The NGO will organize women thrift groups for economic activities.

13 The NGO will work as a channel for grievances redress. It will help VRCs to record all grievances filed and redressed.

14 The NGO will monitor the progress of the income generation activities and propose measures for revision and retrofitting as necessary.

15 The NGO will submit quarterly progress reports on the achievement of the objectives. At the end of the first year, the organization will also submit an annual report, with suggestions for modifications of issues related to the PAPERP and the work program of village Action Plan for the second year.

16. In addition to the above, the NGO will also prepare an inception report at the start of the assignment focusing on strategies for:

- Village institutions;
- Restoration of livelihood;
- Women's development; and
- Training on skills improvement and leadership.

Timeframe

17 The assignment will be on a long term basis for the period of 5 years during project implementation. The service of the NGO will be extended on an annual basis.

The NGO

18 The NGO will have a team of trained people set up for this assignment. The team should have the skills and experience in resettlement and rehabilitation, rural and community development, household livelihood development and participatory methodologies.

Independent Monitoring And Evaluation of

Project Affected Persons Economic Rehabilitation Program

Draft Terms of Reference

Introduction

1. The Government of Andhra Pradesh (GOAP) has proposed Third Andhra Pradesh Irrigation Project (AP III) for World Bank Assistance. AP III comprises two sub-projects, namely (i) Srisailam Right Branch Canal (SRBC) in the Kurnool district and (ii), Sri Rama Sagar Project (SRSP) in the Karimnagar and Warangal districts. Resettlement and Rehabilitation (R & R) is a small but essential part of the project. The displaced persons under the Srisailam Reservoir and Lower Manair Reservoir have been covered under the three Resettlement Action Plans (1988-89, 89-90 and 91-93) under the AP II Project. The R & R Component under AP III envisages economic rehabilitation of the persons affected by the canal system, roads network with a retrofit component for AP II.

2. The GOAP has formulated a R & R Policy indicating the aims and objectives for the rehabilitation of the affected persons. A Project Affected Persons Economic Rehabilitation Action Plans (PAPERP) has been prepared on the basis of this policy. The PAPERP stipulates involvement of a Non-Governmental Organization (NGO) for Monitoring and Evaluation so that the process of land acquisition and implementation of Economic Rehabilitation is carried out as per the set targets. There are about 3,416 PAPs including 1,696 PAPs under SRBC sub-project (Kurnool district) and 2,619 under SRSP sub-project (Karimnagar and Warangal districts).

The Aim

3. The GOAP has a separate cell under the Special Collector, Land Acquisition, to implement the PAPERP with the help of NGOs. In order to ensure effective implementation of the PAPERP and achievement of the designed targets, the GOAP is appointing a Non-Governmental Organization to conduct independent monitoring and evaluation of the R&R components to provide an on-going assessment of R&R implementation to enable timely adjustments of implementation setup and procedures.

4. In order to achieve this aim, the assignment of independent monitoring and evaluation assignment will have the following specific targets:

- Concurrent monitoring of R&R implementation progress as laid out in the PAPERPs for SRBC and SRSP;
- Evaluation of R&R progress and achievement of projected R&R objectives;

formulation of the necessary measures to resolve problems and improve R&R implementation.

Scope of Work

5. The assignment covers the two sub-projects: SRBC in the Kurnool district and SRSP in Karimnagar and Warangal districts. The NGO will work closely with Special Collector, Land Acquisition and his staff at the sub-projects for the period 1997-98 to 2001-2002.

6. The NGO should describe its methodologies in its inception report, specifying the type of quantitative and qualitative methods that will be used in the field for monitoring and evaluation.

7. The NGO should work with the resettlement agency to set up the computerized monitoring system for R&R component. The monitoring system should be operated by the resettlement agency as part of its internal monitoring. It is the responsibility of the resettlement agency to track the daily physical progress of the project as part of the project internal monitoring.

8. As part of the effort to set up the monitoring system, the NGO should develop a detailed list of specific and measurable indicators to indicate achievement of physical targets and fulfillment of program objectives for the GOAP. The indicators should fit into the framework of general project R&R performance indicators prepared for the AP III project and form the basis for R&R internal monitoring. These indicators should cover:

- organization performance;
- community mobilization and participation;
- financial progress;
- physical progress;
- grievance redress;
- performance of rehabilitation activities;
- availability of support services;
- womens' development;
- impacts of training programs;
-

9. The NGO should carry out concurrent monitoring of R&R activities. Provided with updated data on physical R&R progress through internal monitoring, the NGO should verify these information through systematic and extensive PAP contact monitoring activities in the field and thorough diagnostic analysis. Contact monitoring and diagnostic studies should be based on participating in public consultations and PAP meetings, interviewing a random sample of PAPs and resettlement officers, field visit observations and survey of controlled groups of PAPs.

10. Based on analysis of provided progress data and contact observations in the field, the NGO should be able to determine whether the goals of R&R--namely maintenance or increase of PAP living standards--are achieved through evaluating:

- the application of the R&R policy;
- the functioning of the R&R institutional setup;
- the timely delivery of entitlements under the R&R Policy;
- the functioning of consultative and participatory arrangements;
- the operation of designed economic activities;
- the functioning of the grievance redress mechanism; and
- the restoration of PAP living standards.

11. The NGO will conduct a socioeconomic evaluation of the PAPERP implementation at project completion to measure the living standards of the affected persons against that established in the socioeconomic survey before the project.

12. The NGO should submit semi-annual monitoring and evaluaton reports to the GOAP and the World Bank.

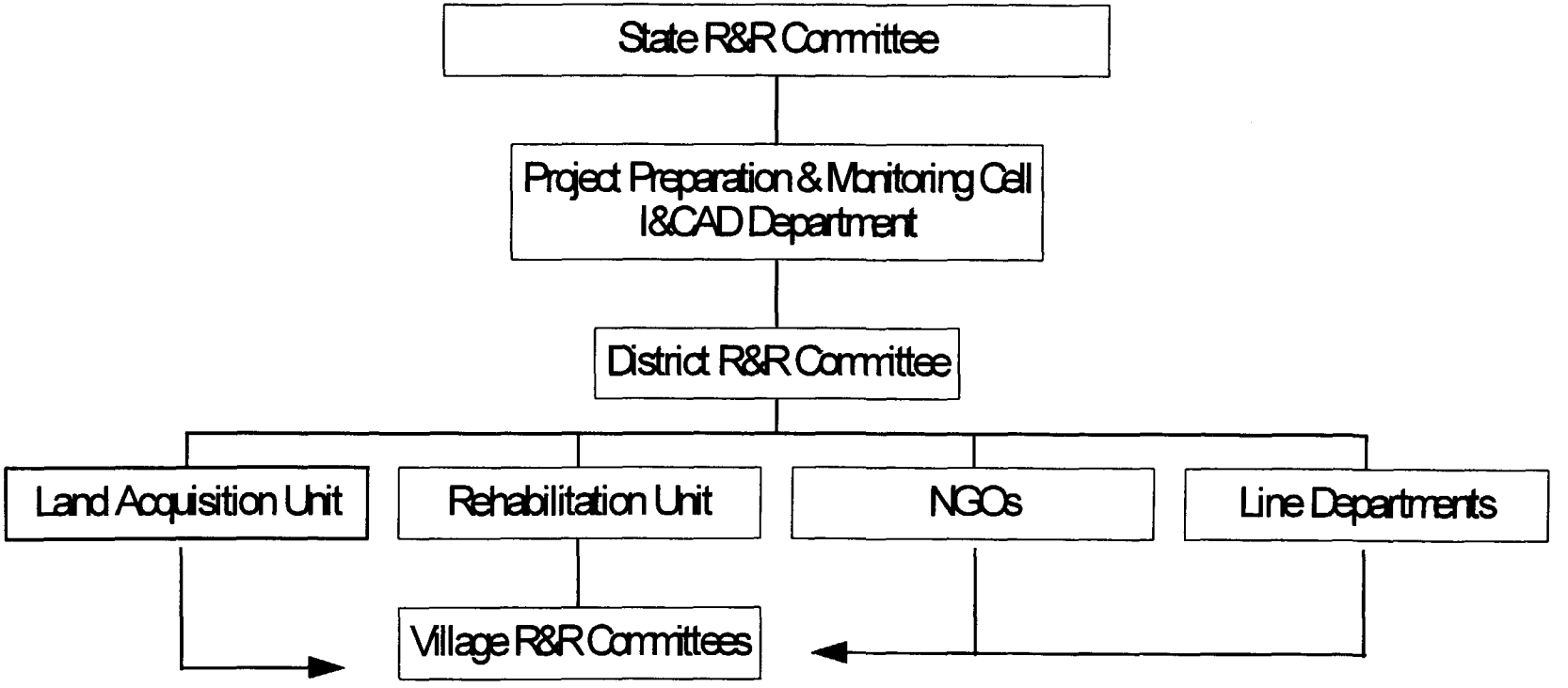
Timeframe

13. The assignment is for three years to be extended annually on the basis of performance.

The Non-Government Organization

14. The NGO will have a team of professionals who have skills and experience in resettlement and rehabilitation, rural community development, social assessment, participatory methodologies and monitoring of social development.

Third Andhra Pradesh Irrigation Project
R&R Organization



Annex 6

PROJECT COST TABLES

INDIA
Third Andhra Pradesh Irrigation Project
Project Cost Summary

	(Rs Million)			(US$ Million)			% Foreign Exchange	% Total Base Costs
	Local	Foreign	Total	Local	Foreign	Total		
A. Irrigation								
1. Above LMD	3,773.68	455.33	4,229.02	109.38	13.20	122.58	11	28
2. Below LMD	1,787.88	199.48	1,987.36	51.82	5.78	57.60	10	13
3. SRBC	5,038.32	693.34	5,731.67	146.04	20.10	166.14	12	38
Subtotal Irrigation	10,599.89	1,348.16	11,948.05	307.24	39.08	346.32	11	80
B. Dam Safety								
1. SRSP	49.75	3.00	52.75	1.44	0.09	1.53	6	-
2. SRBC	574.14	72.80	646.94	16.64	2.11	18.75	11	4
Subtotal Dam Safety	623.89	75.80	699.69	18.08	2.20	20.28	11	5
C. Resettlement & Rehabilitation								
1. SRSP	221.41	3.59	225.00	6.42	0.10	6.52	2	2
2. SRBC	517.52	9.79	527.32	15.00	0.28	15.28	2	4
Subtotal Resettlement & Rehabilitation	738.93	13.38	752.31	21.42	0.39	21.81	2	5
D. Agric. Support Services								
1. Support to Central Offices	38.98	2.38	41.36	1.13	0.07	1.20	6	-
2. SRSP	208.76	13.22	221.98	6.05	0.38	6.43	6	1
3. SRBC	97.62	8.63	106.25	2.83	0.25	3.08	8	1
Subtotal Agric. Support Services	345.36	24.23	369.59	10.01	0.70	10.71	7	2
E. Environment Management Plan								
1. SRSP	528.01	57.11	585.12	15.30	1.66	16.96	10	4
2. SRBC	489.73	45.62	535.35	14.20	1.32	15.52	9	4
Subtotal Environment Management Plan	1,017.74	102.73	1,120.47	29.50	2.98	32.48	9	7
F. Project Preparation and monitoring								
1. PPMU	85.08	-	85.08	2.47	-	2.47	-	1
Subtotal Project Preparation and monitoring	85.08	-	85.08	2.47	-	2.47	-	1
Total BASELINE COSTS	13,410.89	1,564.30	14,975.19	388.72	45.34	434.06	10	100
Physical Contingencies	709.97	92.26	802.23	20.58	2.67	23.25	12	5
Price Contingencies	2,794.23	326.19	3,120.42	18.02	2.09	20.11	10	5
Total PROJECT COSTS	16,915.09	1,982.74	18,897.83	427.32	50.11	477.43	10	110

INDIA
Third Andhra Pradesh Irrigation Project
Project Cost Summary

	(Rs Million)					(US$ Million)				
	Local	Foreign	Total	% Foreign Exchange	% Total Base Costs	Local	Foreign	Total	% Foreign Exchange	% Total Base Costs
I. Investment Costs										
A. Land Acquisition	458.85	-	458.85	-	3	13.30	-	13.30	-	3
B. Survey & Eng. Administration	1,146.00	-	1,146.00	-	8	33.22	-	33.22	-	8
C. Civil Works										
1. Grounded Works	2,826.39	367.27	3,193.66	12	21	81.92	10.65	92.57	11	21
2. Ungrounded Works	6,291.65	817.56	7,109.20	12	47	182.37	23.70	206.06	11	47
Subtotal Civil Works	9,118.04	1,184.83	10,302.87	12	69	264.29	34.34	298.63	11	69
D. Command Area development	451.39	58.65	510.04	12	3	13.08	1.70	14.78	12	3
E. Feeder Roads										
1. Grounded Works	96.13	12.49	108.63	12	1	2.79	0.36	3.15	11	1
2. Ungrounded Works	174.19	22.64	196.83	12	1	5.05	0.66	5.71	12	1
Subtotal Feeder Roads	270.33	35.13	305.45	12	2	7.84	1.02	8.85	11	2
F. Buildings	92.12	11.97	104.09	12	1	2.67	0.35	3.02	11	1
G. Inc. Irrigation O&M	120.56	15.67	136.23	12	1	3.49	0.45	3.95	12	1
H. O&M Upgrading	90.36	11.74	102.10	12	1	2.62	0.34	2.96	12	1
I. Equipment	213.12	174.37	387.50	45	3	6.18	5.05	11.23	45	3
J. Furniture	5.73	-	5.73	-	-	0.17	-	0.17	-	-
K. Vehicles	21.98	5.50	27.48	20	-	0.64	0.16	0.80	20	-
L. Resettlement & Rehabilitation	132.99	-	132.99	-	1	3.85	-	3.85	-	1
M. Forest Plantation	597.96	66.44	664.40	10	4	17.33	1.93	19.26	10	4
N. Training	137.12	-	137.12	-	1	3.97	-	3.97	-	1
O. Consultancy services	162.54	-	162.54	-	1	4.71	-	4.71	-	1
P. Studies	73.16	-	73.16	-	-	2.12	-	2.12	-	-
Total Investment Costs	13,092.26	1,564.30	14,656.55	11	98	379.49	45.34	424.83	11	98
II. Recurrent Costs										
A. Inc. Salaries & Allowance	68.04	-	68.04	-	-	1.97	-	1.97	-	-
B. Operating Costs	89.24	-	89.24	-	1	2.59	-	2.59	-	1
C. vehicle hire charge	69.00	-	69.00	-	-	2.00	-	2.00	-	-
D. Project Preparation & Monitoring Unit	72.58	-	72.58	-	-	2.10	-	2.10	-	-
E. R&R Administration	19.78	-	19.78	-	-	0.57	-	0.57	-	-
Total Recurrent Costs	318.63	-	318.63	-	2	9.24	-	9.24	-	2
Total BASELINE COSTS	13,410.89	1,564.30	14,975.19	10	100	388.72	45.34	434.06	10	100
Physical Contingencies	709.97	92.26	802.23	11	5	20.58	2.67	23.25	12	5
Price Contingencies	2,794.23	326.19	3,120.42	10	21	18.02	2.09	20.11	10	5
Total PROJECT COSTS	16,915.09	1,982.74	18,897.83	10	126	427.32	50.11	477.43	10	110

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts by Components - Base Costs
(Rs Million)

	Irrigation			Dam Safety		Resettlement & Rehabilitation		Agric. Support Services: Support to Central Offices	Agric. Support Services: SRSP	Agric. Support Services: SRBC	Environment Management Plan		Project Preparation and monitoring		Physical Contingencies	
	Above LMD	Below LMD	SRBC	SRSP	SRBC	SRSP	SRBC				SRSP	SRBC	PPMU	Total	%	Amount
I. Investment Costs																
A. Land Acquisition	-	-	-	-	-	92.41	366.45	-	-	-	-	-	-	458.85	-	-
B. Survey & Enq. Administration	380.50	305.50	460.00	-	-	-	-	-	-	-	-	-	-	1,146.00	-	-
C. Civil Works																
1. Grounded Works	357.15	700.22	2,136.29	-	-	-	-	-	-	-	-	-	-	3,193.66	-	-
2. Ungrounded Works	2,928.53	677.19	2,561.53	6.50	603.70	7.18	9.01	-	-	-	258.42	57.15	-	7,109.20	10.0	710.92
Subtotal Civil Works	3,285.68	1,377.41	4,697.83	6.50	603.70	7.18	9.01	-	-	-	258.42	57.15	-	10,302.87	6.9	710.92
D. Command Area development	261.03	138.51	110.50	-	-	-	-	-	-	-	-	-	-	510.04	10.0	51.00
E. Feeder Roads																
1. Grounded Works	50.43	30.74	27.46	-	-	-	-	-	-	-	-	-	-	108.63	-	-
2. Ungrounded Works	-	-	115.58	-	-	13.56	67.68	-	-	-	-	-	-	196.83	10.0	19.68
Subtotal Feeder Roads	50.43	30.74	143.04	-	-	13.56	67.68	-	-	-	-	-	-	305.45	6.4	19.68
F. Buildings	22.01	11.86	22.88	-	-	2.97	2.52	3.60	24.70	13.55	-	-	-	104.09	10.0	10.41
G. Inc. Irrigation O&M	100.58	14.35	21.30	-	-	-	-	-	-	-	-	-	-	136.23	-	-
H. O&M Upgrading	40.50	61.60	-	-	-	-	-	-	-	-	-	-	-	102.10	10.0	10.21
I. Equipment	49.79	24.95	264.12	5.00	7.50	1.12	1.12	3.00	18.24	12.66	-	-	-	387.50	-	-
J. Furniture	-	-	-	-	-	0.28	0.28	3.00	1.36	0.81	-	-	-	5.73	-	-
K. Vehicles	2.50	1.45	-	-	-	1.80	0.90	3.10	10.86	6.86	-	-	-	27.48	-	-
L. Resettlement & Rehabilitation	-	-	-	-	-	77.37	55.62	-	-	-	-	-	-	132.99	-	-
M. Forest Plantation	-	-	-	-	-	-	-	-	-	-	273.94	390.46	-	664.40	-	-
N. Training	-	-	-	-	-	12.86	9.10	5.30	12.89	7.31	26.35	63.32	-	137.12	-	-
O. Consultancy services	-	-	-	2.00	7.44	2.50	3.30	0.60	103.60	30.60	-	-	12.50	162.54	-	-
P. Studies	-	-	-	39.25	28.30	2.20	2.31	-	0.80	0.30	-	-	-	73.16	-	-
Total Investment Costs	4,193.02	1,966.36	5,719.67	52.75	646.94	214.25	518.29	18.60	172.45	72.09	558.71	510.93	12.50	14,656.55	5.5	802.23
II. Recurrent Costs																
A. Inc. Salaries & Allowance	-	-	-	-	-	-	-	19.40	27.80	20.85	-	-	-	68.04	-	-
B. Operating Costs	-	-	-	-	-	-	-	3.36	21.74	13.31	26.41	24.42	-	89.24	-	-
C. vehicle hire charge	36.00	21.00	12.00	-	-	-	-	-	-	-	-	-	-	69.00	-	-
D. Project Preparation & Monitoring Unit	-	-	-	-	-	-	-	-	-	-	-	-	72.58	72.58	-	-
E. R&R Administration	-	-	-	-	-	10.75	9.02	-	-	-	-	-	-	19.78	-	-
Total Recurrent Costs	36.00	21.00	12.00	-	-	10.75	9.02	22.76	49.53	34.16	26.41	24.42	72.58	318.63	-	-
Total BASELINE COSTS	4,229.02	1,987.36	5,731.67	52.75	646.94	225.00	527.32	41.36	221.98	106.25	585.12	535.35	85.08	14,975.19	5.4	802.23
Physical Contingencies	325.21	88.92	281.05	0.65	60.37	2.37	7.92	0.36	2.47	1.36	25.84	5.72	-	802.23	-	-
Price Contingencies																
Inflation																
Local	956.58	331.27	808.52	10.67	193.08	45.36	111.40	8.10	39.85	20.29	113.34	97.47	16.18	2,752.10	-	-
Foreign	26.54	8.79	24.76	0.05	6.39	0.10	0.53	0.02	0.15	0.10	2.77	1.86	-	72.07	-	-
Subtotal Inflation	983.11	340.07	833.28	10.72	199.47	45.46	111.93	8.12	40.01	20.39	116.11	99.33	16.18	2,824.17	-	-
Devaluation	104.57	35.01	110.65	0.40	21.78	0.60	2.19	0.28	1.65	1.10	10.72	7.32	-	296.25	-	-
Subtotal Price Contingencies	1,087.68	375.08	943.92	11.11	221.25	46.06	114.12	8.40	41.66	21.49	126.82	106.65	16.18	3,120.42	6.5	203.59
Total PROJECT COSTS	5,641.90	2,451.36	6,956.64	64.51	928.56	273.43	649.35	50.12	266.11	129.09	737.78	647.72	101.26	18,897.83	5.3	1,005.82
Taxes	693.32	280.51	901.99	2.51	120.89	4.84	15.04	2.42	11.44	7.21	46.56	10.05	-	2,096.80	6.4	135.02
Foreign Exchange	609.29	248.59	843.52	3.43	104.93	4.48	13.12	2.67	14.95	9.74	72.73	55.29	-	1,982.74	5.8	115.67

INDIA

Third Andhra Pradesh Irrigation Project

Expenditure Accounts by Components - Base Costs

(US$ Million)

	Irrigation			Dam Safety		Resettlement & Rehabilitation		Agric. Support Services: Support to Central Offices	Agric. Support Services		Environment Management Plan		Project Preparation and monitoring		Physical Contingencies	
	Above LMD	Below LMD	SRBC	SRSP	SRBC	SRSP	SRBC		SRSP	SRBC	SRSP	SRBC	PPMU	Total	%	Amount
I. Investment Costs																
A. Land Acquisition	-	-	-	-	-	2.68	10.62	-	-	-	-	-	-	13.30	-	-
B. Survey & Eng. Administration	11.03	8.86	13.33	-	-	-	-	-	-	-	-	-	-	33.22	-	-
C. Civil Works																
1. Grounded Works	10.35	20.30	61.92	-	-	-	-	-	-	-	-	-	-	92.57	-	-
2. Ungrounded Works	84.88	19.63	74.25	0.19	17.50	0.21	0.26	-	-	-	7.49	1.66	-	206.06	10.0	20.61
Subtotal Civil Works	95.24	39.92	136.17	0.19	17.50	0.21	0.26	-	-	-	7.49	1.66	-	298.63	6.9	20.61
D. Command Area development	7.57	4.01	3.20	-	-	-	-	-	-	-	-	-	-	14.78	10.0	1.48
E. Feeder Roads																
1. Grounded Works	1.46	0.89	0.80	-	-	-	-	-	-	-	-	-	-	3.15	-	-
2. Ungrounded Works	-	-	3.35	-	-	0.39	1.96	-	-	-	-	-	-	5.71	10.0	0.57
Subtotal Feeder Roads	1.46	0.89	4.15	-	-	0.39	1.96	-	-	-	-	-	-	8.85	6.4	0.57
F. Buildings	0.64	0.34	0.66	-	-	0.09	0.07	0.10	0.72	0.39	-	-	-	3.02	10.0	0.30
G. Inc. Irrigation O&M	2.92	0.42	0.62	-	-	-	-	-	-	-	-	-	-	3.95	-	-
H. O&M Upgrading	1.17	1.79	-	-	-	-	-	-	-	-	-	-	-	2.96	10.0	0.30
I. Equipment	1.44	0.72	7.66	0.14	0.22	0.03	0.03	0.09	0.53	0.37	-	-	-	11.23	-	-
J. Furniture	-	-	-	-	-	0.01	0.01	0.09	0.04	0.02	-	-	-	0.17	-	-
K. Vehicles	0.07	0.04	-	-	-	0.05	0.03	0.09	0.31	0.20	-	-	-	0.80	-	-
L. Resettlement & Rehabilitation	-	-	-	-	-	2.24	1.61	-	-	-	-	-	-	3.85	-	-
M. Forest Plantation	-	-	-	-	-	-	-	-	-	-	7.94	11.32	-	19.26	-	-
N. Training	-	-	-	-	-	0.37	0.26	0.15	0.37	0.21	0.76	1.84	-	3.97	-	-
O. Consultancy services	-	-	-	0.06	0.22	0.07	0.10	0.02	3.00	0.89	-	-	0.36	4.71	-	-
P. Studies	-	-	-	1.14	0.82	0.06	0.07	-	0.02	0.01	-	-	-	2.12	-	-
Total Investment Costs	121.54	57.00	165.79	1.53	18.75	6.21	15.02	0.54	5.00	2.09	16.19	14.81	0.36	424.83	5.5	23.25
II. Recurrent Costs																
A. Inc. Salaries & Allowance	-	-	-	-	-	-	-	0.56	0.81	0.60	-	-	-	1.97	-	-
B. Operating Costs	-	-	-	-	-	-	-	0.10	0.63	0.39	0.77	0.71	-	2.59	-	-
C. vehicle hire charge	1.04	0.61	0.35	-	-	-	-	-	-	-	-	-	-	2.00	-	-
D. Project Preparation & Monitoring Unit	-	-	-	-	-	-	-	-	-	-	-	-	2.10	2.10	-	-
E. R&R Administration	-	-	-	-	-	0.31	0.26	-	-	-	-	-	-	0.57	-	-
Total Recurrent Costs	1.04	0.61	0.35	-	-	0.31	0.26	0.66	1.44	0.99	0.77	0.71	2.10	9.24	-	-
Total BASELINE COSTS	122.58	57.60	166.14	1.53	18.75	6.52	15.28	1.20	6.43	3.08	16.96	15.52	2.47	434.06	5.4	23.25
Physical Contingencies	9.43	2.58	8.15	0.02	1.75	0.07	0.23	0.01	0.07	0.04	0.75	0.17	-	23.25	-	-
Price Contingencies																
Inflation																
Local	27.73	9.60	23.44	0.31	5.60	1.31	3.23	0.23	1.16	0.59	3.29	2.83	0.47	79.77	-	-
Foreign	0.77	0.25	0.72	0.00	0.19	0.00	0.02	0.00	0.00	0.00	0.08	0.05	-	2.09	-	-
Subtotal Inflation	28.50	9.86	24.15	0.31	5.78	1.32	3.24	0.24	1.16	0.59	3.37	2.88	0.47	81.86	-	-
Devaluation	-21.29	-7.46	-18.31	-0.24	-4.16	-1.03	-2.53	-0.18	-0.91	-0.46	-2.57	-2.24	-0.37	-61.75	-	-
Subtotal Price Contingencies	7.21	2.40	5.84	0.07	1.62	0.28	0.72	0.05	0.24	0.13	0.80	0.64	0.10	20.11	6.8	1.37
Total PROJECT COSTS	139.21	62.58	180.12	1.61	22.13	6.87	16.23	1.26	6.75	3.25	18.51	16.33	2.57	477.43	5.2	24.63
Taxes	17.12	7.15	23.29	0.07	2.87	0.12	0.37	0.06	0.30	0.19	1.17	0.26	-	52.98	6.2	3.31
Foreign Exchange	15.05	6.33	21.75	0.09	2.50	0.11	0.33	0.07	0.40	0.26	1.82	1.40	-	50.11	5.7	2.83

INDIA

Third Andhra Pradesh Irrigation Project

Expenditure Accounts by Components - Totals Including Contingencies

(Rs Million)

	Irrigation			Dam Safety		Resettlement & Rehabilitation		Agric. Support Services: Support to Central Offices	Agric. Support Services		Environment Management Plan		Project Preparation and monitoring	
	Above LMD	Below LMD	SRBC	SRSP	SRBC	SRSP	SRBC		SRSP	SRBC	SRSP	SRBC	PPMU	Total
I. Investment Costs														
A. Land Acquisition	-	-	-	-	-	111.54	443.52	-	-	-	-	-	-	555.07
B. Survey & Enq. Administration	474.26	351.48	511.62	-	-	-	-	-	-	-	-	-	-	1,337.37
C. Civil Works														
1. Grounded Works	381.73	790.59	2,201.59	-	-	-	-	-	-	-	-	-	-	3,373.91
2. Ungrounded Works	4,067.82	905.47	3,530.20	8.49	880.33	9.58	11.38	-	-	-	344.93	74.46	-	9,832.66
Subtotal Civil Works	4,449.55	1,696.05	5,731.80	8.49	880.33	9.58	11.38	-	-	-	344.93	74.46	-	13,206.57
D. Command Area development	349.78	190.70	154.06	-	-	-	-	-	-	-	-	-	-	694.55
E. Feeder Roads														
1. Grounded Works	50.43	30.74	27.63	-	-	-	-	-	-	-	-	-	-	108.80
2. Ungrounded Works	-	-	149.17	-	-	17.17	93.07	-	-	-	-	-	-	259.41
Subtotal Feeder Roads	50.43	30.74	176.80	-	-	17.17	93.07	-	-	-	-	-	-	368.21
F. Buildings	28.21	16.23	28.31	-	-	3.92	3.11	4.35	29.87	16.39	-	-	-	130.39
G. Inc. Irrigation O&M	126.97	19.32	28.95	-	-	-	-	-	-	-	-	-	-	175.24
H. O&M Upgrading	56.93	90.09	-	-	-	-	-	-	-	-	-	-	-	147.02
I. Equipment	59.09	29.53	310.52	5.46	8.20	1.23	1.23	3.30	20.28	14.10	-	-	-	452.94
J. Furniture	-	-	-	-	-	0.31	0.31	3.30	1.59	0.96	-	-	-	6.46
K. Vehicles	2.93	1.70	-	-	-	1.98	0.99	3.41	11.94	7.54	-	-	-	30.50
L. Resettlement & Rehabilitation	-	-	-	-	-	93.30	67.02	-	-	-	-	-	-	160.32
M. Forest Plantation	-	-	-	-	-	-	-	-	-	-	330.60	467.30	-	797.91
N. Training	-	-	-	-	-	15.71	11.07	6.63	16.11	9.14	30.99	75.94	-	165.59
O. Consultancy services	-	-	-	2.20	9.28	3.13	4.13	0.66	123.55	37.96	-	-	14.21	195.12
P. Studies	-	-	-	48.37	30.76	2.25	2.34	-	0.88	0.33	-	-	-	84.93
Total Investment Costs	5,598.16	2,425.85	6,942.06	64.51	928.56	260.12	638.18	21.65	204.22	86.42	706.52	617.70	14.21	18,508.18
II. Recurrent Costs														
A. Inc. Salaries & Allowance	-	-	-	-	-	-	-	24.26	34.79	26.09	-	-	-	85.14
B. Operating Costs	-	-	-	-	-	-	-	4.21	27.09	16.58	31.26	30.01	-	109.16
C. vehicle hire charge	43.74	25.51	14.58	-	-	-	-	-	-	-	-	-	-	83.83
D. Project Preparation & Monitoring Unit	-	-	-	-	-	-	-	-	-	-	-	-	87.05	87.05
E. R&R Administration	-	-	-	-	-	13.31	11.17	-	-	-	-	-	-	24.48
Total Recurrent Costs	43.74	25.51	14.58	-	-	13.31	11.17	28.47	61.88	42.67	31.26	30.01	87.05	389.66
Total PROJECT COSTS	5,641.90	2,451.36	6,956.64	64.51	928.56	273.43	649.35	50.12	266.11	129.09	737.78	647.72	101.26	18,897.83
Taxes	693.32	280.51	901.99	2.51	120.89	4.84	15.04	2.42	11.44	7.21	46.56	10.05	-	2,096.80
Foreign Exchange	609.29	248.59	843.52	3.43	104.93	4.48	13.12	2.67	14.95	9.74	72.73	55.29	-	1,982.74

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts by Components - Totals Including Contingencies
(US$ Million)

	Irrigation			Dam Safety		Resettlement & Rehabilitation		Agric. Support Services: Support to Central Offices	Agric. Support Services		Environment Management Plan		Project Preparation and monitoring	
	Above LMD	Below LMD	SRBC	SRSP	SRBC	SRSP	SRBC		SRSP	SRBC	SRSP	SRBC	PPMU	Total
I. Investment Costs														
A. Land Acquisition	-	-	-	-	-	2.80	11.10	-	-	-	-	-	-	13.90
B. Survey & Eng. Administration	11.64	9.08	13.60	-	-	-	-	-	-	-			-	34.33
C. Civil Works														
1. Grounded Works	10.46	20.84	62.05	-	-	-	-	-	-	-	-	-	-	93.35
2. Ungrounded Works	99.09	22.68	86.46	0.21	20.85	0.24	0.29	-	-	-	8.64	1.89	-	240.36
Subtotal Civil Works	109.55	43.53	148.51	0.21	20.85	0.24	0.29	-	-	-	8.64	1.89	-	333.70
D. Command Area development	8.70	4.67	3.75	-	-	-	-	-	-	-	-	-	-	17.12
E. Feeder Roads														
1. Grounded Works	1.46	0.89	0.80	-	-	-	-	-	-	-	-	-	-	3.15
2. Ungrounded Works	-	-	3.80	-	-	0.44	2.28	-	-	-	-	-	-	6.53
Subtotal Feeder Roads	1.46	0.89	4.60	-	-	0.44	2.28	-	-	-	-	-	-	9.67
F. Buildings	0.72	0.40	0.74	-	-	0.10	0.08	0.12	0.79	0.44	-	-	-	3.39
G. Inc. Irrigation O&M	3.10	0.45	0.68	-	-	-	-	-	-	-	-	-	-	4.23
H. O&M Upgrading	1.38	2.13	-	-	-	-	-	-	-	-	-	-	-	3.51
I. Equipment	1.49	0.75	7.89	0.15	0.22	0.03	0.03	0.09	0.54	0.37	-	-	-	11.56
J. Furniture	-	-	-	-	-	0.01	0.01	0.09	0.04	0.02	-	-	-	0.17
K. Vehicles	0.07	0.04	-	-	-	0.05	0.03	0.09	0.32	0.20	-	-	-	0.81
L. Resettlement & Rehabilitation	-	-	-	-	-	2.34	1.69	-	-	-	-	-	-	4.03
M. Forest Plantation	-	-	-	-	-	-	-	-	-	-	8.29	11.78	-	20.07
N. Training	-	-	-	-	-	0.39	0.28	0.16	0.39	0.22	0.79	1.91	-	4.15
O. Consultancy services	-	-	-	0.06	0.23	0.08	0.10	0.02	3.13	0.94	-	-	0.37	4.91
P. Studies	-	-	-	1.20	0.83	0.06	0.07	-	0.02	0.01	-	-	-	2.19
Total Investment Costs	138.12	61.94	179.76	1.61	22.13	6.55	15.96	0.56	5.23	2.20	17.71	15.58	0.37	467.72
II. Recurrent Costs														
A. Inc. Salaries & Allowance	-	-	-	-	-	-	-	0.59	0.85	0.64	-	-	-	2.09
B. Operating Costs	-	-	-	-	-	-	-	0.10	0.67	0.41	0.79	0.75	-	2.72
C. vehicle hire charge	1.09	0.64	0.36	-	-	-	-	-	-	-	-	-	-	2.10
D. Project Preparation & Monitoring Unit	-	-	-	-	-	-	-	-	-	-	-	-	2.20	2.20
E. R&R Administration	-	-	-	-	-	0.33	0.28	-	-	-	-	-	-	0.60
Total Recurrent Costs	1.09	0.64	0.36	-	-	0.33	0.28	0.70	1.52	1.05	0.79	0.75	2.20	9.70
Total PROJECT COSTS	139.21	62.58	180.12	1.61	22.13	6.87	16.23	1.26	6.75	3.25	18.51	16.33	2.57	477.43
Taxes	17.12	7.15	23.29	0.07	2.87	0.12	0.37	0.06	0.30	0.19	1.17	0.26	-	52.98
Foreign Exchange	15.05	6.33	21.75	0.09	2.50	0.11	0.33	0.07	0.40	0.26	1.82	1.40	-	50.11

INDIA
Third Andhra Pradesh Irrigation Project
Project Components by Year

	Base Cost (Rs Million)								Base Cost (US$ Million)							
	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total
A. Irrigation																
1. Above LMD	179.86	98.72	353.28	890.36	1,326.62	1,046.82	333.35	4,229.02	5.21	2.86	10.24	25.81	38.45	30.34	9.66	122.58
2. Below LMD	340.08	148.58	326.53	369.05	303.84	324.95	174.33	1,987.36	9.86	4.31	9.46	10.70	8.81	9.42	5.05	57.60
3. SRBC	1,169.66	869.46	718.55	904.13	1,008.39	833.11	228.36	5,731.67	33.90	25.20	20.83	26.21	29.23	24.15	6.62	166.14
Subtotal Irrigation	1,689.60	1,116.76	1,398.36	2,163.54	2,638.86	2,204.89	736.04	11,948.05	48.97	32.37	40.53	62.71	76.49	63.91	21.33	346.32
B. Dam Safety																
1. SRSP	0.35	-	13.10	14.00	13.30	12.00	-	52.75	0.01	-	0.38	0.41	0.39	0.35	-	1.53
2. SRBC	4.20	2.00	35.10	4.08	197.08	209.48	195.00	646.94	0.12	0.06	1.02	0.12	5.71	6.07	5.65	18.75
Subtotal Dam Safety	4.55	2.00	48.20	18.08	210.38	221.48	195.00	699.69	0.13	0.06	1.40	0.52	6.10	6.42	5.65	20.28
C. Resettlement & Rehabilitation																
1. SRSP	0.55	19.51	56.74	48.71	47.97	25.75	25.78	225.00	0.02	0.57	1.64	1.41	1.39	0.75	0.75	6.52
2. SRBC	1.20	35.38	120.75	120.50	112.91	70.97	65.61	527.32	0.03	1.03	3.50	3.49	3.27	2.06	1.90	15.28
Subtotal Resettlement & Rehabilitation	1.75	54.89	177.49	169.21	160.88	96.71	91.39	752.31	0.05	1.59	5.14	4.90	4.66	2.80	2.65	21.81
D. Agric. Support Services																
1. Support to Central Offices	-	0.52	17.70	6.18	5.88	5.88	5.21	41.36	-	0.02	0.51	0.18	0.17	0.17	0.15	1.20
2. SRSP	4.52	11.06	82.02	40.88	36.54	30.76	16.20	221.98	0.13	0.32	2.38	1.18	1.06	0.89	0.47	6.43
3. SRBC	-	1.33	43.32	18.28	15.55	17.18	10.60	106.25	-	0.04	1.26	0.53	0.45	0.50	0.31	3.08
Subtotal Agric. Support Services	4.52	12.91	143.04	65.33	57.96	53.81	32.01	369.59	0.13	0.37	4.15	1.89	1.68	1.56	0.93	10.71
E. Environment Management Plan																
1. SRSP	13.95	55.39	89.31	140.00	134.66	114.80	37.01	585.12	0.40	1.61	2.59	4.06	3.90	3.33	1.07	16.96
2. SRBC	5.00	43.54	114.40	143.49	120.84	79.30	28.78	535.35	0.14	1.26	3.32	4.16	3.50	2.30	0.83	15.52
Subtotal Environment Management Plan	18.95	98.93	203.71	283.49	255.50	194.10	65.79	1,120.47	0.55	2.87	5.90	8.22	7.41	5.63	1.91	32.48
F. Project Preparation and monitoring																
1. PPMU	6.61	9.67	17.51	17.51	11.26	11.26	11.26	85.08	0.19	0.28	0.51	0.51	0.33	0.33	0.33	2.47
Subtotal Project Preparation and monitoring	6.61	9.67	17.51	17.51	11.26	11.26	11.26	85.08	0.19	0.28	0.51	0.51	0.33	0.33	0.33	2.47
Total BASELINE COSTS	1,725.98	1,295.15	1,988.32	2,717.15	3,334.84	2,782.25	1,131.69	14,975.19	50.03	37.58	57.63	78.76	96.66	80.64	32.80	434.06
Physical Contingencies	12.25	17.90	61.23	150.69	255.48	216.46	88.24	802.23	0.35	0.52	1.77	4.37	7.41	6.27	2.56	23.25
Price Contingencies																
Inflation																
Local	-	36.60	182.21	422.17	796.36	872.84	441.92	2,752.10	-	1.06	5.28	12.24	23.08	25.30	12.81	79.77
Foreign	-	-	1.71	11.18	20.25	25.23	13.70	72.07	-	-	0.05	0.32	0.59	0.73	0.40	2.09
Subtotal Inflation	-	36.60	183.92	433.35	816.61	898.07	455.62	2,824.17	-	1.06	5.33	12.56	23.67	26.03	13.21	81.86
Devaluation	-	4.43	19.58	65.23	81.86	84.11	41.04	296.25	-	-1.06	-4.79	-10.07	-17.89	-18.73	-9.21	-61.75
Subtotal Price Contingencies	-	41.03	203.50	498.58	898.47	982.18	496.66	3,120.42	-	-	0.54	2.49	5.78	7.30	3.99	20.11
Total PROJECT COSTS	1,738.23	1,354.08	2,253.04	3,366.42	4,488.79	3,980.89	1,716.38	18,897.83	50.38	38.06	59.95	85.62	109.85	94.22	39.35	477.43
Taxes	220.10	142.59	208.08	380.82	501.86	451.39	191.96	2,096.80	6.38	4.01	5.54	9.69	12.28	10.68	4.40	52.98
Foreign Exchange	187.69	127.23	205.02	437.44	456.00	398.59	170.76	1,982.74	5.44	3.58	5.46	11.13	11.16	9.43	3.91	50.11

INDIA
Third Andhra Pradesh Irrigation Project
Project Components by Year

	Totals Including Contingencies (Rs Million)								Totals Including Contingencies (US$ Million)							
	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total
A. Irrigation																
1. Above LMD	179.86	101.81	411.66	1,131.12	1,799.65	1,505.79	512.01	5,641.90	5.21	2.86	10.95	28.77	44.04	35.64	11.74	139.21
2. Below LMD	349.71	157.19	370.13	447.21	402.72	458.98	265.42	2,451.36	10.14	4.42	9.85	11.37	9.85	10.86	6.08	62.58
3. SRBC	1,170.59	908.02	809.96	1,126.14	1,381.12	1,210.63	350.19	6,956.64	33.93	25.52	21.55	28.64	33.80	28.65	8.03	180.12
Subtotal Irrigation	1,700.15	1,167.01	1,591.75	2,704.47	3,583.48	3,175.41	1,127.62	15,049.90	49.28	32.80	42.35	68.78	87.69	75.16	25.85	381.92
B. Dam Safety																
1. SRSP	0.35	-	14.53	16.79	16.92	15.93	-	64.51	0.01	-	0.39	0.43	0.41	0.38	-	1.61
2. SRBC	4.20	2.06	39.35	4.79	270.78	305.53	301.84	928.56	0.12	0.06	1.05	0.12	6.63	7.23	6.92	22.13
Subtotal Dam Safety	4.55	2.06	53.89	21.58	287.70	321.46	301.84	993.07	0.13	0.06	1.43	0.55	7.04	7.61	6.92	23.74
C. Resettlement & Rehabilitation																
1. SRSP	0.55	20.12	63.16	58.22	60.93	34.18	36.28	273.43	0.02	0.57	1.68	1.48	1.49	0.81	0.83	6.87
2. SRBC	1.20	36.48	134.74	143.85	142.93	96.05	94.10	649.35	0.03	1.03	3.59	3.66	3.50	2.27	2.16	16.23
Subtotal Resettlement & Rehabilitation	1.75	56.60	197.90	202.07	203.86	130.23	130.37	922.78	0.05	1.59	5.27	5.14	4.99	3.08	2.99	23.11
D. Agric. Support Services																
1. Support to Central Offices	-	0.54	19.86	7.25	7.35	7.80	7.34	50.12	-	0.02	0.53	0.18	0.18	0.18	0.17	1.26
2. SRSP	4.52	11.40	92.88	47.98	45.69	40.83	22.80	266.11	0.13	0.32	2.47	1.22	1.12	0.97	0.52	6.75
3. SRBC	-	1.37	49.11	21.45	19.44	22.81	14.91	129.09	-	0.04	1.31	0.55	0.48	0.54	0.34	3.25
Subtotal Agric. Support Services	4.52	13.31	161.85	76.69	72.47	71.44	45.04	445.32	0.13	0.37	4.31	1.95	1.77	1.69	1.03	11.26
E. Environment Management Plan																
1. SRSP	15.35	59.85	101.19	170.82	174.72	160.97	54.89	737.78	0.44	1.68	2.69	4.34	4.28	3.81	1.26	18.51
2. SRBC	5.30	45.27	127.22	170.25	152.49	106.42	40.76	647.72	0.15	1.27	3.39	4.33	3.73	2.52	0.93	16.33
Subtotal Environment Management Plan	20.65	105.12	228.41	341.07	327.20	267.39	95.65	1,385.50	0.60	2.95	6.08	8.67	8.01	6.33	2.19	34.83
F. Project Preparation and monitoring																
1. PFMU	6.61	9.97	19.25	20.55	14.08	14.95	15.84	101.26	0.19	0.28	0.51	0.52	0.34	0.35	0.36	2.57
Subtotal Project Preparation and monitoring	6.61	9.97	19.25	20.55	14.08	14.95	15.84	101.26	0.19	0.28	0.51	0.52	0.34	0.35	0.36	2.57
Total PROJECT COSTS	1,738.23	1,354.08	2,253.04	3,366.42	4,488.79	3,980.89	1,716.38	18,897.83	50.38	38.06	59.95	85.62	109.85	94.22	39.35	477.43

INDIA
Third Andhra Pradesh Irrigation Project
Project Components by Year -- Investment/Recurrent Costs

	Totals Including Contingencies (Rs Million)								Totals Including Contingencies (US$ Million)							
	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total
A. Irrigation																
1. Above LMD																
Investment Costs	179.86	95.62	405.06	1,124.07	1,792.15	1,497.83	503.57	5,598.16	5.21	2.69	10.78	28.59	43.86	35.45	11.54	138.12
Recurrent Costs	-	6.19	6.60	7.04	7.50	7.97	8.44	43.74	-	0.17	0.18	0.18	0.18	0.19	0.19	1.09
Subtotal Above LMD	179.86	101.81	411.66	1,131.12	1,799.65	1,505.79	512.01	5,641.90	5.21	2.86	10.95	28.77	44.04	35.64	11.74	139.21
2. Below LMD																
Investment Costs	349.71	153.58	366.28	443.10	398.34	454.34	260.50	2,425.85	10.14	4.32	9.75	11.27	9.75	10.75	5.97	61.94
Recurrent Costs	-	3.61	3.85	4.11	4.38	4.65	4.93	25.51	-	0.10	0.10	0.10	0.11	0.11	0.11	0.64
Subtotal Below LMD	349.71	157.19	370.13	447.21	402.72	458.98	265.42	2,451.36	10.14	4.42	9.85	11.37	9.85	10.86	6.08	62.58
3. SRBC																
Investment Costs	1,170.59	905.95	807.76	1,123.79	1,378.62	1,207.98	347.37	6,942.06	33.93	25.46	21.49	28.58	33.74	28.59	7.96	179.76
Recurrent Costs	-	2.06	2.20	2.35	2.50	2.66	2.81	14.58	-	0.06	0.06	0.06	0.06	0.06	0.06	0.36
Subtotal SRBC	1,170.59	908.02	809.96	1,126.14	1,381.12	1,210.63	350.19	6,956.64	33.93	25.52	21.55	28.64	33.80	28.65	8.03	180.12
Subtotal Irrigation	1,700.15	1,167.01	1,591.75	2,704.47	3,583.48	3,175.41	1,127.62	15,049.90	49.28	32.80	42.35	68.78	87.69	75.16	25.85	381.92
B. Dam Safety																
1. SRSP																
Investment Costs	0.35	-	14.53	16.79	16.92	15.93	-	64.51	0.01	-	0.39	0.43	0.41	0.38	-	1.61
2. SRBC																
Investment Costs	4.20	2.06	39.35	4.79	270.78	305.53	301.84	928.56	0.12	0.06	1.05	0.12	6.63	7.23	6.92	22.13
Subtotal Dam Safety	4.55	2.06	53.89	21.58	287.70	321.46	301.84	993.07	0.13	0.06	1.43	0.55	7.04	7.61	6.92	23.74
C. Resettlement & Rehabilitation																
1. SRSP																
Investment Costs	0.55	19.42	60.95	55.85	58.41	31.50	33.44	260.12	0.02	0.55	1.62	1.42	1.43	0.75	0.77	6.55
Recurrent Costs	-	0.69	2.22	2.37	2.52	2.68	2.84	13.31	-	0.02	0.06	0.06	0.06	0.06	0.07	0.33
Subtotal SRSP	0.55	20.12	63.16	58.22	60.93	34.18	36.28	273.43	0.02	0.57	1.68	1.48	1.49	0.81	0.83	6.87
2. SRBC																
Investment Costs	1.20	35.90	132.88	141.86	140.81	93.81	91.72	638.18	0.03	1.01	3.54	3.61	3.45	2.22	2.10	15.96
Recurrent Costs	-	0.58	1.86	1.99	2.12	2.25	2.38	11.17	-	0.02	0.05	0.05	0.05	0.05	0.05	0.28
Subtotal SRBC	1.20	36.48	134.74	143.85	142.93	96.05	94.10	649.35	0.03	1.03	3.59	3.66	3.50	2.27	2.16	16.23
Subtotal Resettlement & Rehabilitation	1.75	56.60	197.90	202.07	203.86	130.23	130.37	922.78	0.05	1.59	5.27	5.14	4.99	3.08	2.99	23.11
D. Agric. Support Services																
1. Support to Central Offices																
Investment Costs	-	0.31	15.09	1.91	1.66	1.76	0.93	21.65	-	0.01	0.40	0.05	0.04	0.04	0.02	0.56
Recurrent Costs	-	0.23	4.77	5.34	5.69	6.04	6.40	28.47	-	0.01	0.13	0.14	0.14	0.14	0.15	0.70
Subtotal Support to Central Offices	-	0.54	19.86	7.25	7.35	7.80	7.34	50.12	-	0.02	0.53	0.18	0.18	0.18	0.17	1.26
2. SRSP																
Investment Costs	4.52	11.40	81.61	36.11	33.79	27.40	9.40	204.22	0.13	0.32	2.17	0.92	0.83	0.65	0.22	5.23
Recurrent Costs	-	-	11.27	11.88	11.90	13.43	13.40	61.88	-	-	0.30	0.30	0.29	0.32	0.31	1.52
Subtotal SRSP	4.52	11.40	92.88	47.98	45.69	40.83	22.80	266.11	0.13	0.32	2.47	1.22	1.12	0.97	0.52	6.75
3. SRBC																
Investment Costs	-	1.37	41.29	13.34	11.17	13.64	5.61	86.42	-	0.04	1.10	0.34	0.27	0.32	0.13	2.20
Recurrent Costs	-	-	7.83	8.11	8.26	9.17	9.30	42.67	-	-	0.21	0.21	0.20	0.22	0.21	1.05
Subtotal RBC	-	1.37	49.11	21.45	19.44	22.81	14.91	129.09	-	0.04	1.31	0.55	0.48	0.54	0.34	3.25
Subtotal Agric. Support Services	4.52	13.31	161.85	76.69	72.47	71.44	45.04	445.32	0.13	0.37	4.31	1.95	1.77	1.69	1.03	11.26
E. Environment Management Plan																
1. SRSP																
Investment Costs	15.35	55.32	95.91	164.54	165.40	155.12	54.89	706.52	0.44	1.55	2.55	4.18	4.05	3.67	1.26	17.71
Recurrent Costs	-	4.54	5.28	6.28	9.31	5.85	-	31.26	-	0.13	0.14	0.16	0.23	0.14	-	0.79
Subtotal RSP	15.35	59.85	101.19	170.82	174.72	160.97	54.89	737.78	0.44	1.68	2.69	4.34	4.28	3.81	1.26	18.51
2. SRBC																
Investment Costs	3.30	44.19	122.76	165.78	147.35	100.46	33.87	617.70	0.10	1.24	3.27	4.22	3.61	2.38	0.78	15.58
Recurrent Costs	2.00	1.08	4.46	4.47	5.14	5.96	6.90	30.01	0.06	0.03	0.12	0.11	0.13	0.14	0.16	0.75
Subtotal RBC	5.30	45.27	127.22	170.25	152.49	106.42	40.76	647.72	0.15	1.27	3.39	4.33	3.73	2.52	0.93	16.33
Subtotal Environment Management Plan	20.65	105.12	228.41	341.07	327.20	267.39	95.65	1,385.50	0.60	2.95	6.08	8.67	8.01	6.33	2.19	34.83
F. Project Preparation and monitoring																
1. PPMU																
Investment Costs	-	-	6.87	7.34	-	-	-	14.21	-	-	0.18	0.19	-	-	-	0.37
Recurrent Costs	6.61	9.97	12.38	13.22	14.08	14.95	15.84	87.05	0.19	0.28	0.33	0.34	0.34	0.35	0.36	2.20
Subtotal Project Preparation and monitoring	6.61	9.97	19.25	20.55	14.08	14.95	15.84	101.26	0.19	0.28	0.51	0.52	0.34	0.35	0.36	2.57
Total PROJECT COSTS	1,738.23	1,354.08	2,253.04	3,366.42	4,488.79	3,980.89	1,716.38	18,897.83	50.38	38.06	59.95	85.62	109.85	94.22	39.35	477.43
Total Investment Costs	1,729.62	1,325.13	2,190.34	3,299.27	4,415.39	3,905.29	1,643.15	18,508.18	50.13	37.25	58.28	83.91	108.05	92.43	37.67	467.72
Total Recurrent Costs	8.61	28.95	62.71	67.15	73.40	75.60	73.24	389.66	0.25	0.81	1.67	1.71	1.80	1.79	1.68	9.70

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts by Years

	Base Cost (Rs Million)								Foreign Exchange		Base Cost (US$ Million)								Foreign Exchange	
	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	%	Amount	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	%	Amount
I. Investment Costs																				
A. Land Acquisition	-	33.58	106.96	103.44	104.37	57.18	53.33	458.85	-	-	-	0.97	3.10	3.00	3.03	1.66	1.55	13.30	-	-
B. Survey & Eng. Administration	90.00	129.00	269.00	272.00	191.00	174.00	21.00	1,146.00	-	-	2.61	3.74	7.80	7.88	5.54	5.04	0.61	33.22	-	-
C. Civil Works																				
1. Grounded Works	1,390.87	821.98	602.60	134.70	119.38	114.38	9.75	3,193.66	11.5	367.27	40.32	23.83	17.47	3.90	3.46	3.32	0.28	92.57	11.5	10.65
2. Ungrounded Works	122.47	178.95	410.84	1,270.94	2,308.12	2,043.52	774.36	7,109.20	11.5	817.56	3.55	5.19	11.91	36.84	66.90	59.23	22.45	206.06	11.5	23.70
Subtotal Civil Works	1,513.34	1,000.93	1,013.44	1,405.64	2,427.50	2,157.90	784.11	10,302.87	11.5	1,184.83	43.86	29.01	29.38	40.74	70.36	62.55	22.73	298.63	11.5	34.34
D. Command Area development	-	-	69.53	145.37	158.63	76.51	60.00	510.04	11.5	58.65	-	-	2.02	4.21	4.60	2.22	1.74	14.78	11.5	1.70
E. Feeder Roads																				
1. Grounded Works	103.21	5.42	-	-	-	-	-	108.63	11.5	12.49	2.99	0.16	-	-	-	-	-	3.15	11.5	0.36
2. Ungrounded Works	-	-	60.24	55.19	54.88	13.88	12.63	196.83	11.5	22.64	-	-	1.75	1.60	1.59	0.40	0.37	5.71	11.5	0.66
Subtotal Feeder Roads	103.21	5.42	60.24	55.19	54.88	13.88	12.63	305.45	11.5	35.13	2.99	0.16	1.75	1.60	1.59	0.40	0.37	8.85	11.5	1.02
F. Buildings	-	-	67.40	22.38	10.67	3.64	-	104.09	11.5	11.97	-	-	1.95	0.65	0.31	0.11	-	3.02	11.5	0.35
G. Inc. Irrigation O&M	-	-	17.08	20.42	23.58	34.26	40.89	136.23	11.5	15.67	-	-	0.50	0.59	0.68	0.99	1.19	3.95	11.5	0.45
H. O&M Upgrading	-	-	4.25	13.00	22.45	27.00	35.40	102.10	11.5	11.74	-	-	0.12	0.38	0.65	0.78	1.03	2.96	11.5	0.34
I. Equipment	0.85	-	44.12	322.72	19.81	-	-	387.50	45.0	174.37	0.02	-	1.28	9.35	0.57	-	-	11.23	45.0	5.05
J. Furniture	-	-	3.56	2.17	-	-	-	5.73	-	-	-	-	0.10	0.06	-	-	-	0.17	-	-
K. Vehicles	-	-	23.53	3.95	-	-	-	27.48	20.0	5.50	-	-	0.68	0.11	-	-	-	0.80	20.0	0.16
L. Resettlement & Rehabilitation	-	15.87	28.94	27.68	26.25	17.24	17.02	132.99	-	-	-	0.46	0.84	0.80	0.76	0.50	0.49	3.85	-	-
M. Forest Plantation	-	55.87	132.32	181.82	161.99	93.37	39.03	664.40	10.0	66.44	-	1.62	3.84	5.27	4.70	2.71	1.13	19.26	10.0	1.93
N. Training	-	8.96	31.43	31.82	29.57	28.24	7.10	137.12	-	-	-	0.26	0.91	0.92	0.86	0.82	0.21	3.97	-	-
O. Consultancy services	4.52	12.69	32.53	39.35	38.44	30.08	8.93	162.54	-	-	0.13	0.37	0.94	1.14	1.00	0.87	0.26	4.71	-	-
P. Studies	5.45	4.76	26.95	13.00	11.00	12.00	-	73.16	-	-	0.16	0.14	0.78	0.38	0.32	0.35	-	2.12	-	-
Total Investment Costs	1,717.37	1,267.08	1,931.28	2,659.95	3,276.14	2,725.30	1,079.44	16,656.55	10.7	1,564.30	49.78	36.73	55.98	77.10	94.96	78.99	31.29	424.83	10.7	45.34
II. Recurrent Costs																				
A. Inc. Salaries & Allowance	-	0.10	13.59	13.59	13.59	13.59	13.59	68.04	-	-	-	0.00	0.39	0.39	0.39	0.39	0.39	1.97	-	-
B. Operating Costs	2.00	5.57	16.99	17.15	18.65	16.89	11.99	89.24	-	-	0.06	0.16	0.49	0.50	0.54	0.49	0.35	2.59	-	-
C. vehicle hire charge	-	11.50	11.50	11.50	11.50	11.50	11.50	69.00	-	-	-	0.33	0.33	0.33	0.33	0.33	0.33	2.00	-	-
D. Project Preparation & Monitoring Unit	6.61	9.67	11.26	11.26	11.26	11.26	11.26	72.58	-	-	0.19	0.28	0.33	0.33	0.33	0.33	0.33	2.10	-	-
E. R&R Administration	-	1.24	3.71	3.71	3.71	3.71	3.71	19.78	-	-	-	0.04	0.11	0.11	0.11	0.11	0.11	0.57	-	-
Total Recurrent Costs	8.61	28.08	57.04	57.21	58.71	56.95	52.05	318.63	-	-	0.25	0.81	1.65	1.66	1.70	1.65	1.51	9.24	-	-
Total BASELINE COSTS	1,725.98	1,295.15	1,988.32	2,717.15	3,334.84	2,782.25	1,131.49	16,975.19	10.4	1,564.30	50.03	37.54	57.63	78.76	96.66	80.64	32.80	434.06	10.4	45.34
Physical Contingencies	12.25	17.90	61.23	150.69	255.48	216.46	88.24	802.23	11.5	92.26	0.35	0.52	1.77	4.37	7.41	6.27	2.56	23.25	11.5	2.67
Price Contingencies																				
Inflation																				
Local	-	36.60	182.21	422.17	796.36	872.84	441.92	2,752.10	-	-	-	1.06	5.28	12.24	23.08	25.30	12.81	79.77	-	-
Foreign	-	-	1.71	11.18	20.25	25.23	13.70	72.07	100.0	72.07	-	-	0.05	0.32	0.59	0.73	0.40	2.09	100.0	2.09
Subtotal Inflation	-	36.60	183.92	433.35	816.61	898.07	455.62	2,824.17	2.6	72.07	-	1.06	5.33	12.56	23.67	26.03	13.21	81.86	2.6	2.09
Devaluation	-	4.43	19.58	65.23	81.86	84.11	41.04	296.25	85.8	254.11	-	-1.06	-4.79	-10.07	-17.89	-18.73	-9.21	-61.75	-	-
Subtotal Price Contingencies	-	41.03	203.50	498.58	898.47	982.18	496.66	3,120.42	10.5	326.19	-	-	0.54	2.49	5.78	7.30	3.99	20.11	10.4	2.09
Total PROJECT COSTS	1,738.23	1,354.08	2,253.04	3,366.42	4,488.79	3,980.89	1,716.38	18,897.83	10.5	1,982.74	50.38	38.06	59.95	85.62	109.85	94.22	39.35	477.43	10.5	50.11
Taxes	220.10	142.59	208.08	380.82	501.86	451.39	191.96	2,096.80	-	-	6.38	4.01	5.54	9.69	12.28	10.68	4.40	52.98	-	-
Foreign Exchange	187.69	127.23	205.02	437.44	456.00	398.59	170.76	1,982.74	-	-	5.44	3.58	5.46	11.13	11.16	9.43	3.91	50.11	-	-

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts by Years

	Totals Including Contingencies (Rs Million)								Totals Including Contingencies (US$ Million)							
	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total	95/96	96/97	97/98	98/99	99/00	00/01	01/02	Total
I. Investment Costs																
A. Land Acquisition	-	34.62	117.50	121.43	130.49	75.90	75.04	555.07	-	0.97	3.13	3.09	3.19	1.80	1.72	13.90
B. Survey & Eng. Administration	90.00	133.03	295.71	319.29	238.80	230.99	29.55	1,337.37	2.61	3.74	7.87	8.12	5.84	5.47	0.68	34.33
C. Civil Works																
1. Grounded Works	1,390.87	847.67	662.43	158.12	149.25	151.84	13.72	3,373.91	40.32	23.83	17.63	4.02	3.65	3.59	0.31	93.35
2. Ungrounded Works	134.72	203.00	496.80	1,641.09	3,174.30	2,984.12	1,198.64	9,832.66	3.90	5.71	13.22	41.74	77.68	70.63	27.48	240.36
Subtotal Civil Works	1,525.59	1,050.67	1,159.23	1,799.21	3,323.55	3,135.97	1,212.36	13,206.57	44.22	29.53	30.85	45.76	81.33	74.22	27.79	333.70
D. Command Area development	-	-	84.08	187.70	218.16	111.73	92.87	694.55	-	-	2.24	4.77	5.34	2.64	2.13	17.12
E. Feeder Roads																
1. Grounded Works	103.21	5.59	-	-	-	-	-	108.80	2.99	0.16	-	-	-	-	-	3.15
2. Ungrounded Works	-	-	72.86	71.26	75.47	20.27	19.55	259.41	-	-	1.94	1.81	1.85	0.48	0.45	6.53
Subtotal Feeder Roads	103.21	5.59	72.86	71.26	75.47	20.27	19.55	368.21	2.99	0.16	1.94	1.81	1.85	0.48	0.45	9.67
F. Buildings	-	-	81.50	28.90	16.67	5.32	-	130.39	-	-	2.17	0.74	0.36	0.13	-	3.39
G. Inc. Irrigation O&M	-	-	18.78	23.96	29.48	45.48	57.54	175.24	-	-	0.50	0.61	0.72	1.08	1.32	4.23
H. O&M Upgrading	-	-	5.14	16.79	30.87	39.43	54.80	147.02	-	-	0.14	0.43	0.76	0.93	1.26	3.51
I. Equipment	0.85	-	48.50	378.82	24.77	-	-	452.94	0.02	-	1.29	9.63	0.61	-	-	11.56
J. Furniture	-	-	3.91	2.55	-	-	-	6.46	-	-	0.10	0.06	-	-	-	0.17
K. Vehicles	-	-	25.86	4.64	-	-	-	30.50	-	-	0.69	0.12	-	-	-	0.81
L. Resettlement & Rehabilitation	-	16.37	31.81	32.49	32.81	22.89	23.94	160.32	-	0.46	0.85	0.83	0.80	0.54	0.55	4.03
M. Forest Plantation	-	57.62	145.46	213.43	202.53	123.95	54.92	797.91	-	1.62	3.87	5.43	4.96	2.93	1.26	20.07
N. Training	-	9.24	34.55	37.35	36.97	37.49	9.99	165.59	-	0.26	0.92	0.95	0.90	0.89	0.23	4.15
O. Consultancy services	4.52	13.08	35.76	46.19	43.06	39.94	12.57	195.12	0.13	0.37	0.95	1.17	1.05	0.95	0.29	4.91
P. Studies	5.45	4.91	29.63	15.26	13.75	15.93	-	84.93	0.16	0.14	0.79	0.39	0.34	0.38	-	2.19
Total Investment Costs	1,729.62	1,325.13	2,190.34	3,299.27	4,415.39	3,905.29	1,643.15	18,508.18	50.13	37.25	58.28	83.91	108.05	92.43	37.67	467.72
II. Recurrent Costs																
A. Inc. Salaries & Allowance	-	0.10	14.94	15.95	16.99	18.04	19.12	85.14	-	0.00	0.40	0.41	0.42	0.43	0.44	2.09
B. Operating Costs	2.00	5.74	18.67	20.13	23.32	22.42	16.87	109.16	0.06	0.16	0.50	0.51	0.57	0.53	0.39	2.72
C. vehicle hire charge	-	11.86	12.64	13.50	14.38	15.27	16.18	83.83	-	0.33	0.34	0.34	0.35	0.36	0.37	2.10
D. Project Preparation & Monitoring Unit	6.61	9.97	12.38	13.22	14.08	14.95	15.84	87.05	0.19	0.28	0.33	0.34	0.34	0.35	0.36	2.20
E. R&R Administration	-	1.27	4.08	4.35	4.64	4.92	5.22	24.48	-	0.04	0.11	0.11	0.11	0.12	0.12	0.60
Total Recurrent Costs	8.61	28.95	62.71	67.15	73.40	75.60	73.24	389.66	0.25	0.81	1.67	1.71	1.80	1.79	1.68	9.70
Total PROJECT COSTS	1,738.23	1,354.08	2,253.04	3,366.42	4,488.79	3,980.89	1,716.38	18,897.83	50.38	38.06	59.95	85.62	109.85	94.22	39.35	477.43

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts Breakdown
(Rs Million)

	Base Cost				Physical Contingencies				Price Contingencies				Total Incl. Cont.				Base Costs + Price Cont. on Base Costs	Physical Cont. Plus Price Cont. on Physical Cont.
	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total		
I. Investment Costs																		
A. Land Acquisition	-	458.85	-	458.85	-	-	-	-	-	96.21	-	96.21	-	555.07	-	555.07	555.07	-
B. Survey & Eng. Administration	-	1,146.00	-	1,146.00	-	-	-	-	-	191.37	-	191.37	-	1,337.37	-	1,337.37	1,337.37	-
C. Civil Works																		
1. Grounded Works	367.27	2,395.25	631.14	3,193.66	-	-	-	-	20.73	135.18	24.33	180.24	388.00	2,530.43	655.48	3,373.91	3,373.91	-
2. Ungrounded Works	817.56	5,331.90	959.74	7,109.20	81.76	533.19	95.97	710.92	231.44	1,509.40	271.69	2,012.53	1,130.76	7,374.49	1,327.41	9,832.66	8,938.78	893.88
Subtotal Civil Works	1,184.83	7,727.15	1,390.89	10,302.87	81.76	533.19	95.97	710.92	252.17	1,644.58	296.03	2,192.78	1,518.76	9,904.92	1,782.89	13,206.57	12,312.69	893.88
D. Command Area development	58.65	387.63	63.76	510.04	5.87	38.76	6.38	51.00	15.35	101.46	16.69	133.50	79.87	527.86	86.82	694.55	631.41	63.14
E. Feeder Roads																		
1. Grounded Works	12.49	81.47	14.66	108.63	-	-	-	-	0.02	0.13	0.02	0.17	12.51	81.60	14.69	108.80	108.80	-
2. Ungrounded Works	22.64	147.62	26.57	196.83	2.26	14.76	2.66	19.68	4.93	32.18	5.79	42.90	29.83	194.56	35.02	259.41	235.83	23.58
Subtotal Feeder Roads	35.13	229.09	41.24	305.45	2.26	14.76	2.66	19.68	4.95	32.30	5.81	43.07	42.34	276.15	49.71	368.21	344.62	23.58
F. Buildings	11.97	78.07	14.05	104.09	1.20	7.81	1.41	10.41	1.83	11.92	2.15	15.89	15.00	97.79	17.60	130.39	118.54	11.85
G. Inc. Irrigation O&M	15.67	103.53	17.03	136.23	-	-	-	-	4.49	29.65	4.88	39.02	20.15	133.18	21.91	175.24	175.24	-
H. O&M Upgrading	11.76	77.60	12.76	102.10	1.17	7.76	1.28	10.21	3.99	26.38	4.34	34.71	16.91	111.74	18.38	147.02	133.66	13.37
I. Equipment	174.37	116.25	96.87	387.50	-	-	-	-	29.45	19.63	16.36	65.44	203.82	135.88	113.23	452.94	452.94	-
J. Furniture	-	5.04	0.69	5.73	-	-	-	-	-	0.64	0.09	0.73	-	5.69	0.78	6.46	6.46	-
K. Vehicles	5.50	17.03	4.95	27.48	-	-	-	-	0.60	1.87	0.54	3.02	6.10	18.91	5.49	30.50	30.50	-
L. Resettlement & Rehabilitation	-	132.99	-	132.99	-	-	-	-	-	27.33	-	27.33	-	160.32	-	160.32	160.32	-
M. Forest Plantation	66.44	597.96	-	664.40	-	-	-	-	13.35	120.16	-	133.51	79.79	718.12	-	797.91	797.91	-
N. Training	-	137.12	-	137.12	-	-	-	-	-	28.47	-	28.47	-	165.59	-	165.59	165.59	-
O. Consultancy services	-	162.56	-	162.56	-	-	-	-	-	32.58	-	32.58	-	195.12	-	195.12	195.12	-
P. Studies	-	73.16	-	73.16	-	-	-	-	-	11.77	-	11.77	-	84.93	-	84.93	84.93	-
Total Investment Costs	1,564.30	11,450.03	1,642.23	14,656.55	92.26	602.28	107.69	802.23	326.19	2,376.33	346.88	3,049.40	1,982.74	14,428.64	2,096.80	18,508.18	17,502.36	1,005.82
II. Recurrent Costs																		
A. Inc. Salaries & Allowance	-	68.04	-	68.04	-	-	-	-	-	17.10	-	17.10	-	85.14	-	85.14	85.14	-
B. Operating Costs	-	89.24	-	89.24	-	-	-	-	-	19.92	-	19.92	-	109.16	-	109.16	109.16	-
C. vehicle hire charge	-	69.00	-	69.00	-	-	-	-	-	14.83	-	14.83	-	83.83	-	83.83	83.83	-
D. Project Preparation & Monitoring Unit	-	72.58	-	72.58	-	-	-	-	-	14.47	-	14.47	-	87.05	-	87.05	87.05	-
E. R&R Administration	-	19.78	-	19.78	-	-	-	-	-	4.70	-	4.70	-	24.48	-	24.48	24.48	-
Total Recurrent Costs	-	318.63	-	318.63	-	-	-	-	-	71.02	-	71.02	-	389.66	-	389.66	389.66	-
Total	1,564.30	11,768.66	1,642.23	14,975.19	92.26	602.28	107.69	802.23	326.19	2,447.35	346.88	3,120.42	1,982.74	14,818.29	2,096.80	18,897.83	17,892.01	1,005.82

INDIA
Third Andhra Pradesh Irrigation Project
Expenditure Accounts Breakdown
(US$ Million)

	Base Cost				Physical Contingencies				Price Contingencies				Total Incl. Cont.				Base Costs + Price Cont. on Base Costs	Physical Cont. Plus Price Cont. on Physical Cont.
	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total		
I. Investment Costs																		
A. Land Acquisition	-	13.30	-	13.30	-	-	-	-	-	0.60	-	0.60	-	13.90	-	13.90	13.90	-
B. Survey & Eng. Administration	-	33.22	-	33.22	-	-	-	-	-	1.11	-	1.11	-	34.33	-	34.33	34.33	-
C. Civil Works																		
1. Grounded Works	10.65	69.43	12.50	92.57	-	-	-	-	0.09	0.58	0.11	0.78	10.74	70.01	12.60	93.35	93.35	-
2. Ungrounded Works	23.70	154.55	27.82	206.06	2.37	15.45	2.78	20.61	1.57	10.26	1.85	13.68	27.64	180.27	32.45	240.36	218.50	21.85
Subtotal Civil Works	34.34	223.98	40.32	298.63	2.37	15.45	2.78	20.61	1.66	10.85	1.95	14.46	38.38	250.28	45.05	333.70	311.85	21.85
D. Command Area development	1.70	11.24	1.85	14.78	0.17	1.12	0.18	1.48	0.10	0.65	0.11	0.86	1.97	13.01	2.14	17.12	15.57	1.56
E. Feeder Roads																		
1. Grounded Works	0.36	2.36	0.43	3.15	-	-	-	-	-	-	-	-	0.36	2.36	0.43	3.15	3.15	-
2. Ungrounded Works	0.66	4.28	0.77	5.71	0.07	0.43	0.08	0.57	0.03	0.19	0.03	0.25	0.75	4.89	0.88	6.53	5.93	0.59
Subtotal Feeder Roads	1.02	6.64	1.20	8.85	0.07	0.43	0.08	0.57	0.03	0.19	0.03	0.25	1.11	7.26	1.31	9.67	9.08	0.59
F. Buildings	0.35	2.26	0.41	3.02	0.03	0.23	0.04	0.30	0.01	0.05	0.01	0.07	0.39	2.54	0.46	3.39	3.08	0.31
G. Inc. Irrigation O&M	0.45	3.00	0.49	3.95	-	-	-	-	0.03	0.21	0.03	0.28	0.49	3.21	0.53	4.23	4.23	-
H. O&M Upgrading	0.34	2.25	0.37	2.96	0.03	0.22	0.04	0.30	0.03	0.19	0.03	0.25	0.40	2.67	0.44	3.51	3.19	0.32
I. Equipment	5.05	3.37	2.81	11.23	-	-	-	-	0.15	0.10	0.08	0.32	5.20	3.47	2.89	11.56	11.56	-
J. Furniture	-	0.15	0.02	0.17	-	-	-	-	-	0.00	0.00	0.00	-	0.15	0.02	0.17	0.17	-
K. Vehicles	0.16	0.49	0.14	0.80	-	-	-	-	0.00	0.01	0.00	0.01	0.16	0.50	0.15	0.81	0.81	-
L. Resettlement & Rehabilitation	-	3.85	-	3.85	-	-	-	-	-	0.17	-	0.17	-	4.03	-	4.03	4.03	-
M. Forest Plantation	1.93	17.33	-	19.26	-	-	-	-	0.08	0.73	-	0.81	2.01	18.06	-	20.07	20.07	-
N. Training	-	3.97	-	3.97	-	-	-	-	-	0.18	-	0.18	-	4.15	-	4.15	4.15	-
O. Consultancy services	-	4.71	-	4.71	-	-	-	-	-	0.20	-	0.20	-	4.91	-	4.91	4.91	-
P. Studies	-	2.12	-	2.12	-	-	-	-	-	0.07	-	0.07	-	2.19	-	2.19	2.19	-
Total Investment Costs	45.34	331.88	47.60	424.83	2.67	17.46	3.12	23.25	2.09	15.30	2.25	19.64	50.11	364.64	52.98	467.72	443.10	24.63
II. Recurrent Costs																		
A. Inc. Salaries & Allowance	-	1.97	-	1.97	-	-	-	-	-	0.11	-	0.11	-	2.09	-	2.09	2.09	-
B. Operating Costs	-	2.59	-	2.59	-	-	-	-	-	0.13	-	0.13	-	2.72	-	2.72	2.72	-
C. vehicle hire charge	-	2.00	-	2.00	-	-	-	-	-	0.10	-	0.10	-	2.10	-	2.10	2.10	-
D. Project Preparation & Monitoring Unit	-	2.10	-	2.10	-	-	-	-	-	0.10	-	0.10	-	2.20	-	2.20	2.20	-
E. R&R Administration	-	0.57	-	0.57	-	-	-	-	-	0.03	-	0.03	-	0.60	-	0.60	0.60	-
Total Recurrent Costs	-	9.24	-	9.24	-	-	-	-	-	0.47	-	0.47	-	9.70	-	9.70	9.70	-
Total	45.34	341.12	47.60	434.06	2.67	17.46	3.12	23.25	2.09	15.77	2.25	20.11	50.11	374.35	52.98	477.43	452.80	24.63

Annex 7

FINANCING, DISBURSEMENT AND PROJECT ACCOUNTS

Table of Contents

INDIA
Third Andhra Pradesh Irrigation Project

Disbursements (US$ Million)

BANK FY	IDA		IBRD		TOTAL BANK/IDA	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
FY98	28.50	28.50	33.50	33.50	62.00	62.00
FY99	17.35	45.85	20.40	53.90	37.75	99.75
FY00	26.30	72.15	30.90	84.80	57.20	156.95
FY01	35.30	107.45	41.40	126.20	76.70	233.65
FY02	30.20	137.65	35.40	161.60	65.60	299.25
FY03[b/]	12.35	150.00	13.40	175.00	25.75	325.00

[a/]Including retroactive financing of US$42.25 million.
[b/]Project Completion on July 31, 2002 and Loan/Credit Closing on January 31, 2003.

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
Components by Financiers
(US$ Million)

	Government of Andhra Pradesh		IDA and IBRD		Total				
	Amount	%	Amount	%	Amount	%	Foreign Exchange	Local (Excl. Taxes)	Duties & Taxes
A. Irrigation									
1. Above LMD	43.68	31.4	95.53	68.6	139.21	29.2	15.05	107.05	17.12
2. Below LMD	23.03	36.8	39.55	63.2	62.58	13.1	6.33	49.10	7.15
3. SRBC	54.00	30.0	126.12	70.0	180.12	37.7	21.75	135.08	23.29
Subtotal Irrigation	120.71	31.6	261.21	68.4	381.92	80.0	43.14	291.22	47.56
B. Dam Safety									
1. SRSP	0.15	9.3	1.46	90.7	1.61	0.3	0.09	1.46	0.07
2. SRBC	5.11	23.1	17.01	76.9	22.13	4.6	2.50	16.76	2.87
Subtotal Dam Safety	5.26	22.2	18.48	77.8	23.74	5.0	2.59	18.22	2.94
C. Resettlement & Rehabiliation									
1. SRSP	3.66	53.2	3.22	46.8	6.87	1.4	0.11	6.64	0.12
2. SRBC	12.24	75.4	3.99	24.6	16.23	3.4	0.33	15.53	0.37
Subtotal R&R	15.90	68.8	7.21	31.2	23.11	4.8	0.44	22.17	0.50
D. Agric. Support Services									
1. Support to Central Office	0.79	62.9	0.47	37.1	1.26	0.3	0.07	1.12	0.06
2. SRSP	2.09	31.0	4.66	69.0	6.75	1.4	0.40	6.05	0.30
3. SRBC	1.35	41.5	1.90	58.5	3.25	0.7	0.26	2.80	0.19
Subtotal Agric. Support Services	4.23	37.6	7.03	62.4	11.26	2.4	0.72	9.98	0.56
E Environmental Management Plan (EMP)									
1. SRSP	3.32	17.9	15.19	82.1	18.51	3.9	1.82	15.52	1.17
2. SRBC	1.88	11.5	14.44	88.5	16.33	3.4	1.40	14.68	0.26
Subtotal EMP	5.20	14.9	29.63	85.1	34.83	7.3	3.22	30.20	1.42
F. Project Prep. & Monitoring									
1. PPMU	0.95	37.1	1.62	62.9	2.57	0.5	0.00	2.57	0.00
Total Disbursement	152.26	31.9	325.16	68.1	477.43	100.0	50.11	374.35	52.98

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
Expenditure Accounts by Financiers
(US$ Million)

	Government of Andhra Pradesh		IDA and IBRD		Total		Foreign Exchange	Local (Excluding Taxes)	Duties & Taxes
	Amount	%	Amount	%	Amount	%			
I. Investment Costs									
A. Land Acquisition	13.90	100			13.90	2.9		13.90	
B. Survey & Engin. Admin.	34.33	100			34.33	7.2		34.33	
C. Civil Works									
1. Grounded Works	22.40	24	70.95	76	93.35	19.6	10.74	70.01	12.60
2. Ungrounded Works	57.69	24	182.67	76	240.36	50.3	27.64	180.27	32.45
Subtotal Civil Works	80.09	24	253.62	76	333.70	69.9	38.38	250.28	45.05
D. Command Area Development	4.11	24	13.01	76	17.12	3.6	1.97	13.01	2.14
E. Feeder Roads									
1. Grounded Works	0.76	24	2.39	76	3.15	0.7	0.36	2.36	0.43
2. Ungrounded Works	1.57	24	4.96	76	6.53	1.4	0.75	4.89	0.88
Subtotal Feeder Roads	2.32	24	7.35	76	9.67	2.0	1.11	7.26	1.31
F. Buildings	0.81	24	2.58	76	3.39	0.7	0.39	2.54	0.46
G. Canal O&M	2.29	54.1	1.94	45.9	4.23	0.9	0.49	3.21	0.53
H. O&M Upgrading	2.02	57.5	1.49	42.5	3.51	0.7	0.40	2.67	0.44
I. Forest & Canal Plantation	1.00	5.0	19.06	95	20.07	4.2	2.01	18.06	
J. Equipment & Furnitureq	2.92	24.9	8.80	75.1	11.73	2.5	5.20	3.62	2.91
K. Vehicles	0.16	20	0.64	80	0.81	0.2	0.16	0.50	0.15
L. Resettlement & Rehabilitation	0.81	20	3.22	80	4.03	0.8		4.03	
M. Training	0.21	5	3.94	95	4.15	0.9		4.15	
N. Consultancy Services	0.25	5	4.67	95	4.91	1.0		4.91	
O. Studies	0.11	5	2.08	95	2.19	0.5		2.19	
Total Investment Costs	145.32	31.1	322.40	68.9	467.72	98.0	50.11	364.64	52.98
II. Recurrent Costs									
A. Inc. Salaraies & Op. Costs-Agric. & Environ.	4.80	100			4.80	1.0		4.80	
B. Project Preparation & Monitoring Unit	0.93	42.5	1.27	57.5	2.20	0.5		2.20	
C. Vehicle Hire Charges	0.92	44.1	1.17	55.9	2.10	0.4		2.10	
D. R&R Administration	0.28	46.9	0.32	53.1	0.60	0.1		0.60	
Total Recurrent Costs	6.94	71.6	2.76	28.4	9.70	2.0		9.70	
Total Disbursement	152.26[a]	31.9	325.16[a]	68.1	477.43	100.0	50.11	374.35	52.98

[a] Excess or shortfall due to rounding error.

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
Local/Foreign/Taxes by Financiers
(US$ Million)

Currency and Taxes	Government of Andhra Pradesh		IDA and IBRD		Total Expenditure	
	Amount	%	Amount	%	Amount	%
I. Foreign	0.00	0.0	50.11	100.0	50.11	10.5
II. Local (Excluding Taxes)	99.29	26.5	275.06	73.5	374.35	78.4
III. Taxes	52.98	100.0	0.00	0.00	52.98	11.1
Total Project	152.26	31.9	325.16	68.1	477.43	100.0

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
Disbursement by Semester and Government Cash Flow
(US$ Million)

Semester	Financing Available: IDA and IBRD Amount	Costs to be Financed: Project Costs	Government of Andhra Pradesh	
			Cash Flow	Cumulative Cash Flow
1	36.33	50.38	- 14.06	- 14.06
2	25.72	38.06	- 12.35	- 26.41
3	30.44	47.26	- 16.82	- 43.22
4	7.30	12.69	- 5.39	- 48.62
5	40.96	61.14	- 20.18	- 68.80
6	16.24	24.48	- 8.24	- 77.04
7	54.50	77.99	- 23.48	-100.52
8	22.17	31.86	- 9.69	-110.21
9	46.75	67.03	- 20.28	-130.49
10	18.87	27.19	- 8.32	-138.81
11	18.20	27.64	- 9.44	-148.25
12	7.70	11.71	- 4.01	-152.26
TOTAL	325.16[a]	477.43	-152.26	- 152.26

[a] Excess of US$0.16 million due to rounding error.

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Proposed Credit/Loan Allocation

Expenditure Category	Estimated Amount of Credit/Loan Allocation (US$ M)	Percentage Financed by Bank/IDA
1. **Civil Works**		
- Irrigation Works	253.6	76%
- Command Area Development	13.0	76%
- Feeder Roads	7.3	76%
- Other Civil Works[a]	2.6	76%
- Canal O&M After Construction	3.4	90% during FY96 and FY97; 80% during FY98 and FY99; 55% during FY00 and FY01; and 25% in FY02
2. **Forest Plantation**	19.0	95%
3. **Equipment, Vehicles and Furniture**	9.5	100% of foreign expenditures or 100% of local ex-factory costs or 80% of other local costs of equipment, furniture and vehicles.
4. **Resettlement and Rehabilitation Programs**	3.2	80%
5. **Training, Consultancy Services and Studies**	10.7	100% of expenditures on foreign consultant services and 95% of expenditures on national consultant services, studies and training
6. **Recurrent Costs**		
- PPMU	1.3	90% during FY96 and FY97;
- Vehicle Hire Charge	1.1	80% during FY98 and FY99;
- R&R Administration	0.3	55% during FY00 and FY01; and 25% in FY02
Total	325.0	

[a/] Including buildings, community infrastructure and soil conservation/drainage structures for catchment treatment and afforestation works

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT -

FORMAT OF PROJECT ACCOUNTS

Fiscal Year: .....

Expenditure Item	Expenditure (Rs. Million)	Share of Funding		Cumulative Expenditure to End of the Year
		Bank/IDA	GOAP	
A. Land Acquisition				
B. Survey, Eng. & Admin.				
C. Civil Works				
D. Command Area Development				
E. Feeder Roads				
F. Buildings				
G. O&M Costs				
H. Equipment				
I. Furnitures				
J. Vehicles				
K. Resettlement & Rehabilitation.				
L. Training				
M. Consultants				
N. Studies				
O. Plantation				
P. Inc. Staff and Allowance				
Q. Vehicle Hire				
R. Other Operating costs				
S. Project Prep. & Monitoring				

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

PROJECT ACCOUNTS BY COMPONENTS

Fiscal Year:...

		Current Period		Cumulative	
		Actual	Budget	Actual	Budget
A.	**Irrigation Sub-Projects**				
	1. SRSP				
	2. SRBC				
	Sub-total				
B.	**Dam Rehabilitation and Safety Assurance**				
	1. Dam Safety in SRSP				
	2. Dam Safety in SRBC				
	Sub-total				
C.	**Resettlement & Rehabilitation**				
	1. R&R - SRSP				
	2. R&R - SRBC				
	Sub-total				
D.	**Agricultural Support Services**				
	1. *Irrigation Agronomy Program*				
	SRBC				
	SRSP				
	2. WUA Promotion Program				
	SRBC				
	SRSP				
	3. Farmer Training Program				
	SRBC				
	SRSP				
	WALAMTARI HQ				
	Sub-total				
E.	**Environmental Management Plan**				
	1. Compensatory Afforestation				
	2. Eco-restoration program				
	SRBC				
	SRSP				
	3. Catchment Treatment				
	SRBC				
	SRSP				
	4. Environmental Health Program				
	5. Agro-Forestry Program				
	Sub-total				
F.	**Project Preparation and Monitoring Unit**				
	Total Project Expenditure				

ICADD STAFFING SCHEDULES

Table of Contents

The following staffing schedules have been submitted by GOAP on December 20, 1996

THIRD ANDHRA PRADESH IRRIGATION PROJECT
(SRBC AND SRS SUB-PROJECTS)

STAFFING SCHEDULE

DECEMBER, 1996

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT
(SRBC AND SRS SUB-PROJECTS)
EXISTING AND FUTURE MANPOWER REQUIREMENTS - IRRIGATION DEPARTMENT
STAFFING SCHEDULE - IRRIGATION DEPARTMENT
STAFFING BUILDUP (CUMULATIVE)
SRBC SUB-PROJECT

Description	Pre-project status					FY 1997-98					FY 1998-99					FY 1999-2000					FY 2000-01					FY 2001-02				
	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE
Project Administration	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-
Project Co-ordinating Unit	-	-	1	3	6	-	-	1	3	6	-	-	1	3	6	-	-	1	3	6	-	-	1	3	6	-	-	1	3	6
Project Accounting Unit	-	-	-	1*	-	-	-	-	1*	-	-	-	-	1*	-	-	-	-	1*	-	-	-	-	1*	-	-	-	-	1*	-
Quality Control	-	1	2	8	30	-	1	4	12	48	-	1	4	12	48	-	1	4	12	48	-	1	2	11	36	-	-	1	3	9
Designs Wing	-	-	3	8	26	-	1	2	6	24	-	1	2	6	24	-	-	1	4	13	-	-	-	-	-	-	-	-	-	-
Construction Circles	-	3	17	67	266	-	3	17	67	266	-	3	17	67	266	-	1	6	24	90	-	1	6	24	90	-	-	2	6	40
Dam Safety Measures	-	1	1	3	4	-	1	1	5	15	-	1	2	8	31	-	1	2	8	31	-	1	1	5	20	-	-	-	-	-

STAFF11.WQ1

LEGEND

CE - Chief Eningeer
SE - Superintending Engineer
EE - Executive Engineer
DEE - Deputy Executive Engineer
AEE - Asst.Executive Engineer
* - Pay and Accounts Officer

III A.P. IRRIGATION PROJECT- S.R.B.C. SUB-PROJECT

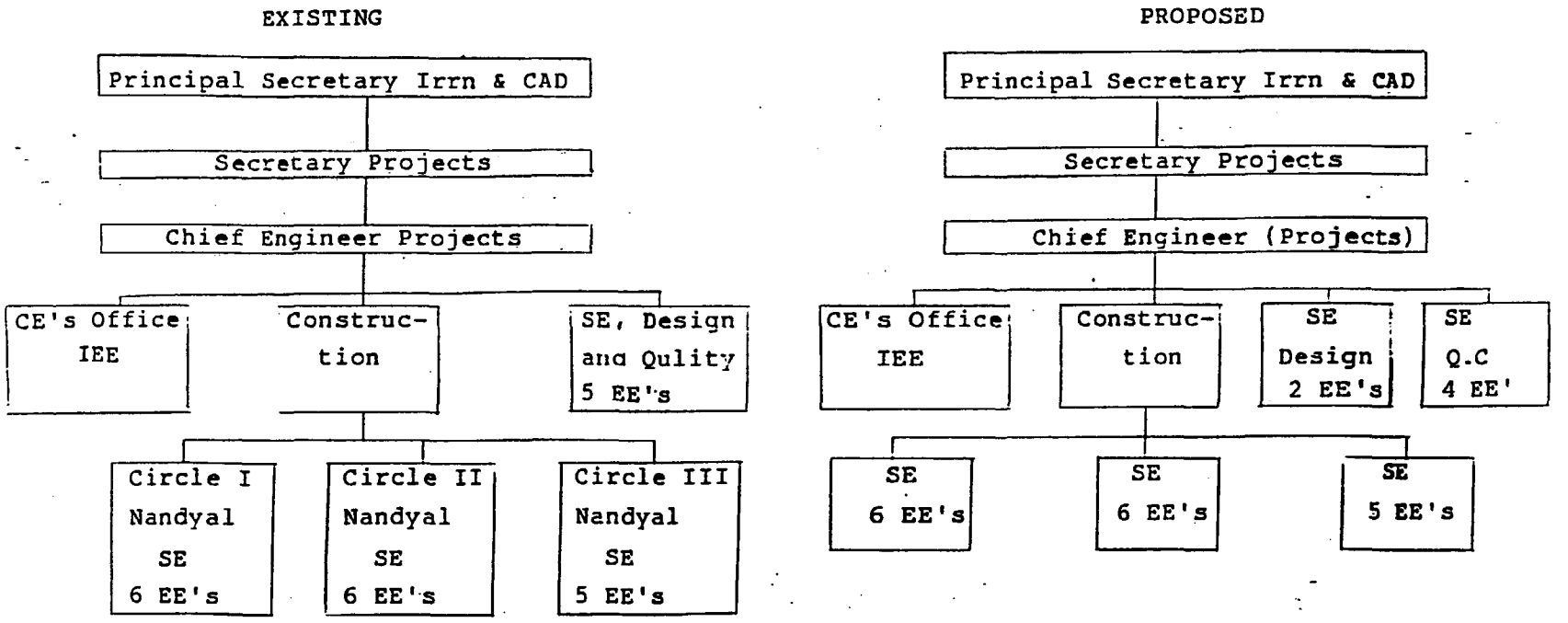
Existing and Future Manpower requirements for Dam Safety Measures of Srisailam Dam

Sl No.	Description	Pre-Project Status					FY 1997-98					FY 1998-99					FY 1999-2000					FY2000-2001				
		C.E.	S.E.	E.E.	DEE	AEE	C.E.	S.E.	E.E.	DEE	AEE	C.E.	S.E.	E.E.	DEE	AEE	C.E.	S.E.	E.E.	DEE	AEE	CE	SE	EE	DEE	AEE
1.	Civil Works	-	1	1	1	2	-	1	1	3	8	-	1	2	6	24	-	1	2	6	24	-	1	1	3	16
2.	Studies	-	-	-	1	1	-	-	-	1	4	-	-	-	1	4	-	-	-	1	4	-	-	-	1	2
3.	Equipment	-	-	-	1	1	-	-	-	1	3	-	-	-	1	3	-	-	-	1	3	-	-	-	1	2

FOR Bhargava 18/12/96

ORGANOGRAM OF S.R.B.C. SUB - PROJECT

CONSTRUCTION



CE : Chief Engineer

SE : Superintending Engineer

EE : Executive Engineer

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT
(SRBC AND SRS SUB-PROJECTS)
EXISTING AND FUTURE MANPOWER REQUIREMENTS - IRRIGATION DEPARTMENT
STAFFING SCHEDULE - IRRIGATION DEPARTMENT
STAFFING BUILDUP (CUMULATIVE)

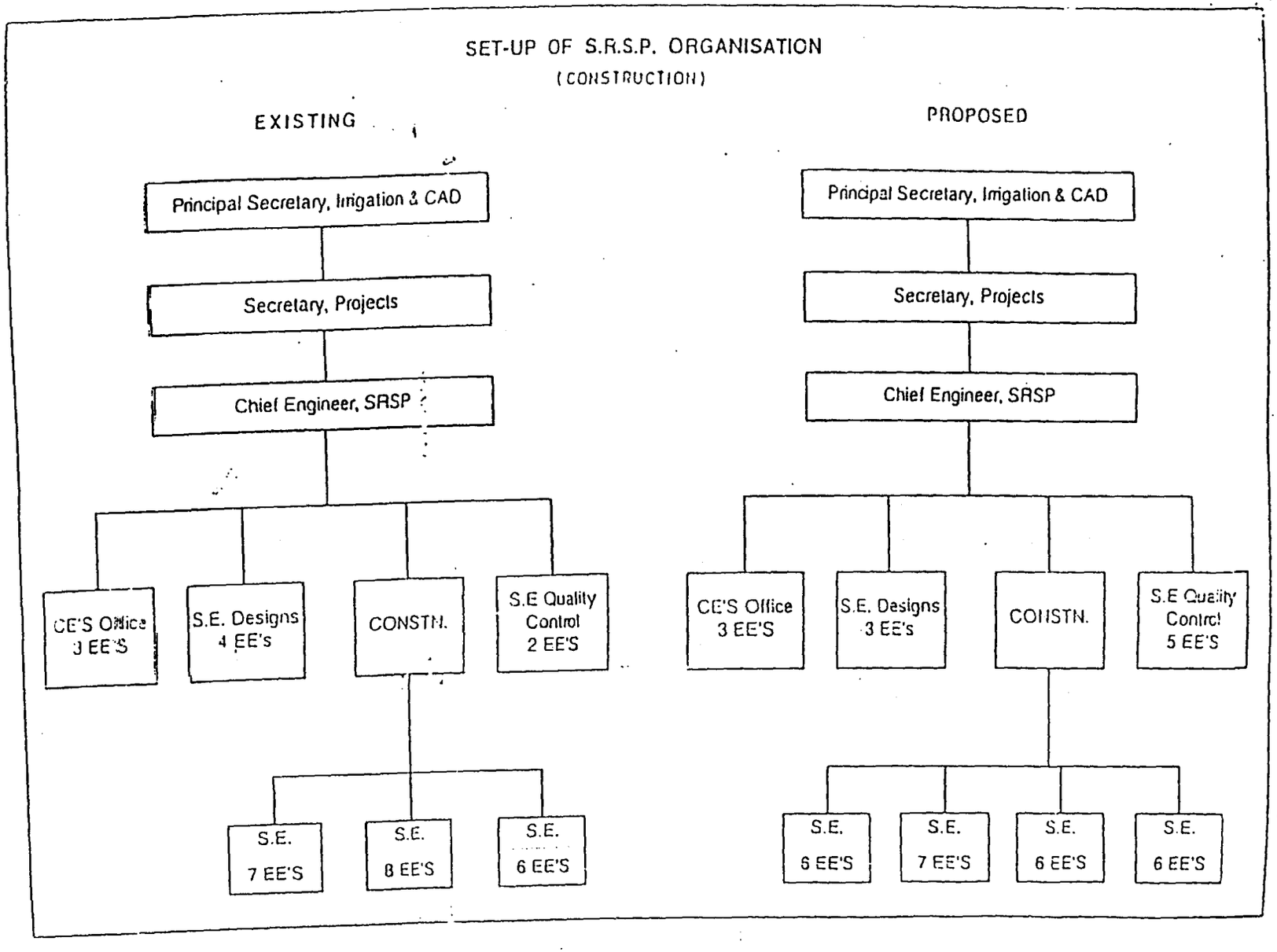
SRIRAMSAGAR SUB-PROJECT

Description	Pre-project status					FY 1997-98					FY 1998-99					FY 1999-2000					FY 2000-01					FY 2001-02				
	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE
Project Administration	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-
Project Co-ordinating Unit	-	-	2	8	19	-	-	3	8	19	-	-	3	8	19	-	-	3	8	19	-	-	3	8	19	-	-	3	8	19
Project Accounting Unit	-	-	-	3*	-	-	-	-	3*	-	-	-	-	3*	-	-	-	-	3*	-	-	-	-	3*	-	-	-	-	3*	-
Quality Control	-	-	1	11	33	-	1	5	22	93	-	1	5	22	93	-	1	5	22	93	-	1	4	18	78	-	1	3	14	64
Designs Wing	-	-	4	14	42	-	1	3	10	30	-	1	3	10	30	-	1	3	10	30	-	1	3	10	30	-	1	3	10	30
Construction Circles	-	1	18	100	329	-	4	25	106	450	-	4	25	106	450	-	4	25	106	450	-	3	18	72	420	-	2	15	60	408

LEGEND

CE - Chief Eningeer
SE - Superintending Engineer
EE - Executive Engineer
DEE - Deputy Executive Engineer
AEE - Asst.Executive Engineer
* - Pay and Accounts Officer

SET-UP OF S.R.S.P. ORGANISATION
(CONSTRUCTION)



THIRD ANDHRA PRADESH IRRIGATION PROJECT
(SRBC & SRS SUB-PROJECTS)
EXISTING & FUTURE MAN POWER REQUIREMENT - IRRIGATION DEPARTMENT
STAFFING SCHEDULES - IRRIGATION DEPARTMENT

OPERATION & MAINTENANCE CAD OF SRS PROJECT

Description	Pre-Project Status 1996-97					FY 1997-98						FY 1998-99						FY 1999-2000						FY 2000-01						FY 2001-02						FY 2002-03					
	ACE	SE	EE	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE	ACE	SE	EE	DDA	DEE	AEE
I.Project Administarion	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-
- Project Co-ordinating Unit	-	-	1	1	2	-	-	1	-	1	2	-	-	1	-	1	2	-	-	1	-	1	2	-	-	1	-	1	2	-	-	1	-	1	2	-	-	1	-	1	2
- Agriculture Cell	-	-	-	-	1@	-	-	-	1	-	1@	-	-	-	1	-	2@	-	-	-	1	-	1@	-	-	-	1	-	1@	-	-	-	1	-	1@	-	-	-	1	-	1@
- Co-operative Cell	-	-	-	2$	3$	-	-	-	-	2$	3$	-	-	-	-	2$	3$	-	-	-	-	2$	3$	-	-	-	-	2$	3$	-	-	-	-	2$	3$	-	-	-	-	2$	3$
- Planning Monitoring & Statistical Cell	-	-	-	-	1@	-	-	-	-	-	1@	-	-	-	-	-	1@	-	-	-	-	-	1@	-	-	-	-	-	1@	-	-	-	-	-	1@	-	-	-	-	-	1@
- Project Accounting Unit	-	-	-	2*	-	-	-	-	-	2*	-	-	-	-	-	2*	-	-	-	-	-	2*	-	-	-	-	-	2*	-	-	-	-	-	2*	-	-	-	-	-	2*	-
II. O&M CAD																																									
Irrigation Engineers	-	-	6	30	115	-	2	12	-	36	179	-	2	12	-	36	179	-	2	12	-	36	179	-	3	16	-	36	185	-	3	16	-	36	185	-	3	16	-	36	185
Agriculture Engineers	-	-	-	-	-	-	-	-	-	5	20	-	-	-	-	5	20	-	-	-	-	5	20	-	-	-	-	8	32	-	-	-	-	8	32	-	-	-	-	8	32

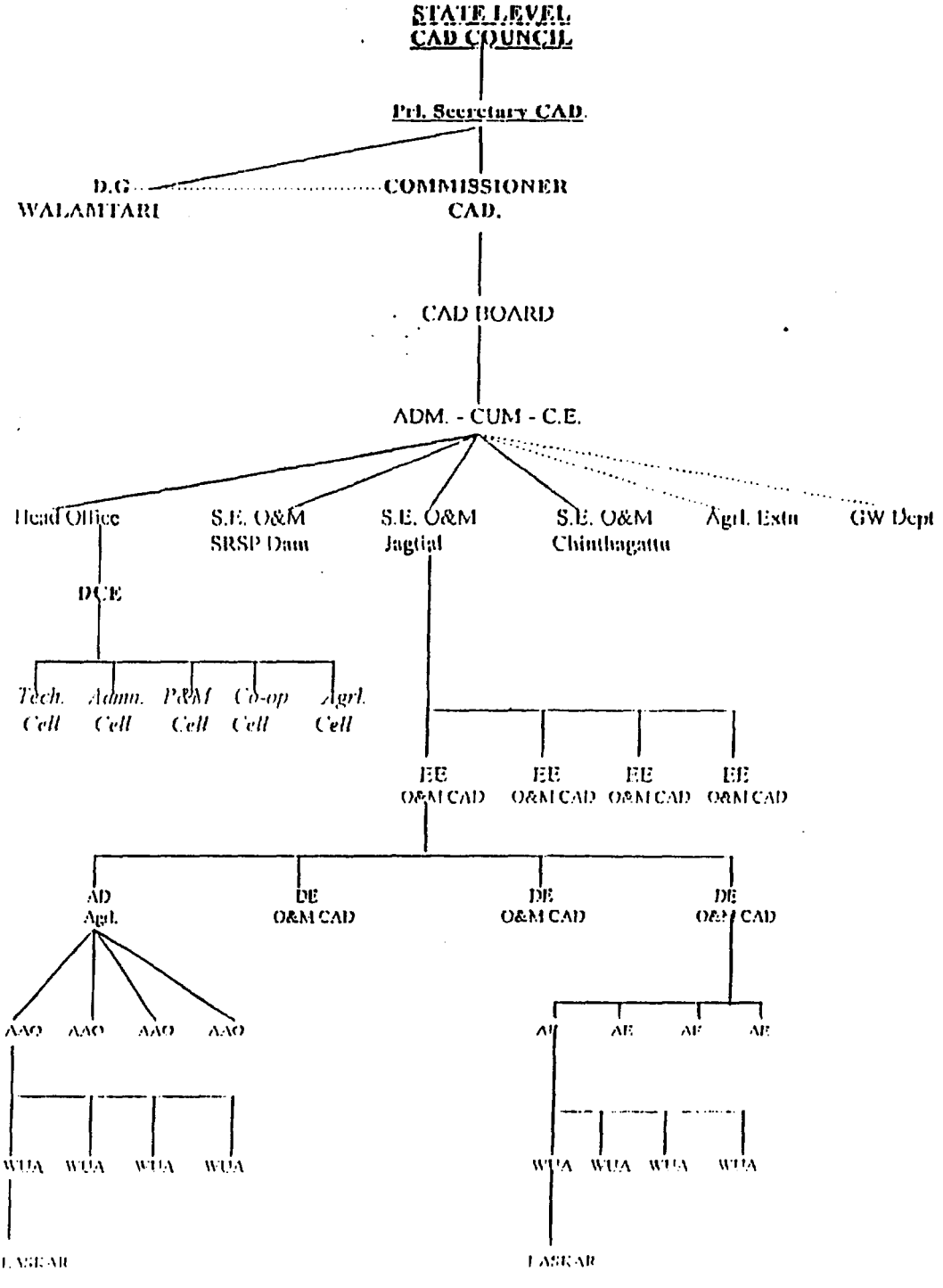
LEGEND

ACE - Administrator-cum-Chief Engineer
SE - Superintending Engineer
EE - Executive Engineer
DDA - Deputy Director Agriculture
DEE - Deputy Executive Engineer
AEE - Asst.Executive Engineer

* Agricultural Officer
\# Deputy Registrar
$ Co-operative Sub-Registrar
@ Statistical Officer
* Accounts Officer

PROPOSED ORGANISATION CHART OF CAD.

SRIRAMASAGAR SUB-PROJECT



INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT
(SREC AND SRS SUB-PROJECTS)
EXISTING AND FUTURE MANPOWER REQUIREMENTS - IRRIGATION DEPARTMENT
STAFFING SCHEDULE - IRRIGATION DEPARTMENT
STAFFING BUILDUP (CUMULATIVE)
PROJECT PREPARTAION AND MONITORING

Description	Pre-project status					FY 1997-98					FY 1998-99					FY 1999-2000					FY 2000-01					FY 2001-02					FY 2002-03				
	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE	CE	SE	EE	DEE	AEE
Monitoring and Evaluation	-	1	2	6	6	1	1	2	6	6	1	1	2	6	6	1	1	2	6	6	1	1	2	6	6	1	1	2	6	6	1	1	2	6	6
Agriculture Cell	-	-	1*	1**	-	-	-	1	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1	1	-
Accounts and Reimbursement	-	-	-	1***	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-

CE - Chief Eningeer
SE - Superintending Engineer
EE - Executive Engineer
DEE - Deputy Executive Engineer
AEE - Asst.Executive Engineer

* DDA - Deputy Director Agriculture

** ADA - Asst.Director Agriculture

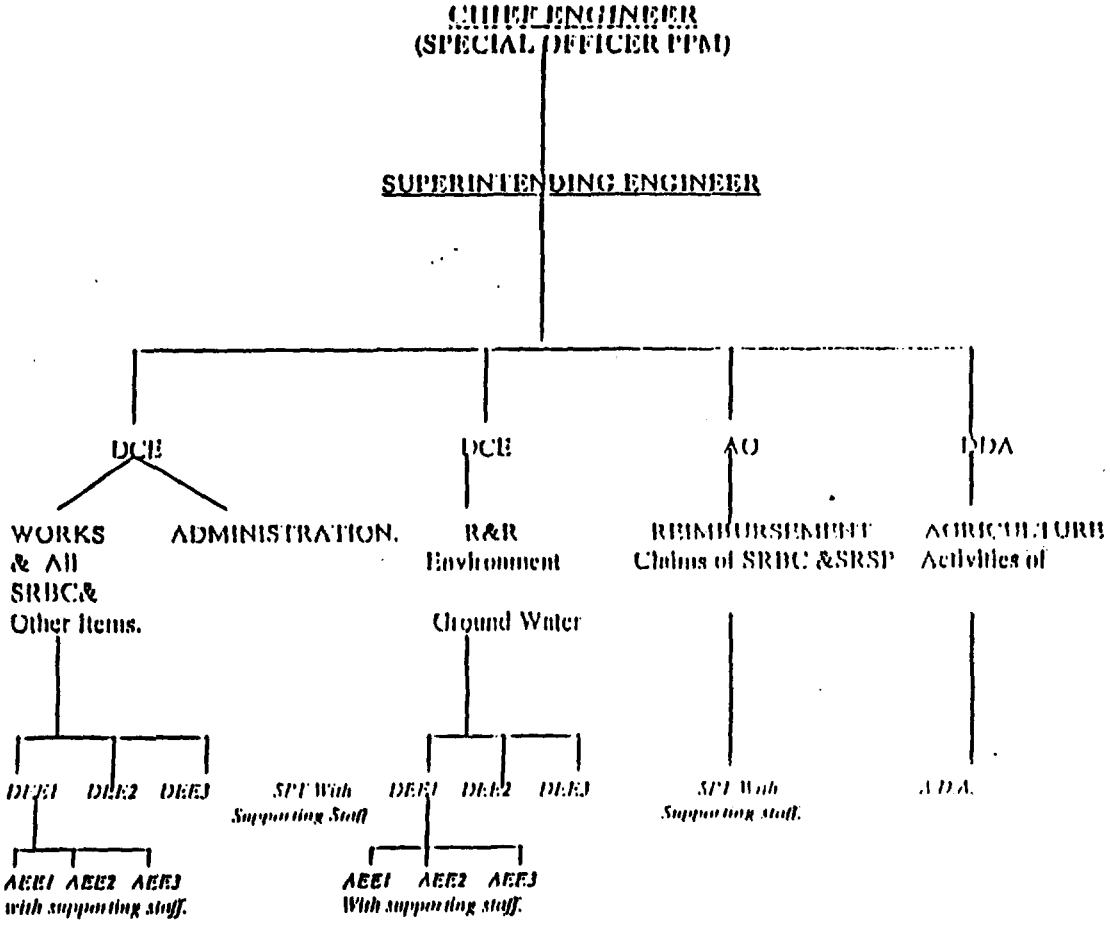
*** AO - Accounts Officer

Table 2

INDIA
Third Andhra Pradesh Irrigation Project
PPMU Staffing Build-up
(Cumulative)

	FY95/96	FY96/97	FY97/98	FY98/99	FY99/00	FY00/01	FY01/02
PPMU:							
Chief Engineer	0	0	1	1	1	1	1
SE	1	2	2	2	2	2	2
EE	2	4	4	4	4	4	4
Dy EE	6	12	12	12	12	12	12
Accounts	1	1	1	1	1	1	1
Dy Director Agric.	1	1	1	1	1	1	1
Asst. Director Agric.	1	1	1	1	1	1	1
Agric. Officers	0	0	2	2	2	2	2
Asst. EE	9	24	24	24	24	24	24
Draftman	2	2	2	2	2	2	2
Superintendents	2	2	2	2	2	2	2
Senior Assistants	5	5	5	5	5	5	5
Junior Assistants	2	2	2	2	2	2	2
Junior Steno	1	1	1	1	1	1	1
Typists	6	6	6	6	6	6	6
Attendents	8	8	8	8	8	8	8
R&R Administration:							
SRSP	0	7	21	21	21	21	21
SRBC	0	6	18	18	18	18	18

ORGANISATION CHART OF PROJECT PREPARTAION AND MONITORING (PPM).



D.C.E. Deputy Chief Engineer. A.O: Accounts Officer. DDA Dy. Director of Agriculture. ADA Asst. Director Agriculture D.E.E Deputy Executive Engineer A.E.E. Asst. Executive Engineer. SPT: Superintendent.

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
EXISTING & FUTURE MANPOWER REQUIREMENTS-IRRIGATION DEPARTMENT
STAFFING SCHEDULE - IRRIGATION DEPARTMENT
STAFFING BUILDUP (CUMULATIVE)

SRISAILAM RIGHT BRANCH CANAL

Description	Pre-Project Status				Project Status From 1996-97 TO 2001-2002								
	SC(LA)	EE	DEE	AEE/AE	SC(LA&R)	RO(EE)	DEE	ARO(AEE/AE)					ENGG'
						GEN	ENGG'	ENGG'	EO(IND)	W&CWO	PE	EDP/MIS	AEE/AE
Resettlement & Rehabilitation	1	1	3	12	1	1	1	3	1	1	1	1	12

SC' : Special Collector
EE : Executive Engineer
RO : Rehabilitation Officer
ARO : Assistant Rehabilitation Officer
DEE : Deputy Executive Engineer
AEE : Assistant Executive Engineer
AE : Assistant Engineer

SC(LA) : Special Collector Land Acquisition
SC(LA&R) : Special Collector Land Acquisition and Rehabilitation
RO(GEN) : R.O. Joint Registrar (Co-Operative Dept.)
RO(ENGG) : R.O. Infrastructure (EE)
EO(IND) : Extension Officer (Industries)
W&CWO : Woman & Child Welfare Officer
PE : Project Economist
EDP MIS : Electronic Data Processing Management Information System

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

EXISTING & FUTURE MANPOWER REQUIREMENTS-IRRIGATION DEPARTMENT

STAFFING SCHEDULE - IRRIGATION DEPARTMENT

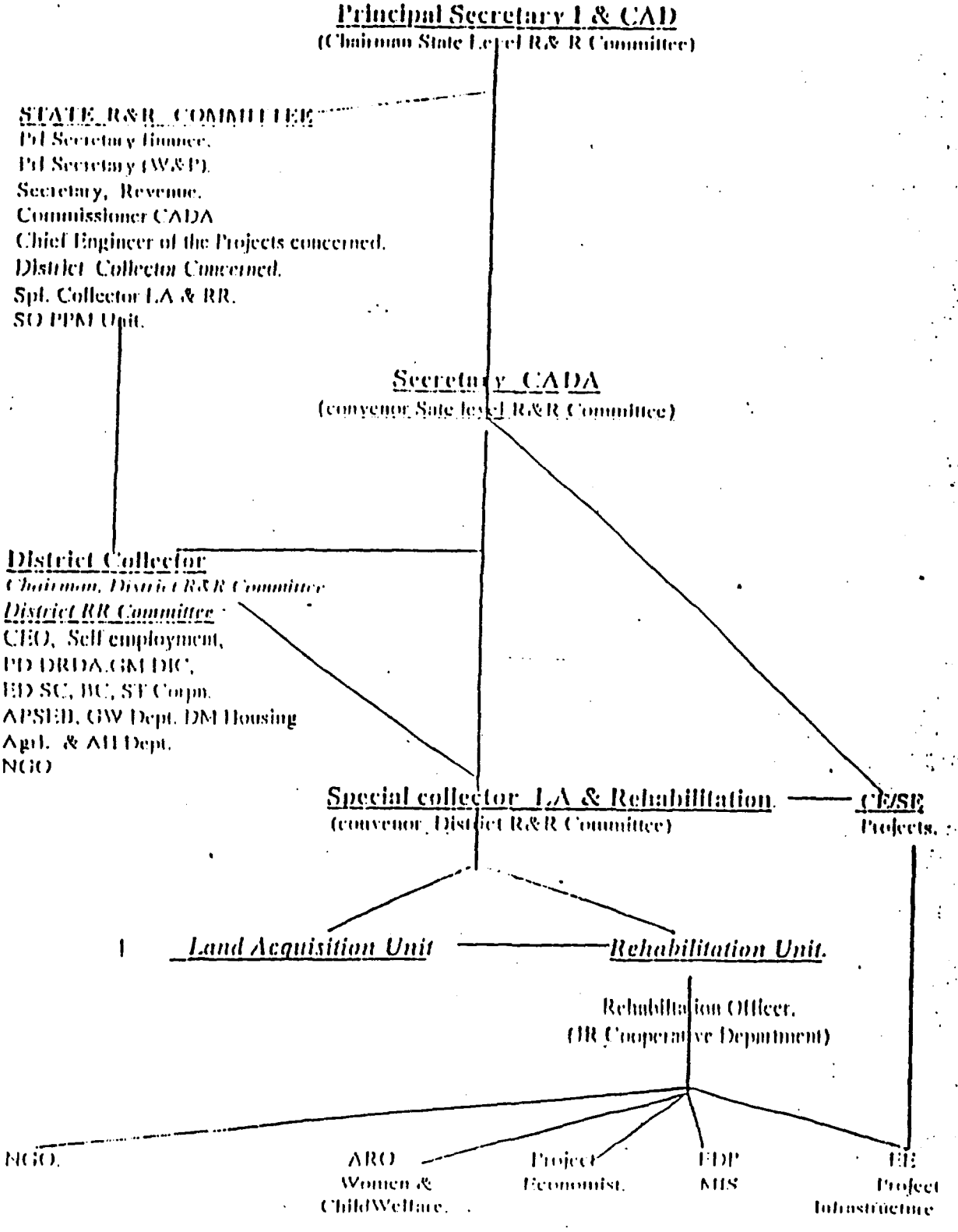
STAFFING BUILDUP (CUMULATIVE)

SRIRAMSAGAR PROJECT

Description	Pre-Project Status				Project Status From 1996-97 TO 2001-2002								
	SC(LA)	EE	DEE	AEE/AE	SC(LA&R)	RO(EE)		DEE	ARO(AEE/AE)			ENGG'	
						GEN	ENGG'	ENGG'	W&CWO	PE	EDP/MIS	AEE/AE	
Resettlement & Rehabilitation	1	1	3	6	1	1	1	2	1	1	1	3	

SC : Special Collector
EE : Executive Engineer
RO : Rehabilitation Officer
ARO : Assistant Rehabilitation Officer
DEE : Deputy Executive Engineer
AEE : Assistant Executive Engineer
AE : Assistant Engineer

SC(LA) : Special Collector Land Acquisition
SC(LA&R) : Special Collector Land Acquisition and Rehabilitation
RO(GEN) : R.O. Joint Registrar (Co-Operative Dept.)
RO(ENGG) : R.O. Infrastructure (EE)
EO(IND) : Extension Officer (Industries)
W&CWO : Woman & Child Welfare Officer
PE : Project Economist
EDP MIS : Electronic Data Processing Management Information System



ORGANONGRAM OF THE R&R IMPLEMINTATION AT THE STATE AND PROJECT LEVEL

Table 3

INDIA
Third Andhra Pradesh Irrigation Project
Agricultural Support Services – Staffing Build – up
(Cumulative)

	FY95/96	FY96/97	FY97/98	FY98/99	FY99/00	FY00/01	FY01/02
WALAMTARI HQ	0	0	60	60	60	60	60
Training:							
SRSP	0	0	16	16	16	16	16
SRBC	0	0	16	16	16	16	16
Agric. Extension: 1/							
Above LMD	0	0	2	2	2	2	2
Below LMD	0	0	41	41	41	41	41
Research:							
SRSP	0	0	3	3	3	3	3
SRBC	0	0	3	3	3	3	3
Water Charge Review Committee:							
Economist	0	1	1	1	1	1	1
Support Staff	0	2	2	2	2	2	2

1/ No incremental staff in SRBC.

IRRIGATION AGRONOMY RESEARCH STAFFING

PART A: Posts need not be created, they are to be re-deployed from the parent department, but the salaries are to be debited to the project cost during the implementation period.

Sl.No	Post	Scale	No. of positions in each project	Total No.of positions required in both the Projects	Parent Department from which personnel are to be re-deployed
1.	Agronomist	3700-5700	1	2	A.P.Agricultural University
2.	Asst.Agri. Engr./ Asst. soil physicist	2200-4000	1	2	do
3.	Dy. Exe. Engineer	3640-5200	1	2	CAD &WALAMTARI
4.	Agri. Officer	3110-5200	1	2	Dept. of Agril.
5.	Asst. Dir. (Hydrology)	3600-5200	1	2	Dept. of Ground Water
6.	A.R.O. (Agronomy)	2200-4000	3	6	APAU
7.	Field Supervisor/ Sub Assistant.	1875-3750	3	6	APAU/DOA
8.	J.A.C.T.	1875-4320	1	2	APAU/DOA
9.	Jeep Drivers	1595-3020	1	2	APAU/DOA

PART B: Position to be created on consolidated basis in the project as these positions will not be in regular scale of pay and not part of establishment of any organisation.

1.	Research Associates	3200/Month	3	6	Temporary filling up in the project.
2.	Data Recorder	1500/Month	3	6	do

AGRICULTURAL EXTENSION INCREMENTAL STAFF REQUIREMENTS

Sl.No.	Category	No. of staff required	No. of staff available	No. of staff incremental
I.	SRSP			
	i. **Karimnagar**			
	Asst. Dir. Agri.	7	7	-
	Agri. Officer	34	34	-
	V.E.O.	221+2	221	-
		-	-	(2 Apprentice in F.T.C.)
	Total	264	262	-
	ii. **Warangal**			
	Asst. Dir. Agri.	1	-	1
	Agri. Officer	12	7	5
	V.E.O.	45+2	10	35 + 2
		-	-	(2 Apprentice in F.T.C.)
	Total	58	17	41
	Sub-total	320	279	41
II.	SRBC			
	i. **Kurnool**			
	Asst. Dir. Agri.	2	2	-
	Agri. Officer	8	8	-
	V.E.O.	28+2	28	-
		-	-	(2 Apprentice in F.T.C.)
	Sub-total	40	38	-
	Grand Total	364	317	47

Annex 9

CONSTRUCTION QUALITY CONTROL ORGANIZATION

Table Of Contents

THIRD ANDHRA PRADESH IRRIGATION PROJECT

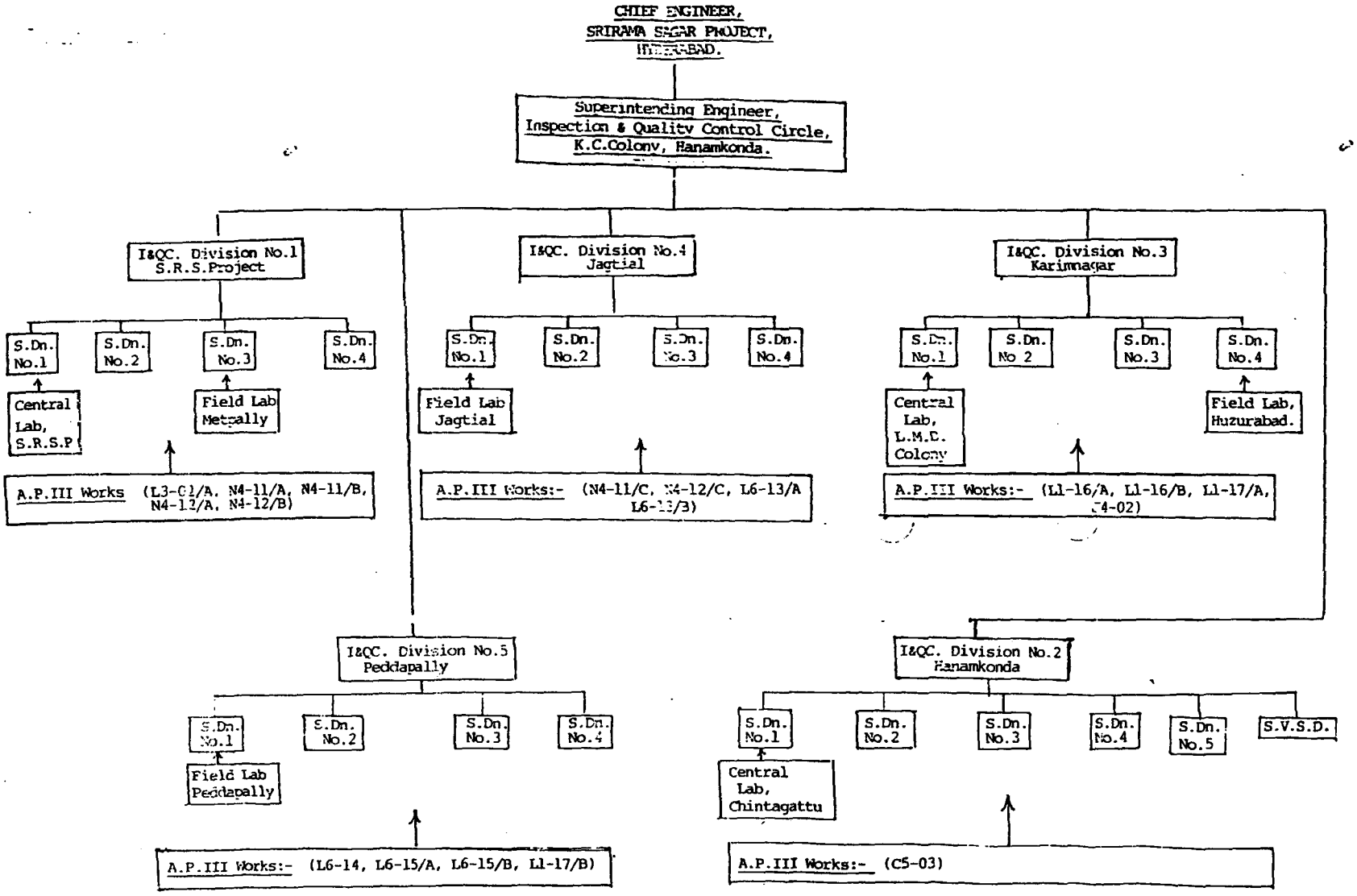
(SRBC AND SRS SUB-PROJECTS)

QUALITY CONTROL ORGANISATION UNDER

SREERAMASAGAR PROJECT

DECEMBER, 1996

PROPOSED I.& Q.C. ORGANISATION SET-UP

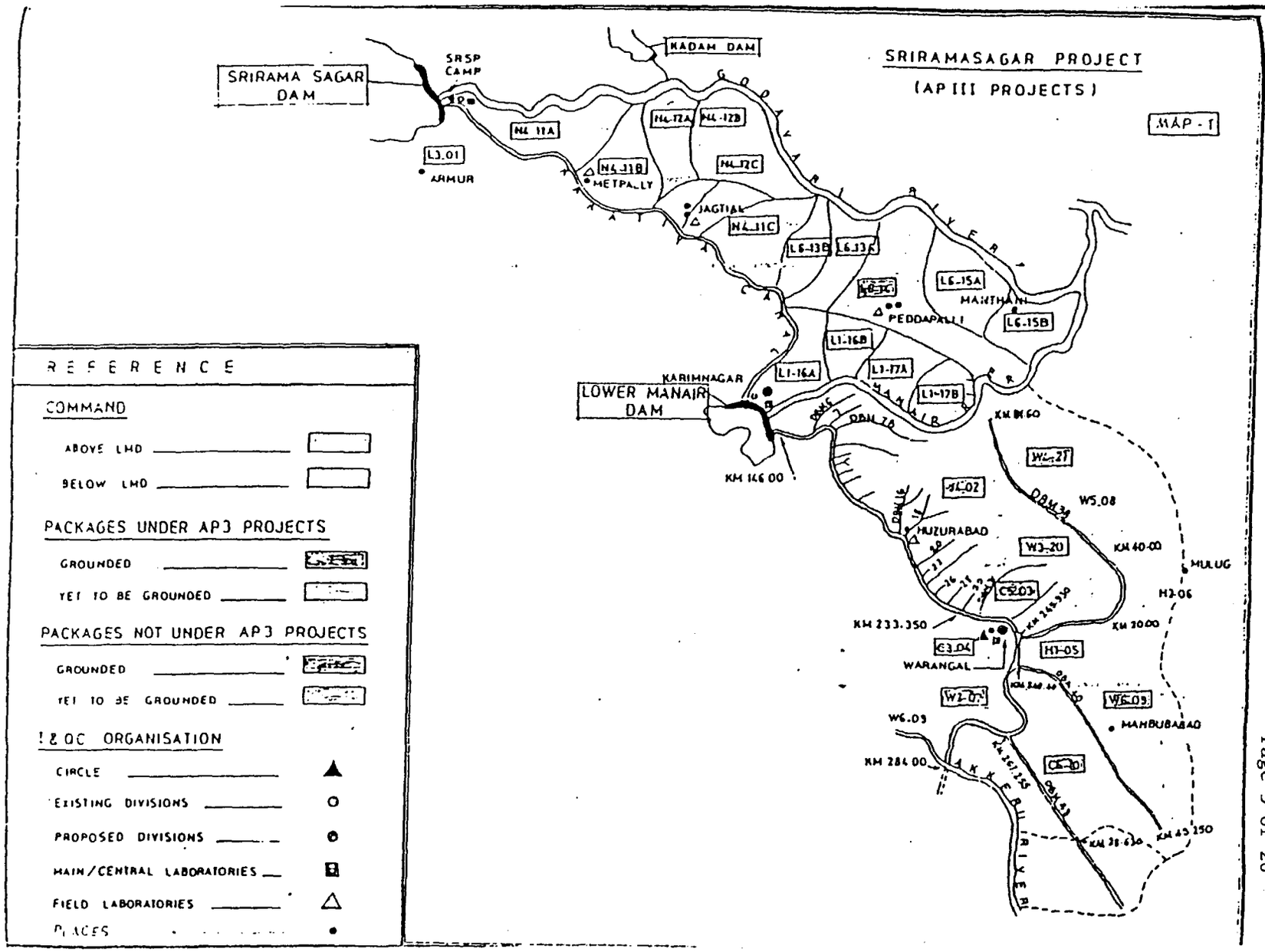


STATEMENT SHOWING THE LIST OF QUALITY CONTROL PERSONNEL REQUIRED FOR THE I. & Q.C. DIVISIONS

Sl. No.	Category of personnels	I&QC. Divn. Jagtial	I&QC. Divn. S.R.S.P.	I&QC. Divn. Hanam-konda	I&QC. Divn. Karim-nagar	I&QC. Divn. Pedda-pally	No.of personnel Total	Existing	Required
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	TECHNICAL								
01.	Executive Engineers	1	1	1	1	1	5	2	3
02.	Dy.Executive Engineers	4	4	6	4	4	22	10	12
03.	Asst.Executive Engineers/ Assistant Engineers	17	17	25	17	17	93	31	62
04.	Work Inspectors	16	16	24	16	16	88	38	50
05.	Man Mazdoors	16	16	24	16	16	88	31	57
	NON-TECHNICAL								
01.	Superintendents	1	1	1	1	1	5	-	5
02.	Senior Assistants	2	2	2	2	2	10	3	7
03.	Junior Assistants	3	3	3	3	3	15	8	7
04.	Typists	3	3	3	3	3	15	6	9
05.	Attenders	7	7	9	7	7	37	32	5
06.	Record assistants	1	1	1	1	1	5	-	5
07.	Draughtsman	1	1	1	1	1	5	-	5
08.	Drivers	5	5	7	5	5	27	12	15

STATEMENT SHOWING THE LIST OF QUALITY CONTROL PERSONNEL REQUIRED FOR LABORATORIES

Sl No.	Category of personnel	Main/Central Laboratories			Field Laboratories				No. of personnel		
		SRSP	L.M.D.	Hanam-konda	Met-pally	Jagtial	Pedda-pally	Huzura-bad	Total	Exist-ing	Requi-red
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
01.	Asst.Executive Engineers	1	1	1	1	1	1	1	7	-	7
02.	Computor Programmer	1	1	1	1	1	1	1	7	-	7
03.	Lab - Boys	5	5	5	3	3	3	3	27	15	12
04.	Man Mazdoors	6	6	6	3	3	3	3	30	17	13


SRIRAMASAGAR PROJECT
(AP III PROJECTS)
MAP - I
SRIRAMA SAGAR DAM
SRSP CAMP
KADAM DAM
GODAVARI RIVER
ARMUR
METPALLY
JAGTIAL
PEDDAPALLI
MANTHANI
KARIMNAGAR
LOWER MANAIR DAM
MANAIR
HUZURABAD
WARANGAL
MULUG
MAHBUBABAD
KM 146.00
KM 233.350
KM 284.00
KM 40.00
KM 20.00
REFERENCE
COMMAND
ABOVE LMD
BELOW LMD
PACKAGES UNDER AP3 PROJECTS
GROUNDED
YET TO BE GROUNDED
PACKAGES NOT UNDER AP3 PROJECTS
GROUNDED
YET TO BE GROUNDED
I & OC ORGANISATION
CIRCLE
EXISTING DIVISIONS
PROPOSED DIVISIONS
MAIN/CENTRAL LABORATORIES
FIELD LABORATORIES
PLACES

GOVERNMENT OF ANDHRA PRADESH

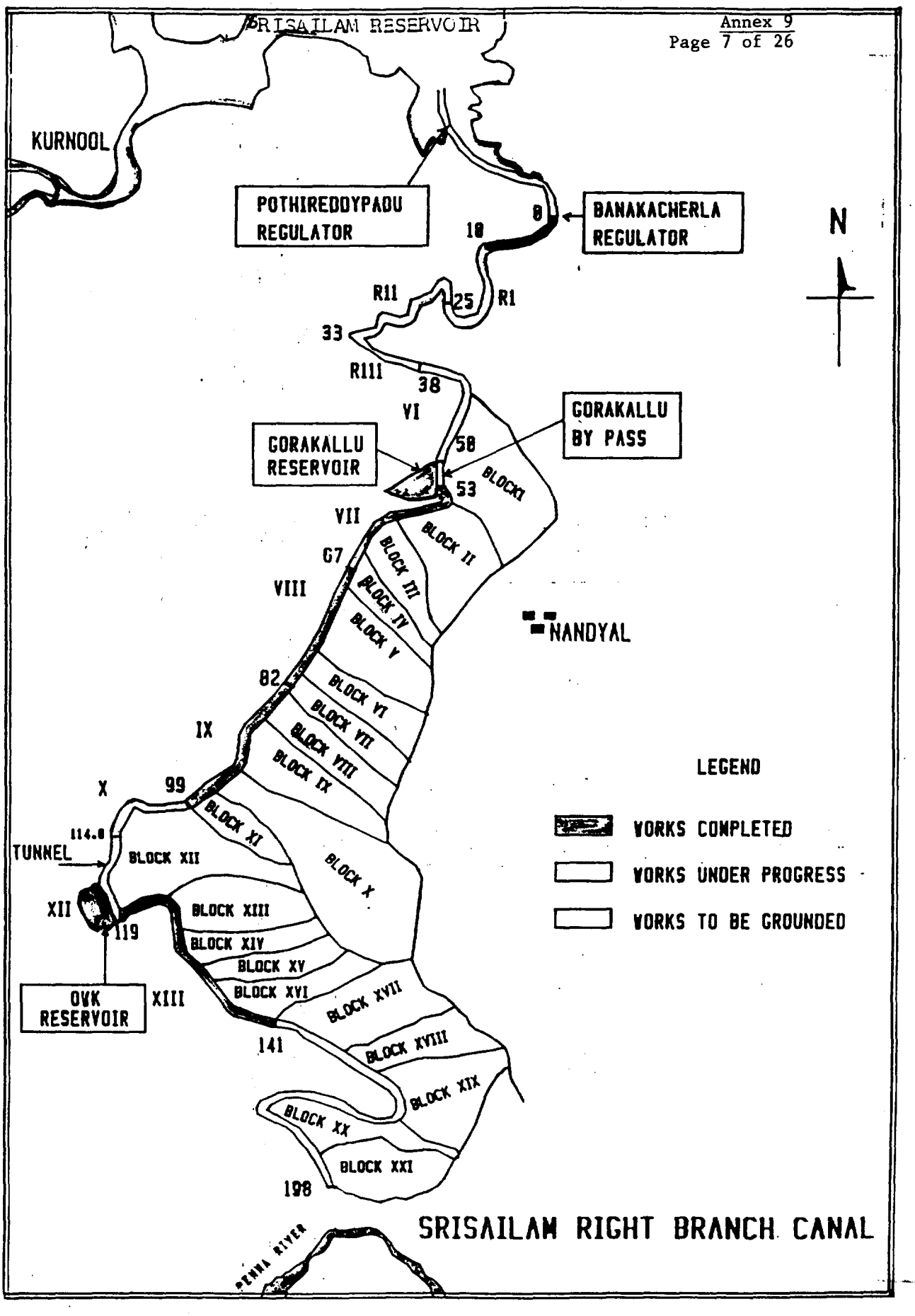
IRRIGATION & COMMAND AREA DEVELOPMENT DEPARTMENT

SRISAILAM RIGHT BRANCH CANAL

ANDHRA PRADESH

(INDIA)

ACTION PLAN FOR QUALITY CONTROL ORGANISATION


SRISAILAM RESERVOIR
KURNOOL
POTHIREDDYPADU REGULATOR
BANAKACHERLA REGULATOR
0
10
R11
25
R1
33
RIII
38
VI
GORAKALLU BY PASS
GORAKALLU RESERVOIR
58
53
BLOCK I
VII
BLOCK II
67
BLOCK III
VIII
BLOCK IV
BLOCK V
NANDYAL
82
BLOCK VI
BLOCK VII
IX
BLOCK VIII
BLOCK IX
X
99
BLOCK XI
114.8
TUNNEL
BLOCK XII
BLOCK X
XII
BLOCK XIII
119
BLOCK XIV
BLOCK XV
OVK RESERVOIR
XIII
BLOCK XVI
BLOCK XVII
141
BLOCK XVIII
BLOCK XIX
BLOCK XX
BLOCK XXI
198
PENNA RIVER
N
LEGEND
WORKS COMPLETED
WORKS UNDER PROGRESS
WORKS TO BE GROUNDED
SRISAILAM RIGHT BRANCH CANAL

ACTION PLAN FOR QUALITY CONTROL ORGANISATION FOR S.R.B.C. SUB PROJECT UNDER A.P.III.

A.P.III Irrigation Project is a composite project comprising of two sub-projects viz. Srisailam Right Bank Canal and Sriramasagar Project for construction of Kakatiya Canal. Both these Sub-projects were assisted by World Bank under A.P.I.P-II which has closd on 30th June 1994. The World Bank aid under A.P.III Project is sought for completion of balance works of A.P.I.P.II.

1.0.0

S.R.B.C. is one of the sub-project under A.P.III Project under World Bank scheme. The works proposed under the sub-project are listed below.

1. Completion of residual work in A.P.II

   a) Works from Km 0/0 to 50.910 of S.R.B.C.
   b) Gorakallu Bypass Canal Structure Complex between KM 50.910 to 53.355 of S.R.B.C.
   c) Balance works from KM 53.355 to KM 114.814. of S.R.B.C.
   d) Completion of balance works between KM 116.00 to KM 141.00 of S.R.B.C.

2. Work to be grounded.

   a) Excavation of Tunnel.
   b) Owk complex, between KM 114.814 to KM 116.000 of S.R.B.C.
   c) Distributory system for blocks 1 to 3, 5 to 8 and 9 to 16.
   d) Micronetwork & drainage for 65000 Ha.

2.0.0

QUALITY CONTROL UNIT IN S.R.B.C.

The existing quality control unit in S.R.B.C. is headed by a Superentending Engineer who is also attending to the work of design. For quality control of works the Superentending ENgineer is assisted by two Executive Engineers. Each Executive Enginer has 4 Deputy Executive Engineers under his control. Similarly each Deputy Executive Engineer is assisted by four section officers under his control.

Contd...2

:: 2 ::

Thus for the quality control of works two divisions are functioning in the organisation.

3.0.0 Teh various duties and functions of the quality control staff and the various tests that are to be conducted by the quality control organisation are listed below.

3.1.0. DUTIES OF OFFICERS AND STAFF OF THE QUALITY CONTROL:

DUTIES OF EXECUTIVE ENGINEER: QUALITY CONTROL:

i) To remain in constant touch with the execution of works and supervise the work of DEE's under him.

ii) To suggest ways and means to improve the standards of work, in case the test results indicate falling standard.

iii) To organise proper upkeep and account, and calibration of the quipment in the main and field laboratory at proper intervals.

iv) To organise test procedures and to submit weekly, reports on the quality of works to higher authorities.

v) TO maintain copies of approved design. reports, plans and estimates, specifications, extracts of inspection notes and data of machinary used on work.

vi) To carry out at least 5 percent of important tests in a month personally so that the defficiencies, if any, are brought to light.

vii) To be in touch with latest development in the field testing and have rapport with A.P.E.R.L., Hyderabad and ISI.

viii) The Executive Engineer, Quality Control should also exercise check whether the E.E./Stores is adopting the principle of "first come first served" for use of cement and whether the E.E., stores is ;planning issue of cement in the chronological order of receipt of cement (State Funding Works).

In addition to normal tests, E.E./Quality Control will carry out surprise check for tests being done in laboratory.

He should check whether shuttering and centering are proper and whether steel is provided as per drawing.

ix) The foundation level of the structure is to be checked for all structures on main canal and branches and satisfy the design criteria and approval recorded in the placement register.

x) Shall test the compaction and moisture content of the embankment atleast one sample for each 150 Mt. length of embankment for a rise in height of about 2 to 3 Mts.

xi) The Executive Engineer, Quality Control is empowered to order the stoppage of work if some serious flaw is noticed. He shall however record the reasons for stoppage of works and shall intimate the Executive Engineer, constructfon immediately and discuss the issue with him and sort it out. Thereafter, it is for the Exe.Engineer, construction to solve the problem and to resume the work.

In addition to the above, the Executive Engineer, Quality control has to jointly, Inspect the works along with the EE., construction where there is variation in classification by plus or minus 10%. In case the variation in classification is more than plus or minus 10% the S.E./quality control and S.E., construction will inspect the works jointly, and approve the classification.

3.2.0 FUNCTIONS OF FIELD STAFF I&QC. DEPUTY EXECUTIVE ENGINEERS INCHARGES OF SUPERVISION OF WORKS AT SITE (FIELD)

a) Concrete & Masonry:

i) Shall regularly inspect the work and supervise the work of Assistant Engineer/Assistant Executive Engineers and conduct test check personally whenever he visits site and see that adquate preparations of foundations have been made before covering the same.

ii) The construction and Quality Control staff shall check whether the work is proceeding in accordence with the specifications, drawings, concerning diamensions, vertically straight edges, reinforcement cover, etc., and to bring the sub standard work to the notice of the Executive Engineer, contruction and Quality Control for action.

iii) Shall see that the input materials brought at site are as per the specifications and check whether they are being entered in the placement register.

Contd...4

iw) Shall ensure that moisture content and F.M. of sand and grade are as per prescribed standards and recod the same.

v) Shall see that slump test for concrete is conducted and recorded.

vi) Shall ensure proper placement of concrete and mortar at project site.

vii) Shall check proportion of input material as per mix design.

viii) Shall see that test samples as per norms are collected for testing, for example, mortar cubes, concrete cubes etc.

ix) Shall compile weekly reports of tests conducted at site in the prescribed form and submit to the Executive Engineer, Quality Control. Executive Engineer, Construction and Dy.Executive Engineer, Quality Control.

x) When a certain grade of concrete is poured daily for considerable number of days quality controll charts be prepared and analysed by statistical method.

b. Earth Work:

i) Shall regularly inspect the work and see that adequate preparations for foundations have been made before covering the same. The Deputy Exe.Engineer in-charge of Quality control unit shall co-ordinate, Supervise and guide the staff under his jurisdiction and conduct test check whenever he visits site and make endeavours to fulfill, the instructions and orders by the higher authorities from time to time.

q ii) He should send the disturbed soil samaples in various reaches well in advance to the central lab. and get the soil tested for various properties and obtain OMC and MDD values.

iii) He should arrange to get the foundation of soil tested in case of weak soil over which heavy embankments are proposed.

iv) Shall arrange to take standard cores from each layer of earth work laid and consolidated for testing for dry bulk density, Moisture content and percentage compaction at site, In addition, he should arrange to collect cores from doubtful compaction and test them as above.

v) Shall see that various materials forming the embankment are laid in appropriate zones and compacted to the required densities at OMC..

iv) Shall check the specifications of sand, metal gravel shingle for filter & stones for pitching wrap-around and rock toes.

v) Shall submit weekly test report and progress report in the proforma to the Executive Engineer, Quality Control and E.E. construction.

3.3.0 QUALITY CONTROL DUTIES OF AEs/AEEs AT FIELD:

i) He is empowered through his construction staff counter part to stop defective and sub standard execution of works before bringing the matter to his Executive Engineer for immediate resolution.

ii) Shall regularly supervise the work to see the materials as per approved specifications, are received at site and entered in the placement register and shall see that work is executed an per specifications.

iii) Shall check the registers, (i) Mark out Register, (ii) Placement Register and (iii) Load Register being maintained by AE/AEE construction, and see that the work is executed as per specifications.

iv) Shall discharge all duties assigned by Dy.Exe.Engineer.

v) Shall collect samples as per norms for testing the mortar, concrete etc.

vi) Shall keep watch over weighing of cement, use of materials as per specificaion (cement bag containing lumps should be rejected).

viiShall check mixing time and water cement ratio and mixing of air entraining agents in required proportion.

viii) Shall check bulkage of sand three times a day and shall conduct water content test thrice a day and correct mixing of water accordingly.

ix) Shall attend to any other duties assigned to them by the Executive Engineer, Quality Control or Deputy Executive Engineer.

x) Shall check the gradation of fine and coarse aggregate daily to satisfy the specification required from each stock or dump.

Contd...6

xi) Shall cast concrete/mortar specimens daily at site as per the frequency of the sample to be taken when small mixers are used samples be taken atleast 3 times in day for each mixer to cover the weather condition.

xii) Shall prepare the control chests for concretes and cement sample, and communicate them to the construction counterparts.

b. Earth Work:

i) Shall obtain the certified copies of quarry chart duly marking leads and trial pits and shall ensure marking of the quarries and opening of the quarries, by clearing jungle, roots and over burden.

ii) Shall carry out grain size analysis and other tests required for deciding suitability of soils for different zones and ensure placing of soils and materials in appropriate zones as per drawing and speciciations.

iii) Shall ensure preparation of sub-grade and Laying of soils in uniform layer as specified.

iv) Shall ensure uniform watering of dumps and layers to get CMC and ensure completion.

v) Shall maintain records of the dimension of spread area and number of passes and details or rolling.

vi) Shall check profiles of earth work for ever 1.5 M. rise of embankment, and ensure 0.6 m extra width of section over designed width.

vii) Shall perform needle density test and core sample for in-situ moisture and wet density for every 570 cum. of earth rolled or for every layer of earth deposited, whichever is less.

viii) Shall find out M.C. & D.D. in field and enter results in placement register allowing tolerance as under:

ix) Moisture +/- 1% for hearting and -1 to +2% for casing zones.

ix) Shall check gradation of filter materials like sand, aggregate.

x) Shall check quality and size of stoanes and spalls to be used in pitching wrap around and boulder toe.

xi) Shall maintain records of field tests and make entries in the register.

xii) Frequency of compaction tests. When the water standing against the embankment is more than one metre compaction to be carried out every alternate day by quality control staff. However, every layer is to be checked up by the construction staff.

3.4.0 FUNCTIONS OF LABORATORY STAFF I&OC
DUTIES OF DEPUTY EXECUTIVE ENGINEER INCHARGE OF LABORATORY:

i) To ensure proper up-keep and maintenance of laboratory equipment in laboratory.

ii) To ensure proper up-keep of records of all samples being tested in the laboratory as per annexure prescribed from vide annexure 2.3 to 13 to the Executive Enginer, Quality Control.

iii) To supervise the testing works of Assitant Engineer/ Assitant Executive Enginees. Laboratory assistants and personally to check the tests to the extent of 25%.

iv) To prepare fortnightly reviews of all the test results and submit to the Executive Engineer, Quality Control.

v) To conduct any research work as may be assigned by the Executive Engineer.

vi) The Central Laboratory shall also collect samples of construction materials on its own. Fortnightly from borrow areas quarries, conduct testing reports to the quality control wing for further action.

vii) Steel rods as proposed to be used shall be tested for ultimate tensile strength elongation and bend etc. as per standards.

viii) Samples of welded rods, welded at site shall be collected and tested for the quality of welding.

ix) The Central Laboratory has to conduct the test on the suitability of materials proposed from various quarries of work well in advance of the actual execution of work.

3.5.0 DUTIES OF A.Es/AEEs (LABORATORY)

Shall perform all the tests available in the Laboratory.

DUTIES OF LABORATORY TECHNICIANS/WORK INSPECTORS:

i) To assist Assitant Enginer/Assitant Executive Engineers whenever required in laboratory and field work.

Contd..8

DUTIES OF LABORATORY ATTENDANTS:

a) To keep instruments clean.
b) To assist AEs/AEEs and Laboratory Technicians in conducting tests.

c) To prepare samples for tests.

d) To arrange samples systematically.

3.6.0 DUTIES OF FIELD STAFF IN RELATION TO QUALITY CONTROL:

i) Quality control is achieved in a two tier system. The construction staff is concerned with the execution of works and they are primarily responsible for proper execution of works and ensuring that specificaions laid down are strictly followed and quality of work is maintained. However the quality control staff will carry out routine tests prescribed in the specifications as per contract document and based on the test results and site inspection, advise construction staff in case of short coming in the workmanship and other respects. The quality control staff shall exercise 100% check over input materials like cement, sand, aggregate but this will not absolve the Executive Staff of their responsibility of doing work as per specifications.

ii) The Executive Engineer construction should give intimation of signing agreements for starting of new work by endorsing copy of work order to the Executive Engineer, Quality Control. The Executive Engineer should also immediately supply copy of agreement and specifications withdrawings and construction programme to the Executive Engineer, Quality Control and Superintending Engineer, Quality Control for works to be started.

iii) The Executive Engineer should see that all ingredients of concrete & Masonry such as sand, coars aggregate, bricks stones are got tested before use.

iv) The section office (AEE/AE) construction should maintain the following records.

a) Mark out registers.
b) Placement Registers.
c) Load Register (separate for mortars, concrete produced by individual mixers).
d) Load registers for concrete produced by the batching plants.

The registers shall be supplied to them by their respective construction divisions and shall be serially numbered and a record of them is maintained just as the case of M.Books,

the pages shall be numbered and the certificate of total number of pages shall be furnished on the last page. The registers will place on record the day to day work done and details of area got ready for placement of concrete, filters. These registers shall be available with the section officer (construction) for different works for recording the test results and remarks of Q.C. Staff. In day to day work there should be close co-ordination between two section officers (S.O. construction S.O. O.C) and if there is any difference on opinion the Dy.E.E. construction and O.C. shall take decision.

3.7.0 DEPUTY EXECUTIVE ENGINEER (CONSTRUCTION):

i) The Deputy Executive Engineer incharge of work should give an intimation to Quality Control staff about actual start of work by the agency.

The Deputy Executive Engineer construction should see that no work proceeds without the approval of O.C. and materials and arrangements made for execution like vibrators and mixers etc.

3.8.0 FUCTIONS OF LABORATORIES:

The project will have main/Central Laboratory under Executive Engineer, Quality Control for carrying out all tests on contruction materials and their processing or proportioning as the case may be. In addition, field laboratories, which will be part of General Laboratory, shall be established at site of work to conduct daily routine.

3.9.0 FUCNTIONS OF CENTRAL LABORATORY:

i) To conduct laboratory tests on samples of sand, agregates, stones, cement and steel for use in masonry and concrete works.

ii) To conduct laboratory tests from foundation soil, and for selection of soils from proposed borrow areas, for use in the various zones of embankment as per specification.

Contd...10

iii) For masonry and concrete, the strenyth of mortar and concrete is as specified in ayreement. Laboratory has to desiyn the proportions of different inyredients throuyh tests for the specified strenyth . The proportioniny shall be done by weiyht.

iv) For concrete and mortars where streynth is not yiven and only proportions have been specified the strenyth of mix be worked out the laboratory and this should be treated as standard for execution.

v) When controlled concrete is specified it is essential that mix desiyn be done.

vi) Since the strenyth of cement varies from batch to batch in a cement factory itself, it is essential that a relation between strenyth of cement versus strenyth of concrete may be worked out in the lab. Well in advance of the startiny of the work. This would facilitate in furnishiny the proper proportion to the field staff for the mix for it entails addiny or reducing cement content based on the strenyth of cement.

vii) The strenyth of concrete is specified for 28 days. It will be difficult for 28 days to yet the strenyth of concrete and assess its quality. Hence accelerated curiny test be under taken as per the relevant I.S. usiny boilding water method. From this method a relationship between strenyth attained with accelarated curiny versus normal curiny at 28 days be arrived at.

viii) Apart from these, control charts for cement and concrete will also be prepared in the Laboratory to assess the level of quality control and to take remedial measures for the defective works, if any. Other statistical analysis as required would also be under taken.

Contd...11

:: 11 ::

ix) Results of tests performed in the central laboratory should be reported in the prescribed proforma.

3.10.0 MODERNISATION OF LABORATORY:

As per the observations of world bank the experts of N.C.B. visited the Laboratory at Nandyal and suggested steps to improve the adequacy and reliabilities of the testing in the laboratory. Incorporating the suggestions of N.C.B. action was initiated for improvement of the Laboratory.

:: 12 ::

LIST OF TESTS AND EQUIPMENTS FOR MAIN/CENTRAL LABS FOR CEMENT, SOIL AND CONCRETE TESTING

TEST.	EQUIPMENT
A. CEMENT.	
(a) Chemical	
(i) Alkalies	These tests will be refered to A.P.E.R.L. as they are.
(ii) Minor, Major Oxides by caloRIMETRY	frequently not required.
(iii) Chloride	
(iv) General	Water distillation still, oven, Hot plate, Balance (Acc.-0-002 9), Muffle Furnace (upto 1200°C) platinum crucibles, condictivity Bridge, PH meter, sample divider for powders, Physical Balance (Cap.150 g).
(b) Physical	
(i) Fineness	Blaine's Apparatus, Stop Watch.
(ii) Soundness Le-chatelier	Le-chatelier Mould, Hot Water bath Autoclave, Length Comparator moulds 25 x 240 mm.
(iii) Consistency and setting time. Initial and Final	Vicat Apparatus, Moulds setting time needles and plunger.
(iv) Compressive strength	Compression testing machine (50 tonne) Vibrating Machine, moulds 50 Sq.Cm.aRea.

:: 13 ::

TEST	EQUIPMENT
(v) Heat of Hydration	Calorimeter, Beckmann Thermometer.
(vi) Drying shrinkage	Length comparator, Flow table.
(vii) General	Stop watch, Timer, Temperature controlled oven, Humidity Chamber Incubator, Physical Balance (Acc. 0.001 g) Balance (Cap. 5 Kg. Acc.1 g.), Control Rom (Temp. controlled curing tanks), Set of Standard sieves lid and receiver.
B. AGGREGATES & CONCRETE	-
(a) General	Electric Drier, Hot plates, set of standard sieves lid and receiver. Balance: 10Kg (Acc. 1 g) 100 Kg (acc. 100g) 250 Kg (Acc. 0.5 Kg) Scoop, Enamel Trys, Balance, showel, compression testing machine (200 Tonne), crusher and Ball Mill, Proving Rings, 5, 25, 50, 100 tonne.
Physical:	
(i) Crushing value	Crushing apparatus
(ii) Impact value	Aggregate impact test machine.
(iii) Abrasion Value	Los Angles Machine.
Chemical :	
(i) Alkali Aggregate Reactivity	Reaction containers
(ii) Flakiness & Elongation Indices	Apparatus for measuring flakiness and Elongation Indices.

TEST	EQUIPMENT
(iii) Unit weight containers	Minimum Capacity of measures

Max. size of C.A., mm	Capacity of measure
2.5	6
37.5	11
50.0	14
75.0	28
114.0	71
152.0	99

(iv) Sampling (Sand)	
(v) Specific Gravity and Absorption	Pycnometer
C. CONCRETE:	
(a) Fresh Concrete:	
(i) Air content	Air meter
(ii) Vibration	Internal vibrator, Table Vibrator
(iii) Temperature Measurement	Metallic Thermometer
(iv) Mix proportions	Equipment as in IS: 1199 for determination of constituents.
(b) Workability Tests:	
(i) Slump test	Slump cone apparatus
(ii) Compaction, Factor test	Compaction Factor Apparatus
(c) Hardened Concrete:	
(i) Compression, Flexural, TEnsion Bending and Brineel's Hardness tests	Universal, Testing Machines with accessories (Cap.100 tonne)
(ii) Capping of cyliners	Capping Moulds
(iii) Mixing of concrete	Laboratory concrete mixer
(iv) Testing of curing compounds	This tests will be referred to APERL

Contd...15

(d) Special Tests:

(i) Mircoscopy	- do -
(ii) Non-Destructive	Ultrasonic pulse Velocity, Rebound Hammer.
(iii) Core testing	Core Drilling Machine, Rock Cutting Machine, Thermal Conductivity apparatus permeability apparatus.

3.11.0 FUNCTIONING OF FIELD LABORATORY

i) To carry out routine daily tests of soils and filter material such as sieve analysis moisture content, needle density tests, compaction efficiency field density tests etc., and to take samples from compacted fill from different zones of the embankment.

ii) To carry out routine daily tests, like silt test of fine aggregates, F.M. sieve analysis bulking of fine aggregates. Absorption specific gravity and grade analysis, surface moisture content tests on coarse aggregates. Slump test of concrete and mortar and collect samples of concrete and morter in moulds as per approved frequency.

iii) To report results of tests performed in the field laboratories in the prescribed proforma pertaining to the following tests in the placement register.

a) SOILS:

1. Moisture content.
2. Density and compaction efficiency.
3. Needle panetration.
4. proctors compaction.
5. Sieve analysis.

b) SAND.

1. Presence of deleterious materials.
2. Grade analysis.
3. Bulkage.

c) COARSE AGGREGATES:

1. Grading.

d) FRESH CONCRETE AND MORTAR

1. Water cement ratio.
2. Workability by slump test/flow table test.

e) BOULDER SAMPLE:

Absorption
Dimensions

visual observation as regards weathering etc.,

f) Cement
Setting time by Vicat needle test.

g) Bricks:

All tests for phical properties except strength which will be conducted at central Laboratory.

All other tests will be conducted in Central Laboratory for which samples shall be sent by the field laboratory to Central laboratory.

iv) The field laboratories will report the testing data with prescribed form in the placement register meant for all, concrete mesonry, filter and boulder pitching work grading etc.

4.0.0. PROPOSED :ORGANISATION SET UP.

The works under the S.R.B.C. sub project are along the length of SRBC from Km 0/0 to 141/0. The works of distributory system are scattered over Gadivenula Panyam, Nandyal, Banganapalli, Koilakuntla, Sanjamala, Uyyalawada, Owk and Gospadu Mandals of Kurnool District, Pedda Mudium, Mylavaram and Jammalamadugu Mandals of Cuddapah District. The length of Major distributory is 179 Km and that of Minor distributory system in 490 Km. To ensure better quality works in the widely,Scatired reaches

It is proposed to have two more divisions nearer to the works site exclusively a separate Q.C.division for owk complex as suggested by Q.C. adit team of W.B. addition of the two division the distribution of work load will be detailed below.

1. QUALITY CONTROL DIVISION I NANDIKOTKUR.

1. Balance works in Km 0/0 to Km 50.910 of S.R.B.C.
2. Blocks 1 to 3.
3. Gorakallu Bypass canal structure complex.

2. QUALITY CONTROL DIVISION II NANDYAL.

1. Control Laboratory at Nandyal.
2. Field Laboratory at Banyanapalli & Owk.
3. Block 5 to 8.

3. QUALITY CONTROL DIVISION BANGANAPALLI.

1. Block 9 to 16.
2. Balance work in SRBC KM 53.355 to 114.814.

4. QUALITY CONTROL DIVISION OWK.

1. Owk tunnel and owk reservior complex.
2. Balance work in SRBC between Km 116.000 to 141.00.

The oryanoyrammes indicatiny both existiny proposed staff patterns is appended.

12/12/96

Deputy Executive Engineer
SRBC Quality Control
Nandyal.

A.P. III IRRIGATION PROJECT: SRBC-SUB PROJECT

Statement showing the List of Q.C.Personnel Required for Laboratory

egory of Personnel	Main Laboratory	Field Laboratories			No.of Personnel		
	At Nandyal	At Banaganapalli	At OWK	Total	Existing	Required	Remarks
ecutive Engineers	2	-	-	2	1	1	
tant Executive Engineers	4	2	2	8	2	6	
rch Assistant	2	-	-	2	Nil	2	
ssistants	6	1	1	8	5	3	
oys:Men:Mazdoors	18	3	3	24	12	12	

Sd/
Chief Engineer(Projects),
N.S.R.S.Project,Hyderabad.

PROPOSED ORGANOGRAM OF QUALITY CONTROL

rintending Engineer
(Porposed)

Superintending Engineer (Quality Control)
(Existing)

utive Engineer ns Wing I rabad with divisions & 12 ons (Existing)	Executive Engineer Designs wing II Hyderabad with 4 sub divisions & 12 sections (Existing)	Executive Enginer Q.C.& I. Division No.1 Nandikotkur with 4 sub division & 17 sections (Existing)	Executive Enginer Q.C.&I, Division No.2. Nandayal with 4 sub divisions & 13 Sections (Existing)	Executive Enginer Q.C.& .I. Division Banayanipalle with 4 sub division & 17 sectionns (Proposed)	Executive Enginer Q.C.&I Division Owk with 4 sub division 13 sections (Proposed)
		WORKS	WORKS	WORKS	WORKS
		1. Spill over works of A.P.III in the reach from KM 0 to Km 50.910 of S.R.B.C.	1. Blocks 5 to 8	1. Balance works of S.R.B.C. from K.M. 53.355 to KM 114.814	1. Owk Tunnel and Owk Reservior Complex
		2.Gorakallu Bypass Canal Structure	2. Central Laboratory at Nandyal	2. Blocks 9 to 16	2. Balance work of S.R.B.C. below KM 116.000 to KM 141.000
		3. Blocks 1 to 3	3. Field Laboratories at Banayanapalli & Owk.		

PROJECT BENEFITS AND ECONOMIC ANALYSIS

Table of Contents

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

BENEFITS AND ECONOMIC JUSTIFICATION

A. Project Benefits

Economic and Environmental Impacts

1. **Agricultural Benefits**. Assistance to GOAP for rehabilitation and completion of the SRSP 253,000 ha command area and completion of the 65,000 ha SRBC project begun under the AP II project would add 153,000 ha to the 2.3 million ha of surface irrigation commands in AP. The agricultural objective of these works is to promote the production of high value cash crops in upland irrigation schemes by improved water delivery, applied farming systems research, irrigation agronomy extension and farmer training. These inputs would result in significant incremental agricultural production consisting of cereals and pulses, oilseeds, cotton and other cash crops. Project agricultural output would generate an annual Value Added to the local economy estimated at Rs.5.03 billion (about US$140 million) in 1995 prices. These project outputs would be sustained by investment to ensure the safety and economic life of the Srisailam and Sriramasagar dams which, in turn, would ensure sustained irrigated and hydroelectric power production within the Krishna and Godavari river basins outside the project areas. Completion of the AP II command area feeder road program would promote farm produce marketing and provide quantifiable economic benefits in travel time and vehicle operating cost savings.

2. **Employment**. The number of directly benefiting farm families is estimated at about 447,700 (about 2.24 million people). At full development, the increased demand for farm labor would amount to about 31.6 million man-days per annum (equivalent to about 105,450 full-time jobs). About one half of the manpower demand would be supplied by hired labor, the majority of which consists of landless workers. The increased agricultural production would generate off-farm employment and have significant employment multiplier effects. It is estimated that over 26,000 transport, marketing and processing jobs would be generated in the sub-project area Districts. Construction of civil works would generate a temporary five year increase in local employment opportunities since a large number of unskilled laborers would be employed in construction during project implementation period.

3. **Afforestation Products and Environmental Conservation**. The Environmental Management Plan component would also generate several diverse benefits. These include: (a) reduced reservoir sedimentation as a result of soil and water conservation in treated catchments comprising reservoir foreshore areas; (b) generation of forest products by compensatory afforestation, farm forestry, canal bank and the green belt plantations; (c) water-borne disease control under the environmental health program; (d) natural resources and wildlife conservation in protected areas would be improved; and (e) project programs and two environmental education facilities would be provided to increase the environmental awareness of the local population along with agro-forestry training. Investments in a comprehensive environmental monitoring program would monitor progress in improvement of the regional environment and conservation. The above benefits are not readily quantifiable in economic terms: however, compensatory afforestation, canal bank and reservoir green belt plantation would produce about significant quantities of salable fuelwood, pulpwood, faggotwood in the future.

4. The overall direct project impact at full development is summarized in the table below:

Project Impact

Incremental Project Outputs	SRBC	Above LMD	Below LMD	Total Project
Directly Benefiting Farm Families (No.)	57,700	254,350	135,650	447,700
Increased Net Command Area (ha)	65,000	165,000	88,000	318,000
Cereals and Pulses (tons/year)	0	262,250	107,677	369,823
Oilseed Production (tons/year)	119,413	43,650	63,395	226,458
Cotton Production (tons/year)	24,210	10,950	22,792	57,862
Farm Employment (jobs/year)[b/]	10,100	49,000	46,350	105,450
Off-Farm Employment (jobs/year)[b/]	2,520	12,250	11,590	26,360
Agricultural Value Added (Rs.Million/year)[c/]	1,750	1,800	1,480	5,030

a/ Including mainly sugarcane and vegetables, and some fruits and seed production.
b/ Estimated at 300 days per job.
c/ Defined as the sum of gross farm incomes minus cash inputs and family labor.

Impact on Farm Incomes and Poverty Alleviation

5. **Farm Model Analysis.** The project impact on farm incomes has been assessed by representative farm models based on average holding sizes of 1.1 ha for SRSP and 1.8 ha for SRBC as these represent about 80% and 70% respectively of total farm holdings in the two sub-project areas (Table 16). Farm model net incomes were evaluated for three development scenarios: the present (P), the future without project (FWOP) and the future at full development with the project (FWP). The average 1995 financial farm gate prices prevailing in the sub-project areas were used to value outputs and inputs in the computation of unit area crop budgets for each likely crop under each of the three scenarios. The per ha financial crop budgets are given in Tables 1-12 along the crop yield assumptions used. Farm cropping patterns are modeled on the regional cropping patterns for each of the three scenarios (Tables 13-15). The farm model analysis results are detailed in Table 17. A summary of average farm net income results is given in the table below:

Annual Net Incomes of Average Farms

Command and Average Farm Size	Present	Without Project	With Project	Net Increase due to Project		Net Increase Ratio[b/]
	Rs.	Rs.	Rs.	Rs	%	
SRBC (1.8 ha)	10,890	13,445	61,840	48,395	360	3.52
SRSP						
- Above LMD (1.1 ha)	10,570	11,530	23,555	12,025	104	2.06
- Below LMD(1.1 ha)	7,910	9,375	27,885	18,150	197	1.95

a/ Net return to family labor before water charge and production tax payments.
b/ Ratio of incremental net income to incremental production costs

6. The impact of the project on project area farm incomes would be substantial. At full development, annual net farm incomes in with project are estimated to increase by 200%-360% in areas where presently there is little or no canal irrigation (i.e. in SRBC and in SRSP below LMD), and by about 100% in areas where presently there is already some canal and well irrigation (in SRSP above LMD). Incremental annual net farm incomes in SRSP range from Rs.12,025 for farms in the above LMD area to Rs 18,150 in the below LMD area, while in SRBC they could average about Rs.48,395. The incremental benefit cost ratio for SRSP farms is about 2 while that of SRBC could attain 3.5.

7. **Poverty Alleviation Impact**. In Andhra Pradesh, the number of population living below the poverty line has declined from 44% in 1981 to 32% in 1991, compared with 48% and 30% respectively for all India. In the project districts, the number of population who live below the poverty line range from 36% in SRBC and 50% in SRSP. The percentage of landless population in the project areas is estimated to be about 25% in the SRBC and 21% in SRSP. Since a farm family of five requires an annual income of about Rs.11,000 to be above the Andhra Pradesh absolute poverty threshold, the results for the "present" (P) scenario shown in the table imply that, at present, 80% of farmers in SRSP and 70% of farmers in SRBC have incomes below the poverty threshold of Rs.11,000 per annum. Given that opportunities for off-farm incomes are limited, it may be assumed that the per capita income of most of these families and those of the landless population at present do not reach this level. Under the FWOP scenario farm income would increase very marginally above the poverty line threshold while under the full development FWP scenario, all average farm incomes would be above the poverty line.

Irrigation Management Reform

8. **Participatory Irrigation Management (PIM)**. Having served as a catalyst for GOAP irrigation sector management and fiscal reform, the project would be of a pilot nature to test management reform modalities for statewide adoption. Its pilot benefits include: (a) finalization of legal and administrative modalities for empowerment of irrigators to take over the and operation and maintenance of minor canal networks by voluntary establishment of autonomous Water User Associations (WUAs); (b) devolution of responsibility for equitable water delivery to WUAs; and (c) involvement of irrigators in joint management of reservoirs and major canal schemes through democratic representation on public Command Area Development Boards or Scheme Committees. Thus a significant part of the burden of canal network O&M funding and enforcement of water delivery discipline would be transferred to irrigation scheme beneficiaries.

9. **Improved Irrigation Service**. An important benefit of the project would be the piloting of modalities to realize GOAP strategy for increasing the potential of upland canal commands having scarce water resources. The strategy is based on an ICADD focus on: (a) providing intermittent water supply uniformly to a whole command and allowing farmers to cultivate crops of their choice with available water supplies, instead of using Localization to regulate high consumptive use crops to specific locations and seasons; and (b) ensuring reliable and adequate water supply to WUA jurisdictions by specific ICADD scheme organizations having system O&M and water management as their primary function. Thus, success of the twin pronged approach of PIM and improved irrigation service under the project would lay the foundation for improvement of irrigation efficiency in upland areas and contribute to the irrigation sector's unavoidable adaptation to growing water demands from other sectors.

10. **Improved ICADD Implementation Capacity**. The project's construction quality assurance arrangements (including ICADD construction staff training and and management of improved civil works contract documents developed for the project), together with the focus on public consultation

and participation, would improve ICADD's implementation capacity for other large state irrigation projects. The project R&R Policy and its implementation arrangements sets a precedent for more equitable treatment of project affected families of future irrigation projects and the experience to be gained would improve ICADD's R&R implementation capacity.

B. Economic Analysis

Analysis Approach and Methodology

11. **Project Components Considered**. The project would modernise/rehabilitate the existing irrigation infrastructure in the Sriramasagar Project (SRSP), and complete the on-going irrigation works to develop the 65,000 ha Srisailam Right Branch Canal (SRBC) command. In SRSP, the modernisation and rehabilitation works would be carried out within the 165,000 ha command served by km 0-146 of Kakatiya Canal above Lower Mannair Dam (LMD), where the existing irrigation network is shrinking due to neglect, and along its km 146-234 below LMD serving a 88,000 ha area where there are already some distributaries but very few minor canals. The economic rates of return (ERRs) and Net Present Values (NPVs) have therefore been calculated separately for: (a) the three commands of the sub-project areas (SRBC, above LMD and below LMD in SRSP); (b) SRSP as a whole; and (c) the overall project.

12. The analysis included only the direct costs to be incurred and benefit accrual from the irrigation sub-projects and the feeder road program. This included R&R expenditures for SRBC only since SRSP R&R expenditures are provided for addressing the impoverishment of people outside the command area that were affected by the construction of irrigation works under the AP II project. However, the investments for ensuring the safety of the Srisailam Dam spillway were excluded from the analysis because their very significant benefits would be attributable to the protection against a possible irreparable the dam's hydroelectric plants and other downstream facilities in the river basin, as well as stoppage of Madras and Telegu Ganga Project water supply. Consequently inclusion of these benefits in the form of damage prevention would distort the economic assessment of SRBC as an irrigation project on the one hand, while the apportionable investment cost to SRBC is very small on the other. The costs and benefits of the Environment Management Plan were excluded from the analysis because most of the benefits are related to regional environmental conservation while the present value of direct benefits such as revenues derived from afforestation activities, are very small in relation to quantifiable agricultural benefits.

13. **Treatment of Groundwater Development**. The area irrigated by village irrigation tanks has remained more or less constant in both sub-project areas and is not expected to increase. However, there has been substantial groundwater development within and outside the SRSP sub-project area because of increased recharge due to canal seepage, improved electrification, cheap credit and the limited coverage of the deteriorating irrigation network. This activity will likely continue in the future albeit at a reduced rate within the SRSP command because of the availability of greatly expanded canal irrigation after project completion. The total area irrigated by electrified and bullock-driven wells is currently about 50,000 ha and could potentially be increased by about 30,000 ha. Although conversion of the bullock-driven wells to electric pumping is possible to expand their coverage by 5,000-8,000 ha, this is unlikely once canal irrigation is available. However, given the uncertainties of private sector investment in wells in SRSP after scheme rehabilitation, the analysis postulates that the private development of groundwater would continue at the same level in both the "With Project" (WP) and "Without Project" (WOP) scenarios. Accordingly, it is assumed that in SRSP the additional wells installed by rice cultivators to cope with the rotational water supply regime in the WP case would equal the number that would be installed as a response to inadequate canal irrigation coverage under the WOP

scenario albeit not in the same locations. Therefore, the economic resource costs of development and operation of wells and their benefits have been excluded in both the WOP and WP cases for SRSP.

14. For the new SRBC command, the limitations of groundwater exploitation make it unlikely that groundwater development will expand significantly beyond its present level of about 3,500 ha as the hydrogeology of 70% of the command does not lend itself to viable groundwater development. The maximum potential increment in groundwater development is only about 5,000 ha and then only if water tables rise significantly after several years in parts of three or four of the sixteen irrigation blocks of the command area as a result of seepage losses and a relatively less pervious subsurface layer (Annex CC). Thus, groundwater development is regarded as identical for both the WP and WOP scenarios and not included in the SRBC economic analysis.

15. **Derivation of Economic Benefits.** The quantified benefits are mainly incremental agricultural production due to cropping pattern and productivity changes in each command, supplemented by an estimate of the likely economic benefits that could be attributed to feeder road investments (e.g. economic savings in vehicle operating costs and travel time). In SRSP, the agricultural benefits are expected to come mainly from significant shifts from low value to higher value crops as a result of rehabilitation of the existing irrigation network and expansion of reliable canal irrigation to the whole command. For SRBC, project benefits are derived from the change from rainfed to irrigated production in the form of higher crop yields, an increase in cropping intensity and shift to higher value crops. The WOP and WP cropping patterns were initially based on data and estimates provided by agricultural research and Agriculture Department staff and modified on the basis of Participatory Rural Appraisals[1] (PRA) managed by a specialized NGO with GOAP assistance. The PRA was based on farmer consultations conducted in 70 and 48 villages respectively above and below LMD in SRSP, and in 42 villages within the SRBC command area. Proposed cropping patterns resulting from the PRA and proposed crop yields were reviewed during project preappraisal and finalized by agreement between Bank, FAO, GOAP and Agricultural University agronomists.

16. **Sensitivity/Risk Analysis.** Risk and assumptions that may not fully materialize are treated in the sensitivity analysis by varying benefit and cost streams to reflect particular risk scenarios. The risks analyzed include: (a) seasonal water delivery deficits; (b) the percentage change in net benefits or project costs (i.e. "switching values") that would reduce ERRs to the opportunity cost of capital (12%); (c) impact of implementation delays; (d) combinations of increased costs and lagging benefits; (f) expanded rice cultivation instead of the expected predominantly upland cropping pattern of cash and food crops grown under a rotational water supply regime; and (g) over-estimation of projected yields for rice and cash crops.

Cost Assumptions

17. **Pricing Framework.** The economic analysis has been carried out in 1995 constant prices over a project life of 30 years. All local costs, including unskilled labor and other non-traded goods, were converted to economic costs and values by using a Standard Conversion Factor (SCF) of 0.90. The economic prices of traded commodities and fertilizers were derived from the world market price forecasts and adjusted for transport and handling charges to farm gate prices (Table 18).

---

[1] The PRAs are documented in the following ICADD reports: (a) *Agricultural Aspects of Srisailam Right Branch Canal Command*, June 1994; and (b) *Agricultural Aspects of Sriramasagar Command*, July 1994.

18. **Irrigation Investment**. The investment in irrigation civil works, including command area development, equipment, buildings and physical contingencies is estimated at: (a) Rs.4,544 million and Rs.2,099 million for commands above and below LMD respectively; and (b) Rs.5,999 million for completion of SRBC. These works require a mixture of equipment, local materials, fuel and both skilled and unskilled labor. Based on a sample of seven ongoing construction contracts, these costs may be broken down into about 13.5% in taxes and duties, 11.5% in foreign exchange components, and 75% local materials, unskilled labor, engineering and administration. Local costs were adjusted to economic prices by using the SCF of 0.9. On this basis, a specific conversion factor (CF) for construction equal to 0.79 was derived.

19. **Irrigation O&M**. Annual irrigation operation and maintenance costs (O&M) are estimated at Rs.494/ha in SRBC and SRSP below LMD, and an increment of Rs.314/ha in the existing irrigation areas in above LMD (currently O&M expenditures in this command are Rs.120/ha). These costs were adjusted to economic terms by SCF of 0.90 as they consist mostly of salaries, local materials and unskilled labor.

20. **Dam Safety Assurance**. Investment costs--excluding those to be incurred for safety of the Srisailam Dam spillway--are mainly consultancy services and studies, and some equipment. Total costs, including physical contingencies, are estimated at Rs.35 million for above LMD, Rs.19 million for below LMD in SRSP[2] and Rs.45 million for SRBC. The financial costs were converted to border prices by using SCF of 0.90.

21. **Resettlement and Rehabilitation**. The project provides funds for R&R programs, including grant packages, training and community infrastructures, to people whose lands were and would be acquired for construction under the previous AP II project and under this project. The total costs, including physical contingencies but excluding land compensation, are estimated at Rs.173 million for SRBC and Rs.138 million for areas beyond km 234 of Kakatiya Canal. The latter costs were excluded from the economic analysis (para. 12). The local costs were adjusted to border prices by using SCF of 0.90, except for investments in community infrastructure which were adjusted by CF of 0.79.

22. **Agricultural Support Services.** Total costs over the implementation period, including physical contingencies, are estimated at Rs.178 million and Rs.114 million respectively for SRSP's above and below LMD commands, and Rs.139 million for SRBC. To provide continuing support for agricultural extension and water user associations thereafter, annual costs of Rs.7.7 million, Rs.5.8 million and Rs.7.9 million are provided for the above LMD, below LMD and SRBC commands in that order. Local costs were adjusted to border prices by using SCF of 0.90.

23. **Feeder Roads**. The total length of rural roads completed under AP II (up to March 1995) were 171 km in the above LMD, 265 km in the below LMD and 102 km in SRBC. During FY95/96, 47 km of road were completed in the above LMD, 22 km in the below LMD and only 5 km in SRBC. An additional 94 km of on-going and new roads would be completed during the project period. In order to complete residual works started under the previous AP II project's R&R program, about 108 km of rural roads would be constructed in 104 resettlement villages for reservoir oustees under the project's R&R component as shown in the table below.

---

2 In the separate analyses of the above and below LMD commands, the dam safety assurance costs included in the analyses were allocated in the proportion of 65:35 to each command.

Annual Length of Feeder Roads (km)

Fiscal Year	Above LMD	Below LMD	SRBC	R&R Area
Completed in June 1994	171	265	102	-
FY95/96	47	22	5	-
FY96/97	-	-	6	-
FY97/98	-	-	50	22
FY98/99	-	-	44	22
FY99/00	-	-	-	22
FY00/01	-	-	-	22
FY01/02	-	-	-	20
Total	218	287	207	108

24. Using the practice followed on other Bank rural road projects in India, only 50% of feeder road construction costs were included in the economic analysis because several known benefits cannot be easily quantified. The SRSP cost estimates used on this basis were Rs.25 million and Rs.15 million above and below LMD respectively, while for SRBC the cost used in the analysis was Rs.71.5 million. Annual O&M costs have been based the average costs of Rs.35,000/km estimated by the AP Department of Roads and Buildings. All financial costs were adjusted to border prices by a CF of 0.79.

25. **Foregone Benefits of Land Used for Construction.** A total of 75 ha and 312 ha were acquired for the construction of SRSP feeder roads in the above LMD and below LMD commands respectively. In SRBC, a total of 2,244 ha were and would be acquired for the construction of irrigation infrastructure and feeder roads in SRBC. The foregone benefits from land lost for construction have been valued at the economic net production value of crops under the without project scenario. These are estimated at about Rs.17,560/ha and Rs.11,550/ha for SRSP's above and below LMD commands and Rs.8,110/ha in SRBC.

26. **Foregone Benefits of Hydroelectric Power.** When SRBC is completed and water is used for irrigation, there could be some loss of hydroelectric power due to diversion of stored water for irrigation. Simulation studies indicate that, assuming *full development* of the Krishna river basin, there could be about 45 million kwh (Gwh) of power generation foregone annually out of a potential generation of 2,435 Gwh with a 97% reliability (Annex **KK**). Although the basin is not yet fully developed and larger irrigation projects are planned, this opportunity cost has been attributed to SRBC only to capture losses that may occur in the state economy, i.e. such as the cost of purchasing power from other sources. Based on the estimates of AP State Electricity Board, the marginal cost of electricity--ranging from Rs.1.2/kwh to Rs.2.0/kwh--is averaged at Rs.1.6/kwh. Thus, the forgone hydropower benefits at full development have been valued at Rs.72 million annually.

Benefit Assumptions

27. **Market Prospects**. Andhra Pradesh is a net exporter of food grains, oilseeds, sugarcane and fruits. Incremental production resulting from the project will be a small percentage of AP's total agricultural production and therefore would be readily handled by existing marketing channels. Prices

of oilseeds are likely to be kept steady by India's high income elasticity of demand for edible oils, and by GOI's continuing efforts to reduce its large vegetable oil imports. In the long run, prices of agricultural produce would be dictated by international market prices. For cotton, the production trend indicates a change from short and medium-staple to long-staple cotton which responds better to irrigation and is internationally more readily marketable.

28. **SRSP Sub-Project Cropping Pattern**. In the 163,874 ha command above LMD where currently about 30-40% of the area receives canal irrigation, overall cropping intensity is about 147% due to the presence of tanks and wells. The maximum gross canal irrigated area has never exceeded 106,000 ha, while in 1992/93 it was only 80,268 ha implying an irrigation intensity of only about 49% due to deficiencies in the water distribution system resulting from deferred maintenance. Rice is cultivated on over 95% of the area irrigated by canals. In the 67,431 ha command below LMD where the maximum gross area irrigated was 25,648 ha in 1990/91, the cropping pattern is subsistence oriented and its cropping intensity is about 109%. A participatory rural appraisal was conducted by ICADD to determine likely changes in cropping patterns in the advent of command area rehabilitation and increase in the area under canal irrigation.

29. Based on the past cropped areas and production trends in the sub-project areas, the WOP cropping intensity in the above LMD areas is expected to remain at the present level, but cropping patterns would change by a shift towards high value crops. Cropping intensity in the below LMD area is estimated to increase slightly to 114% under the WOP scenario. The present and expected cropping patterns in the two sub-project areas are shown in Tables 13 and14. However, with rehabilitation of the canal network, the cropping intensity is expected to reach not less than 150% because of conjunctive groundwater use, made largely possible by the higher aquifer recharge rates due to irrigation. The principal crops grown in the WP scenario would be paddy, maize, pulses, groundnuts, sunflower, cotton (mainly below LMD), sugarcane (mainly above LMD) and vegetables.

30. **SRBC Sub-Project Cropping Pattern**. The present cropping intensity in the SRBC project area is about 103%. The rainfed cropping pattern is largely subsistence oriented: food grains and legumes for home consumption and oilseeds, cotton, sugarcane and vegetables as cash crops. Double cropping is sustained by wells irrigating about 3,500 ha. The existing cropping pattern was determined from agricultural statistics and a participatory rural appraisal survey of potential project beneficiaries conducted by ICADD. The survey also elicited responses about crop preferences and likely crop mixes under irrigation. Without irrigation, neither the present crop mix nor cropping intensities are likely to change much. However, better extension services, coupled with appropriate rainfed production technology, and increased adoption of high yielding variety seeds may enable yields to increase somewhat without the project. Based on the past cropped areas and production trends in the sub-project area, cropping intensity under the "without project" (WOP) scenario is estimated to increase slightly to about 107% (Table 15). With irrigation under the "with project" (WP) scenario, production would become more stable, intensified and would shift to higher value crops. Cropping intensity is estimated to reach about 160%. The largest output increments are expected from oilseeds (groundnut, soybean and sunflower), sugarcane, and vegetables, and from the change to long-staple cotton (para. 27).

31. **Benefited Areas**. The build-up rate of benefited areas was derived from the projected command area contract completion schedule. The maturation rate of irrigation benefits has been assumed over 3 years at a constant rate in the above LMD command which is already irrigated and over 5 years in commands where new irrigation would be introduced. Incremental annual benefited areas by sub-projects are summarized below:

Incremental Annual Benefited Area (ha)

Fiscal Year	Above LMD	Below LMD	SRBC
FY95/96	-	-	-
FY96/97	-	-	-
FY97/98	13,600	8,400	-
FY98/99	30,700	24,500	6,400
FY99/00	67,600	32,200	7,995
FY00/01	53,100	22,900	29,790
FY01/02	-	-	-
FY02/03	-	-	20,815
Total	165,000	88,000	65,000

32. **Economic Prices of Commodities and Inputs.** The economic prices of paddy, maize, sugar, soybeans, sorghum, groundnuts and fertilisers were based on the average FY2000-2005 import parity prices and cotton export parity price derived from the World Bank's Commodity Price Projection as shown in Table 18. The domestic costs of transport, handling charges and processing were adjusted by SCF of 0.90. The economic prices of non-traded commodities were derived by applying the SCF to prevailing financial farm gate prices. Table 19 gives a summary of financial and economic prices.

33. **Opportunity Cost of Labour.** Current market wage rates for hired unskilled labour range from Rs.20 per man-day during slack periods to Rs.30 per man-day during peak periods in SRSP, and from Rs.15 per man-day to Rs.25 per man-day in slack and peak periods respectively in SRBC. The unskilled labour wage is averaged at Rs.25 per man-day in SRSP and Rs.20 per man-day in SRBC. The shadow wage rate is assumed to be the average market wage, adjusted by SCF of 0.90.

34. **Feeder Road Benefits.** Benefits generated from rural feeder roads have been quantified from vehicle operating cost (VOC) savings, passenger time saved and the incremental load from time saved. The analysis has been based on the results of surveys conducted in December 1994 by the AP Department of Roads and Highway on 12 rural feeder roads in SRSP and 6 feeder roads in SRBC. Traffic counts and VOC savings were covered under the surveys while the passenger and incremental load time saved were based on the Central Roads Research Institute "Impact of Rural Roads Traffic Flow Patterns and Economic Benefits", case study in Haryana, 1987, updated to 1995 constant prices. Based on the above information and assumptions, annual economic benefits per km have been estimated at Rs.227,465/km/year in SRSP and Rs.207,130 in SRBC as shown in Tables 20 and 21.

35. Under the project, annual economic benefits from rural roads at full development are estimated at Rs.10.7 million in the above LMD command, Rs.5.0 million in the below LMD command and Rs.44.1 million in SRBC. Including the benefits generated from feeder roads constructed under the previous AP II project, annual economic benefits from rural roads at full development are estimated at Rs.49.5 million and Rs.65.1 million in the above LMD and below LMD commands of SRSP and Rs.65.2 million in SRBC.

Economic Rate of Return

36. On the basis of the above assumptions, the economic rate of return (ERR) of the whole project is estimated at 23.9% (Table 18). The ERRs of sub-projects are all favorable, ranging from 13.7% for SRBC to 30.9% and 35.8% respectively for the SRSP above LMD and below LMD commands and 33.7% for the SRSP sub-project as a whole (Tables22-26). The net present value (NPV) at the discount rate of 12% is estimated at Rs.12,280 million for the whole project. The results are summarized in the following table:

Summary of Base Case Economic Analysis

Economic Evaluation Criterion	Above LMD	Below LMD	Combined SRSP	SRBC	Whole Project
Base Case ERR (%)	35.8	30.9	33.7	13.7	23.9
ERR with AP II Sunk Costs (%)	35.0	27.5	31.4	9.2	18.7
Present Value of Net Benefits(Rs. M)	7,228.0	4,272.0	11,501.0	780.0	12,280.0

37. **Impact of Sunk Costs.** The expenditures incurred under AP II, including expenditures incurred after its closure up to February 1995, amounted to Rs.264.0 million and Rs. 600.4 million respectively for the above and below LMD commands of SRSP and Rs. 3,822.2 million for SRBC. Restated in 1995 constant prices and in economic terms, all expenditures of AP II would be Rs.215.9 million for the above LMD command, Rs.566.2 million for the below LMD command and Rs.3,623.0 million for SRBC. As shown in the above table, with inclusion of AP II sunk costs, the ERRs of the individual commands would fall to 35.0% and 27.5% for the for the above LMD command and below LMD commands of SRSP, and to 9.2% for SRBC. The ERRs of the combined SRSP and the whole project would fall to 31.4% and 18.7% respectively. Although not strictly relevant to the investment decision for the project, these results indicate completion of the project would be justified including the full costs of the AP II project.

Sensitivity Analyses

38. **Switching Values.** Sensitivity analysis was conducted to determine the effect of deviations from the main assumptions on the economic viability of the project. The measure of sensitivity used, " the switching value" is the value of the variable tested which would reduce the present value of the project's net incremental benefits to zero when discounted at a capital opportunity cost of 12%. The analysis results indicate that, except for the SRBC sub-project which has comparatively low switching values, ERRs of the above and below LMD commands of SRSP are neither sensitive to substantial increases in the total costs, nor to substantial decreases in incremental benefits.

39. The ERRs of the two SRSP commands would fall to 12% when the total costs increased by 278%-309%, or incremental net benefits decreased by 74%-76%. Because of the relatively high completion costs and small benefited areas of SRBC, its ERR would fall to 12% when the total costs increased by 19%, or incremental net benefits decreased by 16%. ERRs of the whole project would fall to 12% when the total costs increased by 160% respectively, or incremental net benefits decreased by 62%. The switching values are summarized below:

Switching Value at 12% Discount Rate

Command	Net Incremental Benefits			Total Costs		
	Appraisal Value (Rs. M)	Switching Value (Rs.M)	Change (%)	Appraisal Value(Rs.M)	Switching Value (Rs.M)	Change (%)
Above LMD	9,832.9	2,605.7	-73.5%	2,604.8	8,530.7	+277.5%
Below LMD	5,655.5	1,379.9	-75.6%	1,383.1	5,658.3	+309.1%
All SRSP	15,488.4	3,996.0	-74.2%	3,987.9	15,465.1	+287.8%
SRBC	4,824.5	4,042.9	-16.2%	4,044.6	4,825.2	+19.3%
Whole Project	20,312.9	7,800.2	-61.6%	8,032.5	20,892.5	+160.1%

Risk Analysis

40. Several tests were performed to assess the sensitivity of the economic analysis to planning, implementation and operational risks (para. 16). The results are given in the following table:

Sensitivity of ERR to Planning Assumptions and Risks

Risk Categories	Above LMD	Below LMD	Combined SRSP	SRBC	Whole Project
Base Case	35.8	30.9	33.7	13.7	23.9
Investment Costs (+20%)	31.9	28.3	30.4	12.2	21.5
Benefits Lagged 1 Year	29.8	27.1	28.7	12.4	21.0
Benefits Lagged 2 Years	25.8	24.2	25.1	11.4	18.9
Investment Costs (+20%) and Benefits Lagged 2 Years	23.4	22.3	22.9	10.1	17.1
Seasonal Water Deficits	29.1	25.4	27.5	12.2	20.0
Larger Area under Paddy Rice	23.1	30.9	26.6	13.7	21.0
Paddy Rice Yield 25% Lower	29.7	29.5	29.6	13.6	21.5
Lower Yields for all Crops	24.5	26.2	25.2	11.8	18.5

41. **Implementation Delays**. Shortage of counterpart funds and/or contractual problems could be potential risk causing delays in the implementation schedule. This would result in the increases in the construction costs and delay the project's expected benefits. The sensitivity analyses undertaken on the above variables show that ERRs would still be acceptable for the combined SRSP and the whole project. However, ERRs of command areas are more sensitive to delayed benefits than to increased construction costs. The above LMD command is more sensitive to the below LMD command in this respect--especially if benefits are delayed two years--but still remains well above the cutoff ERR. SRBC, however, becomes marginal if benefits are lagged by two years. Increases in the construction costs by 20% would only reduce ERRs of SRSP sub-projects slightly but brings the ERR of SRBC

close to 12%. A combination of 20% increases in the construction costs and benefits lagged by two years would reduce ERRs by 3.6%-12.4% for sub-project commands and 6.8% for the whole project. In this case, the ERR for SRBC would drop to 10%. These results indicate that the project is robust provided that implementation is properly managed to contain cost escalation and implementation delay.

42. **Reduced Seasonal Water Availability**. Reduced seasonal water availability is always a potential risk for an irrigation project planned with an overall water supply reliability target of 75% (the irrigation project standard for India). Reduction in irrigation water supply would result in the reduction of the projected cropping intensities. Supply reliabilities for each command were selected based on the results of the Krishna and Godavari river basin simulation models (Annex **). In the monsoon (kharif) season, full irrigation water supply for the above LMD command was found to be available over 85% of the time and over 75% of times at the below LMD and SRBC commands. For the analysis, it is conservatively assumed that, because of delay in reservoir filling, no water is available for irrigation in the kharif season during deficit years. In the post-monsoon (rabi) irrigation season, full irrigation water supply was found to be available about 85% of times for the above LMD command and about 75% of times at the below LMD and SRBC. When rabi season deficits occur, the analysis assumes that only 50% of irrigation water supply would be available above LMD and at SRBC. However for SRSP's below LMD command, due to the sensitivity of supply reliability to water delivery (Annex **$$**), it is assumed that there would be no rabi water supply during a rabi season deficit year. Thus, in terms of weighted probabilities, the supply probability for the rabi season is 92.5% above LMD, 87.5% at SRBC and 75% at below LMD.

43. Based on the above assumptions, the net agricultural production benefits at full development would reduce by 10% at above LMD, 16% at below LMD and 11% at SRBC. Accordingly, seasonal water deficit impacts are found to reduce ERRs by 1.5% for SRBC, 5.5% and 6.7% for below and above LMD, and 3.9% for the whole project. These results are probably overstated since: (a) the modelled supply reliability for SRBC were based on full future development of the Krishna river basin within AP whereas there some uncertainty that full development could be completed in the next 20-25 years; (b) no allowance was made for production from groundwater irrigation when assuming that supply in deficit years would be reduced to 50% and zero respectively above and below LMD; and (c) the impact of deficit years has been assumed to be extreme as deficits may vary from marginal to large.

44. **Changes in the Expected Cropping Patterns.** The projected predominantly cash crop cropping patterns might not materialize despite enforcement of rotational water supply since farmers may opt to expand the cultivated areas with paddy particularly in SRSP's above LMD command. As the water requirement for paddy is about twice that of upland crops, the dry crop area would be reduced and the commands would be partially irrigated. Assuming that the projected paddy areas in both kharif and rabi seasons would increase by 50% in all commands, the cash crop areas in both seasons would reduce by 46%-73% above LMD, 3%-57% at below LMD and 1%-6% at SRBC[3]. If this occurs, the

---

[3] For above LMD: paddy areas increase from 55,000 ha to 82,500 ha and cash crop areas reduce from 75,500 ha to 20,500 ha in kharif season; while in the rabi season, paddy areas increase from 28,000 ha to 42,000 ha and cash crop areas reduce from 61,000 ha to 33,000 ha. At below LMD: paddy areas increase from 20,504 ha to 30,760 ha and cash crop areas reduce from 36,168 ha to 15,656 ha in kharif season; while paddy areas increase from 1,056 ha to 1,585 ha and cash crop areas reduce from 43,120 ha to 42,062 ha in the rabi season. For SRBC: paddy areas increase from 2,336 ha to 3,505 ha and cash crop areas reduce from 38,675 ha to 36,337 ha in kharif season; and during the rabi season, paddy areas increase from 500 ha to 750 ha and cash crop areas reduce from 40,125 ha to 39,625 ha.

reduction in the cropping intensity is significant at about 47% at above LMD, but only marginal at about 13% at below LMD and only 3% at SRBC.

45. Although the per ha financial returns from paddy are more or less equal to those of some cash crops (e.g. sunflower, soybean, maize, vegetables and groundnut), the per ha *economic returns* from paddy (expressed in border prices) are about 80% higher than high value cash crops, but 25%-35% lower than cotton and seed production. Therefore the economic analysis is not overly sensitive to errors in forecasting the paddy area since the substantial reduction in cropping intensity, particularly in above LMD command, is partly offset by the higher economic returns from paddy. In terms of production benefits, total net production benefits would reduce by 22% at above LMD only 1% at both below LMD and SRBC, and the estimated ERRs would reduce from 35.8% to 23.1% for the above LMD command, but are likely to remain unchanged for the below LMD and SRBC commands. The estimated project ERR would however reduce from 23.9% to 21.0%.

46. **Possible Over-Estimation of Crop Yields**. Although the estimation of crop yields for the SRSP WP case was carefully discussed (para. 15), the irrigated paddy yield selected by experts for the WP scenario would seem to be relatively high relative to the paddy yields of the WOP scenario. For cash crops there is less cause for concern as these crops are largely grown under rainfed conditions at present in all sub-project areas: hence WOP case yields are understandably lower than the yields that could be achieved with irrigation. However, there is always the risk that all assumed crop yields may not be achieved by average farmers because the expected input levels might not be applied, or improved seeds, fertilizers and production credits might not always be available.

47. Thus, assuming that paddy yields in the WP case are 25% lower than those used for the base case analysis, WP net production benefits are reduced by 11% and 6% above and below LMD respectively, and only by 1% at SRBC (which has a very small paddy area). Accordingly, the estimated ERRs would fall to 29.7%, 29.5% and 13.6% for above LMD, below LMD and SRBC in that order. When yields also include a 10% yield reduction for other crops, the reductions in WP net production benefits are 20% for above LMD, 17% for below LMD and 14% for SRBC. Thus the estimated ERRs would fall to 24.5% for above LMD, 26.2% for below LMD and 11.8% for SRBC. Thus, using conservative crop yields, the overall project ERR drops to 21.5%.

Per Ha Financial Crop Budget
Present-Above LMD

	kharif & Two Season Crops										Rabi Crops				
	paddy	pigeon pea	maize	sunflower	pulses	groundnuts	cotton	chillies	sugarcane	Tumeric	sunflower	paddy	groundnuts	maize	pulses
Output:															
Main Produce:															
Yield(t/ha)	3.2	0.5	2.5	0.5	0.6	1.3	1.2	1	70	3	0.5	3.5	1.3	2.5	0.6
Price/t	4000	9000	3800	10750	10500	10500	18500	15000	550	15000	10750	4000	10500	3800	10500
Value	12800	4500	9500	5375	6300	13650	22200	15000	38500	45000	5375	14000	13650	9500	6300
By-Products:															
Yield(t/ha)	1.6	0	2.5	0	0	1.3	0	0	0	0	0	1.7	1.3	2.5	0
Price/t	300	0	80	0	0	300	0	0	0	0	0	300	300	80	0
Value	480	0	200	0	0	390	0	0	0	0	0	510	390	200	0
Total Gross Value	13280	4500	9700	5375	6300	14040	22200	15000	38500	45000	5375	14510	14040	9700	6300
Inputs:															
Seeds(kg/ha)	40	15	20	10	20	90	13	4	8000	3	10	40	90	20	20
Price/kg	6.9	12	10	15	10	20	25	200	0.6	1000	15	6.9	20	10	10
Value	276	180	200	150	200	1800	325	800	4800	3000	150	276	1800	200	200
Urea(kg/ha)	150	40	120	50	30	40	30	100	250	150	50	150	40	120	30
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	160	480	200	120	160	120	400	1000	600	200	600	160	480	120
DAP(kg/ha)	100	50	50	50	50	100	25	50	75	100	50	100	100	50	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	425	425	425	425	850	212.5	425	637.5	850	425	850	850	425	425
MOP(kg/ha)	0	0	30	0	0	0	0	50	35	75	0	0	0	30	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	0	150	0	0	0	0	250	175	375	0	0	0	150	0
Manure(t/ha)	2	0	3	0	0	2	0	3	6	10	0	2	2	3	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	0	420	0	0	280	0	420	840	1400	0	280	280	420	0
Chemicals:															
kg/litre	2.5	0	2	0	0	1	0	5	0	1	0	2.5	1	2	0
Price/kg/litre	218.0	218.0	252.0	218.0	0.0	252.0	0.0	252	0	216	0.0	218.0	252	252.0	226.8
Value	545	0	504	0	0	252	0	1260	0	216	0	545	252	504	0
Total Labour(md/ha)	170	38	94	70	48	97	78	230	352	624	70	180	97	94	48
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs50%	2125	475	1175	875	600	1213	975	2875	4400	7800	875	2250	1213	1175	600
Total Animal Days(ad)	25	10	18	12	10	13	12	24	38	24	12	25	13	18	10
Price/ad	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	335	603	402	335	435.5	402	804	1273	804	402	837.5	435.5	603	335
Total Costs	5514	1575	3957	2052	1680	4990	2035	7234	13126	15045	2052	5639	4990	3957	1680
Net Production Value	7767	2925	5743	3323	4620	9050	20166	7766	25375	29955	3323	8872	9050	5743	4620

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 2

Per Ha Financial Budget

FWOP - Above LMD

	Kharif & Two Season Crops										Rabi				
	paddy	pegeon pea	maize	sunflower	pulses	groundnuts	cotton	chillies	sugarcane	Tumeric	sunflower	paddy	groundnuts	maize	pulses
Output:															
Main Produce:															
Yield(t/ha)	3.2	0.6	2.7	0.7	0.7	1.4	1.3	1.1	75	3.2	0.7	3.5	1.4	2.7	0.7
Price/t	4000	9000	3800	10750	10500	10500	18500	15000	550	15000	10750	4000	10500	3800	10500
Value	12800	5400	10260	7525	7350	14700	24050	16500	41250	48000	7525	14000	14700	10260	7350
By-Products:															
Yield(t/ha)	1.6	0	2.7	0	0	1.4	0	0	0	0	0	1.7	1.4	2.7	0
Price/t	300	0	80	0	0	300	0	0	0	0	0	300	300	80	0
Value	480	0	216	0	0	420	0	0	0	0	0	510	420	216	0
Total Gross Value	13280	5400	10476	7525	7350	15120	24050	16500	41250	48000	7525	14510	15120	10476	7350
Inputs:															
Seeds(kg/ha)	40	15	20	10	20	90	13	4	8000	3	10	40	90	20	20
Price/kg	6.9	12	10	15	10	20	25	200	0.6	1000	15	6.9	20	10	10
Value	276	180	200	150	200	1800	325	800	4800	3000	150	276	1800	200	200
Urea(kg/ha)	150	50	120	50	30	40	30	100	250	150	50	150	40	120	30
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	200	480	200	120	160	120	400	1000	600	200	600	160	480	120
DAP(kg/ha)	100	50	50	50	50	100	25	50	75	100	50	100	100	50	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	425	425	425	425	850	212.5	425	637.5	850	425	850	850	425	425
MOP(kg/ha)	0	0	30	0	0	0	0	50	35	75	0	0	0	30	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	0	150	0	0	0	0	250	175	375	0	0	0	150	0
Manure(t/ha)	2	0	3	0	0	2	0	3	6	10	0	2	2	3	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	0	420	0	0	280	0	420	840	1400	0	280	280	420	0
Chemicals:															
kg/l	2.5	0	2	0	0	1	0	5	0	1	0	2.5	1	2	0
Price/kg/l	218.0	0.0	252.0	0.0	252.0	252	0.0	252	0	216	0.0	218.0	252	252	252
Value	545	0	504	0	0	252	0	1260	0	216	0	545	252	504	0
Total Labour(md/ha)	170	42	98	78	57	103	84	245	364	645	78	180	103	98	57
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs 50%	2125	525	1225	975	713	1288	1050	3063	4550	8063	975	2250	1288	1225	713
Total Animal Days(ad)	25	10	18	12	10	13	12	24	38	24	12	25	13	18	10
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	335	603	402	335	435.5	402	804	1273	804	402	837.5	435.5	603	335
Total Costs	5514	1665	4007	2152	1793	5065	2110	7422	13276	15308	2152	5639	5065	4007	1793
Net Production Value	7767	3735	6469	5373	5558	10055	21941	9079	27975	32693	5373	8872	10055	6469	5558

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 3

Per Ha Financial Crop Budget
FWP - Above LMD

	Kharif & Two Season Crops													Rabi Crops								
Output:	paddy	maize	sunflower	unflower seeds	pulses	maize seed	vegetables	groundnuts	cotton	cotton seeds	chillies	sugarcane	Tumeric	sunflower	paddy	sunflower seeds	maize seeds	vegetables	groundnuts	maize	soybeans	pulses
Main Produce:																						
Yield(t/ha)	5.4	4	1.5	1	1.2	3	15	1.8	2.5	0.75	2.5	100	4	2.0	5.6	1	3.5	15	2.2	4.5	1.5	1.2
Price/t	4000	3800	10750	30000	10500	7500	2200	10500	20400	110000	15000	550	15000	10750	4000	30000	7500	2200	10500	3800	8000	10500
Value	21600	15200	16125	30000	12600	22500	33000	18900	51000	82500	37500	55000	60000	21500	22400	30000	26250	33000	23100	17100	12000	12600
By-Products:																						
Yield(t/ha)	2.7	4	0	0.5	0	1	0	1.8	0	0.5	0	0	0	0	2.8	0.5	1.2	0	2.2	4.5	0	0
Price/t	300	80	0	10750	0	3800	0	300	0	20400	0	0	0	0	300	10750	3800	0	300	80	0	0
Value	810	320	0	5375	0	3800	0	540	0	10200	0	0	0	0	840	5375	4560	0	660	360	0	0
Total Gross Value	22410	15520	16125	35375	12600	26300	33000	19440	51000	92700	37500	55000	60000	21500	23240	35375	30810	33000	23760	17460	12000	12600
Inputs:																						
Seeds(kg/ha)	40	20	10	10	20	20	0.8	90	3	3	4	8000	3	10	40	10	20	0.8	90	20	75	20
Price/kg	6.9	20	15	110	10	20	150	20	25	200	200	0.6	1000	15	6.9	110	20	150	20	10	10	10
Value	276	400	150	1100	200	400	120	1800	75	600	800	4800	3000	150	276	1100	400	120	1800	200	750	200
Urea(kg/ha)	240	200	90	200	50	250	220	100	150	300	300	300	200	120	240	200	250	220	100	200	100	50
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	960	800	360	800	200	1000	880	400	600	1200	1200	1200	800	480	960	800	1000	880	400	800	400	200
DAP(kg/ha)	150	120	80	100	100	150	120	150	150	250	100	100	150	100	150	100	150	120	150	120	60	100
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	1275	1020	680	850	850	1275	1020	1275	1275	2125	850	850	1275	850	1275	850	1275	1020	1275	1020	510	850
MOP(kg/ha)	0	80	0	50	0	100	100	0	200	300	100	50	100	0	0	50	100	100	0	80	35	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	400	0	250	0	500	500	0	1000	1500	500	250	500	0	0	250	0	500	0	400	175	0
Manure(t/ha)	3	4	2	3	0	6	6	3	3	4	6	8	15	2	3	3	6	6	3	4	2	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	420	560	280	420	0	840	840	420	420	560	840	1120	2100	280	420	420	840	840	420	560	280	0
Chemicals:																						
kg/l	4.2	4	1.5	2	1	4	7	2	10	16	10	0	2	1.5	4.2	2	4	7	2	4	1	1
Price/kg/l	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0
Value	1058	1008	378	504	252	1008	1764	504	2520	4032	2520	0	504	378	1058	504	1008	1764	504	1008	252	252
Total Labour(md/ha)	211	120	94	106	69	174	380	118	230	1240	430	472	738	108	219	106	188	380	122	132	110	69
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs 50%	2638	1500	1175	1325	863	2175	4750	1475	2875	15500	5375	5900	9225	1350	2738	1325	2350	4750	1525	1650	1375	863
Total Animal Days(ad)	25	22	14	14	10	28	34	18	23	28	36	44	29	14	25	14	28	34	18	22	16	10
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	737	469	469	335	938	1139	603	770.5	938	1206	1474	971.5	469	837.5	469	938	1139	603	737	536	335
Total Costs	7464	6425	3492	5718	2700	8136	11013	6477	9536	26455	13291	15594	18376	3957	7564	5718	7811	11013	6527	6375	4278	2700
Net Production Value	14946	9095	12633	29657	9901	18164	21987	12963	41465	66245	24209	39406	41625	17543	15676	29657	22999	21987	17233	11085	7722	9901

Per Ha Financial Crop Budget
Present - Below LMD

	Kharif & Two Season Crops									Rabi Crops				
	paddy	pegeon pea	maize	sunflower	pulses	groundnuts	cotton	chillies	Tumeric	sunflower	paddy	groundnuts	maize	pulses
Output:														
Main Produce:														
Yield(t/ha)	3.2	0.5	2	0.5	0.5	0.9	1	0.8	3	0.5	3.5	0.9	2.2	0.5
Price/t	4000	9000	3800	10750	10500	10500	18500	15000	15000	10750	4000	10500	3800	10500
Value	12800	4500	7600	5375	5250	9450	18500	12000	45000	5375	14000	9450	8360	5250
By-Products:														
Yield(t/ha)	1.6	0	2	0	0	0.9	0	0	0	0	1.7	0.9	2.2	0
Price/t	300	0	80	0	0	300	0	0	0	0	300	300	80	0
Value	480	0	160	0	0	270	0	0	0	0	510	270	176	0
Total Gross Value	13280	4500	7760	5375	5250	9720	18500	12000	45000	5375	14510	9720	8536	5250
Inputs:														
Seeds(kg/ha)	40	15	20	10	20	90	13	4	3	10	40	90	20	20
Price/kg	6.9	12	10	15	10	20	25	200	1000	15	6.9	20	10	10
Value	276	180	200	150	200	1800	325	800	3000	150	276	1800	200	200
Urea(kg/ha)	150	40	100	50	30	20	30	100	150	50	150	20	100	30
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	160	400	200	120	80	120	400	600	200	600	80	400	120
DAP(kg/ha)	100	50	40	50	50	100	25	50	100	50	100	100	40	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	425	340	425	425	850	212.5	425	850	425	850	850	340	425
MOP(kg/ha)	0	0	20	0	0	0	0	50	75	0	0	0	20	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	0	100	0	0	0	0	250	375	0	0	0	100	0
Manure(t/ha)	2	0	2	0	0	2	0	3	10	0	2	2	2	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	0	280	0	0	280	0	420	1400	0	280	280	280	0
Chemicals:														
kg/l	2.5	0	1.5	0	0	1	0	5	1	0	2.5	1	1.5	0
Price/kg/l	218.0	0.0	252.0	0.0	226.8	252	0.0	252	216	0.0	218.0	252	252	252
Value	545	0	378	0	0	252	0	1260	216	0	545	252	378	0
Total Labour(md/ha)	170	38	80	70	44	80	68	206	624	70	180	80	84	44
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs 50%	2125	475	1000	875	550	1000	850	2575	7800	875	2250	1000	1050	550
Total Animal Days(ad)	25	10	18	12	10	13	12	24	24	12	25	13	18	10
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	335	603	402	335	435.5	402	804	804	402	837.5	435.5	603	335
Total Costs	5514	1575	3301	2052	1630	4698	1910	6934	15045	2052	5639	4698	3351	1630
Net Production Value	7767	2925	4459	3323	3620	5023	16591	5066	29955	3323	8872	5023	5185	3620

Per Ha Financial Crop Budget
FWOP - Below LMD

	Kharif & Two Season Crops									Rabi				
	paddy	pegeon pea	maize	sunflower	pulses	groundnuts	cotton	chillies	Tumeric	sunflower	paddy	groundnuts	maize	pulses
Output:														
Main Produce:														
Yield(t/ha)	3.2	0.6	2.2	0.6	0.6	1	1.1	0.9	3.2	0.6	3.5	1	2.5	0.6
Price/t	4000	9000	3800	10750	10500	10500	18500	15000	15000	10750	4000	10500	3800	10500
Value	12800	5400	8360	6450	6300	10500	20350	13500	48000	6450	14000	10500	9500	6300
By-Products:														
Yield(t/ha)	1.6	0	2.2	0	0	1	0	0	0	0	1.7	1	2.5	0
Price/t	300	0	80	0	0	300	0	0	0	0	300	300	80	0
Value	480	0	176	0	0	300	0	0	0	0	510	300	200	0
Total Gross Value	13280	5400	8536	6450	6300	10800	20350	13500	48000	6450	14510	10800	9700	6300
Inputs:														
Seeds(kg/ha)	40	15	20	10	20	90	13	4	3	10	40	90	20	20
Price/kg	6.9	12	10	15	10	20	25	200	1000	15	6.9	20	10	10
Value	276	180	200	150	200	1800	325	800	3000	150	276	1800	200	200
Urea(kg/ha)	150	50	100	50	30	20	30	100	150	50	150	20	120	30
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	200	400	200	120	80	120	400	600	200	600	80	480	120
DAP(kg/ha)	100	50	40	50	50	100	25	50	100	50	100	100	50	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	425	340	425	425	850	212.5	425	850	425	850	850	425	425
MOP(kg/ha)	0	0	20	0	0	0	0	50	75	0	0	0	30	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	0	100	0	0	0	0	250	375	0	0	0	150	0
Manure(t/ha)	2	0	2	0	0	2	0	3	10	0	2	2	3	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	0	280	0	0	280	0	420	1400	0	280	280	420	0
Chemicals:														
kg/l	2.5	0	1.5	0	0	1	0	5	1	0	2.5	1	2	0
Price/kg/l	218.0	0.0	252.0	0.0	226.8	252	0.0	252	216	0.0	218.0	252	252	252
Value	545	0	378	0	0	252	0	1260	216	0	545	252	504	0
Total Labour(md/ha)	170	42	84	74	48	84	74	220	645	74	180	84	94	48
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs 50%	2125	525	1050	925	600	1050	925	2750	8063	925	2250	1050	1175	600
Total Animal Days(ad)	25	10	18	12	10	13	12	24	24	12	25	13	18	10
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	335	603	402	335	435.5	402	804	804	402	837.5	435.5	603	335
Total Costs	5514	1665	3351	2102	1680	4748	1985	7109	15308	2102	5639	4748	3957	1680
Net Production Value	7767	3735	5185	4348	4620	6053	18366	6391	32693	4348	8872	6053	5743	4620

Per Ha Financial Crop Budget
FWP - Below LMD

	Kharif & Two Season Crops												Rabi Crops								
Output:	paddy	soybeans	maize	sunflower	sunflower seeds	pulses	maize seeds	groundnu	cotton	cotton seeds	chillies	Tumeric	sunflower	paddy	sunflower seeds	maize seeds	vegetable	groundnuts	maize	soybean	pulses
Main Produce:																					
Yield(t/ha)	5.4	1.5	4	1.5	1	1.2	3	1.8	2.5	0.75	2.5	4	2.0	5.6	1	3.5	15	2.2	4.5	1.5	1.2
Price/t	4000	8000	3800	10750	30000	10500	7500	10500	20400	110000	15000	15000	10750	4000	30000	7500	2200	10500	3800	8000	10500
Value	21600	12000	15200	16125	30000	12600	22500	18900	51000	82500	37500	60000	21500	22400	30000	26250	33000	23100	17100	12000	12600
By-Products:																					
Yield(t/ha)	2.7	0	4	0	0.5	0	1	1.8	0	0.5	0	0	0	2.8	0.5	1.2	0	2.2	4.5	0	0
Price/t	300	0	80	0	10750	0	3800	300	0	20400	0	0	0	300	10750	3800	0	300	80	0	0
Value	810	0	320	0	5375	0	3800	540	0	10200	0	0	0	840	5375	4560	0	660	360	0	0
Total Gross Value	22410	12000	15520	16125	35375	12600	26300	19440	51000	92700	37500	60000	21500	23240	35375	30810	33000	23760	17460	12000	12600
Inputs:																					
Seeds(kg/ha)	40	75	20	10	10	20	20	90	3	3	4	3	10	40	10	20	0.8	90	20	75	20
Price/kg	6.9	10	10	15	110	10	20	20	25	200	200	1000	15	6.9	110	20	150	20	10	10	10
Value	276	750	200	150	1100	200	400	1800	75	600	800	3000	150	276	1100	400	120	1800	200	750	200
Urea(kg/ha)	240	100	200	90	200	50	250	100	150	300	300	200	120	240	200	250	220	100	200	100	50
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	960	400	800	360	800	200	1000	400	600	1200	1200	800	480	960	800	1000	880	400	800	400	200
DAP(kg/ha)	150	60	120	80	100	100	150	150	150	250	100	150	100	150	100	150	120	150	120	60	100
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	1275	510	1020	680	850	850	1275	1275	1275	2125	850	1275	850	1275	850	1275	1020	1275	1020	510	850
MOP(kg/ha)	0	35	80	0	50	0	100	0	200	300	100	100	0	0	50	100	100	0	80	35	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	175	400	0	250	0	500	0	1000	1500	500	500	0	0	250	0	500	0	400	175	0
Manure(t/ha)	3	2	4	2	3	0	6	3	3	4	6	15	2	3	3	6	6	3	4	2	0
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	420	280	560	280	420	0	840	420	420	560	840	2100	280	420	420	840	840	420	560	280	0
Chemicals:																					
kg/l	4.2	1	4	1.5	2	1	4	2	10	16	10	2	1.5	4.2	2	4	7	2	4	1	1
Price/kg/l	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252.0	252	252.0	252
Value	1058	252	1008	378	504	252	1008	504	2520	4032	2520	504	378	1058	504	1008	1764	504	1008	252	252
Total Labour(md/ha)	211	110	120	94	106	69	174	118	230	1240	430	738	108	219	106	188	380	122	132	110	69
Price/md	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Labour Costs 50%	2638	1375	1500	1175	1325	863	2175	1475	2875	15500	5375	9225	1350	2738	1325	2350	4750	1525	1650	1375	863
Total Animal Days(ad)	25	16	22	14	14	10	28	18	23	28	36	29	14	25	14	28	34	18	22	16	10
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	536	737	469	469	335	938	603	770.5	938	1206	971.5	469	837.5	469	938	1139	603	737	536	335
Total Costs	7464	4278	6225	3492	5718	2700	8136	6477	9536	26455	13291	18376	3957	7564	5718	7811	11013	6527	6375	4278	2700
Net Production Value	14946	7722	9295	12633	29657	9901	18164	12963	41465	66245	24209	41625	17543	15676	29657	22999	21987	17233	11085	7722	9901

Per Ha Financial Crop Budget
Present - SRBC

	Kharif & Two Season Crops											Rabi Crops							
	paddy	soybeans	sorghum	sunflower	bendhisee	vegetabl	groundnuts	cotton	chillies	sugarcan	Tumeric	sunflowe	sorghum	vegetable	groundnu	coriander	chickpea	oilseeds castor	Tobacco
Output:																			
Main Produce:																			
Yield(t/ha)	3.2	0.8	1.1	0.6	0.4	6	0.9	1	0.8	70	3	0.6	1.1	6	0.9	0.3	0.5	0.8	1.0
Price/t	4000	8000	3500	10750	15000	2200	10500	18500	15000	550	15000	10750	3500	2200	10500	13000	9350	10000	13000
Value	12800	6400	3850	6450	6000	13200	9450	18500	12000	38500	45000	6450	3850	13200	9450	3900	4675	8000	13000
By-Products:																			
Yield(t/ha)	1.6	0	2.2	0	0	0	0.9	0	0	0	0	0	2.2	0	0.9	0	0	0	0
Price/t	300	0	120	0	0	0	300	0	0	0	0	0	120	0	300	0	0	0	0
Value	480	0	264	0	0	0	270	0	0	0	0	0	264	0	270	0	0	0	0
Total Gross Value	13280	6400	4114	6450	6000	13200	9720	18500	12000	38500	45000	6450	4114	13200	9720	3900	4675	8000	13000
Inputs:																			
Seeds(kg/ha)	40	75	8	10	15	0.8	90	13	4	8000	3	10	8	0.8	90	20	50	5	0.5
Price/kg	6.9	10	8	15	30	150	20	25	200	0.6	1000	15	8	150	20	15	15	45	130
Value	276	750	64	150	450	120	1800	325	800	4800	3000	150	64	120	1800	300	750	225	65
Urea(kg/ha)	150	40	65	50	25	150	20	30	100	250	150	50	65	150	20	30	25	50	80
Price/kg	4.0	4.0	4.0	4.0	4.0	4 0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	160	260	200	100	600	80	120	400	1000	600	200	260	600	80	120	100	200	320
DAP(kg/ha)	100	25	60	50	10	40	100	25	50	75	100	50	60	40	100	10	25	60	100
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	212.5	510	425	85	340	850	212.5	425	637.5	850	425	510	340	850	85	212.5	510	850
MOP(kg/ha)	0	10	0	0	0	35	0	0	50	35	75	0	0	35	0	0	0	0	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	50	0	0	0	175	0	0	250	175	375	0	0	175	0	0	0	0	0
Manure(t/ha)	2	1	0	0	0	4	2	0	3	6	10	0	0	4	2	0	1	2	1
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	140	0	0	0	560	280	0	420	840	1400	0	0	560	280	0	140	280	140
Chemicals:																			
kg/l	2.5	0	0	0	1	4	1	0	5	0	1	0	0	4	1	25	2	2	1
Price/kg/l	218.0	0.0	0.0	0.0	252.0	252.0	252	0.0	252	0	216	0.0	0.0	252.0	252	4	252	252	252
Value	545	0	0	0	252	1008	252	0	1260	0	216	0	0	1008	252	100	504	504	252
Total Labour(md/ha)	170	75	50	74	88	292	80	68	206	352	624	74	50	292	80	32	32	84	152
Price/md	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Labour Costs 50%	1700	750	500	740	880	2920	800	680	2060	3520	6240	740	500	2920	800	320	320	840	1520
Total Animal Days(ad)	25	16	12	12	11	28	13	12	24	38	24	12	12	28	13	10	13	18	18
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	536	402	402	368.5	938	435.5	402	804	1273	804	402	402	938	435.5	335	435.5	603	603
Total Costs	5089	2599	1736	1917	2136	6661	4498	1740	6419	12246	13485	1917	1736	6661	4498	1260	2462	3162	3750
Net Production Value	8192	3802	2378	4533	3865	6539	5223	16761	5581	26255	31515	4533	2378	6539	5223	2640	2213	4838	9250

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 8

Per Ha Financial Crop Budget
FWOP - SRBC

	Kharif & Two Season Crop											Rabi Crops									
	paddy	soybeans	sorghum	sunflower	bendhisee	vegetable	groundnut	cotton	chillies	sugarcane	Tumeric	sunflowe	sorghum	vegetabl	groundnut	coriander	chickpea	sorghum	sorghum seeds	castorseed	Tobacco
Output:																					
Main Produce:																					
Yield(t/ha)	3.2	0.9	1.2	0.6	0.5	7	1	1.1	0.9	75	3.2	0.6	1.2	7	1	0.4	0.6	2.5	0.8	0.9	1.1
Price/t	4000	8000	3500	10750	15000	2200	10500	18500	15000	550	15000	10750	3500	2200	10500	13000	9350	3500	7500	10000	13000
Value	12800	7200	4200	6450	7500	15400	10500	20350	13500	41250	48000	6450	4200	15400	10500	5200	5610	8750	6000	9000	14300
By-Products:																					
Yield(t/ha)	1.6	0	2.4	0	0	0	1	0	0	0	0	0	2.4	0	1	0	0	5	0	0	0
Price/t	300	0	120	0	0	0	300	0	0	0	0	0	120	0	300	0	0	120	0	0	0
Value	480	0	288	0	0	0	300	0	0	0	0	0	288	0	300	0	0	600	0	0	0
Total Gross Value	13280	7200	4488	6450	7500	15400	10800	20350	13500	41250	48000	6450	4488	15400	10800	5200	5610	9350	6000	9000	14300
Inputs:																					
Seeds(kg/ha)	40	75	8	10	15	0.8	90	13	4	8000	3	10	8	0.8	90	20	50	12	12	5	0.5
Price/kg	6.9	10	5	15	30	150	20	25	200	0.6	1000	15	5	150	20	15	15	8	40	45	130
Value	276	750	40	150	450	120	1800	325	800	4800	3000	150	40	120	1800	300	750	96	480	225	65
Urea(kg/ha)	150	50	65	50	25	150	20	30	100	250	150	50	65	150	20	30	30	150	180	50	100
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	600	200	260	200	100	600	80	120	400	1000	600	200	260	600	80	120	120	600	720	200	400
DAP(kg/ha)	100	30	60	50	10	40	100	25	50	75	100	50	60	40	100	10	30	50	120	60	120
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	850	255	510	425	85	340	850	212.5	425	637.5	850	425	510	340	850	85	255	425	1020	510	1020
MOP(kg/ha)	0	15	0	0	0	35	0	0	50	35	75	0	0	35	0	0	0	40	80	0	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	75	0	0	0	175	0	0	250	175	375	0	0	175	0	0	0	200	0	0	0
Manure(t/ha)	2	1	0	0	0	4	2	0	3	6	10	0	0	4	2	0	1	2	3	3	1.5
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	280	140	0	0	0	560	280	0	420	840	1400	0	0	560	280	0	140	280	420	420	210
Chemicals:																					
kg/l	2.5	0	0	0	1	4	1	0	5	0	1	0	0	4	1	25	2	0	0	3	1
Price/kg/l	218.0	0.0	0.0	0.0	252.0	252.0	252	0.0	252	0	216	0.0	0.0	252.0	252	5	252	0.0	0.0	252	252
Value	545	0	0	0	252	1008	252	0	1260	0	216	0	0	1008	252	125	504	0	0	756	252
Total Labour(md/ha)	170	85	53	74	96	315	84	74	220	364	645	74	53	315	84	36	34	90	90	92	166
Price/md	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Labour Costs 50%	1700	850	530	740	960	3150	840	740	2200	3640	6450	740	530	3150	840	360	340	900	900	920	1660
Total Animal Days(ad)	25	16	12	12	11	28	13	12	24	38	24	12	12	28	13	10	13	16	16	18	18
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	536	402	402	368.5	938	435.5	402	804	1273	804	402	402	938	435.5	335	435.5	536	536	603	603
Total Costs	5089	2806	1742	1917	2216	6891	4538	1800	6559	12366	13695	1917	1742	6891	4538	1325	2545	3037	4076	3634	4210
Net Production Value	8192	4394	2746	4533	5285	8509	6263	18551	6941	28885	34305	4533	2746	8509	6263	3875	3066	6313	1924	5366	10090

Per Ha Financial Crop Budget
FWP - SRBC

	Kharif & Two Season Crops													Rabi Crops							
Output:	paddy	soybeans	sorghum	sunflower	sunflower *seeds*	bendhisee	vegetable	groundnut	cotton	cotton *seeds*	chillies	sugarcane	Tumeric	sunflower	sorghum	sunflowe *seeds*	sorghum *seeds*	vegetable	groundnut	coriander	chickpea
Main Produce:																					
Yield(t/ha)	5.4	1.5	2.5	1.8	1.0	1.0	15.0	2.2	2.5	0.75	2.5	100	4	2.0	3	1	1	15	2.5	1	1.5
Price/t	4000	8000	3500	10750	30000	15000	2200	10500	20400	110000	15000	550	15000	10750	3500	30000	7500	2200	10500	13000	9350
Value	21600	12000	8750	18813	30000	15000	33000	23100	51000	82500	37500	55000	60000	21500	10500	30000	7500	33000	26250	13000	14025
By-Products:																					
Yield(t/ha)	2.7	0	5	0	0.5	0	0	2.2	0	0.5	0	0	0	0	6	0.5	0	0	2.5	0	0
Price/t	300	0	120	0	10750	0	0	300	0	20400	0	0	0	0	120	10750	0	0	300	0	0
Value	810	0	600	0	5375	0	0	660	0	10200	0	0	0	0	720	5375	0	0	750	0	0
Total Gross Value	22410	12000	9350	18813	35375	15000	33000	23760	51000	92700	37500	55000	60000	21500	11220	35375	7500	33000	27000	13000	14025
Inputs:																					
Seeds(kg/ha)	40	75	12	10	10	15	0.8	90	3	3	4	8000	3	10	12	10	12	0.8	90	20	50
Price/kg	6.9	10	8	15	110	30	150	20	25	200	200	0.6	1000	15	8	110	40	150	20	15	15
Value	276	750	96	150	1100	450	120	1800	75	600	800	4800	3000	150	96	1100	480	120	1800	300	750
Urea(kg/ha)	240	100	150	90	200	50	220	100	150	300	300	300	200	120	160	200	180	220	100	50	50
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	960	400	600	360	800	200	880	400	600	1200	1200	1200	800	480	640	800	720	880	400	200	200
DAP(kg/ha)	150	60	50	80	100	20	120	150	150	250	100	100	150	100	50	100	120	120	150	25	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	1275	510	425	680	850	170	1020	1275	1275	2125	850	850	1275	850	425	850	1020	1020	1275	212.5	425
MOP(kg/ha)	0	35	40	0	50	15	100	0	200	300	100	50	100	0	40	50	80	100	0	0	0
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	0	175	200	0	250	75	500	0	1000	1500	500	250	500	0	200	250	0	500	0	0	0
Manure(t/ha)	3	2	2	2	3	2	6	3	3	4	6	8	15	2	2	3	3	6	3	0	2
Price/t	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Value	420	280	280	280	420	280	840	420	420	560	840	1120	2100	280	280	420	420	840	420	0	280
Chemicals:																					
kg/l	4.2	1	0	1.5	2	2	7	2	10	16	10	0	2	1.5	0	2	0	7	2	25	4
Price/kg/l	252.0	252.0	0.0	252.0	252	252.0	252.0	252	252.0	252.0	252	0	216	252.0	0.0	252	0.0	252.0	252	4	252
Value	1058	252	0	378	504	504	1764	504	2520	4032	2520	0	432	378	0	504	0	1764	504	100	1008
Total Labour(md/ha)	211	110	90	94	106	120	380	122	230	1240	430	472	738	108	96	106	92	380	130	48	46
Price/md	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Labour Costs 50%	2110	1100	900	940	1060	1200	3800	1220	2300	12400	4300	4720	7380	1080	960	1060	920	3800	1300	480	460
Total Animal Days(ad)	25	16	16	14	14	11	34	18	23	28	36	44	29	14	16	14	16	34	18	10	13
Price/day	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Animal Costs 67%	837.5	536	536	469	469	368.5	1139	603	770.5	938	1206	1474	971.5	469	536	469	536	1139	603	335	435.5
Total Costs	6937	4003	3037	3257	5453	3248	10063	6222	8961	23355	12216	14414	16459	3687	3137	5453	4096	10063	6302	1628	3559
Net Production Value	15473	7997	6313	15556	29922	11753	22937	17538	42040	69345	25284	40586	43542	17813	8083	29922	3404	22937	20698	11373	10467

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 10

Per Ha Financial Crop Budget
Existing Mango

	FWOP	FWP
Output:		
Main Produce:		
Yield(t/ha)	4	4.5
Price/t	5000	5000
Value	20000	22500
By-Products:		
Yield(t/ha)	0	0
Price/t	0	0
Value	0	0
Total Gross Value	20000	22500
Inputs:		
Seedlings(no)	0	0
Price/kg	0	0
Value	0	0
Urea(kg/ha)	50	60
Price/kg	4.0	4.0
Value	200	240
DAP(kg/ha)	30	35
Price/kg	8.5	8.5
Value	255	297.5
MOP(kg/ha)	0	0
Price/kg	5.0	5.0
Value	0	0
Manure(t/ha)	0	0
Price/t	140	140
Value	0	0
Chemicals:		
kg/litre	0.5	1
Price/kg/litre	252.0	216
Value	126	216
Total Labour(md/ha)	68	75
Price/md	20	20
Labour Costs50%	680	750
Total Animal Days(ad)	2	2
Price/ad	50	50
Animal Costs 67%	100	100
Total Costs	1361	1604
Net Production Value	18639	20897

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 11

Per Ha Financial Crop Budget
New Mango

	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9
Output:									
Main Produce:									
Yield(t/ha)	0	0	0	1	3	4.5	7	9	12
Price/t	5000	5000	5000	5000	5000	5000	5000	5000	5000
Value	0	0	0	5000	15000	22500	35000	45000	60000
By-Products:									
Yield(t/ha)	0	0	0	0	0	0	0	0	0
Price/t	0	0	0	0	0	0	0	0	0
Value	0	0	0	0	0	0	0	0	0
Total Gross Value	0	0	0	5000	15000	22500	35000	45000	60000
Inputs:									
Seedlings(no)	100	10	0	0	0	0	0	0	0
Price/kg	10	10	0	0	0	0	0	0	0
Value	1000	100	0	0	0	0	0	0	0
Urea(kg/ha)	20	40	60	75	100	125	150	150	150
Price/kg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Value	80	160	240	300	400	500	600	600	600
DAP(kg/ha)	5	10	15	25	35	50	50	50	50
Price/kg	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Value	42.5	85	127.5	212.5	297.5	425	425	425	425
MOP(kg/ha)	5	10	15	25	35	50	50	50	50
Price/kg	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Value	25	50	75	125	175	250	250	0	250
Manure(t/ha)	8	0	0	0	0	0	0	0	0
Price/t	140	140	140	140	140	140	140	140	140
Value	1120	0	0	0	0	0	0	0	0
Chemicals:									
kg/litre	0.5	1	1.5	2	2.5	3	3	3	3
Price/kg/litre	252.0	252.0	0.0	252	0	216	0.0	218.0	252
Value	126	252	0	504	0	648	0	654	756
Total Labour(md/ha)	146	67	63	68	75	81	85	88	93
Price/md	25	25	25	25	25	25	25	25	25
Labour Costs50%	1825	838	788	850	938	1013	1063	1100	1163
Total Animal Days(ad)	28	8	8	8	8	8	8	8	8
Price/ad	50	50	50	50	50	50	50	50	50
Animal Costs 67%	1400	400	400	400	400	400	400	400	400
Total Costs	5619	1885	1630	2392	2210	3236	2738	3179	3594
Net Production Value	-5619	-1885	-1630	2609	12790	19265	32263	41821	56407

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 12

Per Ha Financial Crop Budget
Mulberry

	Year1	Year2	Year3
Output:			
Main Produce:			
Yield(t/ha)	0	5.2	5.2
Price/t	5000	8500	8500
Value	0	44200	44200
By-Products:			
Yield(t/ha)	0	0	0
Price/t	0	0	0
Value	0	0	0
Total Gross Value	0	44200	44200
Inputs:			
Seedlings(no)	12500	1250	0
Price/kg	0.25	0.25	0
Value	3125	312.5	0
Urea(kg/ha)	100	300	300
Price/kg	4.0	4.0	4.0
Value	400	1200	1200
DAP(kg/ha)	50	150	150
Price/kg	8.5	8.5	8.5
Value	425	1275	1275
MOP(kg/ha)	50	150	150
Price/kg	5.0	5.0	5.0
Value	250	750	750
Manure(t/ha)	5	5	5
Price/t	140	140	140
Value	700	700	700
Chemicals:			
kg/litre	0	0	0
Price/kg/litre	252.0	252	216
Value	0	0	0
Total Labour(md/ha)	186	346	346
Price/md	20	20	20
Labour Costs50%	1860	3460	3460
Total Animal Days(ad)	28	6	6
Price/ad	50	50	50
Animal Costs 67%	1400	300	300
Total Costs	8160	7998	7685
Net Production Value	-8160	36203	36515

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 13

Cropped Area, Yields and Production-Above LMD

	Present			Without Project			With Project		
Kharif:	Area (ha)	Yield (t/ha)	Total production	Area (ha)	Yield (t/ha)	Total production (tons)	Area (ha)	Yield (t/ha)	Total Production (tons)
Paddy	57345	3.2	183504	52000	3.2	166400	55000	5.4	297000
Maize	25320	2.5	63300	35000	2.7	94500	36000	4.0	144000
Maize Seeds	0	0.0	0	0	0.0	0	2000	3.0	6000
Groundnut	3266	1.3	4246	5000	1.4	7000	8000	1.8	14400
Sunflower	96	0.5	48	1500	0.7	1050	2200	1.5	3300
Sunflower Seeds	0	0.0	0	0	0.0	0	300	1.0	300
Pulses	38820	0.6	23292	35000	0.7	24500	24000	1.2	28800
vegetables	0	0.0	0	0	0.0	0	3000	15.0	45000
Subtotal	124847		274390	128500		293450	130500		538800
Two Seasons:									
Cotton	5933	1.2	7120	6000	1.3	7800	7500	2.5	18750
Cotton Seeds	0	0.0	0	0	0.0	0	500	0.8	375
Chillies	4668	1.0	4668	5000	1.1	5500	7000	2.5	17500
Tumeric	10693	3.0	32079	10000	3.2	32000	11000	4.0	44000
Sugarcane	2879	70.0	201530	3000	75.0	225000	3500	100.0	350000
Pigeon Pea	2061	0.5	1031	2500	0.6	1500	1500	1.2	1800
Fruits (mango)	0	0.0	0	0	0.0	0	1000	12.0	12000
Subtotal	26234		246427	26500		271800	32000		444425
Rabi:									
Paddy	36496	3.5	127736	30000	3.5	105000	28000	5.6	156800
Maize	22562	2.5	56405	24000	2.7	64800	20700	4.5	93150
Maize Seeds	0	0.0	0	0	0.0	0	1300	3.5	4550
Groundnut	16479	1.3	21423	17000	1.4	23800	18000	2.2	39600
Sunflower	8903	0.5	4452	9000	0.7	6300	8500	2.0	17000
Sunflower Seeds	0	0.0	0	0	0.0	0	2000	1.0	2000
Pulses	7354	0.6	4412	8000	0.7	5600	2500	1.2	3000
Vegetables	0	0.0	0	0	0.0	0	3000	15.0	45000
Soybean	0	0.0	0	0	0.0	0	5000	1.5	7500
Subtotal	91794		214428	88000		205500	89000		368600
Total Cropped Area	242875		735245	243000			251500		
Net Cultivable Area	165000			165000			165000		
Cropping Intensity (%)	147%			147%			152%		

Third Andhra Pradesh Irrigation Project

Annex 10
Table-14

Cropped Area, Yields and Production-Below LMD

	Present			Without Project			With Project		
Kharif:	Area (ha)	Yield (t/ha)	Total production (tons)	Area (ha)	Yield (t/ha)	Total production (tons)	Area (ha)	Yield (t/ha)	Total Production (tons)
Paddy	19448	3.2	62234	18920	3.2	60544	20504	5.4	110722
Maize	7568	2.0	15136	8360	2.2	18392	9680	4.0	38720
Maize Seeds	0	0.0	0	0	0.0	0	1056	3.0	3168
Groundnut	11352	0.9	10217	11000	1.0	11000	12936	1.8	23285
Sunflower	528	0.5	264	616	0.6	370	1496	1.5	2244
Sunflower Seeds	0	0.0	0	0	0.0	0	176	1.0	176
Pulses	12936	0.5	6468	13200	0.6	7920	6512	1.2	7814
vegetables	0	0.0	0	0	0.0	0	1584	15.0	23760
soybean	0	0.0	0	0	0.0	0	2728	1.5	4092
Subtotal	51832		94318	52096		98226	56672		213981
Two Seasons:									
Cotton	17776	1.0	17776	18480	1.1	20328	17248	2.5	43120
Cotton Seeds	0	0.0	0	0	0.0	0	1584	0.8	1188
Chillies	8096	0.8	6477	8096	0.9	7286	8096	2.5	20240
Tumeric	2112	3.0	6336	2454	3.2	7853	2728	4.0	10912
Sugarcane	0	0.0	0	0	0.0	0	0	0.0	0
Pigeon Pea	2728	0.5	1364	4312	0.6	2587	0	1.2	0
Fruits (mango)	0	0.0	0	0	0.0	0	528	12.0	6336
Subtotal	30712		31953	33342		38054	30184		81796
Rabi:									
Paddy	3256	3.5	11396	3080	3.5	10780	1056	5.6	5914
Maize	1584	2.2	3485	4400	2.5	11000	11352	4.5	51084
Maize Seeds	0	0.0	0	0	0.0	0	1056	3.5	3696
Groundnut	4840	0.9	4356	4400	1.0	4400	14080	2.2	30976
Sunflower	2112	0.5	1056	1760	0.6	1056	8624	2.0	17248
Sunflower Seeds	0	0.0	0	0	0.0	0	528	1.0	528
Pulses	1584	0.5	792	880	0.6	528	4312	1.2	5174
Vegetables	0	0.0	0	0	0.0	0	1584	15.0	23760
Soybean	0	0.0	0	0	0.0	0	1584	1.5	2376
Subtotal	13376		21085	14520		27764	44176		140756
Total Cropped Area	95920		147356	99958		164044	131032		
Net Cultivable Area	88000			88000			88000		
Cropping Intensity (%)	109%			114%			149%		

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 15

Cropped Area, Yields and Production - SRBC

	Present			Without Project			With Project		
Kharif:	Area (ha)	Yield (t/ha)	Total production (tons)	Area (ha)	Yield (t/ha)	Total production (tons)	Area (ha)	Yield (t/ha)	Total Production (tons)
Paddy	2000	3.2	6400	2150	3.2	6880	2336	5.4	12614
soyabean	650	0.8	520	750	0.9	675	7800	1.5	11700
sorghum	6850	1.1	7535	7000	1.2	8400	5200	2.5	13000
sunflower	2600	0.6	1560	2600	0.6	1560	2600	1.8	4680
seed bendhi	200	0.4	80	400	0.5	200	4550	1.0	4550
vegetables	100	6.0	600	150	7.0	1050	950	15.0	14250
groundnut	9100	0.9	8190	9100	1.0	9100	17575	2.2	38665
Subtotal	21500		24885	22150		27865	41011		99459
Two Seasons:									
Cotton	11050	1.0	11050	12050	1.1	13255	14950	2.5	37375
Cotton Seeds	0	0.0	0	0	0.0	0	1300	0.8	975
Chillies	260	0.8	208	300	0.9	270	2600	25.0	65000
sugarcane	65	70.0	4550	65	75.0	4875	650	100.0	65000
tumeric	65	3.0	195	65	3.2	208	1950	4.0	7800
mulberry	0	0.0	0	0	0.0	0	650	5.2	3380
existing mango	455	4.0	1820	455	4.0	1820	455	4.5	2048
new mango	0	0.0	0	0	0.0	0	845	12.0	10140
Subtotal	11895		17823	12935		20428	23400		191718
Rabi:									
vegetables	100	6.0	600	273	7.0	1911	500	15.0	7500
sunflower	2730	0.6	1638	4200	0.6	2520	15500	2.0	31000
sunflower seed	0	0.0	0	0	0.0	0	2000	1.0	2000
coriander	8100	0.3	2430	8600	0.4	3440	500	1.0	500
chick pea	6045	0.5	3023	6100	0.6	3660	500	1.5	750
sorghum	4745	1.1	5220	4511	2.5	11278	1250	3.0	3750
sorghum seeds	0	0.0	0	100	0.0	0	100	1.0	100
groundnut	1300	0.9	1170	1413	1.0	1413	20275	2.5	50688
tobacco	7800	1.0	7800	6800	1.1	7480	0	0.0	0
castor	2880	0.8	2304	2280	0.9	2052	0	0.0	0
Subtotal	33700		24184	34277		33754	40625		96288
Total Cropped Area	67095		66892	69362		82047	105036		387464
Net Cultivable Area	65000			65000			65000		
Cropping Intensity (%)	103%			107%			162%		

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 16

Population and Land Holdings

	SRSP		SRBC	
Population	1830000		286000	
Households	390000		57700	
Active Labor Force (%)				
Farmers	51		49	
Farm Laborers	30		24	
	21		25	
Average Farm Size (ha)	1.1		1.8	
Farm Size Distribution (%):	No	Area	No	Area
Marginal & Small Farms	83.1	47.2	66.0	26.0
Medium Farms	16.4	47.2	31.0	54.0
Large Farms	0.5	5.6	3.0	20.0
Total	100.0	100.0	100.0	100.0

Third Andhra Pradesh Irrigation Project

Estimated Farm Budgets at Full Development

(Rs)

	Farm Size	Time	Gross Production Value	Hired Labor	Other Inputs	Total Inputs	Net Value
SRSP:							
Presently Irrigated Areas	1.1	P	21165	2900	7695	10595	10570
		WOP	22105	2915	7660	10575	11530
		WP	39960	4140	12265	16405	23555
Newly Irrigated Areas	1.1	P	14470	1727	4830	6557	7913
		WOP	16340	1870	5095	6965	9375
		WP	44155	4040	12230	16270	27885
SRBC:							
Newly Irrigated Areas	1.8	P	17280	1420	4970	6390	10890
		WOP	20380	1600	5335	6935	13445
		WP	82525	2440	18245	20685	61840

P = present; WOP = without project; WP = with project

a/ net return to family labor before taxes and water charge payments. Details estimates for the above results are available in the project files.

Summary of Financial and Economic prices

	Financial	Economic
Outputs (Rs/ton)1/		
Paddy	4000	6740
Sorghum	3500	6470
Sorghum seeds	7500	13945
Maize	3800	6540
Maize seeds	7500	12330
Soybeans	8000	11990
Groundnuts	10500	11480
Pulses	10500	9450
Pigeon Pea	9000	8100
Chick Pea	9350	8415
Chillies	15000	13500
Vegetables	2200	1980
Coriander	13000	11700
Mulberry	8500	7650
Sugarcane	550	1043
Fruits	5000	4500
Tumeric	15000	13500
Sunflower	10750	9675
Sunflower seeds	30000	27000
Bendhi seeds	15000	13500
Seed Cotton (MS)	18500	19965
Seed Cotton (LS)	20400	21890
Cotton seeds	110000	120740
Tobacco	13000	11700
Castor oilseeds	10000	9000
By-products:		
Paddy	300	270
Sorghum	120	108
Maize	80	72
Groundnuts	300	270

	Financial	Economic
Inputs (Rs/kg)		
Seeds 2/:		
Paddy	6.90	11.50
Sorghum	8-40	15-35
Maize	10-20	16.5-33.0
Soybeans	10	15
Bendhi seeds	30	27
Groundnuts	20	22
Sunflower	15-110	13.5-100
Pulses	10	9
Pegeon Pea	12	10.8
Ckick Pea	15	13.5
Tumeric	1000	900
Chillies	200	180
Vegetables	150	135
Coriander	15	13.5
Cotton	25-200	22.5-180
Sugarcane cuttings	0.60	0.54
Tobacco	130	117
Castor oilseeds	45	40.5
Fertilizers (Rs/kg)		
Urea	4.00	7.90
DAP	8.50	8.50
MOP	5.00	6.50
Manure (Rs/ton)	0.14	0.13
Labour (Rs/md)	20-25	18.0-22.5
Draft Power(Rs/ad)	50	45

1/ Non-traded outputs, inputs, labour and draft power were adjusted by SCF of 0.90.

2/ For traded commodities, the economic prices were based on the financial price ratio between grains and seeds.

Estimation of Rural Roads Benefits
(SRBC)

	no./day	no. of one-way trip	Savings/km p (Rs.)1/	Savings/km/da day (Rs.)	Savings/km/year (Rs.)
1. Operating Cost Savings:					
Trucks	10	1	2.9	29.0	10585
Buses	10	1	2.3	23.0	8395
Cars	22	1	1.2	26.4	9636
Scooters/motorcycles	48	1	0.6	28.8	10512
bycycles	123	1	0.4	49.2	17958
Bullock carts	86	1	0.3	25.8	9417
Tractors	95	1	2.9	275.5	100558
			Subtotal	457.7	167061

	no./day	no. of one-way trip	No. passengers	Min. saved (Rs./km)2/	% Prod. Time	e3/ Prod. Minutes	Prod. Hours	Econ. Val per day 4/	ue Savings/ km/year
2. Value of Passerger Time Saved.									
Buses	10	1	25.0	5.0	40	500	8.3	18.0	6844
Cars	22	1	2.0	2.5	40	44	0.7	0.6	20
Tractors	95	1	5.0	6.3	40	1197	20.0	18.0	16384
Scooters/motorcycles	48	1	1.5	4.0	40	115	1.9	6.3	552
								subtotal	23800

3. Value of Incremental Load from Time Saved

	no./day	no. of one-way trip	Min. saved/ km 2/ p	%Prod Time	Prod. Minutes	es Prod. Hours	Econ. Value per day 5/	Econ. Val ue per km/ ye ar
4. Value of Passerger Time Saved.								
Trucks	10	1	5	80	40	5	5.3	1209
Bullock Carts	86	1	7	50	482	60	1.3	3571
Tractors	95	1	5	80	380	48	5.3	11486
							subtotal	16266

1/Based on the results of traffic surveys conducted by the Roads and Highway Department, AP.

2/ Central roads research Institute, " Impact of Rural Roads Traffic Flow patterns and economic benefits. A case study in Haryana,New Delhi,1987.

3/ World Bank Staff Working Papers no. 610, 1983, Annex X, Page 110; includes employment-related business (25%) and trading goods to markets (15%)

4/ Daily Wage of Rs. 20 adjusted by SCF of 0.90.

3/ World Bank Staff Working Papers no. 610, 1983, Annex X, Page 116; truck and tractor time valued at Rs. 2.5/hr; bullock cart time at Rs.1.3/hr.

Estimation of Rural Roads Benefits
(SRSP)

	no./day	no. of one-way trip	Savings/km p (Rs.)1/	Savings/km/day (Rs.)	day Savings/km/year (Rs.)
1. Operating Cost Savings:					
Trucks	14	1	2.9	40.6	14819
Buses	14	1	2.3	32.2	11753
Cars	17	1	1.2	20.4	7446
Scooters/motorcycles	69	1	0.6	41.4	15111
bycycles	167	1	0.4	66.8	24382
Bullock carts	75	1	0.3	22.5	8213
Tractors	71	1	2.9	205.9	75154
			Subtotal	429.8	156877

	no./day	no. of one-way trip	No. passengers	Min. saved/km (Rs.)	% Prod. Time 3/	e3/ Prod. Minutes	Prod. Hours	Econ. Value per day 4/	Savings/km/year
2. Value of Passerger Time Saved.									
Buses	14	1	25	5.0	40	700.0	11.7	22.5	11977
Cars	17	1	2	2.5	40	34.0	0.6	0.6	16
Tractors	71	1	5	6.3	40	894.6	14.9	22.5	15306
Scooters/motorcycles	69	1	1.5	4.0	40	165.6	2.8	6.3	793
								subtotal	28091

3. Value of Incremental Load from Time Saved

	no./day	no. of one-way trip	Min. saved/km 2/	% Prod Time	Prod. Minutes	es Prod. Hours	Econ. Value per day 5/	Econ. Value per km/year
2. Value of Passerger Time Saved.								
Trucks	35	4	5	80	560	70	5.3	16927
Bullock Carts	107	2	7	50	1198	150	1.3	8885
Tractors	69	2	5	80	552	69	5.3	16685
							subtotal	42497

1/Based on the results of traffic surveys conducted by the Roads and Highway Department, AP.

2/ Central Roads Research Institute, " Impact of Rural Roads Traffic Flow patterns and economic benefits. A case study in Haryana,New Delhi,1987.

3/ World Bank Staff Working Papers no. 610, 1983, Annex X, Page 110; includes employment-related business (25%) and trading goods to markets (15%)

4/ Daily Wage of Rs. 25 adjusted by SCF of 0.90.

3/ World Bank Staff Working Papers no. 610, 1983, Annex X, Page 116; truck and tractor time valued at Rs. 2.5/hr; bullock cart time at Rs.1.3/hr.

Third Andhra Pradesh Irrigation Project

Annex
Table 21

Economic Price Derivation

	Sugar	Paddy	Maize	Sorghum	Groundnuts	Soybeans.	Cotton MS	Cotton LS	Urea	DAP	MOP
	M	M	M	M	M	M	X	X	M	M	M
Average 2000-2005 World Price(US$/ton)1/	256	275	101	99	593	274	1725	1725	148	168	108
Quality Adjustment(%)	100	80	100	100	100	100	90	100	100	100	100
Adjusted World Price (US$/ton)	256	220	101	99	593	274	1553	1725	148	168	108
International shipping costs	70	35	65	65	65	50	65	65	50	50	50
CIF/FOB Price, Madras (US$/ton)	326	255	166	164	658	324	1488	1660	198	218	158
CIF/FOB Price, Madras (Rs/ton)2/	11247	8798	5727	5658	22701	11178	51319	57270	6831	7521	5451
Port charges & Handling	450	450	450	450	450	450	450	450	450	450	450
Handling, storage & marketing 3/	240	225	190	190	385	190	600	655	195	205	185
Transport to/from wholesaler 4/	250	250	250	250	340	250		390	325	325	325
Processing ratio	10	70	100	100	40	100	35	35			
Value of by-products 5/	162	261	0	0	3240	0	3510	3510			
Processing cost 5/	266	253	0	0	1232	0	1064	1064	0	0	0
Wholesale price	1115	6814	6617	6548	11558	12068	20040	21967	7801	8501	6411
Transport to/from farm 6/	75	75	75	75	75	75	75	75	75	75	75
Economic Farmgate price(Rs/ton)	1040	6739	6542	6473	11483	11993	19965	21892	7876	8576	6486
Financial Farm-gate price(rm-gate Price (R	550	4000	3800	3500	10500	8000	18500	20400	4000	8500	5000

1/ IBRD Commodity Price Forecats, May 1996, adjusted to 1995 constant value.
Sugar: ISA daily price, FOB and stowed at greater carribbean ports.
Rice: Thai, milled 5% broken, FOB Bangkok.
Maize: US, No. 2 Yellow, FOB Gulf Ports.
Sorghum: US, No. 2, Milo yellow, FOB Gulf Ports.
Cotton: Middling (1-3/32"), CIF Europe.
Groundnut oil, any origin, CIF Rotterdam.
Soybeans:US, cif, Rotterdam.
Urea: bagged, FOB Europe.
DAP: FOB US Gulf.
Potasium Chloride (Muriate of Potash): FOB Vancouver.
2/ US$ 1.0 = Rs. 34.5
3/ Loading & unloading (Rs. 150) adjusted by SCF of 0.9, and storgae and marketing costs (1% of cif/fob value).
4/ About 750 km by rail, adjusted by SCF of 0.9.
5/ Adjusted by SCF of 0.90.
Sugar: 4% molasses at Rs. 1.5/kg and 30% bagassee at Rs. 0.4/kg.
Paddy: 5% bran at Rs.5/kg and 20% husk at Rs. 0.2/kg.
groundnuts: 60% cake at Rs. 6/kg.
Coton: 655 seeds at Rs. 6/kg.
6/ About 50 km by road, adjusted by SCF of 0.90.

Third Andhra Pradesh Irrigation Project

Annex 10
Table 22

Economic Analysis-Above LMD
(Rs. Million)

	Irrigation Investment Costs	Inc. O&M Costs	Land Acquisition	Dam Safety	Ag. Support Services	Roads Investment	O&M roads	Total Costy	WOP Net Prod. Benefits	WP Net Prod. Benefits	Road Benefits	Inc. Net Benefits	Balance
Yr1(FY95/96)	111.7	0	1.3	0.2	2.6	16.0	0.0	131.8	0.0	0.0	0.0	0.0	-131.8
Yr2	87.2	0	1.3	1.9	6.8		1.3	98.5	0.0	0.0	10.7	10.7	-87.8
Yr3	492.6	0	1.3	12.3	63.1		1.3	570.6	75.6	75.6	10.7	10.7	-559.9
Yr4	1029.1	0	1.3	8.9	26.6		1.3	1067.2	323.9	359.5	10.7	46.3	-1020.9
Yr5	1218.2	0	1.3	7.0	23.6		1.3	1251.4	954.7	1141.6	10.7	197.6	-1053.8
Yr6	697.7	0	1.3	0	20.2		1.3	720.5	1819.5	2414.5	10.7	605.7	-114.8
Yr7	35.1	0	1.3	0	11.4		1.3	49.1	2529.1	3812.3	10.7	1293.9	1244.8
Yr8	0.0	46.6	1.3		6.9		1.3	56.1	2864.1	4858.6	10.7	2005.2	1949.1
Yr9	0.0	46.6	1.3		6.9		1.3	56.1	2889.5	5338.5	10.7	2459.7	2403.6
Yr10	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr11	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr12	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr13	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr14	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr15	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr16	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr17	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr18	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr19	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr20	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr21	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr22	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr23	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr24	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr25	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr26	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr27	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr28	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr29	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5
Yr30	0.0	46.6	1.3		6.9		1.3	56.1	2897.4	5485.3	10.7	2598.6	2542.5

NPV = Rs. 7228.1 million ERR = 35.8%

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 23

Economic Analysis-Below LMD
(Rs. Million)

	Irrigation Investment Costs	Inc. O&M Costs	Land Acquisition	Dam Safety	Agric. Support Services	Roads Investment	O&M roads	Total Cost	WOP Net Prod. Benefits	WP Net Prod. Benefits	Road Benefits	Inc. Net Benefits	Balance
Yr1	243.8	0.0	0.0	0.1	1.4	9.8	0	255.1	0.0	0.0	0.0	0.0	-255.1
Yr2	152.3	0.0	3.6	1.1	3.6		0.6	161.2	0.0	0.0	5.0	5.0	-156.2
Yr3	213.4	0.0	3.6	6.6	42.6		0.6	266.8	16.9	16.9	5.0	5.0	-261.8
Yr4	399.7	0.0	3.6	4.9	16.8		0.6	425.6	82.8	91.7	5.0	13.9	-411.7
Yr5	393.8	0.0	3.6	3.8	14.4		0.6	416.2	215.1	267.3	5.0	57.2	-359.0
Yr6	255.2	0.0	3.6	0	12.6		0.6	272.0	398.1	561.4	5.0	168.3	-103.7
Yr7	42.1	0.0	3.6	0	7.9		0.6	54.2	588.5	954.5	5.0	371.0	316.8
Yr8	0.0	39.2	3.6		5.3		0.6	48.7	768.7	1420.2	5.0	656.5	607.8
Yr9	0.0	39.2	3.6		5.3		0.6	48.7	904.5	1889.8	5.0	990.3	941.6
Yr10	0.0	39.2	3.6		5.3		0.6	48.7	975.8	2284.5	5.0	1313.7	1265.0
Yr11	0.0	39.2	3.6		5.3		0.6	48.7	996.5	2560.5	5.0	1569.0	1520.3
Yr12	0.0	39.2	3.6		5.3		0.6	48.7	1009.7	2737.7	5.0	1733.0	1684.3
Yr13	0.0	39.2	3.6		5.3		0.6	48.7	1016.3	2825.4	5.0	1814.1	1765.4
Yr14	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr15	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr16	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr17	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr18	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr19	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr20	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr21	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr22	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr23	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr24	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr25	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr26	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr27	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr28	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr29	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2
Yr30	0.0	39.2	3.6		5.3		0.6	48.7	1018.2	2851.1	5.0	1837.9	1789.2

NPV = Rs. 4272.4 million **ERR = 30.9%**

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 24

Economic Analysis-SRSP
(Rs. Million)

	Irrigation Investment Costs	Inc. O&M Costs	Land Acquisition	Dam Safety	Ag. Support Services	Roads Investment	O&M roads	Total Costs	WOP Net Prod. Benefits	WP Net Prod. Benefits	Road Benefits	Inc. Net Benefits	Balance
Yr1(FY95/96)	355.5	0	2.6	0.3	4	25.75	0	388.15	0	0	0	0	-388.15
Yr2	239.5	0	6.2	3	10.4		1.9	261	0	0	15.7	15.7	-245.3
Yr3	706	0	6.2	18.9	105.7		1.9	838.7	92.5	92.5	15.7	15.7	-823
Yr4	1428.8	0	6.2	13.8	43.4		1.9	1494.1	406.7	451.2	15.7	60.2	-1433.9
Yr5	1612	0	6.2	10.8	38		1.9	1668.9	1169.8	1408.9	15.7	254.8	-1414.1
Yr6	952.9	0	6.2	0	32.8		1.9	993.8	2217.6	2975.9	15.7	774	-219.8
Yr7	77.2	0	6.2	0	19.3		1.9	104.6	3117.6	4766.8	15.7	1664.9	1560.3
Yr8	0	85.8	6.2		12.2		1.9	106.1	3632.8	6278.8	15.7	2661.7	2555.6
Yr9	0	85.8	6.2		12.2		1.9	106.1	3794	7228.3	15.7	3450	3343.9
Yr10	0	85.8	6.2		12.2		1.9	106.1	3873.2	7769.8	15.7	3912.3	3806.2
Yr11	0	85.8	6.2		12.2		1.9	106.1	3893.9	8045.8	15.7	4167.6	4061.5
Yr12	0	85.8	6.2		12.2		1.9	106.1	3907.1	8223	15.7	4331.6	4225.5
Yr13	0	85.8	6.2		12.2		1.9	106.1	3913.7	8310.7	15.7	4412.7	4306.6
Yr14	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr15	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr16	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr17	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr18	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr19	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr20	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr21	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr22	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr23	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr24	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr25	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr26	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr27	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr28	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr29	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4
Yr30	0	85.8	6.2		12.2		1.9	106.1	3915.6	8336.4	15.7	4436.5	4330.4

NPV=Rs. 11500.5 million **ERR= 33.7%**

Annex 10

Table 25

Economic Analysis-SRBC

(Rs. Million)

	Irrigation Investment Civil Works	Incremental O&M	Land Acquisition	Dam Safety 1/	R&R	Agric. Support Services	Foregone Hydropower	Road Investment	O&M Road	Total Costs	WOP Net Prod. Benefits	WP Net Prod. Benefits	Road Benefits	Inc. Net Benefits	Balance
Yr1	928	0	0	3.7	1.1	0	0	2	0	934.8	0	0	0	0	-934.8
Yr2	1055.4	0	1.2	1.8	10.6	1.3	0	2.2	0.1	1072.6	0	0	1	1	-1071.6
Yr3	651.1	0	5.5	30.3	26.3	55.3	0.4	23.4	0.3	792.6	0	0	2.3	2.3	-790.3
Yr4	915.5	0	9.7	1.8	26.7	20.2	0.9	22.9	2.3	1000	8.9	8.9	17.2	17.2	-982.8
Yr5	600.4	0	13.9	0	18.1	15.4	1.3	0	4.1	653.2	29.2	38.1	30.9	39.8	-613.4
Yr6	552.6	0	16.1	0	17	16.8	3.7	0	4.7	610.9	91.6	129.4	35.5	73.3	-537.6
Yr7	94.9	0	16.2	0	16.1	10.9	9.3	0	5.3	154.7	156.7	284.8	40.1	168.2	13.5
Yr8	0	29	16.2			7.1	17.4		5.9	77.6	253.2	533	44.1	323.9	246.3
Yr9	0	29	16.2			7.1	27.4		5.9	87.6	344.3	857.2	44.1	557	469.4
Yr10	0	29	16.2			7.1	41.6		5.9	102	426.9	1234.5	44.1	851.7	749.7
Yr11	0	29	16.2			7.1	53.4		5.9	113.6	468.7	1579.7	44.1	1155.1	1041.5
Yr12	0	29	16.2			7.1	61.9		5.9	122.1	509.1	1891.1	44.1	1426.1	1304
Yr13	0	29	16.2			7.1	68.5		5.9	128.7	518.1	2109.7	44.1	1635.7	1507
Yr14	0	29	16.2			7.1	72.1		5.9	132.3	523.6	2243.3	44.1	1763.8	1631.5
Yr15	0	29	16.2			7.1	72.1		5.9	132.3	526	2303.6	44.1	1821.7	1689.4
Yr16	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr17	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr18	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr19	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr20	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr21	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr22	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr23	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr24	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr25	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr26	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr27	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr28	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr29	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3
Yr30	0	29	16.2			7.1	72.1		5.9	132.3	527.3	2333.8	44.1	1850.6	1718.3

NPV=Rs 779.864033 million ERR= 13.7%

1/ Excluding dam protection works.

Third Andhra Pradesh Irrigation Project

Annex 10
Table - 26

Economic Analysis-Whole Project
(Rs. Million)

	Investment Costs	Inc. O&M Costs	Land Acquisition	Dam Safety	R&R	Foregone Power Ben.	Ag. Support Services	Roads Investment	O&M roads	PPMU	Total Costs	WOP Net Prod Benefits	WP Net Prod Benefits	Road Benefits	Inc. Net Benefits	Balance
Yr1(FY95/96)	1283.5	0	2.6	4	1.1	0	4	27.75	0	5.9	1328.85	0	0	0	0	-1328.85
Yr2	1294.9	0	7.4	4.8	10.6	0	11.7	2.2	2	8.7	1342.3	0	0	16.7	16.7	-1325.6
Yr3	1357.1	0	11.7	49.2	26.3	0.4	161	23.4	2.2	15.8	1647.1	92.5	92.5	18	18	-1629.1
Yr4	2344.3	0	15.9	15.6	26.7	0.9	63.6	22.9	4.2	10.2	2504.3	415.6	460.1	32.9	77.4	-2426.9
Yr5	2212.4	0	20.1	10.8	18.1	1.3	53.4	0	6	10.2	2332.3	1199	1447	46.6	294.6	-2037.7
Yr6	1505.5	0	22.3	0	17	3.7	49.6	0	6.6	10.2	1614.9	2309.2	3105.3	51.2	847.3	-767.6
Yr7	172.1	0	24.4	0	16.1	9.3	30.2	0	7.2		259.3	3274.3	5051.6	55.8	1833.1	1573.8
Yr8	0	114.8	24.4		0	17.4	19.3		7.8		183.7	3886	6811.8	59.8	2985.6	2801.9
Yr9	0	114.8	24.4		0	27.4	19.3		7.8		193.7	4138.3	8085.5	59.8	4007	3813.3
Yr10	0	114.8	24.4		0	41.8	19.3		7.8		208.1	4300.1	9004.3	59.8	4764	4555.9
Yr11	0	114.8	24.4		0	53.4	19.3		7.8		219.7	4362.6	9625.5	59.8	5322.7	5103
Yr12	0	114.8	24.4		0	61.9	19.3		7.8		228.2	4416.2	10114.1	59.8	5757.7	5529.5
Yr13	0	114.8	24.4		0	68.5	19.3		7.8		234.8	4431.8	10420.4	59.8	6048.4	5813.6
Yr14	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4439.2	10579.7	59.8	6200.3	5961.9
Yr15	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4441.6	10640	59.8	6258.2	6019.8
Yr16	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr17	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr18	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr19	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr20	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr21	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr22	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr23	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr24	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr25	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr26	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr27	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr28	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr29	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7
Yr30	0	114.8	24.4		0	72.1	19.3		7.8		238.4	4442.9	10670.2	59.8	6287.1	6048.7

NPV=Rs. 12280.4 million **ERR = 23.9%**

FINANCIAL AND FISCAL ANALYSIS

Table of Contents

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

FINANCIAL AND FISCAL ANALYSIS

A. Public Irrigation Sector Finances

Public Irrigation Finances

1. **State Finances.** The assured counterpart funding during project implementation, and funding for O&M works after construction under the project could potentially be a risk from general fiscal crisis in Andhra Pradesh (AP). The fiscal stress has been caused by (a) declining state own revenues; and (b) sharp rising unproductive public expenditures on subsidies, poorly targeted welfare programs, especially the 2-Rupee rice scheme, and salaries which has crowed out productive expenditures on physical and social infrastructures, and non-waged O&M. As a result, the main fiscal and debt indicators have deteriorated together with the slow growth performance. The fiscal deficit in the State has increased to 3.4% of Gross State Domestic Product (GSDP) in FY95/96and amounted to Rs.22.5 billion in FY95/96, and is estimated to increase further to about Rs.23.9 billion in FY96/97. The debt/GSDP ratio currently stands at about 24% of GSDP.

2. In recent years, about 22% of State's total expenditures were financed through borrowings, and the share of capital expenditures has been only 15%. Total capital expenditures were Rs.16.0 billion in FY95/96, while the revenue expenditures amounted to Rs.102.0 billion (Table 1). An increasing reliance on central loans to finance the State plan expenditures has led to a high level of debt relative to the revenues of the State. Expenditures on interest payments alone presently absorbed about 16.4% of total State revenue receipts, and the share is projected to increase some 20% of total State's revenues and 30% of tax revenues before the end of the decade.

3. **Irrigation Investment and Revenue Expenditures.** Irrigation has been given the highest priority in the state's capital budget and comprised about 43% thereof in FY95/96. This amounts to 20% of the total investment in the state. Because of its high share in the capital stock of the state, any inefficiency in the irrigation sector generates an adverse effect on overall efficiency in the economy. After peaking at 2.4% of AP's GSDP in 1986/87, public expenditure in the irrigation sector declined to 1.2% of GSDP in 1995/96. However, it has remained the third largest sector in terms of total budgetary allocations after welfare programs and education. Capital expenditures declined from Rs.7.83 billion in FY93/94 to Rs.6.83 billion in FY95/96 while revenue expenditures (excluding debt service) declined from Rs.1.93 billion to Rs.1.32 billion in this period. It should be noted that the total revenue expenditure also included interest payments[1]. Annual interest payments to GOI on irrigation debt increased from Rs.4.04 billion in FY93/94 to Rs.7.22 billion in FY95/96. Accordingly, total irrigation sector revenue expenditure increased from Rs.13.80 billion in FY93/94 to Rs.15.37 billion in FY95/96. Thus, in FY95/96 debt service amounted to about 85% of total sector revenue expenditures and comprised about 38% of total State debt service payments (Table 1).

---

[1] Interest payments are included under the revenue expenditure account and, at the same time, the same amount is recorded under the revenue receipt account. This is an accounting transaction or a notional payment from ICADD to the State Treasury. Because no actual transaction occurs, this practice distorts the fiscal accounts.

4. **Irrigation Subsidies.** Surface and groundwater irrigation subsidies comprise about 6% of the state revenue deficit. These subsidies are granted in the form of water and power rates which are substantially below the cost of delivery. Water subsidies affect the relatively affluent Coastal Region where about 85% of canal schemes are situated. Power subsidies affect the drought-prone upland areas of the Telengana and Rayalaseema Regions, where about 80% of wells are located. The surface water subsidies (difference between the cost of delivering water, including the interest costs of capital invested, and the revenues from it) have reached Rs.7.3 billion in FY95/96, i.e. about 90% of the total public expenditure on irrigation and flood control in that year. Agriculture consumes more than 40% of the total available power in the state at a price that is about 2-3% of the average power production cost. The total agricultural power subsidy amounted to Rs.16.3 billion in 1994/95, or 184% of the total public expenditure in the sector.

5. **Irrigation Revenue Sources.** Until 1984, land revenues and water charges were the two main revenue sources derived from directly the public irrigation sector. Land revenue was abolished in 1984 and irrigation water charge revenue has since become the only direct revenue source. A Betterment Levy for recovery of capital costs was successfully challenged in the Courts and its collection suspended. Direct cost recovery through water charges has been about 0.5% of agricultural value added. Revenue from irrigation water charges in FY94/95 accounted for less than 1% of total GSDP, and only about 12% and 46% respectively of ICADD's O&M budget requests and actual allocations (para. 6). Indirect taxation accounted for 72% of total state tax revenues of which the most important was the sales tax on agricultural products which averages 4% of gross output.

Current O&M Budgets and Water Charge Revenue

6. **O&M Budgets.** The most pressing financial problem faced by the AP public irrigation sector is chronic under-funding of O&M works. This has led to widespread deferred maintenance and a decline of the net canal command area from 2.8 million ha in FY90/91 to 2.3 million ha in FY94/95 (see table below).

O&M Expenditures and Water Charge Revenues

Fiscal Year	Command Area		O&M Expenditures			Water Charge Revenues		
	Gross CCA	Net CCA	Actual Allocation		Budget Requests	Water Charge Assessments		Charge Collection
	ha M	ha M	Rs. M	Rs./ha[2/]	Rs. M	Rs. M	Rs. M	Rs./ha[3/]
FY90/91	3.6	2.8	449	160	1983	254	233	65
FY91/92	3.5	2.7	560	207	2327	354	330	94
FY92/93	3.2	2.5	612	245	2439	382	375	117
FY93/94	3.1	2.3	635	276	2653	461	448	145
FY94/95	3.0	2.3	692	300	2905	407	318	106

1/ Canal irrigation.
2/ Unit O&M allocation computed on basis of net cultivable command area (CCA)
3/ Collected unit water charge computed on basis of gross command area cultivated

7. ICADD's O&M budget requests for surface irrigation schemes increased from Rs.1.98 billion (Rs.708/ha) in FY90/91 to Rs.2,91 billion (Rs.1,263/ha) in FY94/95, while actual O&M expenditure in this period increased from only Rs.449 million (Rs.160/ha) to Rs.692 million (Rs.300/ha). Thus the actual O&M allocation in real terms was kept at only about 24% of the actual funds needed for adequate upkeep of the existing irrigation network. The relatively high unit O&M expenditures of Rs.300/ha is misleading: about 66% (Rs.200/ha) was spent on repair of the ravages of deferred maintenance, while 30% (Rs.90/ha) covered salaries and establishment costs and the remainder of 4% was devoted to normal maintenance. The inadequate O&M allocation is the source of the "deferred maintenance culture" currently practiced in the irrigation sector and inadequate cost recovery is the main cause of under-funding of O&M.

8. **Irrigation Charges Revenues**. Water charge levels for public irrigation schemes are low. The present water rates were set in 1988 and have remained unchanged till January 3, 1997 (para.11). The rates vary depending on whether land is localized as "Irrigated Wet" (IW) or "Irrigated Dry" (ID). When charge assessments are made, rice and sugar-cane are regarded as "Wet Crops"; however if water is supplied for rice under rotational (intermittent) water supply where IW land has been de-localized to ID, dry crop charges would apply. Farmers benefiting from public minor irrigation are charged lower rates than those located within major and medium irrigation schemes because of the higher O&M costs of the latter.

9. Despite their low levels, canal water charges are generally perceived by farmers as taxes and not as user charges for public irrigation services which are generally poor and unreliable. The above table shows that FY94/95 water charge revenue collection amounted to Rs.318 million (Rs.106/gross irrigated ha). Thus revenue amounted to 78% of the water charge assessment, and only 46% of the actual irrigation O&M expenditure of Rs.692 million. Compared to previous years, FY94/95 represents a drastic decline in collection efficiency per gross irrigated ha which had increased from over 91% to 97% in FY93/94.

Fiscal Reforms in Public Irrigation

10. **State Fiscal Adjustment Strategy.** GOAP's counterpart funding during project implementation, and funding for O&M works after completion of the proposed project could potentially be at risk due to the general fiscal crisis in Andhra Pradesh. However, GOAP has begun undertaking several fiscal reforms and is engaged in an on-going dialogue with the Bank regarding further fiscal adjustments and reforms[2]. Overall fiscal reforms that would be implemented to improve the finances of GOAP to bring down the primary deficit to a sustainable level include: (a) enhancement of own tax and non-tax revenues by reforming the state tax system and increasing cost recovery; (b) re-prioritizing public expenditure and improving its management; and (c) restructuring the public enterprise sector. In late 1996, GOAP introduced several measures to ease the severe fiscal crisis including: (i) introduction of new tax measures; (ii) reduction in the rice distribution scheme by increasing the issuing price and reducing the amount of rice ration; and (iii) enhancement power tariffs including raising the agricultural tariff from Rs.0.034/kwh to Rs.0.2/kwh.

---

2 *India - Policy Agenda for Andhra Pradesh for Faster and Sustainable Economic Growth and Social Development*; World Bank Report No. 15901-IN, July 1996.

11. **Revised Water Charges.** As part of its fiscal adjustment strategy, GOAP has gazetted an Ordinance on January 3, 1997 to increase seasonal irrigation water charges for major, medium and minor schemes. The previous (1998 to 1996) and current charges are shown in the table below.

Andhra Pradesh Irrigation Water Charges

Nature of Irrigated Crop	Previous Water Charge Rates (Rs./ha)		Current[1/] Water Charge Rates (Rs./ha)	
Crop Type	Major & Medium Schemes	Minor Irrigation Schemes	Major & Medium Schemes	Minor Irrigation Schemes
First Wet Crop	148	99	494	247
Second Wet Crop	222	148	371	247
First Dry Crop	99	74	247	148
Second Dry Crop	99	74	247	148

1/ Effective July 1, 1997

B. Cost Recovery Analysis

Revenue Potential of Increased Water Charges

12. **Assessable Area for Water Charges.** The increased irrigation water charges should have a positive fiscal impact and substantially reduce the revenue deficit in the public irrigation sector. Upon completion of the proposed project, the assessable net area to which water charges apply would increase from 2.135 million ha (including 0.6 million ha of minor irrigation) to 2.453 million ha. The functional area of major and medium schemes of about 1.600 million ha (including a functional area of 0.065 million ha in SRSP) would increase to 1.853 million ha. It is assumed that for existing schemes: (a) the cropping intensity of large projects and minor irrigation remains about 125% and about 116% respectively; and (b) about 90% of the gross cultivated area remains under wet crops as at present. For SRSP and SRBC, it may be assumed that the planned cropping intensity of about 150% would be achieved. Using the above assumptions, the assessable areas for water charges would be as follows:

Post-Project Water Charge Assessment Areas (thousand ha)

Crop Type	Monsoon (Kharif) Season			Post-Monsoon (Rabi) Season		
	M & M[a/]	M. I[b/].	Project	M & M	M. I.	Project
First Wet Crop	1,381	540				
Second Wet Crop				346	86	
First Dry Crop	154	60	318			
Second Dry Crop				38	10	159
Total Area	1,535	600	318	384	96	159

a/ Major and medium schemes
b/ Minor irrigation

13. **Projected Water Charge Revenue Assessment.** Applying the current water charge rates to the various crop type and scheme category areas totaling 3.092 million ha in the above table, the total water charge assessment could potentially reach about Rs.1.35 billion. This amount would be about

double the actual O&M expenditures of Rs.692 million in FY94/95 and equal to the sector's revenue expenditures of Rs.1.32 billion in that year. It is also 332% higher that the water charge revenue assessment of FY94/95. Achievement of this potential however depends on the water charge collection efficiency. As WUA formation for joint management of major and medium projects is now being implemented as a matter of GOAP policy, it is expected that 40% of the increased water charges would be shared with registered WUAs as an incentive rebate. Thus, there a high likelihood of maintaining a high collection efficiency comparable to that of the early 1990s.

O&M Budget Reform Assumptions

14. **O&M Budget Increase**. Since the net area irrigated continues to decline annually because of the O&M funding deficit, a major rehabilitation effort is required to overcome deferred maintenance and maintain public irrigation at its current level by increasing O&M budgets. Thus a concomitant increase in irrigation O&M expenditures is contemplated to match increase in water revenues. Because the predominant crop grown on existing schemes is rice, it is tentatively assumed for the purposes of this analysis that the O&M allocation would be Rs.494/ha/year. Assuming that staff costs and overhead remain constant at Rs.90/ha, an amount of Rs.304/ha would be available for scheme rehabilitation and normal maintenance.

15. **O&M Burden-Sharing with WUAs**. The proposed revenue sharing arrangement (para. 13) is predicated on the premise that WUAs would be responsible for maintenance of minor canal systems under their jurisdiction. Based on ICADD computations for the SRSP scheme, it would seem that the main canals and headworks comprise about 50% of O&M requirements. Thus, it is tentatively assumed that where WUAs manage minor canals in their jurisdiction, only half of the maintenance budget would be required by ICADD for the main network, while WUA O&M expenses would be provided by WUA members in cash and kind.

Project Cost Recovery Potential

16. **Project Rent**. For the assessment of the project's farmers ability to pay the increased water charge, the Project Rent[3] has been estimated (Table 2). A key assumption with respect to water charges is that due to the introduction of rotational water supply, farmers would be charged dry crop water rates of Rs.247/ha even if they cultivate rice as they would have to provide supplementary water supply from their private wells. Other assumptions about implicit management fees and production risk equivalents are given in Table 2. On the basis of the incremental water charges and estimated average farm budgets under the "future without project" and "with project" scenarios, the Project Rent for an average project farm would be substantial: it could vary from about Rs.9,807/ha to Rs.15,290/ha in SRSP's above and below LMD areas respectively and attain Rs.23,783/ha in the SRBC area (Table 2).

17. **Unit Capital and O&M Costs**. The unit capital costs of irrigation works, including on-farm development works and physical contingencies but excluding feeder roads, are estimated at Rs.26,920/ha (US$770/ha) and Rs.22,520/ha (US$640/ha) in SRSP's above and below LMD areas respectively, and at Rs.80,000/ha (US$2,285/ha) in SRBC. The present value of the above capital costs, discounted at 12% over 30 years, are Rs.21,781/ha and Rs.18,215/ha respectively above and below LMD in SRSP, and Rs.65,554/ha for SRBC. Assuming that GOAP will increase O&M budgets to the

---

[3] Project Rent is defined here as the incremental unit net benefit due to the project after deduction of appropriate allowances for management and risk.

highest seasonal level of the new water charge (para.14), annual O&M costs (including staff and overhead) are estimated at Rs.494 per ha for both sub-projects. While this amount may be too high in the initial years after construction, it has been assumed that the O&M allocation will equal that of the sector as a whole within a few years. Since Rs.180/ha is currently spent in the above LMD area of SRSP, the incremental O&M expenditure would be Rs.314 per ha. The present value of incremental O&M costs is estimated at Rs.2,114/ha for SRSP's above LMD command and Rs.2,793/ha for the SRBC and below LMD commands.

18. **Cost and Rent Recovery Indices.** For the assessment of the water charge as a revenue generation mechanism for cost recovery for project costs, the project cost and rent recovery indices[4] were computed. Since the project's incremental output would generate incremental agricultural sales taxes, these were included in the computation as an indirect source of cost recovery. For the project areas, the present and future estimated level of agricultural sale tax revenues per ha of net CCA are estimated[5] as follows:

Agricultural Sale Tax Revenue Estimates (Rs. per ha)

Present Sales Tax Revenue			Project Sales Tax Revenue		
SRBC	Above LMD	Below LMD	SRBC	Above LMD	Below LMD
369	553	430	2,319	1,266	1,432

19. The project cost recovery indices in terms of O&M costs and overall project costs are 285% and 19% respectively (Table 3) when indirect cost recovery through incremental agricultural sales taxes are considered. In terms of water charges and O&M costs only, the cost recovery index is 66% as a uniform dry crop water charge of Rs.247/ha/season is used. Thus O&M costs may only be fully recovered when all incremental revenue such as sales taxes are considered; however sales taxes are not adequate to recover capital costs during the projects economic life of 30 years. Given the reliance of GOAP on indirect taxation, the effective rate of cost recovery is probably understated as increased agricultural income would generate growth in other sectors of the economy and thus additional tax revenue.

20. Whereas project rent constitutes about 91% of the present value of incremental project net income, the rent recovery index is only 10% (i.e. only 10% of the project rent is recovered through water charges and agricultural sales taxes). The rent recovery index on water charges is only about 8%. The latter rent recovery index indicates that, if the project net benefits would materialize, there could be scope to increase cost recovery further if necessary by raising water charges.

---

4 The Cost Recovery Index is the percentage ratio between unit cost recovery revenues (the incremental water charge and agricultural sales tax revenues) and incremental unit irrigation capital and O&M costs. The Rent Recovery Index is the percentage ratio between the incremental unit tax and water charge revenues and the Project Rent. All amounts are expressed in present values discounted at 12% over 30 years in constant 1995 prices.

5 Assuming one third of cereal and legumes and all cash crops would be marketed and that the incremental revenue would be entirely due to the investment in the project.

C. Financial Sustainability Assessment

Project Debt Service and Revenue Expenditure Impact

21. **Impact on State Finances.** In line with the India CAS, the incremental fiscal impact of the proposed project was analyzed in view of its significant impact on state finances. Excluding past project expenditures in FY94/95 and FY95/96 which amounted to 25% and 20% of the sector capital expenditures respectively, the proposed project as a whole would incur average annual expenditures[6] of Rs.2.86 billion of which GOAP's annual average counterpart contribution would be Rs.1.13 billion (Table 1). In terms of debt service obligations to GOI, standard on-lending conditions for the project would entail an average annual debt service of about Rs.0.801 billion in addition to the current state debt service of about Rs.19.26 billion. Assuming that state capital expenditure can be maintained at its FY95/96 level of Rs.16 billion, the project would require an increment of about 18% in state capital expenditure, and raise state annual debt service by about 4.2% (Table 1). Hence, given the state fiscal stress, the increased water charges and the incremental agricultural sales taxes generated by the project play a vital role in offsetting project debt service and ensuring revenue for a sustainable O&M budget.

22. **Impact on Sector Finances.** Assuming that, with fiscal reform to reduce the state's current fiscal deficit, GOAP could maintain its FY95/96 level of irrigation capital expenditure of Rs.6.83 billion, the project's annual capital outlay would comprise about 42% of irrigation capital expenditures during the project implementation period. Thus if the sector capital budget is not increased, expenditure on other ongoing projects may have to be reduced. In terms of debt service obligations to GOI, standard on-lending conditions for the project would increase the current sector average annual debt service amount of Rs.7.22 billion by about 11% to Rs.8.02 billion. Assuming that, with fiscal reform, the total sector revenue expenditure can be maintained at its FY95/96 level of Rs.8.54 billion, the project's annual debt service would comprise about 9.4% of total sector revenue expenditure. Thus the increased water charge and indirect cost recovery through incremental agricultural sales tax revenues generated by the project are essential to maintaining the irrigation sector's fiscal status quo.

23. Annual revenue costs for project O&M after withdrawal of Bank support are estimated to amount to Rs.157.1 million if the full O&M burden remains with GOAP, or Rs.94 million if ICADD only bears 60% and the remainder is provided by WUAs[7]. Thus if sector revenue expenditure remains at its FY95/96 level of Rs.1.32 billion, project O&M costs would comprise about 12% and 7% sector revenue expenditure without and with WUA burden sharing respectively. The role of a high water charge collection rate to offset the increased revenue expenditures for project O&M is crucial if the project is to be physically sustainable.

24. **Revenue Generation Deficit.** Under the revised water charge structure, the project could generate a water charge assessment of Rs.117.8 million and potential agricultural sales tax revenues of about Rs.485.6 million. However, the total annual potential revenue of Rs.603.4 million would not be adequate to cover the total annual expenditure of Rs.958.1 million consisting of an O&M requirement of Rs.157.1 million and annual average debt service of Rs.801 million. The deficit of Rs.354.7 million

---

6 Actual annual expenditures are estimated to range from Rs.1.74 billion in FY96/97 to Rs.4.49 billion in FY98/99 and fall to Rs.1.72 billion in FY2001/2002.

7 Based on a command area of 318,000 ha for both sub-projects and an estimated O&M budget of Rs.494/ha. If revenue sharing is instituted whereby 40% of the water charge is returned to WUAs, it is assumed that GOAP will only budget Rs.296/ha for O&M.

would have to be covered from general revenues such as agricultural sales taxes from the agricultural production of other irrigation projects whose potential annual sales tax revenue is estimated at Rs.1,101 million (Table 5). If existing project sales tax revenues are regarded as of means of offsetting the annual average sector debt burden of Rs.7,218 million, the project revenue deficit would reduce their debt service contribution by about 32%. This deficit actually depends on water charge and sales tax collection efficiency and could be larger. These deficits would have to be made up by increased revenue generated by other fiscal reforms.

Required Revenue Collection Efficiency

25. **Breakeven Collection Efficiency Without WUAs**. An analysis was made of the water charge collection efficiency required to cover sectoral O&M costs and the project debt service burden assuming that ICADD remains responsible for all O&M works and that no revenue sharing is introduced. This assumes that there is no statewide management transfer to WUAs who would assume part of the O&M expenditure burden in return for revenue sharing rebates on water charges. Under this scenario (Table 4): (a) required sector O&M expenditure at Rs.494/ha would be Rs.1.21 billion; (b) sectoral debt service would increase by Rs.0.80 billion due to the project (para. 21); and (c) potential water charge assessment for all public irrigation would be Rs.1.35 billion (para.13). Accordingly, sectoral O&M costs and incremental project debt service total Rs.2.01 billion. Thus, a water charge collection efficiency of 90% would be required to recover 100% of estimated sectoral O&M costs, or 60% of the sectoral O&M and project average annual debt service (Table 4).

26. Estimated agricultural sales tax revenue generated on existing irrigation schemes (Rs.1.10 billion/year) and the incremental sales tax generated by the project (Rs.0.49 billion/year) would total Rs.1.59 billion per annum (Table 5). Considering both total agricultural sales tax revenue and water charge revenues implies that estimated sector O&M costs would still be fully covered if agricultural sales tax and water charge collection efficiencies drop to 75% respectively (Table 5). However, sector water charges and incremental sales taxes generated by the project are not able to recover the sectoral O&M costs and project debt service: There is a 9% shortfall at 100% collection efficiency to a 32% shortfall at 75% collection efficiency. The amount required for break-even would require a contribution of sales tax revenue generated by other irrigation schemes. The percentage required of sales tax revenue generated by existing schemes varies from 16% at 100% collection efficiency to 77% at 75% collection efficiency (Table 5).

27. **Breakeven Collection Efficiency with Revenue Sharing and WUAs**. An analysis has also been made of the fiscal sustainability of the sector on the assumption that revenue sharing in the form of a rebate on the increased water charge would serve as an incentive for statewide establishment of WUAs in line with GOAP policy. The proposed revenue sharing arrangement between ICADD/GOAP, local government (Gram Panchayats) and WUAs would be in the ratio of 50:10:40 and result in a water charge revenue assessment of Rs.606 million. It is also tentatively assumed that the ICADD O&M budget allocation would be reduced from Rs.494/ha to Rs.247/ha and result in an O&M budget totaling Rs.606 million for existing schemes and the proposed project. Under this scenario (Table 6), whereas water charge revenue would cover O&M expenditure at a collection efficiency of 90%, only 43% of state O&M expenditure and project debt service totaling Rs.1.41 billion would be recovered by water charge revenue alone. If indirect cost recovery via the project's incremental agricultural sale revenue is added, recovery of sector O&M costs and project debt service drops from as high as 82% at 100% collection efficiency to 625 at a 75% collection efficiency. The requisite percentage contribution of agricultural sales taxes generated by other irrigation schemes needed to cover the deficit varies from 2% at 100% collection efficiency to about 65% at a 75% collection efficiency (Table 6).

Overall Project Fiscal Viability Assessment

28. The analysis indicates that the significant fiscal burden of the project may be easily offset provided efforts are made to maintain a revised water charge and agricultural sales tax collection efficiency of at least 75%. Sustainability in terms of recovery of sector O&M costs could be assured even if collection efficiency were to fall to 50%. Joint management of irrigation schemes by establishment of WUAs would significantly reduce the O&M burden expenditure burden albeit that a significant rebate of water charges is contemplated: the rebate would be used by WUAs towards the O&M costs of the network under their control. These rebates are indirectly offset by agricultural sales taxes which indirectly contribute to recovery of project debt. The project design has considered fiscal risks by requiring the establishment of a Water Charge Review Committee which would periodically review water charge assessment and collection and advise government of the adjustments required to maintain the financial viability of the sector.

INDIA
Third Andhra Pradesh Irrigation Project
Table 1: Fiscal Impact on State and Irrigation Sector Expenditure

	Rs. Million
State Total Expenditures (FY95/96)[1/]	137,259
- Capital Expenditures	16,000
- Revenue Expenditures	102,000
- Debt Service	19,259
Irrigation Sector Total Expenditures (FY95/96)[1/]	15,368
- Capital Expenditures	6,830
As % of State Capital Expenditures	42.7%
- Revenue Expenditures (staff salaries, O&M and overhead)	1,320
- Debt Service	7,218
As % of State Debt Service	37.5%
- Total Revenue Expenditure (revenue/O&M and debt service)	8,538
Debt Service as % of Total Revenue Expenditure	84.5%
Project Average Annual Capital Costs	2,860
As % of State Capital Expenditures	17.9%
As % of Sector Capital Expenditures	41.9%
Project Average Annual Revenue Costs After Completion[3/]	157
As % of Sector Revenue Expenditures	11.9%
Project Average Annual Debt Service[4/]	801
As % of Sector Debt Service Expenditures	11.1%
As % of Total State Debt Service	4.2%

1/ Revised FY95/96 budget estimates from *Policy Agenda for AP for Faster and Sustainable Economic Growth and Social Development*, World Bank, July, 1996.

2/ Total project costs are estimated at Rs.17,159 million, excluding FY95/96 expenditures of Rs 1,738 million which were already included in FY 95/96 capital expenditures.

3/ O&M expenditures based on command area of 318,000 ha and the estimated O&M costs of Rs. 494/ha.

4/ Average annual debt service over 25 years based on total IDA credit/IBRD loan of US$325 million on-lent to GOAP at GOI's standard financing terms and condition (30% grant and 70% loan). Half of the loan is repayable at the interest rate of 13% per year over 10 years without grace period, while the other half of the loan is repayable at the interest rate of 13% per year over 20 years, after a grace period of 5 years.

INDIA
Andhra Pradesh Irrigation III Project
Table 2: Estimated Average Farm Budgets and Project Rent at Full Development (Rs./farm)

	SRBC (1.8 Ha)		SRSP (1.1 Ha)			
Farm Budgets:			Above LMD		Below LMD	
	FWOP	FWP	FWOP	FWP	FWOP	FWP
Gross Value of Production	20,380	82,525	22,105	39,960	16,340	44,155
Total Labor Costs	3,200	4,880	5,830	8,280	3,740	8,080
Other Inputs	5,335	18,245	7,660	12,265	5,095	12,230
Water Charges[1/ 2/]	0	720	270	410	0	370
Total Production Costs	8,535	23,845	13,760	20,955	8,835	20,680
Net Value of production	11,845	58,680	8,345	19,005	7,505	23,475
Reward to Family Labor	1,600	2,440	2,915	4,140	1,870	4,040
Net Farm Family Incomes	13,445	61,120	11,260	23,145	9.375	27,515
Project Rent						
Net Return to Farm	13,445	61,840	11,530	23,555	9,375	27,885
Water Charges[1/ 2/]	0	720	270	410	0	370
Management Fee[3/]	1,345	6,184	1,153	2,356	938	2,789
Risk Equivalent[4/]	2,038	2,063	1,105	999	1,634	1,104
Implicit Land Rent	10,062	52,873	9,002	19,790	6,803	23,622
Project Rent (Rs/ha)[5/]		23,783		9,807		15,290

1/ At above LMD in SRSP, in the future without project (FWOP) scenario, average water charges are estimated at Rs.244/ha/year based on the proposed water charge of Rs.494/ha/season for the irrigated first wet crop on about 35% of total cropped areas in kharif season, and Rs.371/ha/season for the irrigated second wet crop on about 35% of the cultivated area in rabi season. About 65% of cultivated areas in both kharif and rabi seasons are either rainfed or irrigated by well irrigation.

2/ Based on cropping intensities of 152 % in above LMD, 149% in below LMD, and 162% in SRBC, and a uniform water charge of Rs 247/ha/season for the irrigation on land de-localized for ID crops.

3/ Assuming 10% of net return to farms.

4/ Assuming 10% of gross value of production without irrigation in SRBC and SRSP's below LMD command, 5% in poorly irrigated areas in SRSP's above LMD command, and 2.5% under the project with irrigation.

5/ Project rent is the incremental rent due to the project.

INDIA
Third Andhra Pradesh Irrigation Project
Table 3: Estimated Project Rent and Cost Recovery[1/] (Rs./Ha)

	SRBC	SRSP		Total Project
		Above LMD	Below LMD	
Gross Value of Production	163,140	88,988	120,517	372,645
Production Costs[2/]	52,592	34,172	49,732	136,496
Net Incomes	110,548	54,816	70,785	236,149
Management Fee & Risk	11,283	4,853	5,619	21,755
Project Rent	99,265	49,963	65,166	214,394
Project Rent as % of Net Incomes	90%	91%	92%	91%
Cost Recovery:				
Direct:				
Water Charge	2,261	741	2,080	5,082
Indirect:				
Agricultural Sales Tax[3/]	8,975	3,484	4,442	16,901
Total Cost Recovery	11,236	4,225	6,522	21,983
Total Cost Recovery as % of Project Rent	11.3%	8.5%	10.0%	10.3%
Average Irrigation Civil Work Costs:				
Capital Costs	65,554	21,781	18,215	105,550
O&M Costs	2,793	2,114	2,793	7,700
Total Costs	68,347	23,895	21,008	113,250
Total Cost Recovery as % of Total Cost	16.4%	17.7%	31.0%	19.4%
Total Cost Recovery as % of O&M Costs	402%	200%	234%	285%
Water Charge as % of O%M Cost	81%	35%[4/]	75%	66%

1/ Expressed in 1995 constant prices and incremental present value discounted at 12% over 30 years.

2/ Including costs of labor.

3/ At 4% of the assumed marketable surplus of 1/3 of cereals and pulses and 100% of cash crops (oilseeds, sugarcane, cotton, vegetables, etc.).

4/ This ratio is low because this is an existing command and only incremental costs and charges are considered.

INDIA
Third Andhra Pradesh Irrigation Project
Table 4: Revenue Collection Efficiency Analysis
Scenario 1-Without Agricultural Sales Tax Revenues

	Rs. Million
Revenue Expenditures	
Estimated Annual O&M Costs[1/]	1,212
Sector Annual Debt Service	7,218
Project Average Annual Debt Service	801
Total Sector Annual O&M Costs and AP III Annual Debt Service	2,013
Total Sector Annual O&M Costs and Total Annual Debt Service	9,231
Water Charge Revenues	
Potential Water Charge Revenue	1,350
Average Effective Water Charge (Rs/ha/season)[2/]	437
Estimated Gross Production Value of Paddy (Rs/ha)	20,000
Average Water Charge as % of Gross Production Value of Paddy	2.2%

Water Charge Collection Effectiveness

Collection Efficiency	100%	90%	80%	75%
Estimated Total Annual Water Charge Revenues[4/]	1,350	1,215	1,080	1,013
As % of Annual Sector O&M Costs Only	111%	100%	89%	84%
As % of Annual Sector O&M Costs + Project Annual Debt Service	67%	60%	54%	50%

1/ Based on total command area of 2.453 million ha (existing net irrigated area of 2.300 ha million plus newly developed command area of 88,000 ha below LMD in SRSP and 65,000 ha in SRBC) and O&M budget of Rs.494/ha.

2/ Based on application of water charge to a gross irrigated area of 3.092 million ha as described in paragraph YY.

3/ Computed by dividing estimated potential water charge revenue of Rs.1,350 million by 3.092 million ha.

4/ Reduction of potential water charge revenue by collection efficiency

INDIA
Third Andhra Pradesh Irrigation Project
Table 5: Revenue Collection Efficiency Analysis
Scenario 2- With Agricultural Sales Tax Revenues

	Rs. Million
Revenue Expenditures	
Estimated Annual O&M Costs	1,212
Sector Annual Debt Service	7,218
Project Average Annual Debt Service	801
Total Sector Annual O&M Costs and AP III Annual Debt Service	2,013
Total Sector Annual O&M Costs and Total Annual Debt Service	9,231
Irrigation Revenues and Cost Recovery	
Potential Annual Water Charge Revenue	1,350
Potential Annual Agricultural Sales Tax Revenue[1/]	1,587
- of which :Sales Tax Generated by the Project	485
- of which: Sales tax Generated by Existing Schemes	1,102
Total Annual Water Charge and Sales Tax Revenue	2,937

Revenue Collection Effectiveness Collection Efficiency (%)	100	90	80	75
Estimated Total Annual Water Charge Revenues	1,350	1,215	1,080	1,013
Estimated Project Annual Agric. Sale Tax Revenues	485	417	388	364
Total Annual Revenues Generated by the Project	1,835	1,632	1,468	1,377
As % of Annual Sector O&M Costs Only	151%	135%	121%	114%
As % of Annual Sector O&M Costs + Project Annual Debt Service	91%	81%	73%	68%
Revenue Deficit for Coverage of Sector O&M and Project Debt Service	178	381	545	636
Estimated Agricultural Sales Revenue from Existing Schemes[1/]	1,102	992	882	827
Percentage of Existing Scheme Sales Tax Revenue Needed to Cover Sector O&M and Project Debt Service Deficit	16%	38%	62%	77%

1/ Agricultural sale tax of 4% on the assumed marketable surplus of 1/3 of cereals and pulses and 100% of cash crops. The average agricultural sale taxes are estimated at: (a) Rs.516/ha/year for 2.135 million ha of existing schemes; and (b) Rs.1,266/ha/year from 165,000 ha and Rs.1,432/ha/year from 88,000 ha in the above and below LMD commands of SRSP, and Rs.2,319/ha/year from 65,000 ha in SRBC .

INDIA
Third Andhra Pradesh Irrigation Project
Table 6: Revenue Collection Efficiency Analysis
Scenario 3-With Cost & Revenue Sharing and Without Agricultural Sales Tax Revenues

	Rs. Million
Revenue Expenditures	
Estimated Annual O&M Costs[1/]	606
Sector Annual Debt Service	7,218
Project Average Annual Debt Service	801
Total Sector Annual O&M Costs and AP III Annual Debt Service	1,407
Total Sector Annual O&M Costs and Total Annual Debt Service	8,625
Water Charge Revenues	
Potential Water Charge Revenue	675
Average Effective Water Charge (Rs/ha/season)[2/]	262
Estimated Gross Production Value of Paddy (Rs/ha)	20,000
Average Water Charge as % of Gross Production Value of Paddy	1.3%

Revenue Collection Effectiveness

Collection Efficiency	100%	90%	80%	75%
Estimated Total Annual Water Charge Revenues[4/]	675	608	540	506
As % of Annual Sector O&M Costs Only	111%	100%	89%	83%
As % of Annual Sector O&M Costs + Project Annual Debt Service	48%	43%	38%	36%

1/ Assuming 50% of O&M costs would be borne by ICADD, and the remaining 50% of O&M costs by WUAs and Gram Panchayats.

2/ Water charge revenues have been calculated based on GOAP's proposed revenue sharing arrangements of 60% to GOAP and 40% to WUAs. Water charge revenues to ICADD have been calculated as 60% of the average water charge of Rs.436/ha/season (Table 2).

INDIA
Third Andhra Pradesh Irrigation Project
Table 7: Revenue Collection Efficiency Analysis
Scenario 4 - Cost and Revenue Sharing with Agricultural Sales Tax Revenues[1/]

	Rs. Million
Revenue Expenditures	
Estimated Annual O&M Costs	606
Sector Annual Debt Service	7,218
Project Average Annual Debt Service	801
Total Sector Annual O&M Costs and AP III Annual Debt Service	1,407
Total Sector Annual O&M Costs and Total Annual Debt Service	8,625
Irrigation Revenues and Cost Recovery	
Potential Annual Water Charge Revenue	675
Potential Annual Agricultural Sales Tax Revenue[1/]	1,587
- of which :Sales Tax Generated by the Project	485
- of which: Sales tax Generated by Existing Schemes	1,102
Total Annual Water Charge and Sales Tax Revenue	2,937

Revenue Collection Effectiveness Collection Efficiency	100%	90%	80%	75%
Estimated Total Annual Water Charge Revenues	675	608	540	506
Estimated Project Annual Agricultural Sale Tax Revenues	485	417	388	364
Total Annual Revenues Generated by the Project	1,160	1,045	928	870
As % of Annual Sector O&M Costs Only	191%	172%	153%	144%
As % of Annual Sector O&M Costs + Project Annual Debt Service	82%	74%	66%	62%
Revenue Deficit for Coverage of Sector O&M and Project Debt Service	247	362	479	537
Estimated Agricultural Sales Revenue from Existing Schemes	1,102	992	882	827
Percentage of Existing Scheme Sales Tax Revenue Needed to Cover Sector O&M and Project Debt Service Deficit	22%	37%	54%	65%

1/ All assumptions and data as in Table 4 except that agricultural sales tax revenues are included.

Annex 12

IMPLEMENTATION MONITORING

Table of Contents

THIRD ANDHRA PRADESH IRRIGATION PROJECT

Project Performance Monitoring Indicators

Project Development Objectives	Outcome/Impact Indicators
1. Increased Agricultural Productivity and Rural Incomes in Sub-Project Districts	1.1 Sub-Project Crop Production: Comparison of Initial Baseline Survey to Final Project Year Survey 1.2 Increase of Sample Farm Net Incomes: Comparison of Baseline to Final Project Year Surveys
2. Improved Irrigation Management in Sub-Project Command Areas.	
2.1 Increase Beneficiary Participation and Participatory Irrigation Management	2.1.1 Total Minor Canal Service Areas and Main Canal System Direct Outlets under Autonomous and Self Sufficient WUA Management 2.1.2 Ratio of Water Charge Revenue Collected to Water Charge Assessment > 0.90
2.2 Improved Irrigation Service	2.2.1 Ratio of Project Cropping Intensity to Pre-Project Cropping Intensity $\geq$ 1.10 in SRBC and >1.47 in SRSP 2.2.2 Ratio of Actual Net Area Irrigated to Net Command Area Developed or Rehabilitated > 0.90
2.3 Improved CADA Management in SRSP	2.3.1 CADA Fully Responsible for Main System O&M 2.3.2 WUAs Represented on the CADA Board
3. Mitigate Adverse Social Impacts of Land Acquisition for Irrigation Works	3.3.1 All of about 3,649 PAPs and their 3,031 major Children Enjoying Increased Income/Living Standard due to the R&R Component's Impact 3.3.2 Completion of Community Infrastructure Program for AP II Project Resettlement Villages
4. Ensure the Safety and Sustainability of Three Project Water Supply Reservoirs	4.1 (a) Srisailam Dam Spillway Capacity Increased and the Hazard of its Stilling Basin Failure Eliminated; and (b) All Six Sriramasagar Dam River Sluice Gates Repaired and Operational 4.2 Dam Safety Assurance Program Completed for Three Dams

Project Development Objectives	Outcome/Impact Indicators
5. Implement a GOI Mandated Regional Program of Environmental Safeguards and Nature Conservation	5.1 Completion of Eco-Restoration Program to Conserve Forest and Wildlife Resources by: (a) Improving and Protecting Six Forest Reserve Areas and the Pakhal Wildlife and Rollapadu Bird Sanctuaries; (b) Improving Public Environmental Awareness by Building Two Environmental Education Centers; and (c) Establishing an LMD Bird Sanctuary 5.2 Compensatory Afforestation Completed. 5.3 Completion of Catchment Area Treatment Programs to Mitigate Sedimentation of the Owk, Srisailam, Lower Mannair and Sriramasagar Reservoirs 5.4 Completion of Environmental Health Programs for the Sub-Project Areas 5.8 Agro-Forestry Program Completed 5.6 Construction Site Restoration Completed 5.7 Lower Mannair Dam Fish Farm Completed
6. Improve ICADD Monitoring & Evaluation Capability for Large Projects	6.1 ICADD Project Preparation & Monitoring Unit Fully Operational in project Monitoring & Evaluation

Project Component Outputs	Output Progress Indicators
1. Command Area Development Works	
1.1 *SRBC*: Completion of Irrigation Network for 65,000 ha and construction of about 50 km of Feeder Roads	1.1.1 Percentage of SRBC Command Area Construction Target Completed (inclusive of micro-network). 1.1.2 Percentage of Feeder Road Target Completed
1.2 *SRSP*: (a)Rehabilitation of 165,000 ha above LMD and 88,000 ha below LMD; and (b) construction of about 50 km of Feeder Roads	1.2.1 Percentage of SRSP Rehabilitation Works and Roads Completed Above LMD and Below LMD
2. Agricultural Support Service Programs	
2.1 *Irrigation Agronomy Program*	
2.1.1 Completion of Applied Research on 6 Demonstration Plots in SRSP (240 ha) and 3 Demonstration Plots in SRBC (120 ha)	2.1.1.1 Number of Plots Established and Issue of Annual Applied Research Progress Report
2.1.2 Improved Extension Services	2.1.2.1 Semi-Annual Report on Extension with Data on Extension Officer Performance as per Extension Performance Parameters (Annex 12)

Project Component Outputs	Project Output Progress Indicators
2.2 *WUA Promotion Program*	
2.2.1 Establishment of WUAs Throughout SRSP and SRBC	2.2.1.1 Percentage of SRSP and SRBC Tertiary Canal Commands Under WUA Management
2.2.2 Establishment of Distributary Committees Represented on SRSP CADA Board	2.2.2.1 Number of Distributary Committees Formed and Represented on SRSP CADA Board
2.3 *Farmer Training Program*	
2.3.1 Completion of 24 Basic and Refresher Courses for 360 Extension Staff	2.3.1.1 Number of Courses Completed and Staff Trained
2.3.2 Completion of 48 WUA courses for 1,440 ICADD staff, 960 courses for 28,800 WUA members.	2.3.2.1 Number of Courses Completed, and Number of GOAP Staff and WUA Members Trained
3. Resettlement & Rehabilitation Program	
3.1 *SRSP and SRBC R&R Action Plans:* Total of: (a) 3,469 PAPs and 3,031 Major Children benefit from Productive Assets Grant (PAG) of which 1,208 PAPs Receive Supplement of Rs.5,000 and 457 Landless PAPs Receive Supplement of Rs.8,000; (b) 3,469 PAPs Receive Vocational Training and Various Allowances; (c) 5,063 Women Receive Women's Thrift Group Grant; (d) Land Replenishment for 49 Scheduled Tribe PAPs; and Housing Grant for 235 Displaced PAPs	3.1.1 Percentage of Each PAP Category Receiving R&R Entitlements for Purchase of Income Generating Schemes and House Construction as per SRSP and SRBC Action Plans
3.2 *AP II Project R&R Retrofit Action Plan:* (a) Completion of Balance Works, New and Improved Community Facilities in 104 Villages Including: 71 km of Roads; 53 Schools, 186 km of Potable Water Pipe, 23 Medical & Veterinary Facilities, Electrification and Community Buildings; (b) 2,231 Free House Plots for Homeless Families; and (c) 778 LMD Oustee Families Receive Income Generating Schemes.	3.2.1 Percentage of Community Facilities in Each Category Completed; Percentage of House Plots and Income Generating Schemes Provided.

Project Component Outputs	Project Output Progress Indicators
4. Dam Safety Works and Assurance	
4.1 Srisailam Dam Spillway Protection Works Completed	4.1.1 Percentage Physical Completion of Works
4.2 Issue of Sriramasagar Dam River Sluices Resolved and Solution Implemented	4.2.1 Studies Completed and Percentage Completion of Works
4.3 Dam Sustainability Assurance Program for Three Dams Completed Including: (a) All Studies and Investigations; (b) Structural Deformation Uplift Pressure Monitoring Instrumentation; and (c) Internal Drainage and Inspection Gallery Ventilation Improvements.	4.3.1 Percentage Completion of Dam Safety Assurance Program Sub-Components.
5. Environmental Management Plan	
5.1 Completion of 1,910 ha of Compensatory Afforestation	5.1.1 Percentage of Compensatory Afforestation Completed
5.2 Eco-Restoration Program Completed Including: (a) Afforestation of 2,100 ha of Degraded Areas in Reserve Forests and 140 ha of Nutritive Fodder Plots; (b) 275 km of Canal Bank Plantation; (c) Construction of Three Environmental Education Centers; (d) Establishment of LMD Bird Sanctuary; and (e) Two Environmental Monitoring Units Operational.	5.2.1 Percentage of Eco-Restoration Sub-Component Targets Completed
5.3 Completion of Afforestation of 55,102 ha Under the Catchment Treatment Program	5.3.1 Percentage of Catchment Treatment Program Target Completed
5.4 Distribution of 100,000 Teak Stumps, 20,000 Fruit Seedlings and Establishment of 2 Mobile Extension Units Under the Agro-Forestry Extension Program in SRSP	5.4.1 Percentage of Agro-Forestry Target Completed
5.5 Completion of SRBC Environmental Health Program Including Immunization of 13,600 Children	5.5.1 Percentage of Program Completed
5.6 Groundwater Monitoring Program Operational in SRBC and SRSP	5.6.1 Percentage of Program Completed
5.7 Establishment of LMD Fish Farm	

Project Component Outputs	Project Output Progress Indicators
6. Project Preparation and Monitoring Unit	
6.1 PPMU Produces All Project Reports	6.1.1 PPMU Produces 5 Semi-Annual Reports, 5 Annual Action Plan Reports and 1 Mid-Term Review Report
6.2 PPMU Maintains Project Accounts By Component and Expenditure Category in Accordance with Bank/IDA Requirements and Agreed Formats	6.2.1 Maintenance of Project Accounts Satisfactory

Key Project Component Inputs	Key Input Implementation Indicators
1. Command Area Development Works	
1.1 Civil Works Contracts: 32 for SRBC and 23 for SRSP	1.1.1 Physical and Financial Progress of Each Contract
1.2 Expenditure of Rs.210 million Allocated for Emergency SRSP Rehabilitation Works by WUAs During Construction	1.2.1 Percentage of Emergency Works Allocation Spent
1.3. Feeder Road Contracts	1.3.1. Physical and Financial Progress of Each Contract
1.4 Establishment/upgrading of Quality Control Laboratories as per *Action Plan for Quality Control Organization*	1.4.1 Completion of Quality Control Laboratory Program Within 12 Months of Project Start Up
1.5 Construction Quality Assurance Training: 210 Site Engineers Trained in Concrete Technology at NCCB; 320 Site Engineers Trained in 16 Quality Control Courses, and 320 Site Engineers Trained in 16 Contract Management Courses.	1.5.1 Percentage Completion of Quality Control Training Program Components.
1.6 OK Card Contract Management In Place	1.6.1 No. of Contracts With OK Card System Satisfactory
1.7 SRBC and SRSP Organization Engineering Staffing Build-Up as per Staffing Schedules Submitted by GOAP on December 20,1996 (SAR Annex)	1.7.1 Staffing of CE, SEs, EEs, DEEs and AEEs as per Annual Schedules for SRBC and SRSP
2. Agricultural Support Service Programs	
2.1 *Irrigation Agronomy Program*	
2.1.1 Procurement/Installation of Equipment for Research/Demonstration Plots	2.1.1.1 Equipment Installation Progress for 9 Plots for Completion Within First Project Year
2.1.2 Appointment of Incremental Staff and Coordination Committee	2.1.2.2 All Appointments Complete Within 6 Months of Project Start-Up

Key Project Component Inputs	Key Input Implementation Indicators
2.1.3 Appointment of 35 VEOs and 5 AOs for SRSP Extension Program	2.1.3.3 Progress in Appointing 35 VEOs and 5 AOs Within 4 Months of Project Start-Up
2.1.4 Appointment of SRSP and SRBC Extension Program Steering Committees	2.14.1 Extension Steering Committees Appointed Within 6 Months of Project Start-Up
2.2 *WUA Promotion Program*	
2.2.1 Appointment of NGO Social Organizers	2.2.1.1 Progress in NGO Appointment
2.2.2 WUA Training Modules Prepared	2.2.2.1 Percentage Completion of Training Modules
2.2.3 Formation WUAs Includes Areas Served by Direct Outlets from Large Canals	2.2.3.1 Percentage of SRSP Direct Outlets Under WUA Jurisdiction
2.2.4 Minor Canal Gate Operators Placed Under WUA Control	2.2.4.1 Percentage of WUAs Having SRSP CADA Gate Operators Under Their Management Control
2.2.5 Introduction of Rotational Water Supply	2.2.5.1 Percentage of SRSP Command and Completed SRBC Blocks Having Rotational Water Supply
2.2.6 Staffing of SRSP CADA O&M Divisions Including Agricultural Engineers) Built Up as per Staffing Schedule Submitted by GOAP on 20.12.96 (SAR Annex)	2.2.6.1 Staffing of ACEs, SEs, EEs, DDAs, DDEs, and AAEs as per Annual Schedule forSRSP CADA
2.3 *Farmer Training Program*	
2.3.1 Completion of Two New Farmer Training Centers (FTC) in SRSP and one New FTC in SRSP	2.3.1.1 Number of FTCs Completed and Fully Staffed
2.3.2 Appointment of WALAMTARI Director (Training & WUAs) and Director (Field Training) and Their Assistants	2.3.2.1 Directors, EEs and DDAs Appointed Within 6 Months of Project Start Up
2.3.3 Equipment Procured and Course/Training Materials Prepared	2.3.3.1 Percentage of Equipment Procured and Training Materials Available for Use
3. Resettlement and Rehabilitation Program	
3.1 Completion of Village Action Plans for 91 Villages in SRBC and 217 Villages in SRSP	3.1.1 Percentage of Village Action Plans Completed
3.2 R&R Training for: 20 Engineers and R&R Officers; Vocational Training for 3,440 PAPs and 5,063 Women	3.2.1 Percentage of Training Targets Met for Each Category to be Trained

Key Project Component Inputs	Key Input Implementation Indicators
3.3 Design, Procurement and Implementation of Contracts for AP II Retrofit Works	3.3.1 Physical and Financial Progress of All AP II Retrofit Works Contracts
3.4 Appointment of State R&R Committee, District R&R Committees and Village R&R Committees	3.4.1 State and District Committees Operational and Percentage of Village R&R Committees Established
3.5 Staffing of SRBC and SRSP Rehabilitation Units with Asst. Rehab. Officer (ARO), EE, Economist and Programmer Plus Other Staff as per Staffing Schedule Submitted by GOAP on 20.12.96 (SAR Annex 8)	3.5.1 Full Staffing of SCs, EEs, AROs, DEEs, AEEs, AEs, EOs etc. Within 6 Months of Start Up
3.6 Appointment of Monitoring & Evaluation (M&E) Consultants	3.6.1 Appointment of M&E Consultant Within 6 Months of Start Up and Submission of Annual Reports
3.7 Appointment of NGOs	3.7.1 Adequate Number of NGOs Appointed
4. Dam Safety Works and Assurance	
4.1 Appoint Consultants for Srisailam Dam Spillway Repair Studies, Prepare Detailed Designs and Bid Documents and Implement	4.1.1 Progress in Design and Physical and Financial Progress of Works Contracts
4.2 Undertake Studies and Contracts for Repair of Sriramasagar Dam Sluice Gates	4.2.1 Progress of Studies and Works
4.3 Procure and Install Instrumentation and Equipment for Dam Safety Assurance and Complete Dam Safety Studies	4.3.1 Physical and Financial Progress in Contract Completion
4.4 Appoint State Dam Safety Committee and Reappoint Dam Safety Review Panel; and Preparation of Dam Safety Manual for Project Dams by ICADD Dam Safety Cell	4.4.1 State Dam Safety Committee Operational and Progress in Dam Safety Manual Preparation
5. Environmental Management Plan	
5.1 Compensatory Afforestation Tree Nurseries	5.1.1 Percentage of Nurseries Established
5.2 SRSP Agro-Forestry: Appointment of 2 Extension Officers and Establishment of a Mobile Unit	5.2.1 Officers Appointed and Mobile Unit Established

Key Project Component Inputs	Key Input Implementation Indicators
5.3 SRBC Eco-Restoration Program	
5.3.1 Complete Inputs for 1,100 ha of Degraded Area Reclamation in 5 Reserve Forests: Tree Nurseries, Tree Planting, Vegetative Strips and Soil Conservation, (including 100 Percolation Tanks); 20 Fodder Plots and Watering Facilities (Saucer Pits and Check Dams) for Wild Herbivores; 100 Nutritive Plots for Cattle; and 35 km of Canal Bank Tree Plantation	5.3.1.1 Percentage Completion of Each Input Category
5.3.2 Complete 2 Environmental Education Centers (EEC), Improve Rollapudu Bird Sanctuary EEC and Establish Monitoring Unit and 3 Anti-Poaching Units	5.3.2.1 Percentage Completion of Each Input Category
5.4 SRSP Eco-Restoration Program	
5.4.1 Complete Aff. of 1000 ha DAs Including Tree Nurseries, Tree Planting, Vegetative Strips and Soil Conservation; Watering Facilities and Fodder Plots; and 235 km of Canal Bank Plantation	5.4.1.1 Percentage Completion of Each Input Category
5.4.2 Complete LMD Bird Sanctuary Including Surveys, Buildings, Plantation of 50 ha, Staffing and Equipment	5.4.2.1 Percentage Completion of Each Input Category
5.4.3 Complete: (a) LMD Deer Park and EEC; and (b) Establish Environmental Unit	5.4.3.1 Percentage Completion of Park and EEC Along With Staffing of Environmental Monitoring Unit
5.4.4 Complete Improvement of Pakhal Bird Sanctuary Including: Buildings, Watering and Fodder Facilities and Conservation Works; and Eco-Development Program for Four Villages	5.4.4.1 Percentage Completion of All Input Categories
5.5 Complete Catchment Area Treatment: (a) for *Sriramasagar Reservoir* - Afforestation (Aff.) of 1,104 ha Degraded Areas (DAs) & 2,208 ha Reservoir Periphery (RP); (b) *LMD* - Aff. of 21,757 ha DAs & 430 ha RP (Including 808 rockfill and 97 check dams) (c) Srisailam Reservoir - Aff. of 10,195 ha DAs & 4,130 ha RP; and (d) Owk Reservoir - Aff. of 14,940 ha of DAs & 23 ha RP (Including 118 rockfill and 14 check dams	5.5.1 Percentage Completion of Catchment Treatment for Each Reservoir

Key Project Component Inputs	Key Input Implementation Indicators
5.6 Complete LMD Fish Farm Including Water Supply, Nurseries, Breeder Ponds, Hatchery and Seed Hall	5.6.1 Percentage Completion of Facility
6. Project Preparation and Monitoring Unit	
6.1 Appoint of Qualified Accountant to PPMU to Set Up Project Accounts	6.1.1 Project Accounts Satisfactory to the Bank
6.2 Staffing of PPMU as per Staffing Schedule Submitted by GOAP on 20.12.96	6.2.1 Staffing of CE, SEs, EEs, DEEs, AEEs and Others as per Schedule

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 1 (a): **Implementation Schedule - SRSP Above LMD**

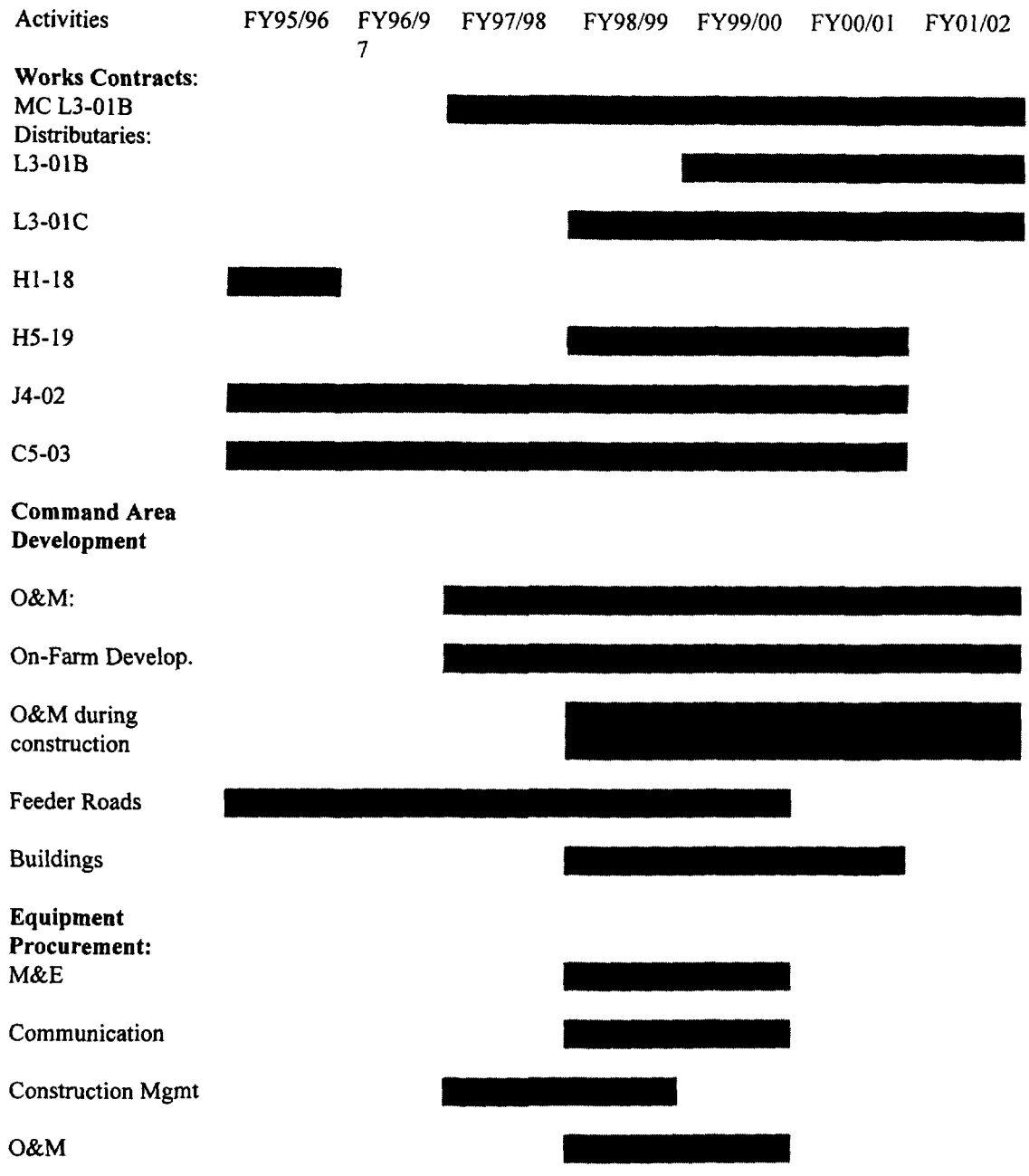
INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 1 (b): **Implementation Schedule - SRSP Above LMD**

Activities	FY95/96	FY96/97	FY97/98	FY98/99	FY99/00	FY00/01	FY01/02
Works Contracts:							
Buildings				[redacted]			
Equipment Procurement:							
Communication				[redacted]			
Construction Mgt			[redacted]				
O&M				[redacted]			
M&E				[redacted]			

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 2: **Implementation Schedule - SRSP Below LMD**

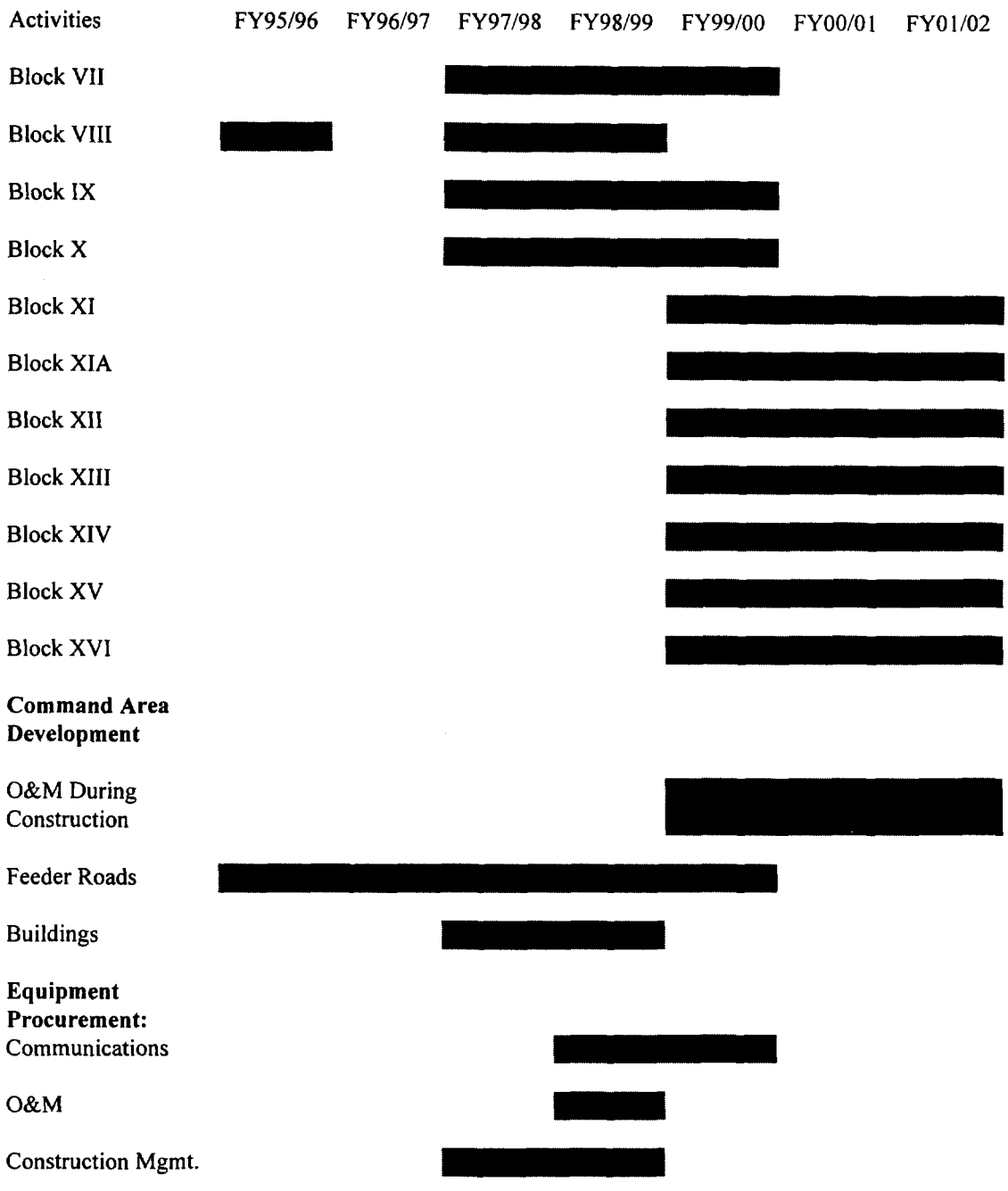


INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 3(a): **Implementation Schedule - SRBC**

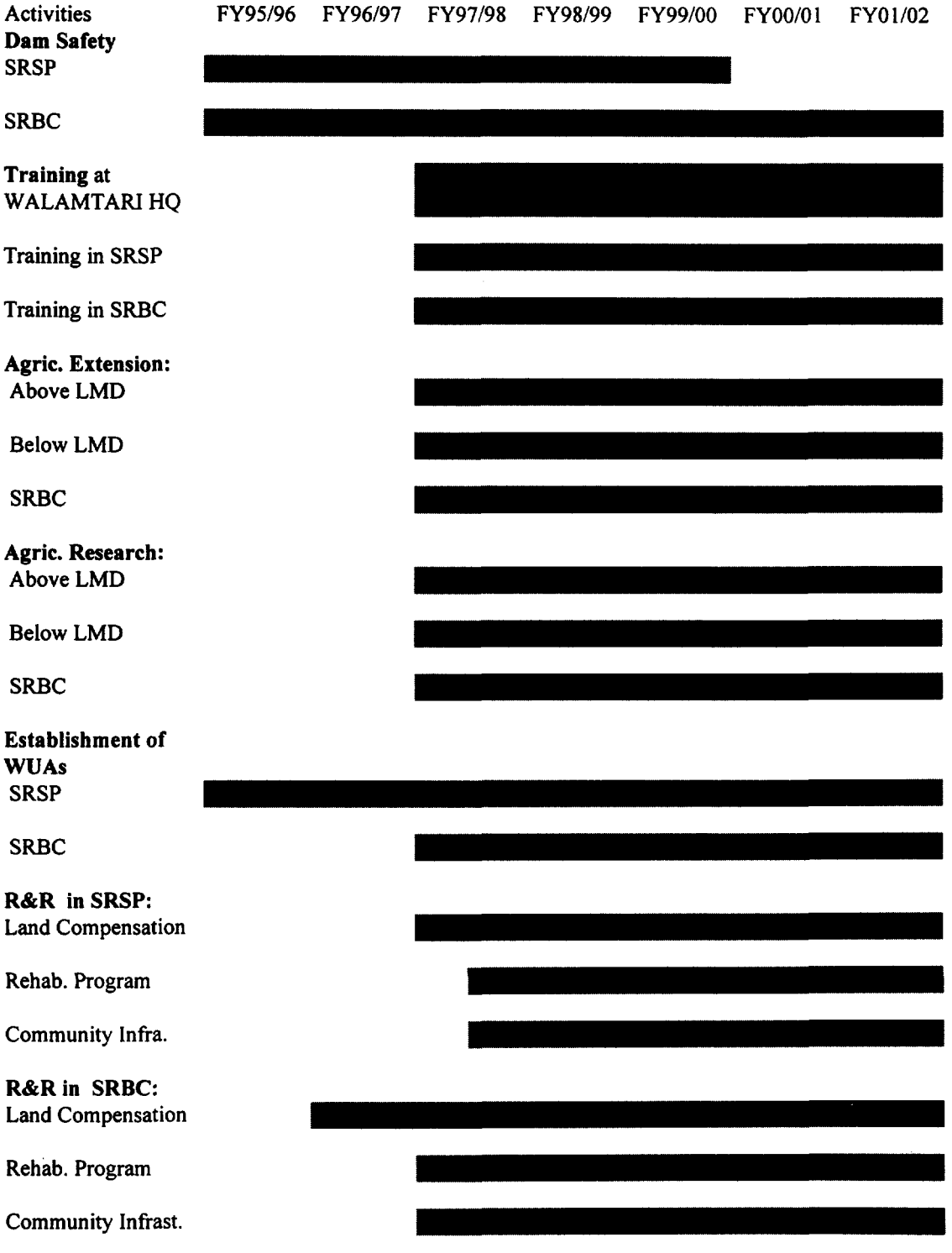
INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 3(b): **Implementation Schedule - SRBC**



INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 4: **Implementation Schedule**



INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Table 5: **Implementation Schedule**

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Bank/IDA Supervision Plan

Timing (Bank FY Semester)	Activity/Theme	Skill Requirements	Total SW Input
Year 1 FY98 I	Project Launch Workshop - Supervision/review arrangements for M&E; accounting, procurement, disbursement, management coordination, staffing, reporting, organizational reforms, training and consultant recruiting. - Fulfillment of Covenants due on October 1, 1997.	Civil Engineer (1.5)[1] Irrigation Engineer (1.5) R&R Expert (1.0) Procurements (0.5) Disbursement (0.5) Forester (1.0) Financial Analyst (1.0) (Accounts) Agriculturist (1.0)	8
FY98 II	Supervision 1 (Main) - Review of Component Inputs and Implementation Progress; - Review of Consultants' Work; - Review of Participatory Irrigation Management Progress; - Review of Water Charge Assessment Data; and - Review of Baseline Survey Progress.	Civil Engineer (2.5) Irrigation Engineer (2.0) Participatory Mgt. (1.5) R&R Expert (1.5) Forester (1.5) Training Expert (1.0) Financial Analyst (1.0) (Public Expenditure)	11
Year 2 FY 99 I	Supervision 1 - Review of Component Inputs and Implementation Progress; - Review of Project Accounts; - Review of R&R Monitoring & Evaluation; - Review of Contract Management and Quality Assurance; and - Review of Dam Safety Studies.	Civil Engineer (2.0) Irrigation Engineer (1.0) R&R Expert (1.0) Participatory Mgt. (1.0) Forester (1.0) Agriculturist (1.0) Financial Analyst (1.0) (Accounts)	8
FY99 II	Supervision 2 (Main) - Review of Component Inputs and Implementation Progress; - Review of PIM Outputs; - Review of Procurement; - Review of Training Outputs; - Assessment of PPMU Performance; - Review of R&R Outputs; and - Review of Micro-Network Design Progress for Completed SRBC Irrigation Blocks.	Civil Engineer (2.0) Irrigation Engineer (2.0) Participatory Mgt. (1.5) R&R Expert (1.5) Procurement (0.5) Agriculturist (1.0) Forester (1.5) Training Expert (1.0)	11

[1] ...Figures in parentheses denote individual team member staff week (SW) input.

Timing (Bank FY Semester)	Activity Theme	Skill Requirements	Total SW Input
FY 2000 I	Supervision 1 (Main) - Review of Component Inputs and Output Indicators; - Mid-Term Reviews; and - Review of Environmental Monitoring.	Civil Engineer (2.0) Irrigation Engineer (2.0) R&R Expert (2.0) Participatory Mgt. (1.0) Forester (1.5) Agriculturalist (1.0) Training Expert (1.0) Financial Analyst (1.0) Unallocated (2.5)	12
FY 2000 II	Supervision 2 - Review of Component Input & Output Indicators;	Civil Engineer (1.0) Irrigation Engineer (1.0) R&R Expert (1.0) Unallocated (3.0)	6
FY 2001 I	Supervision 1 (Main) - Review of Component Input & Output Indicators; - Review of Water Charge Review Committee Findings; - Review of Irrigation Management and O&M monies; - Review of Environment Management Plan; - Review of Irrigation Agronomy Research and Training.	Civil Engineer (2.0) Irrigation Engineer (2.0) Financial Analyst (1.5) Forester (1.5) Environmentalist (1.5) R&R Expert (1.5) Agriculturist (1.5) Training Expert (1.5)	7
FY 2001 II	Supervision 2 - Review of Component Input & Output Indicators	Civil Engineer (1.0) Irrigation Engineer (1.0) R&R Expert (1.0) Participatory Mgt. (1.0) Financial Analyst (0.5) Unallocated (0.5)	5
FY 2002 I	Supervision 1 (Main) - Final Review Review of Component Inputs and Review of Output Indicators; - Initiation of 2nd Baseline Survey.	Civil Engineer (1.5) Irrigation Engineer (1.5) Participatory Mgt. (1.0) Agriculturalist (1.5) Forester (1.5) R&R Expert (1.5) Unallocated (1.5)	10
FY 2002 II	Supervision 2 - Review of Component Output Indicators and Development Objective Indicators; - Review of Baseline Survey; - Review of R&R M&E Results; - Preparation for ICR Mission	Civil Engineer (1.0) Irrigation Engineer (1.0) Participatory Mgt. (1.0) R&R Expert (1.0) Agriculturalist (1.0) Forester (1.0) Economist (1.0)	7

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

PERFORMANCE PARAMETERS FOR PROJECT EXTENSION STAFF

Performance Parameters for an Assistant Director Agriculture (ADA)

* No. of Field visits made in a fortnight
* No. of A.Os supervised
* No. of V.E.Os supervised
* No. of Sadassus organized
* No. of coordination meetings held/attended in a quarter
* No. of Farmers Exchange programs organized
* No. of initial case studies prepared
* No. of anchors activities identified
* Assessment of inputs and arrangements for supply

Performance Parameters for Agricultural Officers (AOs)

* No. of VEOs supervised each fortnight
*No. of field visits made each fortnight
*No. of demonstrations visited
*Evaluation reports of trainings attended
*No. of Farmers Exchange Program proposals made
*No. of farm plans verified

Performance Parameters for Village Extension Offficers (VEOs)

*No. of demonstrations organized
*No. of villages visited
*No. of farmers/farm women contacted
*No. of farmers/farm women enrolled for training

*No. of problems posed as feedback

*No. of farmers brought for sadussus

*Evaluation report of the trainings attended

*No. of farmers enrolled under farmers exchange program

*No. of farm plans prepared

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

Baseline Survey Draft Terms of Reference

1. The objective of a baseline survey are twofold: (a) it should provide the necessary information to assess the current situation before significant project implementation at field level takes place and (b), establish the data base for the project's irrigation development performance indicators required to monitor and evaluate project success prior to its closure and preparation of the Bank Implementation Completion Report (ICR). Based on the assessment of the current situation, the baseline survey would provide simple and low cost performance indicators to monitor project success continuously for all sub-project areas. Performance indicators form part of the performance review of a particular activity to be measured against specified objectives. The baseline survey and the development objective performance indicators is an interdisciplinary product jointly produced by irrigation engineers, agricultural scientists/economists, remote sensing specialists, and water resource managers.

2. The baseline survey also makes use of secondary data sources such as data collected by the Revenue Department, Agriculture Department, Bureau of Economic Statistics, social agencies, etc. Such data would also include, inter alia: land tenure/farm size distribution, number of "Below Poverty Line" families, agricultural sales revenues generated within command area mandals (or other convenient Revenue jurisdiction)

3. The following list gives examples of possible performance indicators for specific project outputs. The necessary information for the indicators should be obtained through the baseline survey in order to assess the current situation and develop an estimate of the value of agricultural production in the sub-project areas. The list is meant as a suggestion of possible indicators. It is neither complete nor do all of the suggested indicators have to be used for the monitoring process.

(a) Engineering indicators for operation performance of existing irrigation:

(i) actual dates of irrigation versus planned dates of irrigation;

(ii) variations in the flow at main canal and distributary heads as a ratio of their planned discharges;

(iii) variations in the flow at minor canals and their tail clusters as a ratio of their planned discharges; and

(iv) volume of the water received at the distributary head as a ratio of water discharged at the main canal head.

(b) Engineering indicators for maintenance performance:

(i) actual capacity of main canal and distributaries as a ratio of their design capacities;

(ii) maintenance cost per kilometer of canal/drain system maintenance broken up in 3-4 categories of different ranges of canal sizes;

(iii) maintenance cost per hectare of command area;

(iv) actual maintenance expenditures versus budget targets; and

(v) actual area irrigated as a percentage of planned area (kharif and rabi seasons separately).

(c) Agricultural production indicators for performance of SRBC and SRSP:

(i) command area receiving full, partial and no canal water supplies as a ratio of total command;

(ii) production of the principal irrigated crops comprising at least 90% of the total gross cultivated area under canals, wells and tanks;

(iii) changes of crop yields in relation to the previous year;

(iv) changes in the cropping pattern in relation to the previous year;

(v) changes of farm income in relation to the previous year; and

(vi) amount and value of the three or four principal crops as a ratio of water deliveries.

(d) Remote sensing to indicate performance of scheme completion, rehabilitation and modernization investments at a command level:

(i) total area under irrigation in each season (differentiated by canals, wells and tanks if possible);

(ii) changes in the cropping pattern/cropping intensity.

(e) Performance indictors for the institutional restructuring of SRSP/CADA:

(i) reorganization benchmarks achieved;

(ii) programming and budgeting plans formulated and submitted on schedule;

(iii) annual training program for SRSP/CADA personnel completed on schedule; and

(iv) number of senior engineers who received management training.

(f) Performance indicator for farmer turnover (WUA) program :

(i) number of WUAs established and participating:

a. collecting water charges;

b. in joint management with SRSP CADA; and

c. taking responsibility for O&M.

(ii) amount of funds collected by farmer councils for maintenance work;

(iii) number of Distributary Committees involved in scheme management;

(iv) number of "laskars" working under WUA control; and

(g) number of WUAs having problems in operation and/or control of irrigators with access to direct outlets from large canals.

4. More detailed baseline field surveys would be conducted by stratified farm and participatory rural appraisal survey to determine representative farm models and their net income levels. These models would include marginal farmers, small farmers and medium farmers. A representative stratified sample would be developed and the same farms would be monitored by a survey prior to project completion.

5. Appropriately experienced universities and/or research institutions would be chosen in consultation with the Bank/IDA, to conduct the work. The survey would be funded as part of the AP III project technical assistance provision.

6. On completion of the baseline survey, the above monitorable indicators would be appropriately modified, and modifications included in ICADD's semi-annual and/or annual reporting system as appropriate as part of the Project Performance Indicators. However, farm models would only be prepared for the baseline survey, project mid-term review and ICR mission. The baseline survey would also form a starting yardstick for ICADD monitoring and evaluation activities and for the project's Implementation Completion Report.

CRITERIA FOR NGO SELECTION

INDIA

THIRD ANDHRA PRADESH IRRIGATION PROJECT

Criteria for the Selection of Non-Government Organizations (NGOs)

The project would seek NGO participation in various activities related to: farmer organization and beneficiary participation in management, operation and maintenance of irrigation systems; and resettlement and rehabilitation of project affected persons. Based on a Terms of Reference prepared by the Irrigation & Command Area Development Department (ICADD), ICADD would solicit detailed proposals for collaboration from interested NGOs. ICADD would be responsible for reviewing the proposals and agreeing on appropriate mechanisms to involve NGOs in the project. The selection of the NGOs would be guided by the following criteria:

(a) As part of legal requirements, the NGO should be a registered body under the relevant State Law. It should regularly maintain its accounting records and have properly audited annual statement of income and expenditure;

(b) Since the program involves working primarily with small and marginal farmers, it is essential that the NGO has a proven track record in community development in the agrarian setting. To avoid creating any biases and misconceptions in the minds of the people, the NGO should be secular and non-political in the conduct of its field activities;

(c) As the project requires NGO support for farmer organization activities at many diverse locations, NGO's should have adequate numbers of field level staff conversant with the local dialect and customs, and having a clear understanding of the socioeconomic and political situation of the areas in which they will operate. They should also possess excellent communication skills and good rapport with the community so as to involve them in their own farmer organization or economic rehabilitation;

(d) A prior understanding of the concept of an irrigation project and experience in areas relevant to the NGO's interest in project participation (for instance, in community development, farmer organization, resettlement and rehabilitation, tribal welfare) would be desirable. Owing to the nature and extent of the physical coverage of the program, each selected NGO will be part of the community organization or R&R process. Hence, the NGO should be able to interact smoothly with, and be a part of ,a team; and

(e) Finally, the NGO should have internal stability so as to assure long-term support to the project.

Annex 14

DOCUMENTS IN PROJECT FILE

INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT

Selected Documents Available in Project Files

General Feasibility and Planning Reports

1. Water and Power Consultancy (India) Limited: Project Report of Third Andhra Pradesh Irrigation Project; Hyderabad, February 1994.

   Water and Power Consultancy (India) Limited: Project Report of Third Andhra Pradesh Irrigation Project, Annexures; Hyderabad, May 1994.

3. Water and Power Consultancy (India) Limited: Project Report of Third Andhra Pradesh Irrigation Project, Volumes I and II; Hyderabad, September 1994.

4. Engineering Staff College of India: Sriramasagar Project--Plan of Operation and Maintenance; Preliminary Report, Volumes I and II, Hyderabad, July 1995.

5. Engineering Staff College of India: Sriramasagar Project--Plan of Operation and Maintenance; Hyderabad January 1996.

6. Engineering Staff College of India: Sriramasagar Project--Simulation Studies for Transition POM from 1996-97 to 2003-04; undated.

7. FAO Investment Centre: Andhra Pradesh Irrigation III Project--Draft Working Papers; Report No. 118/94 CP - IND WP, Rome, October 1994.

Soils, Agricultural Planning and Crop Water Requirements

8. Irrigation & CAD Department: Report on Agricultural Aspects of Srisailam Right Branch Canal Project and Sriramasagar Project; Hyderabad, February 1994.

9. AP Remote Sensing Applications Centre: Soil and Soil Irrigability Mapping of Srisailam Right Branch Canal (SRBC) Command Area; Hyderabad, July 1994.

10. AP Remote Sensing Applications Centre: Soil and Soil Irrigability Mapping of Sriramasagar Project (SRSP); Hyderabad; July 1994.

11. Irrigation & CAD Department: Agricultural Aspects of Srisailam Right Branch Canal Command; Hyderabad, June 1994.

12. Water and Land Management Training and Research Institute: Agricultural Aspects of Sriramasagar Command; Hyderabad, July 1994.

13. FAO Investment Centre: Andhra Pradesh Irrigation III Project, Working Paper No. 3--Agriculture; Rome, January 1995.

14. Irrigation & CAD Department: Sriramasagar Project--Crop Water Requirement and Management of Irrigation Supplies--Validation of Design Assumptions by Field Studies and On-Farm Research by AP Agricultural University; Hyderabad, September 1995.

15. FAO Investment Centre: Andhra Pradesh Irrigation III Project, Aquaculture Component; Rome, November 1994.

Hydrology and Simulation Models

16. Irrigation & CAD Department: Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under AP II Composite Project; July 1993.

17. Irrigation & CAD Department: Note on Hydrology, Cropping Pattern, Water Requirements and Simulation Studies of Sriramasagar Project; February 1994.

18. Works Consultancy Services: AP III Hydrology Appraisal; June 1994.

19. Irrigation & CAD Department: Sriramasagar Sub-Project Water Management Studies; July 1994.

20. Works Consultancy Services: AP III Pre-Appraisal Mission; December 1994

21. Irrigation & CAD Department: Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under AP III Irrigation Project;April 1995.

22. Irrigation & CAD Department: Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under AP III Irrigation Project; April 1995.

23. Works Consultancy Services: AP III Hydrology Progress Report, April-May 1995 Mission; May 1995.

24. Irrigation & CAD Department: Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under AP III Irrigation Project; May 1996.

25. Irrigation & CAD Department: Note on Simulation Studies of World Bank Aided Srisailam Right Branch Canal Sub-Project Under AP III Irrigation Project;May 1996.

26. Works Consultancy Services: AP III - World Bank Appraisal Mission, May 1996; Wellington, New Zealand, July 1996.

27. Irrigation & CAD Department: Operation Rules for Srisailam and Nagarjunasagar Resevoirs; Hyderabad, July 1996.

28. Irrigation & CAD Department: Constitution of Srisailam Reservoir Inter-Agency Committee; Hyderabad, August 1996.

29. Irrigation & CAD Department: Sriramasagar Project - Production of Hydro-Electricity - Agreement with APSEB; Hyderabad, February 1995.

30. World Bank: Water Supply Reliability Analysis; Annex 1, Green Cover Staff Appraisal Report, 26 pages, March 3, 1997.

Reservoir Sedimentation

31. Andhra Pradesh Engineering Research Laboratories: Report on Hydrographic Survey of Sriramasagar Reservoir 1994; Hyderabad, 1996.

32. Irrigation & CAD Department: Supplemental Note to the Report on the Hydrographic Surveys of Sriramasagar Reservoir; May 1996.

33. Irrigation & CAD Department: Sedimentation Studies of Sriramasagar Project; 1995

Groundwater and Drainage Studies

34. Groundwater Department: Interim Report on Groundwater Management Studies in Srisailam Right Branch Canal Command; Hyderabad, December 1991.

35. Groundwater Department: Feasibility Report on Conjunctive Use of Groundwater and Surface Water in Command Area of Distributary 29, Sriramasagar Project; Hyderabad, July 1992.

36. Groundwater Department: Feasibility Study for Conversion of Cropping Pattern from IW to ID in Command Area of RSD 4 (up to RSD 6) D-83, Sriramasagar Project; Karimnagar, October 1992.

37. Groundwater Department: A Report on Conjunctive Use Possibilities Under Srisailam Right Branch Command; Hyderabad, June 1994.

38. Groundwater Department: Scope of Groundwater Development and Monitoring Program in Sriramasagar Project Command Area; Hyderabad, July 1994.

39. Barber W.: July 1994 Preparation Mission - Report on Groundwater Conditions; Aide Memoire Annex 5; Washington D.C.,August 1994.

40. FAO Investment Center: Groundwater and Land Drainage; Working Paper Annex 2, Rome, January 1995.

41. Groundwater Department: Report on Intensified Groundwater Development Action Plan in Sriramasagar Project Command in the 0-234 km Reach of Kakatiya Canal; July 1995.

Construction Quality Assurance

42. Malhotra R.K.: Preappraisal Mission - Guidelines on Quality Control of AP III Works; World Bank, New Delhi, January 1995.

43. Irrigation & CAD Department: SRBC and SRS Sub-Projects - Action Plan for Quality Control Organization; Hyderabad, November 1995.

44. Malhotra R.K.: Retroactive Financing Construction Quality Audit Mission (July 25 - July 1996) - Assessment Report; World Bank, New Delhi, July 1996.

45. Irrigation & CAD Department: Srisailam Right Branch Canal - Report on Gorakullu By-Pass Canal Structure Complex; May 1996.

Dam Safety Assurance

46. GOAP AP III Project Dam Review Panel: Reports of Fourth, Fifth, Eighth, Ninth, Tenth, Eleventh, Thirteenth, Fourteenth, Fifteenth and Sixteenth Meetings; 1993-1997.

47. Irrigation & CAD Department: Dam Safety & Sustainability Sub-Components of Srisailam Dam; November 1995.

48. Irrigation & CAD Department: Note on Dam Safety and Sustainability Component - Sriramasagar Project; December 1995.

49. Malhotra R.K.: Technical Review of GOAP Notes on Dam Safety and Sustainability Components; New Delhi, January 1996.

50. Irrigation & CAD Department: Dam Safety Assurance and Rehabilitation - Identification Report for World Bank Assistance, June 1996.

Engineering Design

51. Irrigation & CAD Department: Sriramasagar Project - Guidelines for Improvement to Existing Irrigation System to Suit Rotational Water Supply System; August 1990.

52. Irrigation & CAD Department: Lining of Canals in Expansive Soils - Sriramasagar Project; November 1994.

Environmental Assessments and Management Plans

53. Water and Power Consultancy (India) Limited: Environmental Impact Assessment for Sriramasagar Scheme; New Delhi, May 1994.

54. Water and Power Consultancy (India) Limited: Environmental Impact Assessment for Srisailam Right Branch Canal; New Delhi, May 1994.

55. WALAMTARI & Irrigation & CAD Department: Environmental Impact Assessment and Management Plan - Sriramasagar Project; Hyderabad, March 1995.

56. WALAMTARI & Irrigation & CAD Department: Environmental Impact Assessment and Management Plan -Srisailam Right Branch Canal; Hyderabad, March 1995.

57. Irrigation & CAD Department: Environmental Management Plan (Action Plan) - ; Srisailam Right Branch Canal; Hyderabad, January 1996.

58. Irrigation & CAD Department: Environmental Management Plan (Action Plan) - ; Sriramasagar Project; Hyderabad, January 1996.

59. AP Remote Sensing Applications Centre; Catchment Area Treatment Plan for Srisailam and Owk Balancing Reservoir; 1995.

60. AP Remote Sensing Applications Centre; Catchment Area Treatment Plan for Sriramasagar Project and Lower Mannair Dam; 1995.

61. Irrigation & CAD Department: Environmental Management Plan - Implementation Schedule by Sub-Project Areas; August 1996.

62. Irrigation & CAD Department: Environmental Management Plan - Cost Analysis; June 1996.

63. Irrigation & CAD Department: Environmental Management Plan - Estimated Benefits from Forest Products; August 1996.

Resettlement & Rehabilitation

64. Irrigation & CAD Department: Policy for Economic Rehabilitation of Project Affected Personsunder AP III Irrigation Project: Hyderabad, March 1996.

65. Agricultural Finance Corporation Limited: Socio-Economic Study of Project Affected Households under Sriramasagar Project; Hyderabad, 1996.

66. Agricultural Finance Corporation Limited: Sriramasagar Project - Project Affected Persons Economic Rehabilitation Programme, Volume I - Action Plan and Volume II - Annexures; Hyderabad, 1996.

67. Agricultural Finance Corporation Limited: AP II R&R Programme in Sriramasagar Project in Karimanagar District- Remedial Action Plan (Infrastructure Development); Hyderabad, 1996.

68. Tribal Cultural Research and Training Institute: Socio-Economic Study of Project Affected Persons under SRBC (Main Canal); Hyderabad, June 1996.

69. Tribal Cultural Research and Training Institute: Socio-Economic Study of Project Affected Persons under SRBC (Distributaries); Hyderabad, June 1996.

70. Tribal Cultural Research and Training Institute: Srisailam Right Branch Canal - Project Affected Persons Economic Rehabilitation Programme, Volume I - Action Plan and Volume II - Action Plan of Individual Affected Persons; Hyderabad, June 1996.

71. Tribal Cultural Research and Training Institute: AP II R&R Programme in SRBC Project Area in Kurnool and Maboobnagar Districts - Remedial Action Plan (Infrastructure Development); Hyderabad, June 1996.

72. Irrigation & CAD Department: Resettlement & Rehabilitation - Remarks on Annex E; June 1996.

73. Irrigation & CAD Department: Resettlement & Rehabilitation - Replies to Comments on PAPERP (June 1996); August 1996.

Training Programs

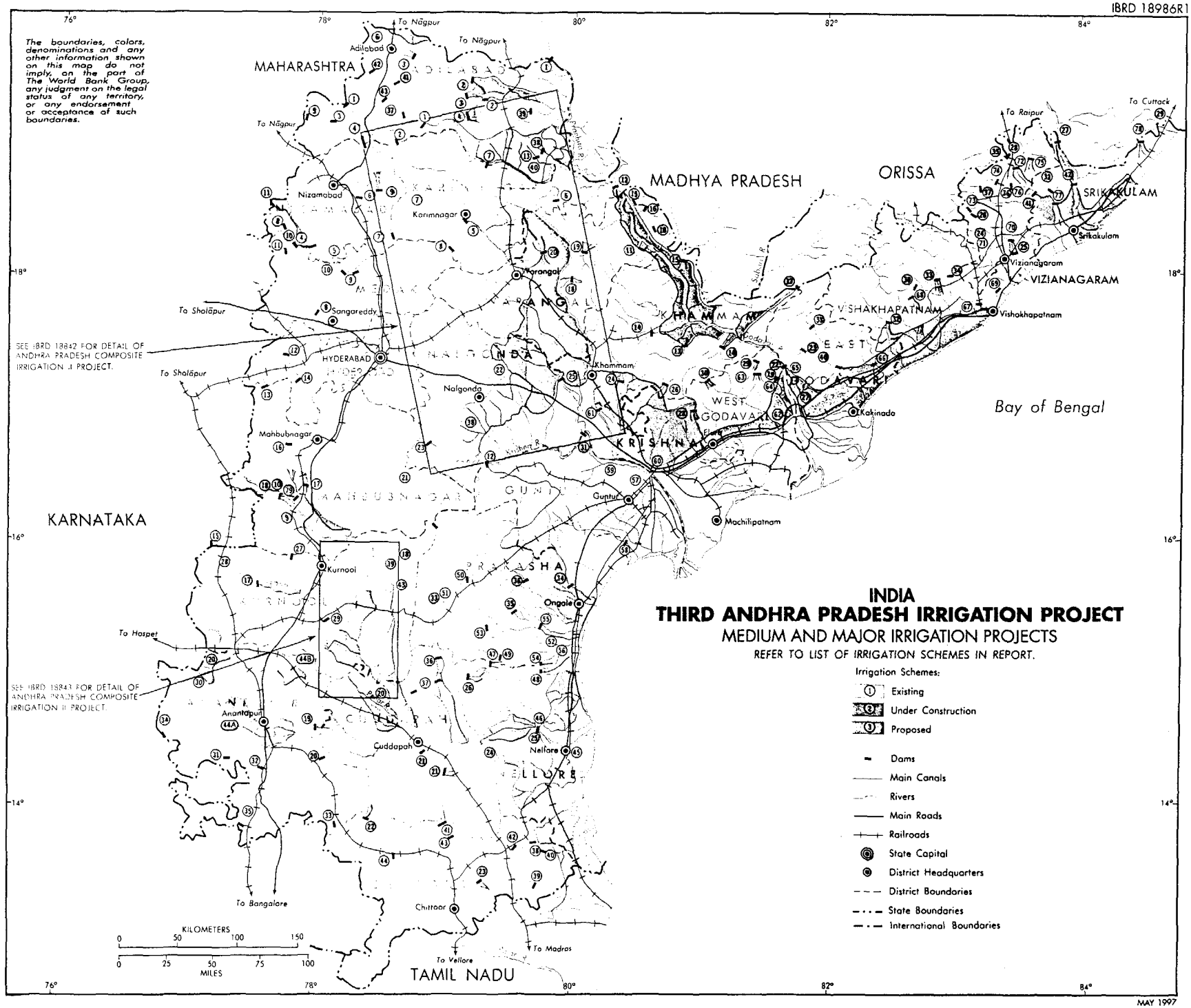
74. Irrigation & CAD Department: Proposed Project on Agricultural Research and Extension under SRS and SRBC Sub-Projects - Third AP Irrigation Project; December 1994.

75. Irrigation & CAD Department: Training Programme; November 1995.

76. WALAMTARI: Training Implementation Plan; May 1995.

Implementation

77. Irrigation & CAD Department: Master Implementation Schedules; August 1996.



INDIA
THIRD ANDHRA PRADESH IRRIGATION PROJECT
MEDIUM AND MAJOR IRRIGATION PROJECTS

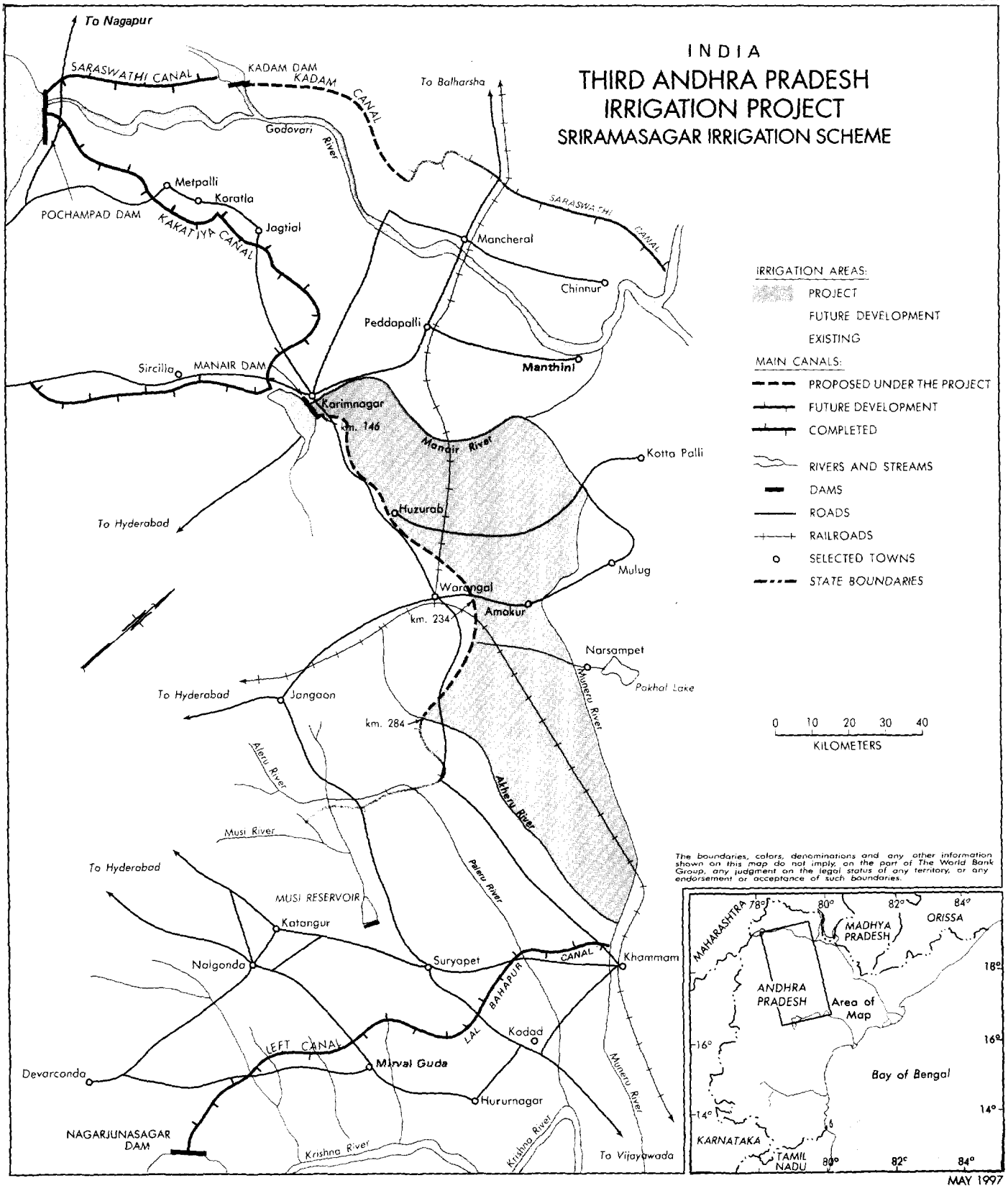
REFER TO LIST OF IRRIGATION SCHEMES IN REPORT.

Irrigation Schemes:
- Existing
- Under Construction
- Proposed

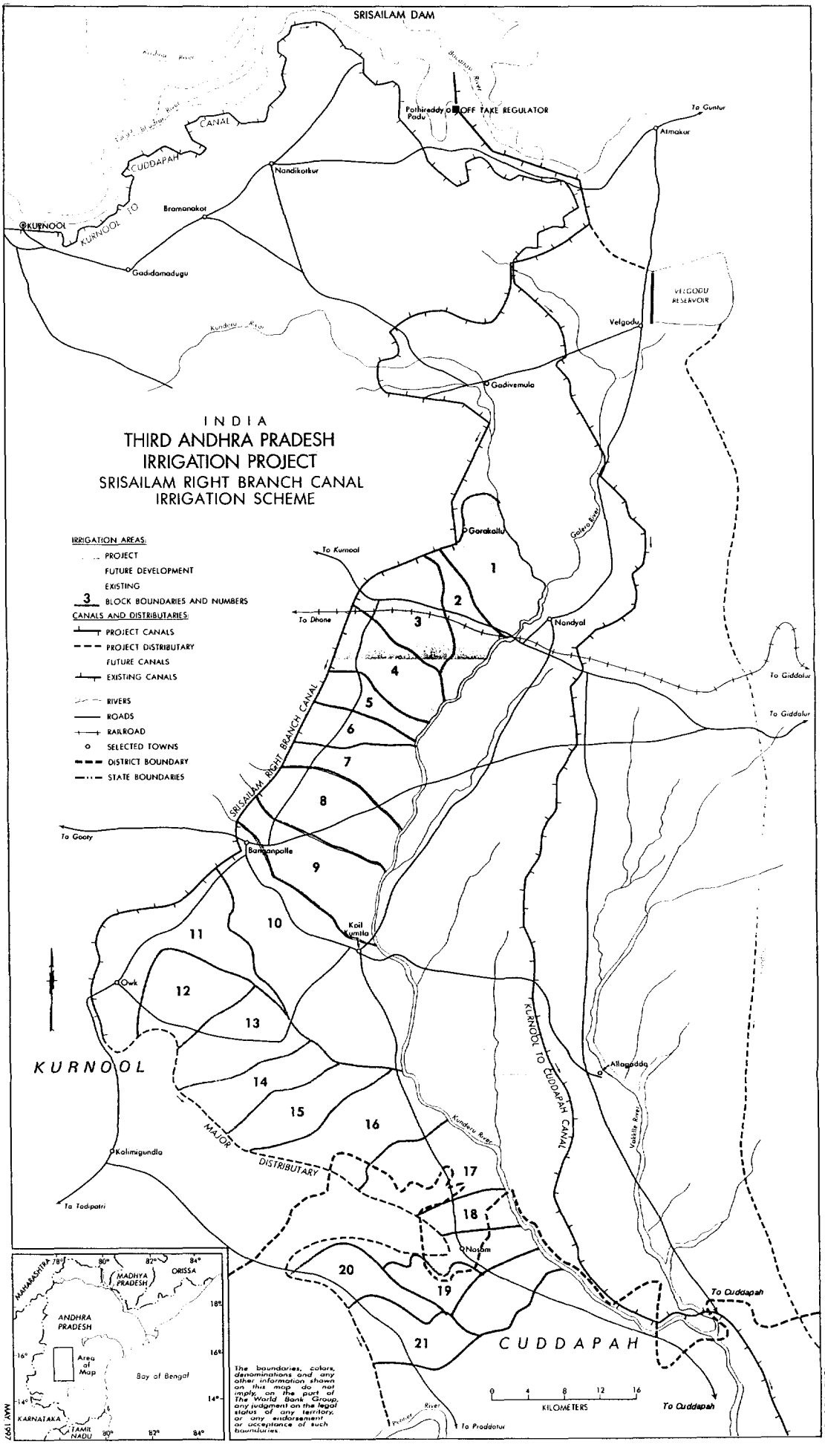
- Dams
- Main Canals
- Rivers
- Main Roads
- Railroads
- State Capital
- District Headquarters
- District Boundaries
- State Boundaries
- International Boundaries

MAY 1997

IBRD18842R



MAY 1997


SRISAILAM DAM
Pothireddy Padu
OFF TAKE REGULATOR
To Guntur
Atmakur
CANAL
CUDDAPAH
KURNOOL TO
KURNOOL
Nandikotkur
Bramanakot
Gadidamadugu
VELGODU RESERVOIR
Velgodu
Kunderu River
Gadivemula
INDIA
THIRD ANDHRA PRADESH
IRRIGATION PROJECT
SRISAILAM RIGHT BRANCH CANAL
IRRIGATION SCHEME
IRRIGATION AREAS:
PROJECT
FUTURE DEVELOPMENT
EXISTING
3 BLOCK BOUNDARIES AND NUMBERS
CANALS AND DISTRIBUTARIES:
PROJECT CANALS
PROJECT DISTRIBUTARY
FUTURE CANALS
EXISTING CANALS
RIVERS
ROADS
RAILROAD
SELECTED TOWNS
DISTRICT BOUNDARY
STATE BOUNDARIES
Gorakallu
Gaiwa River
To Kurnool
To Dhone
Nandyal
To Giddalur
To Giddalur
SRISAILAM RIGHT BRANCH CANAL
To Gooty
Bangenpalle
Koil Kuntla
Owk
KURNOOL
KURNOOL TO CUDDAPAH CANAL
Allagadda
Kunderu River
Vaikila River
MAJOR DISTRIBUTARY
Kalimigundla
To Tadipatri
Nossam
To Cuddapah
CUDDAPAH
To Cuddapah
To Proddatur
Penner River
KILOMETERS
MAHARASHTRA
MADHYA PRADESH
ORISSA
ANDHRA PRADESH
Area of Map
Bay of Bengal
KARNATAKA
TAMIL NADU
The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
MAY 1992
IBRD 18843R

IMAGING

Report No.: 16336 IN
Type: SAR