

REPUBLIC OF INDONESIA  
MINISTRY OF PUBLIC WORKS  
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT  
DIRECTORATE OF IRRIGATION II

# JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT

## FINAL REPORT

### VOLUME I

### MAIN REPORT

CONSULTING ENGINEERS

the associated firm :

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Milan, Italy

July 1988

JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT  
PROGRESS AND PROGRAM OF THE PROJECT

FINAL REPORT

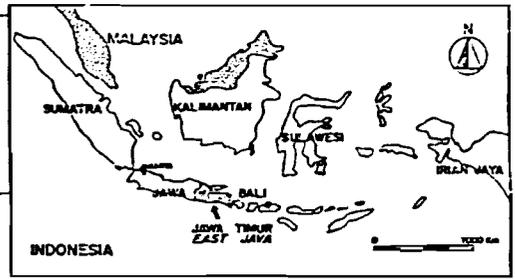
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*This report is referred to as the 'FINAL REPORT' in the Contract for Engineering Services for the Jawa Timur Groundwater Development Project*

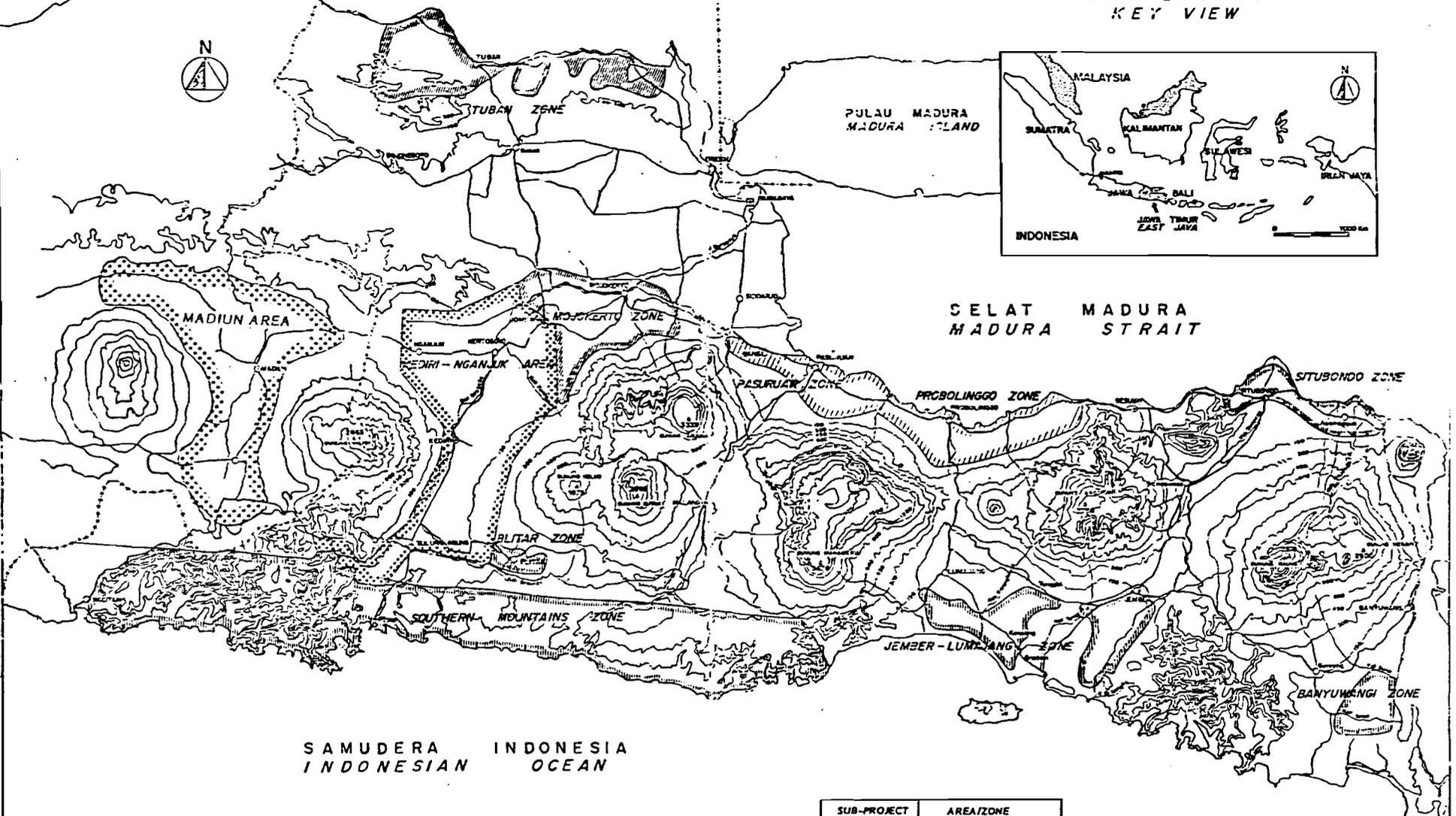
LAUT JAWA  
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KEY VIEW



PULAU MADURA  
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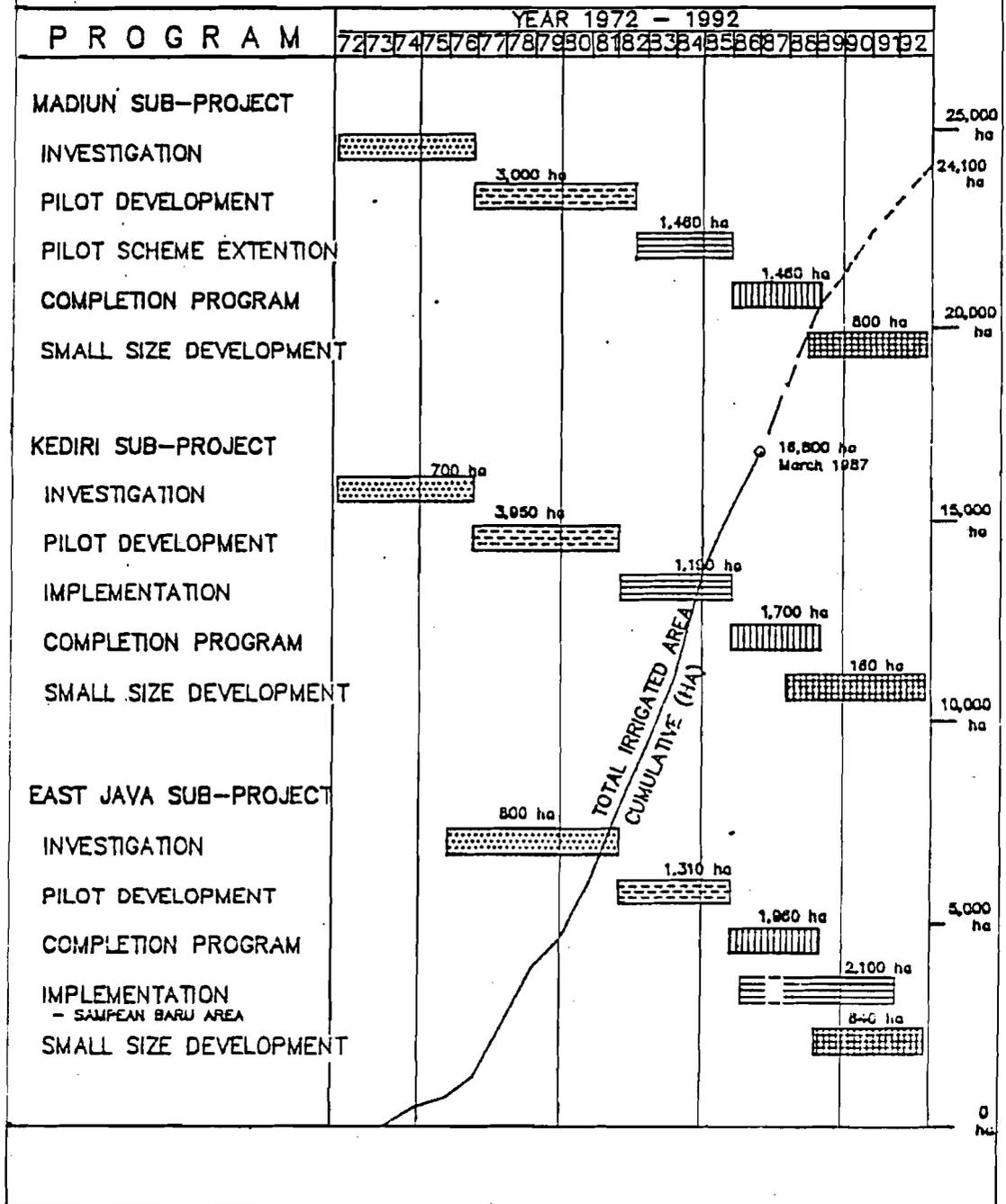
-  IMPLEMENTATION
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-  INVESTIGATION and STUDY

SUB-PROJECT	AREA/ZONE
MADIUN	MADIUN
KEDIRI	KEDIRI-NGANJUK
SURABAYA	TUBAN, MOJOKERTO, PASURUAN, PROBOLINGGO, JEMBER, LUMAJANG, SITUBONDO, BANYUWANGI



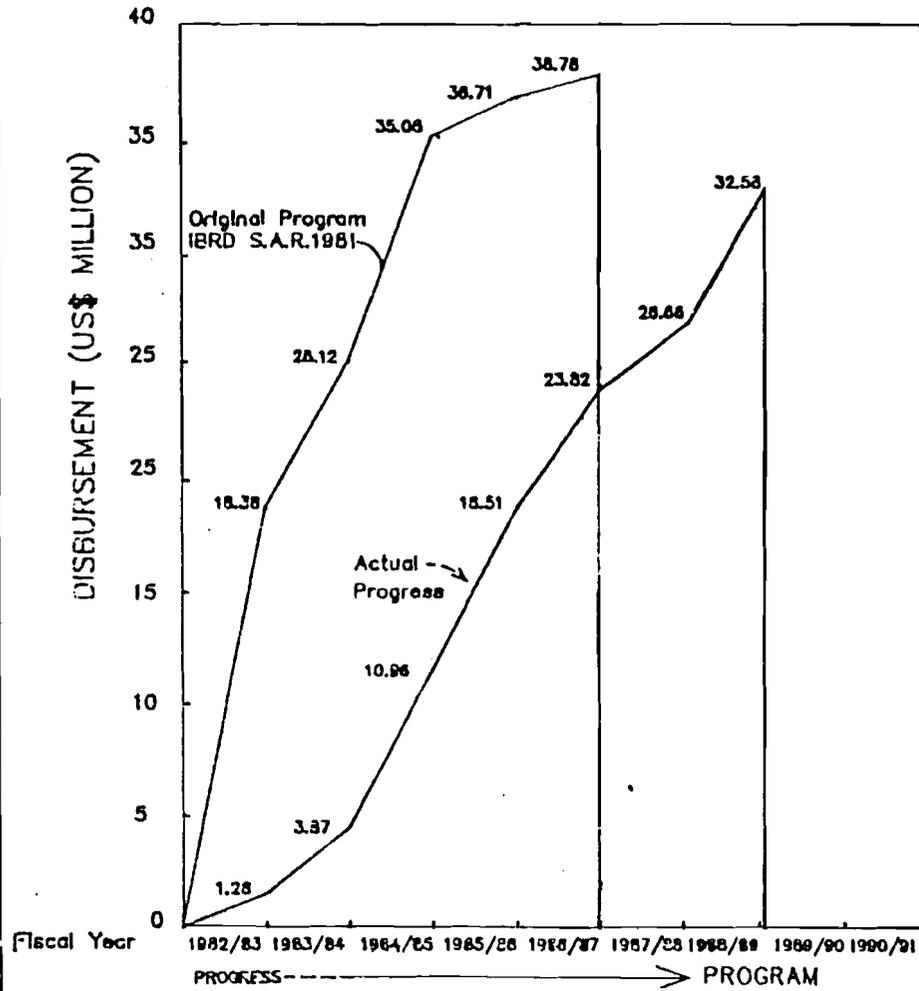
REPUBLIK INDONESIA DEPARTEMEN PERENCANAAN UMUM DIREKTORAT JENRAL PENGUKURAN				
PROYEK PENGEMBANGAN AIR TANAH JAWA TIMUR JAVA TIMUR GROUND WATER DEVELOPMENT PROJECT				
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DIREKTUR DIPONEGORO	DIREKTUR SURABAYA	DIREKTUR SEMARANG	DIREKTUR YOGYAKARTA	THE ASSOCIATED CONSULTING ENGINEERS INDAH KARYA - WIRATAMA ELECTROCONLEY-NIPPON KOGI

# EAST JAVA GROUND WATER DEVELOPMENT PROJECT OVERALL PROJECT IMPLEMENTATION PROGRAM

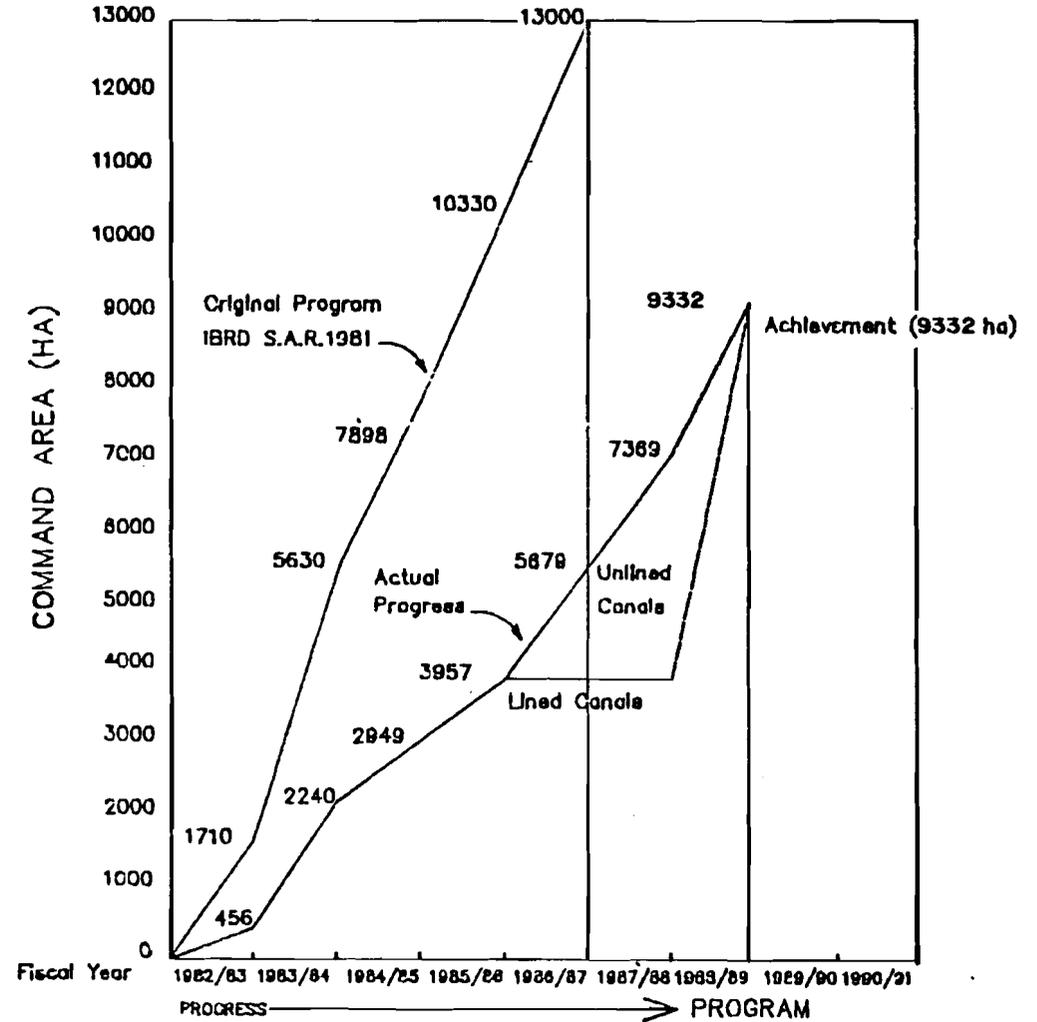


# PROGRESS OF PROJECT

## PROGRESS OF DISBURSEMENT



## PROGRESS OF CANALIZATION



WORD ABBREVIATIONS AND GLOSSARY

<u>ABBREVIATIONS</u>	<u>BAHASA INDONESIA</u>	<u>ENGLISH</u>
BAPPEDA	Badan Perancang Daerah	Regional Development Planning Board
BHP		Brake Horse Power
BIMAS	Bimbingan Massal	Government sponsored scheme to provide agricultural inputs on credit.
BP P2AT JATIM	Badan Pelaksana Proyek Pengembangan Air Tanah Jawa Timur	Execution Agency of Ground Water Development Project in East Java
Dep. PU	Departemen Pekerjaan Umum	Ministry of Public Works
DGWRD		Directorate General of Water Resources Development
DIPERTA	Dinas Pertanian	Agricultural Provincial Office
DOLOG	Depot Logistik	BULOG Office at Provincial level
DCI-II	Direktorat Irigasi II	Directorat of Irrigation II
DP	Daerah Pengairan	Irrigation Service Unit
DPU	Dinas Pekerjaan Umum Drawing	Public Works Provincial Office
EC		Electrical Conductivity
FAO		Food and Agricultural Organization of United Nations
	GABAH	Unhusked rice grains removed from the stalk
	Gabah Kering	Gabah at 14 % moisture content
HIPPA	Himpunan Petani Pemakai Air	Water users Association
IBRD		International Bank for Reconstruction and Development
JATIM	Jawa Timur	East Java

<u>ABBREVIATION</u>	<u>BAHASA INDONESIA</u>	<u>ENGLISH</u>
Kab.	Kabupaten	Regency (District)
Kec.	Kecamatan	Subdistrict
	KOTAMADYA	Urban District
	KOTA	Town or City
	KEPALA DESA	Village Chief
	KONTAK TANI	Contract Farmer
	KELOMPOK TANI	Farmer Group
KUD	Koperasi Unit Desa	Village Cooperative
l/s	liter/detik	liter/second
OB		Observation Hole
P2AT	Proyek Pengembangan Air Tanah	Ground Water Development Project
	PADI GABAH	Unhusked rice grains removed from the stalk
PC	Beton Pracetak	Precast Concrete
P/H	Rumah Pompa	Pump House
PPL	Penyuluhan Pertanian Lapangan	Field Extension Officer
	POLOWIJO	Collective terms for all annual crops other than rice or sugarcane, with or without irrigation
	PROVINSI	Province
PUSLITBANG AIR	Pusat Penelitian dan Pengembangan Air	Central Research and Development of Water Resources
PZ		Piezometer Hole
PVC		Poly Vinyl Chloride
SAR		Sodium Absorption Ratio
TW		Test Well

ABBREVIATIONBAHASA INDONESIAENGLISH

TDH

Total Dynamic Head

ABBREVIATION OF MEASURE(Length)mm  
cm  
m  
kmMillimeter  
Centimeter  
Meter  
Kilometer(Electricity)kv  
kw  
MW  
GWh  
rpm  
Kilovolt  
Kilowatt  
Megawatt  
Gigawatt hour  
Revolution per minute(Area)m<sup>2</sup>, sqm  
km, sqkm  
haSquare Meter  
Square Kilometer  
Hectare(Derivered)m/s  
m<sup>3</sup>/s, cum/s  
m<sup>3</sup>/min, cum/min  
l/s/ha  
t/ha  
ppm  
Meter per Second  
Cubic meter per second  
Cubic meter per minute  
Liter pre second per hectare  
Metric ton per hectare  
Parts per million(Weight)mg  
kg  
ton, t  
qtMilligram  
Killogram  
Metric Ton  
Kwintal = 100 kg(Other Measures)%  
Ø  
°C  
PH<sub>3</sub>  
Percentage  
Diameter  
Centigrade  
Scale for acidity(Volume)m<sup>3</sup>, cum  
lit, l  
MCMCubic Meter  
Litre  
Million Cubic Meters

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## SUMMARY AND RECOMMENDATION

### Consulting Engineering Services of the Project

01. The Consulting Services for the Jawa Timur Groundwater Development Project is provided by PT. Indah Karya as Leading Firm, in association with PT. Wiratman & Associates, Jakarta, ELC-Electroconsult S.p.A, Milan-Italy and Nippon Koei Co., Ltd., Tokyo Japan, to fulfill the task stipulated in the Terms of Reference of Engineering Consulting Services Contract, May 9, 1987 No. HK 02.03.02/001/ABLN/DOI-II/87. The main objective of the services are to assist and advise the Executing Agency for the Jawa Timur Groundwater Development Project during the design and construction works concerning the quality of works to achieve the timely completion of the work at minimum cost within the required standards.

02. The final goal to be achieved by the Project is the establishment of and guidance to water users group for 140 location in the new tubewell irrigation schemes. It is the finishing procedure of a series of works to be implemented by the Project and, if it is successfully done, the benefit of Project will be immediately felt because of well-running water management and of resulting high agricultural return from the area of new tubewell irrigation system.

03. The following programme constitute the workplan of Jawa Timur Groundwater Development Project :

- Completion Program : consisting of (1) consolidation of the project progress so far achieved by FY 1986/1987 including the canalization, pump installation and operation of new scheme where the production wells had been constructed and (2) new development of the rainfed area where groundwater is the most promising resource to be developed as irrigation water supply;
- Extension Program : monitoring and assessing the effect of Project implementation and operation of the constructed facilities to the natural, social and economic environments surrounding the Project, to avoid any undesired effects;
- Preparatory Program : dealing with the preparatory activities for the forthcoming groundwater development project in Palu (Central Sulawesi), Tuban, Gresik, Nganjuk, Magetan and Sampean Baru zone.

04. A first reassessment and updating of the Project situation was conducted after six months from the beginning of the consulting services and was formalized with the Progress Report for First and Second Quarterly Periods of July 1987. Some more revisions were necessary at a letter stage (September 1987) when the Government decided to adopt a new system of precast canal lining for the Project. The revisions have affected the construction target, scope of works and the plan of activity for the Project as well as the assignment of Consultants.

05. To cope with the Project implementation program, the original program and schedule were revised. This revised overall work program and schedule had been reported to the Project Manager and discussed during the submission of "Interim Report" of December 1987. Table S.1 shows the revised project implementation program to be achieved within Three Years Project Implementation including the Project activity schedule for the revised work program.

06. The required Experts and their relevant assigned periods, had been slightly modified to conform with the substantial revision of the Project implementation. The total man months allocated as mentioned in the Contract, however, are kept the same although there are some substitution of the Consultants to be assigned. The total manmonths consumed for the services is in conformity with the total manmonths allocated within the contract i.e. 153 mm for Indonesian Experts and 32 mm for Foreign Experts.

### Progress of the Project Implementation

07. The Present completion program of the Part-Project concerned as stated in the "Revised Overall Work Program and Target" of Jawa Timur Groundwater Development Project consists of the following work items :

Work Item	Units	Revised Target	Madiun	Kediri	Surabaya
1. PROCUREMENT					
Casing & Screen	(m)	2,970	-	-	2,970
Pumpset	(Unit)	70	-	-	70
Maintenance Unit	(Ls)	1	-	-	1
Other Equipment	(Ls)	1	-	-	1
Precast Canal Segment	(Km)	212.6	39.6	86.6	86.4
PVC Pipes	(m)	13,000	-	-	13,000
2. RAINFED AREA STUDY	(Ha)	1,200	-	-	1,200
3. DETAILED DESIGN					
Topo Survey	(Ha)	2,703	-	499	2,204
Detailed Design	(Ha)	3,932	-	1,745	2,187
4. PIPE SYSTEM DESIGN & CONST.(Nos)		6	-	-	6
5. CANAL LINING MINI-TRIAL					
Installation		(0)	-	-	-
Monitoring/Assessment		(1)	-	-	1
6. DRILLING CAMPAIGN					
Production Well	(Nos)	66	27	2	37
7. TERTIARY DEVELOPMENT					
New Distribution System	(Ha)	5,376	1,798	1,686	1,892
Canal Lining	(Km)	212.6	39.6	86.6	86.4
Pump Installation	(Nos)	140	41	45	54
8. HIPPA ORGANIZATION	(LOC)	140	41	45	54

08. Tender of 70 Pumpsets for the second procurement of Equipment & Suppliest have been evaluated, but the awarding to the winner is still pending. Furthermore, enders of two packages of Precast Concrete Paabolic Segments have been awarded to the two Contractors. Totally 212.6 Km or 106,500 pcs of this precast concretes will be supplied consisting of 24,150 pcs of

REVISED PROGRAM AND PROGRESS OF PROJECT IMPLEMENTATION AS OF JULY 1988  
JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT

WORK ITEM	PROGRESS BY (UNITS) MAR. 1988	FY. 1986/87-1988/89			FY 1986/87				FY 1987/88				FY 1988/89				PROJECT TOTAL ACHIEVEMENT						
		REVISED TARGET	PROGRESS JULY 88	BALANCE JULY 88	PROGRAM/PROGRESS				PROGRAM/PROGRESS				PROGRAM/PROGRESS										
					A	M	J	J	A	S	O	N	D	J	F	M		A	M	J	J	A	S
<b>A. COMPLETION PROGRAM</b>																							
<b>1. PROCUREMENT</b>																							
CASING & SCREEN (M)	37,000	2,700	0	2,700													39,700						
PVC PIPES (M)	-	13,000	13,000	0												13,000	13,000						
PUMPSET (UNITS)	176	70	0	70													246						
MAINTENANCE UNIT (LS)	-	1	0	1													1						
OTHER EQUIPMENTS (LS)	-	1	0	1													1						
PRECAST CANAL SEGMENTS (KM)	-	212.6	25	187.6													212.6						
2. RAINFED AREA STUDY (HA)	4,800	1,200	2	1,200													6,000						
<b>3. DETAILED DESIGN</b>																							
TOPO-SURVEY (HA)	10,679	3,603	3,603	0													14,232						
DETAILED DESIGN (HA)	9,442	4,538	4,538	0													13,980						
4. PIPE SYSTEM DESIGN & CONST. (NOS)	3	11	6	5													11						
5. CANAL LINING MINI-TRIAL	0	1	1	0													1						
<b>6. DRILLING CAMPAIGN</b>																							
EX./OB. WELL (NOS)	134	0	-	-													134						
PRODUCTION WELL (NOS)	143	66	60	6													209						
- MADIUN (38)	(38)	(27)	(21)	(6)													(65)						
- KEDIRI (53)	(53)	(2)	(2)	(0)													(55)						
- SURABAYA (52)	(52)	(37)	(37)	(0)													(89)						
<b>7. TERTIARY DEVELOPMENT</b>																							
ACCESS ROADS - MADIUN (KM)	46	15.3	6	9.3													61.3						
DISTRIBUTION SYSTEM (HA)	3,956	5,376	3,408	1,968													9,332						
NEW - MADIUN (0)	(0)	(1,798)	(713)	(1,080)													(1,798)						
- KEDIRI (1,187)	(1,187)	(1,686)	(1,527)	(159)													(2,873)						
- SURABAYA (1,319)	(1,319)	(1,892)	(1,165)	(729)													(3,211)						
EXISTING - MADIUN (HA)	(1,450)	-	-	-													(1,450)						
CANAL LINING (PRECAST) (KM)	-	212.6	4.65	207.95													212.6						
- MADIUN (-)	(-)	(39.6)	0	(39.6)													(39.6)						
- KEDIRI (-)	(-)	(86.6)	(0.7)	(85.9)													(86.6)						
- SURABAYA (-)	(-)	(86.4)	(3.95)	(82.45)													(86.4)						
PUMP INSTALLATION (NOS)	62	(140)	68	72													202						
- MADIUN (24)	(24)	(41)	(19)	(23)													(65)						
- KEDIRI (14)	(14)	(45)	(29)	(16)													(59)						
- SURABAYA (24)	(24)	(54)	(21)	(33)													(78)						
<b>8. HIPPA ORGANIZATION (LOC)</b>																							
- MADIUN (24)	(24)	(41)	(18)	(23)													(65)						
- KEDIRI (14)	(14)	(45)	(29)	(16)													(59)						
- SURABAYA (24)	(24)	(54)	(21)	(33)													(78)						
<b>B. EXTENTION PROGRAM</b>																							
1. MONITORING W/ REQUIREMENT, W/ LEVEL	ONGOING	CONTINUE	CONTINUE	CONTINUE													CONTINUE						
2. SPRING/ARTESIAN AQUIFER INVENTORY	-	PREPARED	PREPARED	PREPARED													PREPARED						
3. DEMO. COMMAND AREA (LOC)	-	SUSPEN'D	SUSPEN'D	SUSPEN'D													SUSPEN'D						
4. PH & E (LS)	-	SUSPEN'D	SUSPEN'D	SUSPEN'D													SUSPEN'D						
5. SEA WATER INT. STUDY (LS)	ONGOING	CONTINUE	CONTINUE	CONTINUE													CONTINUE						
6. D & M UP-GRADING (LS)	ONGOING	CONTINUE	CONTINUE	CONTINUE													CONTINUE						
7. PRIVATE SECTOR INVOLVEMENT	-	PREPARED	PREPARED	PREPARED													PREPARED						
<b>C. PREPARATORY PROGRAM</b>																							
1. INVENTORY IN PALU AREA	-	STARTED	STARTED	COMPL'D													COMPL'D						
2. MONITORING/ANALYSIS OF PALU AREA	-	STARTED	STARTED	COMPL'D													COMPL'D						
3. SHALLOW AQUIFER POTENTIAL STUDY	-	STARTED	STARTED	COMPL'D													COMPL'D						
4. MONITORING IN SAMPEAN BARU AREA	-	STARTED	STARTED	COMPL'D													COMPL'D						

PROGRAM ——— PROGRESS ———

JULY 23, 1988 CONSULTING ENGINEERS IK, WR, ELC, NK

type A (60 l/s) and 82,350 pcs of type B (45 l/s). Other procurements such as casing, screen and drilling tools as well as the monitoring and maintenance equipments are now being processed by the Government.

09. The program of drilling 54 test/production wells distributed under the Part-Project of Madiun (15 wells), Kediri (2 wells) and Surabaya (37 wells) within the FY.1986/1987 and FY.1987/1988 had been completed. Most wells constructed under the Part-Project of Surabaya and Kediri were drilled to the depth of 100-125 m whereas under the Madiun Part-Project they were drilled on the average depths of 200 m. The following table describes the total depth of drilling and installation attained including the distribution of those constructed wells.

<u>Part-Project District</u>	FY.1986/1987			FY.1987/1988		
	Well (Nos)	Drilled depth (m)	Installed depth (m)	Well (Nos)	Drilled depth (m)	Installed depth (m)
<u>Madiun</u>						
- Ngawi	1	179	134	4	767	675
- Madiun	2	420	368	3	615	591
- Magetan	-	-	-	3	624	570
- Ponorogo	1	185	148	1	191	179
<u>Kediri</u>						
- Blitar	-	-	-	2	254	251
<u>Surabaya</u>						
- Tuban	7	838	838	5	593	557
- Pasuruan - Probolinggo	4	533	527	13	1,628	1,563
- Situbondo	8	1,048	1,014	-	-	-
<b>Total</b>	<b>23</b>	<b>3,203</b>	<b>3,029</b>	<b>31</b>	<b>4,672</b>	<b>4,386</b>

10. Different type of pumping tests had been performed to determine both the aquifer properties and well characteristic of the constructed wells. For not high yielding tested wells, application of the conventional Jacob's graphical method (where the exponent of turbulence  $n=2$  is constant) to evaluate the well losses, is recommended. Well losses can be applied to justify the condition of the constructed wells. Table in the following page indicates that out of the 53 wells constructed, 3 wells of them are severe deteriorated or clogged. Improvements of the well constructions are therefore recommended before installation of the pumpsets.

11. According to the Sodium Absorption Ratio (SAR) classification diagram, most of groundwater tapped from the constructed well are of low sodium hazard (group  $C_2 - S_1$ ). High sodium hazard is recorded from water samples of TW 131, 132, 133 EJ and SMD 99 which fall into the  $C_3 - S_1$  and  $C_1 - S_2$  groups respectively. Within the Jawa Timur Groundwater Development Project, irrigation wells are operated during dry season only, especially in most of the rainfed area. In other areas, surface water with low salinity are used during the rest of the year. This situation will encourage a leaching process, so that the use of groundwater of group  $C_3 - S_1$  (Tw 131, 132,

TW 133 EJ) according to this classification should cause no problem (Guideline BP11, 1984).

Zonal Area	Well Condition				Number of Wells
	A*)	B*)	C*)	D*)	
- Madiun	14	-	1	-	15
- Kediri	2	-	-	-	2
- Tuban	5	-	4	2	11
- Pasuruan-					
Probolinggo	7	6	4	-	17
- Sampean Baru	2	2	3	1	8
Total of wells	30	8	12	3	53
Percentage (%)	56.6	15.1	22.6	5.7	100

\*) A = properly designed and developed; B = mild deterioration or clogging  
 C = severe deterioration or clogging, redevelopment is needed  
 D = severe deterioration or clogging, throughout improvement is needed

12. The construction of groundwater irrigation facilities as defined in the revised Term of Reference was programmed to cover the development areas of about 5,122 ha. This program was commenced since August 1986 and the progress achieved by July 1988 under respective Part-Project is summarized in the following table.

Work Item	Madiun		Kediri		Surabaya		Total Achievement
	86/87	87/88	86/87	87/88	86/87	87/88	
<b>DETAILED DESIGN</b>							
- Topo Survey (Ha)	-	-	693	-	430	2,240	3,363
- Detailed Design (Ha)	-	-	903	685	617	1,261	3,466
(Nos)	-	-	-	-	-	-	-
<b>TERTIARY DEVELOPMENT</b>							
- Distribution system (Ha)	-	718	842	685	631	532	3,408
(Nos)	-	12	20	15	15	13	75
- PVC Pipe System (Ha)	-	-	97	-	137	-	234
(Nos)	-	-	3	-	3	-	6
(m)	-	-	5,012	-	7,072	-	12,084
- Earth Canal (Ha)	-	718	745	685	494	532	3,174
(Nos)	-	12	17	15	12	13	69
(m)	-	30,435	33,915	30,911	21,823	21,350	138,434
<b>PUMP INSTALLATION (Nos)</b>	14	4	9	20	6	15	68

13. Within the last two fiscal years, a total number of 75 groundwater irrigation schemes had been constructed completely to irrigate the areas of about 3,408 ha. Most of the irrigation distribution system are constructed with open unlined canals which will converted in the FY 1988/1989 into a precast canal lining system. During the FY. 1986/1987, six (6) buried pipe irrigation systems were constructed in Blitar (TW 211, 212, 214 EJ), Tuban (TW 134 EJ), Pasuruan (TW 118 EJ) an Probolinggo (TW 96 EJ). A total units of 31 pump houses had been constructed during the FY. 1986/1987 and 40 units of those in FY 1987/1988.

14. As of December 1987 the irrigation units and relevant Pump boards whose construction was financed, even partially, from funds made available by IBRD Loan 2119-IND amount to 132 wells. These irrigation units can be subdivided into a number categories (A,B,C,D) depending on the type of works finance by the Loan.

PART PROJECT	TOTAL		CATEGORY A		CATEGORY B		CATEGORY C		CATEGORY D	
	Units	Command	Units	Command	Units	Command	Units	Command	Units	Command
	Area		Area		Area		Area		Area	
	No	(Ha)	No	(Ha)	No	(Ha)	No	(Ha)	No	(Ha)
Kediri	50	1,931.3	34	1,415.4	10	363.9	4	92.5	2	59.5
Madiun	38	3,431.6	38	3,431.6	-	-	-	-	-	-
Surabaya	44	1,956.4	30	1,339.9	-	-	1	48.5	13	567.9
Total	132	7,319.3	102	6,186.9	10	363.9	5	141.0	15	627.4

A = all construction founded by Loan ; B = canal construction only ; C = pump installation only; D = both canal construction and pump installation financed by Loan.

15. All Pump Board presiding over the operations in the above units were however assisted by P2AT in their activities. Some statistical indicators concerning the Pump Boards are given below :

I T E M	UNIT	PART PROJECT			PROJECT
		KEDIRI	MADIUN	SURABAYA	
Number of Units Financed by IBRD Loan 2119-IND	(No)	50	38	44	132
Number of Units Established in the Present Stage	(No)	42	38	44	124
Total Command Area	(Ha)	1,931.2	3,431.6	1,956.3	7,319.3
Average Command Area	(Ha)	38.6	90.2	44.5	55.4
Total Number of Farmers	(No)	4,480	7,734	5,955	18,169
Average Number of Farmers per Command Area	(No)	90	240	135	138
Average Land Tenure per Farmer	(Ha)	0.43	0.44	0.33	0.40

16. A total number of 68 turbine pumpsets had been installed during the FY.1986/1987 and FY.1987/1988. They are installed under the Part-Projects of Madiun (18 sets), Kediri (29 sets) and Surabaya (21 sets). A present 339 pumpsets have been installed since 1972, out of which 130 sets are installed under the ongoing project and 209 sets have been operated since the previous stage. If the pump is installed in plumb, straight and free of sand discharge, a good quality vertical turbine pump can be expected to operate of about 10,000 hours without pulling the pumpsets out of the well. Pumpset repairs should be therefore scarcely.

17. To evaluate the possibility for future repair and maintenance in obtaining a reasonable life expectancy for the inferior quality of vertical turbine pumps, 2 out of 8 damaged pump bowl assemblies were dismantle for

inspection and repair. Consultant had supervised the method of inspection, repair and assembling as well as the correct installation procedure. The result is appropriate and successful.

18. For maintenance purpose, consultant had supervised to Project a Pump Trouble Check List as an activity note. The check list will support P2AT mechanics todo an efficient and intelligent job of inspection for the symptom and the possible cause of trouble. Chonological records for individual pumping plant will be kept up for future maintenance. The history files include pump an engine manufacturer's data, condition of equipment during each inspection and details o repair one.

19. The crop intensities and agricultural production in 52 out of 132 irrigation units were directly monitored within the year of 1987.

The monitored cropping intensities in the Project during 1987 are summarized herebelow :

Crop Intensity (%)	Part-Project									Project		
	Kediri			Madiun			Surabaya					
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Year 1987	243	358	287	129	300	234	257	303	290	129	358	265

As to the agricultural production, the following figures are provided :

Kind of Crop	Average Yield for Project (Year 1987)	(Unit : Tons/Ha)	
		Ultimate Rainfed	Expected Irrigated
Paddy (unhusked grain)	5.7	1.5	6.5
Soya Beans	0.6	0.8	1.5
Maize	3.6	1.5	4.5
Ground Nuts	0.7	1.0	1.5
Green Peas	0.6	0.7	1.2
Onions	11.5	5.0	15.0
Sugar Cane	58.0	40.0	100.0
Tobacco	0.6	1.0	1.5
Sweet Potatoes	7.7	5.0	12.0

20. A monitoring of the 1987 farm management covering farming costs (land preparation through harvest) and farmers' income from crop was carried out by the Project with the assistance of the Agricultural Office. The results of investigation, representing the average value of farmers benefit within the Project area are the following page.

Considering that the average land tenure for the Project amounts to 0.40 ha it can be seen that the 1987 harvest has entailed for an average family living in the Project area benefits ranging from 580,000 to 710,000 Rp/year. Plemahan area, showing a benefit of 1,090,000 Rp/year, is a fortunate, isolate exception.

CROPPING PATTERNS	TYPE OF SOIL	PRODUCTION COST (Rp/ha)	FARMERS INCOME (Rp/ha)	FARMERS BENEFIT (Rp/ha)
Wet-season Paddy/Dry-Season Paddy/Maize	Heavy	693,039	2,464,200	1,771,161
Wet-season Paddy/Soy Beans/Maize	Medium Light	557,618	2,008,200	1,450,582
Wet-Season Paddy/Soy Beans/Onions	Heavy	1,138,844	3,859,500	2,720,656

21. The feasibility study for further implementation of groundwater, had been completed under the previous stage of Madiun Groundwater Development Project and in the framework of the ongoing East Java Groundwater Project. As the results, the following table provides figures of rainfed areas in East Java where groundwater is potentially developed for irrigation supply either by constructing shallow or deep tube wells.

Sub area	Shallow Well	Deep well		T o t a l
	(ha)	Rainfed (ha)	Irrigated	
Madiun	3,135	4,040	-	7,175
Kediri	-	-	-	-
Tuban	-	3,064	1,216	4,280
Mojokerto	-	-	-	-
Pasuruan	-	-	900	900
Probolinggo	-	1,150	-	1,150
Situbondo	-	-	2,100	2,100
Lumajang	-	1,239	-	1,239
Total (Ha)	3,135	9,493	4,216	16,844

The total area mentioned in this table is excluding the total area programmed to be developed by the ongoing project, that is 13,000 ha as stipulated by the Loan Agreement of IBRD - 2119 IND.

#### Plan of Work to be Accomplished during FY.1988/1989

22. The following table describes the summarized project achievement up to March 1988 as programmed within the current consulting engineering services, as well as the balance of works to be accomplished by the Project during FY.1988/1989, i.e. the expiration of IBRD Loan 2119-IND.

Work Item	Program Revised	Progress (1986/87-1987/88)	Balance
Production Wells (Nos)	66	54	12
Distribution System (Ha)	5,112	3,390	1,722
Pump Installation (Nos)	140	68	72

23. The introduction of the precast concrete segment implies that the Project and Consultant's attention should be constantly concentrated on this item of works. It is due to the fact that from technical point of view this adopted lining system represents a milestone for the country, and contrac-



tors already experienced with this subject are lacking so far. Continuous monitoring and support to the contractor's effort is therefore expected to be required, which can only be provided by the Project and Consultant. Furthermore, the very high installation paces are required to comply with the present schedule to install the precast canal lining completely at least before the forthcoming rainy season. This situation constitutes an argument in favor of an intensified organization and quality control.

Following the consideration described above and the balance of works to be completed as well as the validity of the IBRD Loan 2119-IND, the implementation schedule of construction works in FY.1988/1989 is proposed as described in Table S-2.

24. Production, transportation and installation of the canalettes segments are the most crucial aspect in the execution program in FY.1988/89 which is the final year of the IBRD Loan 2119-IND. During the production period the Consultant Irrigation and Construction Engineer have assisted the Project in inspection of the factory, establishing method of quality control, adjusting the production and delivery schedule to avoid huge stock in the stock yard. Figures in the following page provide a tentative delivery schedule from the manufacturers in compliance with the contract agreements.

25. The construction of production wells programmed during the FY.1988/1989 is planned in Madiun only consisting of 12 wells. Each well will be in the average depth of 200 m, cased with 16" pump chamber and 10" production liner and completed with wire wound continuous screen of about 42 m in length. The expected well discharge varies in the range of 60 - 80 l/sec.

26. The program of new scheme canalization (39 schemes) will be constructed under the Part-Projects of Madiun (15 schemes), Kediri (4 schemes) and Surabaya (20 schemes). All the canalization of those new schemes will be immediately completed with the pump installations during the FY.1988/1989. Furthermore, improvements of the existing earth canals have also been programmed to be implemented within this fiscal year. Most of the linings are constructed with precast concrete segments and a small part with ferrocement or PVC pipe distribution system as shown in the following table.

Part-Project Distribution System	Madiun		Kediri		Surabaya		Total
	New Schemes	Existing Schemes	New Schemes	Existing Schemes	New Schemes	Existing Schemes	
Precast Concrete	7	19	4	41	19	37	127
Ferrocement	3	-	-	-	1	-	4
PVC Pipe	5	-	-	-	-	1	6
<b>Total</b>	<b>15</b>	<b>19</b>	<b>4</b>	<b>41</b>	<b>20</b>	<b>38</b>	<b>137</b>

27. As to the installation of precast concrete lining, it should be accomplished under the close cooperation between the Manufacturer, the Contractor and the Transportation Agency. The P2AT assisted by the Consultant has prepared precisely the adjusted schedule of manufacturing, transportation and installation. Monthly coordination meeting between the P2AT and those Contractors is strongly recommended.

28. The progress of the Extension Program to date is at a very slow pace, although the necessary work schedule, guidelines and criteria for the different activities have already been prepared by the Consultant. The main constraint affecting to the implementation of the extension program is due to the limited budget allocation. However, the essential items to be monitored such as fluctuation of ground water table, pumping discharge and hour, cropping pattern as well as crop production and intensities have been still monitored in a very limited scale. Monitoring for other important items such as water quality, water requirement, and socio-economic aspects have been suspended since FY.1986/87 due to the reason as above. It is recommended therefore, that activities of this program should be restarted again within the F.Y 1988/1989.

MINUTES OF MEETING OF DRAFT FINAL REPORT  
FOR  
JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT

I.        INTRODUCTION

The meeting was held at the meeting room of ELMI HOTEL, Surabaya on July 22, 1988 to discuss the issues outlined by the "Draft Final Report" of Jawa Timur Groundwater Development Project with the participation of the following Agencies and Organizations :

- Directorate of Irrigation II;
- Sub-Directorate PAT, Directorate of Irrigation II;
- East Java Provincial Office of Ministry of Public Works;
- Executive Agency of Groundwater Development in East Java (BP.2AT Jawa Timur);
- Part-Project Offices P2AT, Surabaya, Madiun, Besuki and Madura;
- Associated Firms of Consulting Engineers of PT.Indah Karya, PT.Wiratman & Ass, Nippon Koei Co.,Ltd and ELC-Electroconsult S.P.A.

with the special participants invited from :

- Directorate of Environmental Geology, Ministry of Mines and Energy;
- East Java Regional Development Agency (BAPPEDA);
- East Java Provincial Agricultural Services (DIPERTA);
- Project Office of Water Management (PTGA)
- Consultants of Subsector Irrigation Project and P2AT Madura.

For the discussion, the following materials were prepared and distributed by the Consultant to the Participants :

- Executive Summary
- Main Report ( Vol I )
- Annexes :

Vol II    : A. Well Construction  
          B. Civil Work Construction  
          C. Pump Installation and Maintenance  
          D. Operational Aspects of Water Management

Vol III  : Well Data Drawings  
          Canal Alignment Drawings

II.        OPENINGS OF THE DISCUSSION MEETING

The discussion meeting was open by the Director of Directorate Irrigation II, Ir.Sakdoen. Before the meeting was open, the Project Manager of BP.P2AT Jawa Timur, Ir.Tjetjep Sudjana delivered his wellcoming speech and informed about the activities of the Consulting Engineering Services for the

Jawa Timur Groundwater Development Project. He kindly requested also to the audience in giving the comments and corrections to the draft final report prepared by the Consultants during the discussion.

After the welcoming speech by the Project Manager, The Director of Irrigation II, Ir.Sakdoen, addressed the audience and declared the discussion meeting open. Outlines of the Director's address are given below :

- the draft final report should be discussed more in detail to meet the report's quality so , that it should be liable to the Lending Agency who has co-financed the Project; to the Participants, especially to the Counterparts, they are requested to participate more intensely during the discussion;
- it is not clearly explained yet within the Executive Summary both the positive or negative effects of the Project implementation and operation of the constructed facilities. Furthermore, supervision to the construction activities should be explained how they should be carried out within this Project;
- it is mentioned within the Loan Agreement that after the completion of the Project, all the tubewells irrigation facilities should be handed over to the Water User Asociation (HIPPA) through the Provincial Government. The number of those facilities handed over to the HIPPA should be therefore explained;

After having concluded his address to the Participants, the Director of Irrigation II officially opened the discussion on the Draft Final Report of Jawa Timur Groundwater Development Project.

### III. PRESENTATION AND DISCUSSION

#### 3.1 Session on the Executive Summary

The following technical comments was raised by the Director of Irrigation II after the Consultant's presentation of the Executive Summary.

- (1) It is realized that the consulting services are rendered at two responsibilit levels. i.e. the Task Concept and the Assistance Concept. The task concept means the Consultant will be responsible for the end product. However, the final technical and administrative responsibilities are still kept by the Project Manager. As to the Assistant Concept under which the Consultant will give assistance to the Project, i.e to the Engineers or Chief Supervision, assistances in the for of written recommendations or guidelines should be submitted, not orally;
- (2) Mutual check should be carried out properly since control or supervision are not solely carried out on the quality, but the quantity should also be considered for defining the unit price needed.

- (3) Total number of Pump Boards establishment, should be defined whether they are in operation or not. In case of production wells operated near the coast, they should be monitored to avoid the occurrence of sea water intrusion.

In response to this comment the Consultant had completes this Executive Summary with annexes discussing the summary more in detail. As to the supervision and control of the construction works, the Consultant had submitted to the Project Manager a "Technical Activity Note" written in Indonesian language as "Petunjuk Praktis Tentang Cara Pengawasan Pekerjaan Jaringan Irrigasi Sumur Pompa" (Practical Guide for the Supervision on the Construction of Tube Well Irrigation System).

This note can be applied more conveniently to the Counterparts since it was written in Indonesian language.

### 3.2. Session on the Presentation of Main Report

During the discussion meeting, the following main topics of Progress and Program of the Jawa Timur Groundwater Development were presented by the Consultants :

- Well Construction
- Civil Works Construction
- Pump Installation and Maintenance
- Operational Aspects of Water Management
- Recommended Program in FY.1988/1989

The discussion was led by the Sub-Director of Groundwater Development (SUBDIT-PAT), DOI-II, Mr.H.Marzuki Saleh assisted by the Project Manager of BP.P2AT Jawa Timur, Mr.Tjetjep Sudjana.

The following technical comments and questions were raised by the Participants after the Consultants presented the subjects for discussion which were then explained by the Consultants or by the Project itself.

#### 3.2.1 Well Construction

- (1). It is suggested to include the institutional aspect and the groundwater level fluctuation within this report;
- (2). Described the priority setting given by the Government for groundwater development, since there are other areas in Jawa Timur (i.e.Bojonegoro) where local farmers had already development groundwater for irrigation;
- (3). Defined the criteria used for groundwater as irrigation water and pump installation depth.

The Consultant explained for each question and finally accepted by the participant. As to the institutional aspect. Mr.Marzuki Saleh suggested the Consultant to consider this aspect in this report.

Following this suggestion the Consultant had provided an outline of this institutional aspect and was written in Part II, Paragraph 3.5 of the Main Report as "Institutional Arrangement of Groundwater Development".

### 3.2.2 Pump Installation and Maintenance

The Consultant discussed on the subject of procurement, types and total number of pumpsets installed by the Jawa Timur Groundwater Development Project as well as methods of installation and maintenance of those pumpsets.

Suggestions and questions were raised by the participants and explained then by the Consultant.

In case of the operation cost, Mr. Marzuki Saleh suggested the Consultant to complete this report with the subject of "Water Services Fee". This subject was then prepared by the Mechanical Engineer Consultant as shown in Annex-E of this report.

### 3.2.3 Water Management

The Consultant explained this subject covering the Pump Board in operation, establishment of Water User Association including training and assistance given by P2AT as well as the pump operation and fee, agricultural development, crop budget and farmer's income.

Detailed answers were given by the Consultant to the questions raised by the Participants. It is suggested, however, that the Consultant should prepare some kind of guideline for collecting data to be used by the Counterpart for agronomical activities in planning and coordinating the Project monitoring and evaluation. This guideline was prepared then by the Agronomist Consultant and was attached herewith in the report as Annex-F.

It might be worthwhile to note that the name of "Hippa" (an abbreviation of Himpunan Petani Pemakai Air) is an identical name of "Water User's Association" having the same meaning. As to the tubewell irrigation system, the name of "Pump Board" is proposed since it will cover solely on the development of pumping groundwater, excluding the utilization of surface water.

Detailed discussion on this operational aspects of groundwater management, including the Pump Board establishment, was provided in Annex-D of this report.

### 3.2.4 Civil Work Construction

Explanation of the civil work construction implemented during FY.1986/1987 and FY.1987/1988 was given by the Consultant during this meeting. It includes the progress of works so far achieved as well as the type of the constructed works such as canalization and pump-house construction. Assistance to the Counterparts was provided by the Consultant during the design, supervision and mutual checking of the construction works.

Type of linings were also discussed during the meeting including the results of previous trial of canal lining installed in Gresik. On the basis of this trial, it was decided by the Government to introduce the precast parabolic concrete segment for the open canal lining. Furthermore, the need of improving the conveyance efficiency in the tertiary unit served by tubewells irrigation system led to the conclusion of adopting low pressure buried PVC pipelines for irrigation as an alternative to the open precast concrete lining system.

Comment was given by Mr. Marzuki Saleh suggested the Consultant for updating the progress of civil work construction up to the end of the consulting service.

### 3.2.5. Program of the Project to be accomplished during F.Y. 1988/1989

Progress of the Project's completion program was summarized by the Consultant showing that out of the original 13,000 ha which were the target stipulated by the Loan Agreement, 9,332 ha (72 %) will be constructed by the end of FY 1988/1989 as shown in the following table.

Name of Structure	Completed by FY 1987/1988	Balance to be completed by FY 1988/1989	Total Achievement
Production Well	(No) 197 (Ha) (8,840)	12 (492)	202 -
Pump House	(Loc) 163 (Ha) (7,530)	39 (1,802)	202 -
Distribution System	(Ha) 7,364	1,968	9,332
Precast Lining	(Km) 4.7	207.9	212.6
Pumpset	(No) 130 (Ha) (6,006)	72 (3,326)	202 -

As to the program of works to be accomplished within FY.1988/1989, the precast canal lining constitutes the crucial works item for the construction of distribution system implemented within this fiscal year. Furthermore, the pending of pump procurement due to the disagreement between the Bank and the Government will affect the program scheduled for this pump installation which should be completed within this fiscal year.

In case of the program of project affect monitoring the Consultant suggested the Project to continue this program, since the current progress of this monitoring works in quite little being far from the original plan.

After completing the discussion, Mr. Marzuki Saleh requested the Consultant for updating and completing the progress of Project up to the end of the consulting services, i.e. by the end of July 1988.

#### IV. GENERAL COMMENT FROM THE SUB-DIRECTOR OF PAT : Ir. Marzuki Saleh.

- (1) Within this report, the legal aspect should be included; it should discuss both the institutional and the environmental aspects surrounding the tubewell irrigation system, such as the operation of

tubewell in and along the coastal area, should also be taken into account;

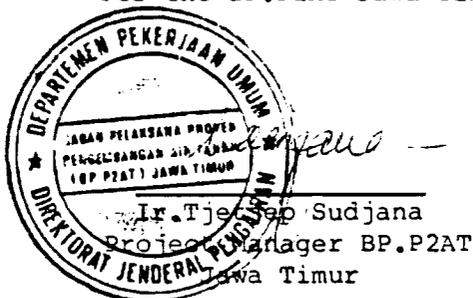
- (2) Information of type of material used for the well construction or burried irrigation system are required;
- (3) Besides the precast concrete segment lining, the Project had introduced a burried PVC pipe for groundwater distribution system. It appears that the introduction of burried pipe irrigation system had been accepted by the farmers. Guidance should be therefore given to the farmers, which are not solely confined to operation and maintenance problems, but the agricultural development practice should also be taken into account. Close Cooperation with external agencies concerned, such as the Regional Irrigation Office and the Provincial Agricultural Services as well as the Agricultural Institution and the Local Administration, should be carried out;
- (4) The Operation and maintenance of pumped tubewells involve the annual and replacement costs since it deals with large diesel engine and turbine pump. To calculate the operation and maintenance costs the Consultant is requested to define the "Water Service Fee" on the basis of those machinery subjects;
- (5) The program of monitoring of water management aspects related to the groundwater development will be continued. The Consultant is therefore requested to prepare a kind of guideline in this monitoring activities. Such kind of monitoring will be later carried out by PTGA and the Project will provide the existing data required.

V. CONCLUSION

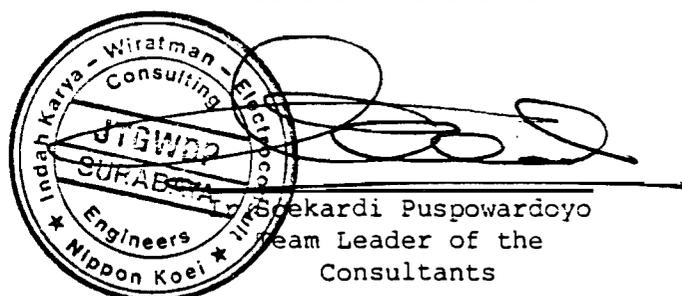
With the above presentation, discussion and comments, the "Draft Final Report" of Jawa Timur Groundwater Developed Project was accepted by DOI-II and the Project Office with some minor correction and addition following the result of discussion.

This minutes of meeting was prepared on August 3, 1988.

For the BP.P2AT Jawa Timur



For the Consultants



MAIN REPORT

## PART I-PROGRESS

### CHAPTER 1 GENERAL

#### 1.1 Objective and Scope

The Consulting Services for the Jawa Timur Groundwater Development Project is provided by PT. Indah Karya as Leading Firm, in association with PT. Wiratman & Associates, Jakarta, ELC-Electroconsult S.p.A, Milan-Italy and Nippon Koei Co., Ltd., Tokyo Japan, to fulfill the task stipulated in the Terms of Reference of Engineering Consulting Services Contract, May 9, 1987 No. HK 02.03.01/001/ABLN/DOI-II/87.

The main objective of the services are to assist and advise the Executing Agency for the Jawa Timur Groundwater Development Project during the design and construction works concerning the quality of works to achieve the timely completion of the work at minimum cost within the required standards.

The change in the groundwater development policy and the budget constraints have involved a considerable revision in the Project target. Out of the original 13,000 ha which were the target stipulated by the Loan 2119 - IND agreement, only 3,956 ha had been constructed by the end of FY 1986/1987. Priorities were therefore worked out, and it was decided to proceed the completion of tube well irrigation system of the already drilled wells and to develop the rainfed areas where groundwater constitutes the most promising resource for irrigation supply.

Groundwater irrigation development in the rainfed and upland areas is somewhat a new concept which was recently promoted by the Government in view of equity in irrigation water availability for every farmer. The aspect requires the establishing of an economically viable plan, since the rainfed area and upland area are generally covered by medium to light soil which require high consumptive use of irrigation water.

The final goal to be achieved by the Project is the establishment of and guidance to water users group for 140 location in the new tubewell irrigation schemes. It is the finishing procedure of a series of works to be implemented by the Project and, if it is successfully done, the benefit of Project will be immediately felt because of well-running water management and of resulting high agricultural return from the area of new tubewell irrigation system.

This report presented herewith describes the progress of Project implementation and the progress of current Consulting Services starting from the commencement of the assignment date, January 02, 1987. A work program to be implemented in the FY 1988/1989, that is until the expiry of this IBRD 2119 - IND Loan Project, was also prepared and recommended within this report.

## 1.2 Organization

The executing agency for the Jawa Timur Groundwater Development Project is "Badan Pelaksana Proyek Pengembangan Air Tanah Jawa Timur" abbreviated as : BP.P2AT Jawa Timur. This agency is composed of a number of Bagian Proyek (Part - Project) namely : the Madura, the Surabaya, the Kediri and the Madiun Part-Projects. The location and extent of those Part-Projects mainly depend on the geographical and administrative consideration.

The BP.P2AT Jawa Timur constitutes an unit of the Directorate of Irrigation II, Ministry of Public Works. Another body, the Sub-Directorate "Pengembangan Air Tanah (PAT)" provides advisory services to both P2AT and the Directorate of Irrigation II.

As requested by the Terms of Reference, the Consultant's organization consists of two main groups, the Technical Management Assistance Group (TMA) and the Field Implementation Assistance Group (FIA). The FIA Group is in turn divided into three sub-groups rendering their services in the Part-Project sites of Kediri, Madiun and Surabaya.

Under the "authority concept" the TMA Group provides technical guidance to the FIA Group as shown in Fig 1.1.1 Furthermore, the TMA Group also provides and receives management and technical information and assistance to and from the Sub-Directorate P2AT, the BP.P2AT Jawa Timur and the Part-Project under the advisory concept. Under the advisory concept the FIA groups exchange information or plan and discuss the activities with the respective Part-Project Managers.

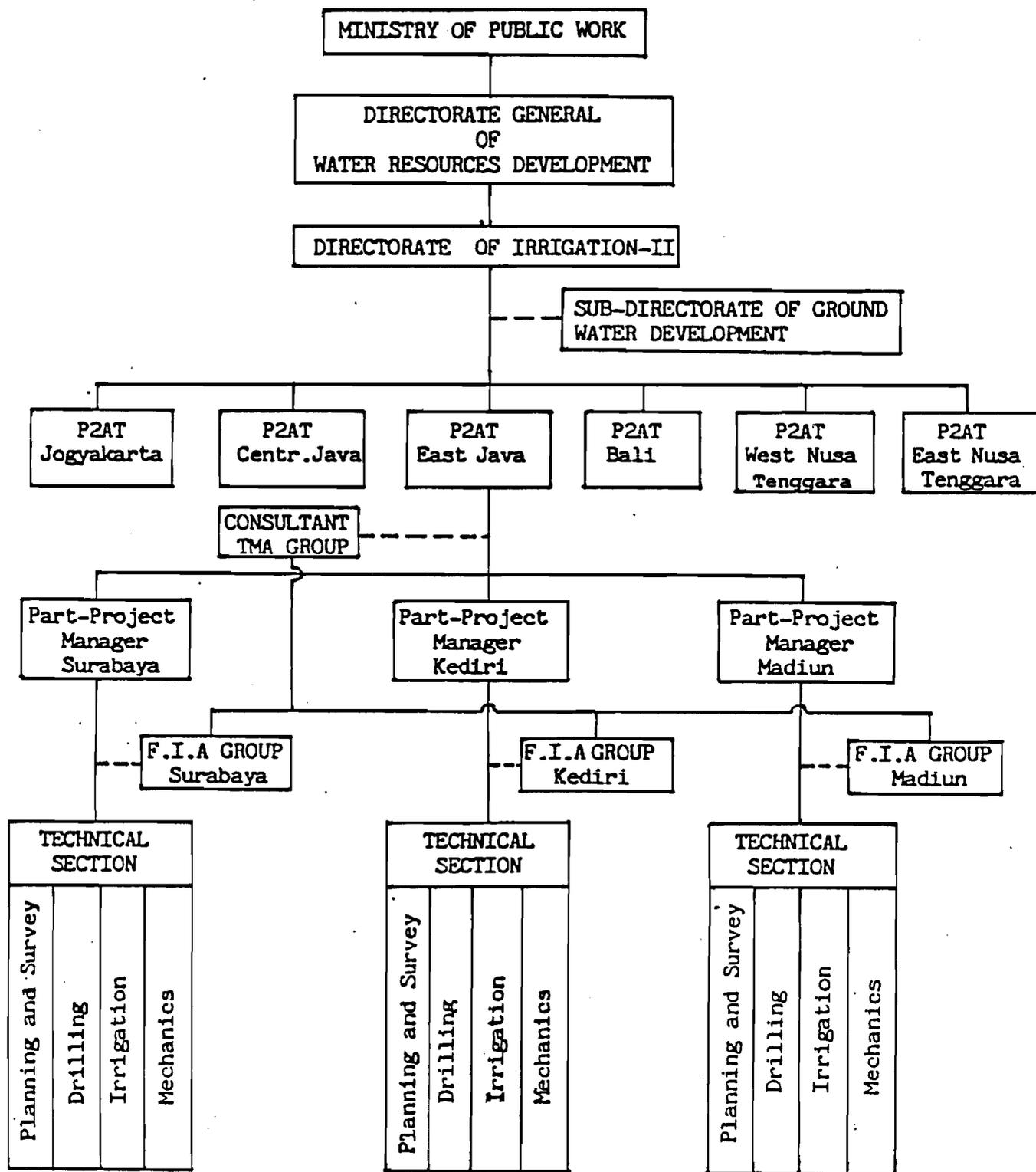
## 1.3 Workplan of the Project

The workplan of Jawa Timur Groundwater Development Project, as it is stipulated in the Terms of Reference, consists of three program, i.e the completion program, extension program and the preparatory program.

- Completion Program : this program consists of (1) consolidation of the project progress so far achieved by FY 1986/1987 including the canalization, pump installation and operation of new scheme where the production wells had been constructed and (2) new development of the rainfed area where groundwater is the most promising resource to be developed as irrigation water supply.
- Extension Program : monitoring and assessing the effect of Project implementation and operation of the constructed facilities to the natural , social and economic environments surrounding the Project, to avoid any undesired effects.
- Preparatory Program : dealing with the preparatory activities for the forthcoming groundwater development project in Palu (Central Sulawesi), Tuban, Gresik, Nganjuk, Magetan and Sampean Baru zone.

Detail description of the program mentioned above was stipulated in the Terms of Reference of the Contract. Among those program, the main work

Fig. 1.1.1 JAWA TIMUR GROUND WATER DEVELOPMENT PROJECT  
PROJECT ORGANIZATION \*)



Legend

———— Authority

- - - - - Advisory Line

\*) As of April 1988 the new Part-Project Office of Besuki was established and the Part-Projects of Kediri and Surabaya were united under the name of Surabaya Part-Project.

item is the Completion Program which was planned originally to construct surface irrigation facilities for 4,700 ha and to drill 63 production well within the new developed rainfed area. These works item of each priority work including the execution schedule planned to be implemented under the Part-Project concerned are shown Table 1.1.1.

**Table 1.1.1 WORK ITEM OF THE ORIGINAL COMPLETION PROGRAM**

Fiscal Year & Part-Project	Consolidation Program			New rainfed Areas Development		
	Prod.Well (No's)	Canals (Ha)	Pump.Inst. (Unit)	Prod.Well (No's)	Canals (Ha)	Pump.Inst. (Unit)
<u>FY. 1986/87</u>						
- Madiun	-	-	14	4	180	4
- Kediri	-	490	12	-	40	1
- Surabaya	-	900	21	14	-	-
<u>FY. 1987/88</u>						
- Madiun	-	-	-	11	495	11
- Kediri	-	490	12	2	80	2
- Surabaya	-	-	-	6	540	12
<u>FY. 1988/1989</u>						
- Madiun	-	-	-	14	675	15
- Kediri	-	285	7	-	-	-
- Surabaya	-	-	-	12	540	12
<b>T o t a l</b>	<b>-</b>	<b>2,165</b>	<b>66</b>	<b>63</b>	<b>2,550</b>	<b>57</b>

After six months from the beginning of the consulting services a reassessment and updating of this workplan was conducted, and some more revisions were necessary as it will be discussed hereafter.

#### 1.4 Consulting Services

The consulting services to support the project implementation were commenced on January 02, 1987 for a period of 19 months until July 1988. The total man-month for the services according to the Contract is 185 man-months which, in turn, were allocated 153 man-months for the Indonesian Experts and 32 man-months for the Foreign Experts. The original assignment schedule of the consulting services including the positions and names of the assigned experts is shown in Fig. 1.1.2.

The following date of arrivals of Experts on the job site had been reported to the Project Manager, describing their official services of their assignments as shown in the following table.

Position	Name	Date of Arrival
<b>TMA - Group</b>		
1. Irrigation Eng.	A.Ashari	January 02, 1987
2. G/W Engineer	Vinyaman S.	January 02, 1987
Replaced by :	Soekardi P.	May 04, 1987
3. Geohydrologist	I.Suzuki	January 02, 1987
Replaced by :	S.Kumazawa	March 01, 1988
4. Water Management	F.Tommasi	February 02, 1987
5. Agroeconomist	P.Navone	October 9, 1987
6. Groundwater Modelist	Y.Tanahashi	Deleted

Fig. J.1.2 ORIGINAL ASSIGNMENT SCHEDULE OF CONSULTING SERVICES

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POSITION	NAME	1987 - 1988																				TOTAL		EACH FIRM			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	I	F	IK	WER	WK	ELC
<b>TMA GROUP</b>																											
Irrigation Engineer	A. Ashari																					19			19		
Ground Water Engineer	Vinyanan S																					17			17		
Geohydrologist	I. Suzuki																						13			13	
Water Management	F. Tomasi																						12				12
Agroeconomist	P. Navone																						3				3
Ground Water Modelist	Y. Tanahashi																						2			2	
Mechanical Engineer	D. Tardia																					7			7		
Project Director	Sofyan A																					1		1			
Home Office Support																							2			1	1
		Sub Total TMA																				44	32	20	24	16	16
<b>FIA GROUP</b>																											
Water Management (M)	Teddy M																					17			17		
Water Management (K)	Yulianto																					17			17		
Water Management (S)	Siswoyo																					8			8		
Geohydrologist (M+K)	J. Mustiano																					15			15		
Geohydrologist (S)	Maryono																					12			12		
Irrigation engineer (S)	Sutasdi																					9			9		
Construction Supervisor (S)	Suyitno																					17			17		
Construction Supervisor (M+K)	Endang S																					14			14		
		SUB TOTAL FIA																				109	0	63	46	0	0
		GRAND TOTAL																				153	32	83	70	16	16

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7. Mechanical Engineer A	D.Tardia	June 03, 1987
8. Mechanical Engineer B	F.Giudici	February 06, 1988
9. Project Director	Sofyan A	April 25, 1987
10. Home Support		

Position	Name	Date of Arrival
<b>FIA - GROUP</b>		
1. Water Management (M)	Teddy M	April 15, 1987
2. Water Management (K)	Yulianto	January 02, 1987
3. Water Management (S)	Siswoyo	June 09, 1987
Replaces by :	W.Widodo	June 08, 1987
4. Geohydrologist (M+K)	J.Hustiano	April 27, 1987
5. Geohydrologist (S)	Haryono	May 15, 1987
6. Irrigation Eng.(S)	Sukasdi	-
Replaced by :	Haeruman	May 04, 1987
7. Const.Supervisor (S)	Suyitno	January 02, 1987
Replaced by :	Aris S	March 01, 1988
8. Cons.Supervisor (M+K)	Endang S	May 04, 1987

M = Madiun FIA , K = Kediri FIA , S = Surabaya FIA

The 19 months consulting services was rendered under two responsibility levels, i.e. under the task concepts. Under the task concept the Consultants are responsible for the end product subject to assistance received by all the Government Agencies, whereas under the assistance concept the Consultants give assistance to the best of their skills and knowledges, but do not hold responsible for the end products. Detail description of the services rendered by the Consultants were stipulated within the Terms of Reference of the Contract.

## 1.5 Revised Scope of Works and Services

### 1.5.1 Revision Requirement

A first reassessment and updating of the Project situation was conducted after six months from the beginning of the consulting services and was formalized with the Progress Report for First and Second Quarterly Periods of July 1987. Some more revisions were necessary at a later stage (September 1987) when the Government decided to adopt a new system of tertiary canal lining for the Project.

- The revision required were based on the following reasons :
- actual progress achieved by the end of Fiscal Year 1987-1988;
  - actual budget allocated for construction in the current Fiscal Year 1987-1988;
  - better definition of the Project development, location and of the actual size of the command areas to be implemented;
  - selection by the Government of the precast parabolic concrete segments as lining material for the entire Project.

The revisions have affected the construction target, the scope of work and the plan of activity for the present stage as well as the Consultant's assignment. The overall perspective Project achievement has been consequently modified based on those changes as discussed below.

#### 1.5.2 Revised Scope of Works

A substantial revision of the implementation of the completion Program had taken place due to the overall adoption of precast concrete canal lining for irrigation water distribution system. This program requires more consultant input to support the preparation of design and installation of the precast concrete segment for 213 km of canals which should be completed within the FY.1988/1989. Furthermore, the total project target of this program had been revised from 4,700 ha to 5,122 ha as the result of reassessment of the actual requirement and the project's capabilities.

On the other hand, implementation of the Extension Program was reduced to the minimum requirement due to the budgetary constraints. As for the Preparatory Program the Consultant had initiated the activity and was completed in accordance with the original Term of Reference.

To cope with this Project implementation program, the original program and schedule were revised. This revised overall work program and schedule had been reported to the Project Manager and discussed during the submission of "Interim Report" of December 1987. Table 1.1.2 shows both the original and revised project implementation program to be achieved within Three Years Project implementation including the Project activity schedule for the revised work program.

#### 1.5.3 Revises Scope of Services and Consultant Assignment

As a consequence of revising the work program, the Term of Reference for the consulting services had been slightly modified, deleted or substituted by new work items. Out of the 21 items stated in the original Term of Reference the following 10 (ten) items had been revised, keeping the remains as their original items.

Items to be revised in the Original Term of Reference (1986)	Proposed revision of Term of Reference (1988)
4. Design of Structures and Facilities to Irrigation 3,366 ha of Rainfed Lands.	4. Design of Structures and Facilities to irrigate 3,765 ha of Rainfed Lands.
5. Supervision to the Drilling of 63 Production Wells in Madiun and Surabaya Part Projects.	5. Supervision to the Drilling of 66 Production Wells in Madiun, Kediri and Surabaya Part-Project.
6. Supervision to the Construction of Irrigation Facilities covering 4,700 ha	6. Supervision to the Construction of Irrigation Facilities covering 5,376ha

Table 1.1.2 JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT  
ORIGINAL AND REVISED PROJECT IMPLEMENTATION PROGRAM

WORK ITEM	: ORIGINAL: (*1)		: TARGET : REVISIED : TOTAL	: P R O G R E S S			: PROGRAM : ESTIMATED:	: TOTAL :
	: BY	: TARGET		: PROGRESS	: IN	: IN		
(UNITS)	: AGREEMENT:	(1986)	: MARCH 86	: FY1986/87:	FY1987/88:	FY1988/89:	: MENT	:
			(A)	(B)	(C)	(D)	(A+B+C+D)	
A. COMPLETION PROGRAM								
1. PROCUREMENT								
CASING & SCREEN (M):	43,000	37,000	37,000	0	0	2,700	39,700	
PUMPSET (UNITS):	380	244	176	0	70	0	246	
MAINTENANCE UNIT (LS):	1	1	0	0	0	1	1	
OTHER EQUIPMENTS (LS):	1	1	0	0	0	1	1	
2. RAINFED AREA STUDY (HA):		6,000	4,800	1,200	0	0	6,000	
3. DETAILED DESIGN								
TOPO-SURVEY (HA):	13,000	13,009	10,679	1,333	998	0	13,010	
DETAILED DESIGN (HA):	13,000	12,808	9,442	2,243	1,513	0	13,198	
4. PIPE SYSTEM DESIGN & CONST. (NOS):	0	10	0	6	0	5	11	
5. CANAL LINING MINI-TRIAL								
	0	1	0	1	0	0	1	
6. DRILLING CAMPAIGN								
EX. /OB.WELL (NOS):	165	144	134		0	0	134	
PRODUCTION WELL (NOS):	275	206	143	23	31	12	209	
- MADIUN	(68)	(68)	(38)	(4)	(11)	(12)	(65)	
- KEDIRI	(107)	(53)	(53)	(0)	(2)	(0)	(55)	
- SURABAYA	(100)	(85)	(52)	(19)	(18)	(0)	(89)	
7. TERTIARY DEVELOPMENT								
ACCESS ROADS - MADIUN (KM):	91	46	46	0	6	10	62	
DISTRIBUTION SYSTEM (HA):	13,000	8,656	3,956	1,473	1,935	1,968	9,332	
NEW - MADIUN	-	(1,334)	(0)	(0)	(718)	(1,080)	(1,798)	
- KEDIRI	(3,600)	(2,576)	(1,187)	(842)	(685)	(159)	(2,873)	
- SURABAYA	(2,650)	(3,287)	(1,310)	(631)	(532)	(729)	(3,202)	
EXISTING -MADIUN	(6,750)	(1,459)	(1,459)	(0)	(0)	(0)	(1,459)	
CANAL LINING (PRECAST) (KM):						212.6	212.6	
- MADIUN	-	-	0	0	0	(39.6)	(39.6)	
- KEDIRI	-	-	0	0	0	(86.6)	(86.6)	
- SURABAYA	-	-	0	0	0	(86.4)	(86.4)	
PUMP INSTALLATION (NOS):	240	172	62	29	39	72	202	
- MADIUN	(68)	(58)	(24)	(14)	(4)	(23)	(65)	
- KEDIRI	(107)	(42)	(14)	(9)	(20)	(16)	(59)	
- SURABAYA	(65)	(72)	(24)	(6)	(15)	(33)	(77)	
8. HIPPA ORGANIZATION (LOC):	240	172	62	29	39	72	202	
- MADIUN	(68)	(58)	(24)	(14)	(4)	(23)	(65)	
- KEDIRI	(107)	(42)	(14)	(9)	(20)	(16)	(59)	
- SURABAYA	(65)	(72)	(24)	(6)	(15)	(33)	(78)	
B. EXTENSION PROGRAM								
1. MONITORING W/REQUIREMENT, W/LEVEL	YES	YES	ONGOING	CONT'D	CONT'D	CONT'D		
2. SPRING/ARTESIAN AQUIFER INVENTORY	-	YES	-	PREP'D	SUSP'D	SUSP'D		
3. DEMO. COMMAND AREA (LOC):	-	3	-					
4. PM & E (LS):	YES	YES	ONGOING	SUSP'D	SUSP'D	SUSP'D		
5. SEA WATER INTRUSION STUDY (LS):	-	YES	ONGOING	CONT'D	CONT'D	CONT'D		
6. O & M UP-GRADING (LS):	-	YES	ONGOING	CONT'D	CONT'D	CONT'D		
7. PRIVATE SECTOR INVOLVEMENT	-	YES	-	-	PREP'D	CONT'D		
C. PREPARATORY PROGRAM								
1. INVENTORY IN PALU AREA	-	YES	-	-	START'D	CONT'D		
2. MONITORING/ANALYSIS OF PALU AREA	-	YES	-	-	START'D	CONT'D		
3. SHALLOW AQUIFER POTENTIAL STUDY	-	YES	-	-	START'D	CONT'D		
4. MONITORING IN SAMPEAN BARU AREA	-	YES	-	-	START'D	CONT'D		

\*1 : T.O.R., Contract for Engineering Services for Jawa Timur Groundwater Development Project

Item so be revised in the Original Term of Reference (1986)	Proposed revision of Term of Reference (1987)
7. Selection, Design and Construction Supervision for 10 Pipe Irrigation Systems.	7. Selection, Design and Construction Supervision for 11 Pipe Irrigation Systems.
9. Location, Survey and Design of a New Trial Section for the Lining Material not Tested in Gresik.	9. Deleted. Substituted by : "Preparation of Detailed Technical Specification for Precast Parabolic Concrete Segments".
10. Installation of new Type of Lining and Monitoring of the Lining Behav- iour.	10. Deleted. Substituted by : Installation of 5 schemes of ferrocement canal lining, and monitoring of the lining behaviour.
13. Provide Services in Water Management for 110 New Schemes.	13. Provide Services in Water Management for 140 New Schemes.

In accordance with the revision of the work program and target, as well as the actual requirement of the consulting services, the assignment schedule of the consultants had been rescheduled and adjusted. As shown in Fig. 1.1.3. of "Revised Assignment Schedule" of the consulting services, the total number of the required Experts and the relevant assignment periods was not changed from the allocation man-months, i.e. 153 mm for Indonesian Experts and 32 mm for Foreign Experts.



## CHAPTER 2      PROGRESS OF CONSULTING SERVICES

### 2.1      Assignment Schedule

The consulting services to support the project implementation were scheduled to start immediately after the end of the previous engineering services in August 1986 as a part of completion program. Due to time required to arrange the agreement between the Government and IBRD and also to process the Contract for Consulting Services, the services were actually commenced in January 1987 for the duration of 19 months until July 1988.

At the early stage of Project implementation some minor adjustment of the Project Program had been done to conform with the FY.1987/1988 available budget, and administrative regulation by the Indonesian Consulting Firm, PT.Indah Karya and PT.Wiratman and Associates. Accordingly the assignment schedule of Consultants had been revised, keeping the total man-month, the detailed work schedule as the same as stated in the Contract.

### 2.2      Mobilization and Activity of the Consultants

Within two weeks after receiving the Letter of Proceed all the TMA resident Consultants and Coordinator of FIA Groups had started to mobilize to the site. Office space facilities, vehicles, equipments and supporting staff for TMA Groups had been arranged within the above mentioned period. Utilizing the office of the TMA as base camp, the Consultant organizes three FIA Offices which are basically to be located inside the Government Part-Project Office.

At the beginning of their services the Consultants prepared detailed work schedule and discussed with the Counterparts to organize the efficient work-system for the best support to the Project implementation. They entered to full active stage and most of them had already arrived. All the office facilities, vehicles and supporting staff had been arranged as stated in the contract.

The Irrigation Engineer of TMA Groups guided the Design Team Consisting of mainly P2AT's Design Engineer and one FIA Irrigation Engineer. This activity was carried out until all the design works had been completed. The TMA Geohydrologist Expert had completed the preparation of computerized data bank and evaluation system for the production wells; this system had been immediately utilized to analyze the result of the on-going drilling campaign of FY 1986/1987 conducted in Sampean Baru. In addition, inventory of the available groundwater resources from artesian aquifer and spring had been commenced with the preparation of work criteria and data system by TMA Geohydrologist Expert.

Drilling Supervisors and Construction Supervisors were assisted by the TMA Groundwater Engineer and FIA Construction Supervisor respectively. Furthermore, the TMA Water Management Expert had guided the FIA Water Management Engineers in establishing Water Use Group (HIPPA) in new operation tubewell command areas and organizing the monitoring in water use.

The Mechanical Engineer of TMA Groups had prepared tender document and technical specification for procurement the equipments purchased by the Project including evaluation of the bid. He guided and giving advise to the P2AT's technical personnel for the pump installation, maintenance and repairing of machinery equipments.

Finally, at the end of their assignments, each Expert prepared a document of "Technical Activity Note" describing the methods, approaches or procedures they used including recommendation for operation and maintenances.

### 2.3 Progress of Engineering Services

The services provided by the Consultant, as it is mentioned before, was rendered under two levels, i.e the task level (T) and the assistance level (A). The following items describe progress of the engineering services in the order of scope of works as stated in Terms of Reference of the Contract.

#### (1) Preparation of Detailed Time Schedule (A).

Since the commencement of the Services in January 1987 the Consultants had assisted P2AT in the preparation of P2AT Work Program. Thereafter, at the start of Fiscal Year 1987/1988 in April 1987, with the issuance of the Project Budget FY 1987/1988, the proposed Work Program have gradually undergone with revision adjusted to the available budget.

The revised P2AT Program had been reported in the "First and Second Quarterly Report". Consequently a "Revised plan of Work for the Consulting Services" (Jan 1987 - July 1988) as reported in the "Interim Report" of January 1988 had been prepared relevant to the P2AT activities. Furthermore following the revised plan of work, the assignment of the Consultants need a minor adjustment as shown in figure of the "Revised assignment Schedule".

#### (2) Work Criteria for Inventory of Artesian Aquifer and Springs (T).

Work criteria had been prepared by the Geohydrologist for spring/artesian aquifer inventory (June 1987). The Part-Project of Madiun, Kediri and Surabaya, had collected, selected and tabulated the existing artesian aquifer in their respective regions.

#### (3) Data Collection & Storage for Item 2 (T).

The Consultant had prepared data storage system for the future collected data in computer type Apple II.

#### (4) Design of Irrigation Facilities for 3,932 ha (T).

Preparation of this design had been started immediately after the commencement of the Services, for Part-Project Surabaya and Kediri. For the Part-Project of Madiun, there was no requirement for design, since design works had been completed during the previous Engineering Services.

The tender bid had been conducted according to schedule, between June and September 1987, in total for Surabaya and Kediri, respectively 33 units and 15 units with a total area of 1,946 ha.

(5) Drilling Supervision for 31 Wells (A.)

Out of the 66 wells constructed, 31 wells had been drilled during FY.1987/1988. Under the Part-Project Kediri, the programmed drilling of 2 (two) production wells in Blitar Zone (TW 222 KN and TW 223 KN) had been completed. Wells were drilled at an average depth of 127 meters, and were completed by installing of 10 inches pump chamber casing and 6 inches blank pipes and screens as intake portion.

Out of the 11 (eleven) production wells constructed under the Madiun Part-Project, 8 (eight) wells had been constructed in the rainfed area. Wells were drilled at various depth of 170-210 meters and completed by installing of 16 inches pump chamber casing and 10 inches blank pipes and screen as the intake portion.

Under Surabaya Part-Project 18 (eighteen) tests wells had been constructed. Wells were drilled at various depths between 100 and 125 m and completed by installing 10 inches pump casing and 6 inches of blank pipes and screens.

(6) Construction Supervision for 5,376 ha (A).

The Consultant assisted the Part-Project of Madiun, Kediri and Surabaya during the supervision of the construction of Tube Well irrigation system. The P2AT had assigned full time Supervision Team for each package.

The construction works had been started between July 1987 and September 1987 for 48 units with Total area of 1,946 ha.

(7) Monitoring of Six Pipe Line Irrigation Units (T).

With the assistance of Consultants six (6) PVC pipe distribution system had been constructed by P2AT during FY.1986/1987 for demonstration and trial purpose. Some monitoring due to trial out during FY.1987/1988 performances had been carried.

(8) Monitoring of Canal Lining Trial Section in Gresik (T).

The Canal Lining Trial Section had been constructed in Gresik in July 1985. Since then, P2AT had conducted several times on monitoring the canal water losses. It was proved, that the Precast Concrete Parabolic Segment was selected to be used for the lining of canals in FY.1988/1989 due to their canal efficiency and durability.

(9) Selection Detailed Survey and Design of New Canal Material Trial (T).

This item was deleted and substituted by the "Preparation of Detailed Technical Specification for Precast Parabolic Concrete Segment".

The Consultants had assisted P2AT in the preparation of the Technical Specification and the budget estimation for the construction and installation of the lining for FY.1988/1989 financed under the present Loan 2119 IND. The total length of Precast Concrete Parabolic Segment is estimated to be 212,6 km and scheduled as " Procurement of Equipment & Supplies".

This specification had been submitted by the Consultant to the Project Manager at the end of September 1987 which was attached to the Tender Document.

(10) Installation of New Lining Type Trial and Monitoring (A)

This item was deleted and substituted by the "Installation of 5 Schemes of Ferrocement Canal Lining". The Consultant had assisted the Project in preparing the technical specification of the installation of this ferrocement canal lining.

(11) Monitoring of Water Requirements, water use and Changes in the Aquifer Level on the Ground of Field Data Collected by the Government (T).

The Consultant's activity for this item work includes the finalization of a Water Management Data Base. Identification of 30 representative tube well (10 wells for each Part-Project) where monitoring should be carried out. Adequate forms had been prepared where the monitored information should be tabulated for data processing and subsequent insertion into the Data Base. Training of the Government Personnel in the use of the above forms had been carried out followed by the preparation of computer programs for data processing & evaluation.

Both the monitoring organization and the data collection campaign were conducted by the Government, while processing and evaluation of the available field data will be carried out by the Consultant.

(12) Review and Updating of the Existing Ground Water Models (T).

This work item was canceled from the program since no more time allocated for the mathematical modeling within FY 1988/89.

(13) Provide Services in Water Management for 140 New Schemes.

Services for this item of work were provided, of which 18 are located in Madiun Part-Project, 29 in Kediri Part-Project and 21 in Surabaya Part-Project; thus bringing the total for this services to 68 schemes.

The remaining 72 units necessary to complete the scope of work (23 in Madiun, 16 in Kediri, and 33 in Surabaya Part-Project) are scheduled to become operative in FY. 1988/1989.

(14) Plan and Establish the Project Economic Monitoring Organization and Data Collection Methods (T).

This work item will be conducted in FY. 1988/1989 after the construction works of this Project completed.

(15) Assist the Government Personnel in Processing the Data Collected for the Project Economic Monitoring (A).

This work item was substituted by the "Preparation of Technical Specification for Procurement of Material and Equipment" for the Sub-Sector Loan Project. This preparation had been completed and submitted to the Project Manager.

(16) Investigation on Ground Water Contamination in the Coastal Area (A).

This work item was substituted by the "Preparation of Technical Specification for Procurement of Salinity Warning System". This preparation had been completed and submitted to the Project Manager.

(17) Assist in Analyzing the Mechanism of Sea Water Intrusion (A).

This item of work will be carried out only if the budget required avails.

(18) Study of Measures to Prevent Sea Water Intrusion (T).

This item of work will be carried out after the items (17) was completed.

(19) Carry out Inventory Survey on Existing Wells in Palu Area (A).

Completed by the Consultant and continued by the Consultant Team for Irrigation Sub-sector Project (SSL Team).

(20) Monitoring of Ground Water Use, Aquifer Behaviour and Water Quality in Sampean Baru Area (A).

Completed, continued by SSL Team.

(21) Ensure Transfer of Knowledge to the Government Personnel (T).

Continuous on the job training and transfer of knowledge had been provided place during the Consulting Services.

(22) Reporting

During the consulting services the following reports and technical activity notes had been prepared and submitted to the Project Manager :

1. Technical Activity Note "Draft Working Criteria for Spring/Artesian Aquifer Inventory First (June 1987);
2. Revised Technical Specifications for Proposed Second Procurement of Equipment & Supplies (Mechnote-I/JT, June 1987);
3. Progress Reports for First and Second Quarterly Period (Jan'87 - March'87 and April'87 - June'87);
4. Special Reports for the IBRD Review Mission 1987 (August 25, 1987);
5. Third Quarterly Report (July'87 - Sept'87);
6. Interim Report (Dec 1987);
7. Technical Activity note "Irrigation Time Schedule" (Agronote - I, FIA Kediri, July 1987);
8. Minutes of Meeting on Review of Jawa Timur Groundwater Development Component Under Loan 2119 - IND (August 28, 1987);
9. JTGWDP - IBRD Loan 2119 - IND Seventeenth Irrigation Project "Project Completion Alternatives and Budget Requirement Estimates" (August 1987);
10. Technical Specifications for Precast Concrete (Quantity of units, Engineers Cost Estimation and Location (September 1987);
11. Technical Activity Note. "Petunjuk Praktis Tentang Cara Pengawasan Pekerjaan Jaringan Irigasi Sumur Pompa" (Practical Guide for the Supervision on the Construction of Tube Well Irrigation System);
12. Completion Report of Drilling Campaign 1986/1987 of Surabaya Part Project (Geonote I, December 1987);
13. Guidelines and Tentative Plan of Work for the Agroeconomical Activities (Agroeco-Note 1, November 1987);
14. Groundwater Quality in Sampean Baru Area (Geonote II, January 1988);
15. Progress Report to IBRD Review Mission;  
- Mr.W Barber (June 1988)
16. Technical Specification for First Procurement of Equipment and Supplies under Irrigation Subsector Project - IBRD Loan 2880 - IND (Mechnote-II, March 1988);

17. Crop Water Requirement for Maize (Agronote-II, FIA Kediri, March 1988);
18. Analysis and Evaluation of Single Well Test Data (Drillnote-I/JT, March 1988);
19. Well Yield Evaluation Report of Surabaya Part-Project Drilling Campaign FY 1987/1988 (Geonote-III, March 1988);
20. Pump Installation Program (Mechnote-III/JT, May 1988);
21. Progress Report to IBRD Review Mission Mr.W.Barber (June 1988);
22. Completion Report on the Construction of Pumphouse & Canalization at Pasuruan, Gresik, Mojokerto, Probolinggo & Tuban in FY. 1987/1988 (Const.-Not-1);
23. Final Report on Water Management Aspects (Water Management Note-2/TMA SBY);
24. Report on Drilling and Geohydrology of Madiun and Kediri (Geonote IV-June 1988);
25. Completion Report of Drilling Campaign FY.1987/1988 of Surabaya Part-Project (Geonote V-June 1988).

#### 2.4 Consultant Assignment

The required Experts and their relevant assigned periods, as it was discussed before, had been slightly modified to conform with the substantial revision of the Project implementation. The total manmonths allocated as mentioned in the Contract, however, are kept the same although there are some substitution of the Consultants to be assigned. The total manmonths consumed for the services until the end of the Contract are shown in the following table.

<u>Position</u>	<u>Rev.Assignment (mm)</u>		<u>Consumed (mm)</u>	
	Indon	Foreign	Indon	Foreign
A. TMA GROUP				
1. Team Leader A Cum Irr.Engineer	14.0	-	14.0	-
2. Team Leader B Cum Groundwater Eng	14.7	-	14.7	-
3. Geohydrologist A	-	14.5	-	14.5
4. Geohydrologist B	-	1.0	-	1.0
5. Water Manag. Eng	-	12.3	-	12.3
6. Agroeconomist	-	0.7	-	0.7
7. Mech.Eng A	10.0	-	10.0	-
8. Mech.Eng B	-	1.5	-	1.5
9. Project Director	1.0	-	1.0	-
10. Home Off.Sup	-	2.0	-	2.0
Sub Total	<u>39.7</u>	<u>32.0</u>	<u>39.7</u>	<u>32.0</u>

B. 1. Water Manag.Eng (M)	15.5	-	15.5	-
2. Geohydrologist (M)	10.6	-	10.6	-
3. Water Manag.Eng (K)	18.5	-	18.5	-
4. Irrigation.Eng (K)	14.9	-	14.9	-
5. Construction.Eng(S)	19.0	-	19.0	-
6. Geohydrologist (S)	12.5	-	12.5	-
7. Irrigation.Eng (S)	14.9	-	14.9	-
8. Water Manag.Eng (S)	<u>7.4</u>	<u>-</u>	<u>7.4</u>	<u>-</u>
Sub Total	113.3	0	113.3	0
Grand Total	153.0	32.0	153.0	32.0

The total man-months consumed during the services is in conformity with the total man-months allocated within the Contract, i.e 153 mm for Indonesian Experts and 32 mm for the Foreign Experts.

CHAPTER 3 PROJECT PROGRESS EVALUATION & FINDINGS

3.1 General

The work plan of this Project, as it is discussed before, constitutes only part of the integrated work program for groundwater development project in East Jawa. This plan consists of three main components, i.e the Completion Program, Extension Program and the Preparatory Program.

Progress of this Project implementation as of July 1988, will be briefly evaluated hereafter with some suggestion for the updating of the current program performed to be implemented within the FY.1988/1989.

3.2 Completion Program

The present completion program of the Part-Project concerned as stated in the "Revised Overall Work Program and Target" of Jawa Timur Groundwater Development Project consists originally of the following work items :

Table 1.3.1 REVISED WORK ITEM & TARGET OF THE COMPLETION PROGRAM

Work Item	Units	Revised Target	Madiun	Kediri	Surabaya
1. PROCUREMENT					
Casing & Screen	(m)	2,970	-	-	2,970
Pumpset	(Unit)	70	-	-	70
Maintenance Unit	(Ls)	1	-	-	1
Other Equipment	(Ls)	1	-	-	1
Precast Canal Segment	(Km)	212.6	39.6	86.6	86.4
PVC Pipes	(m)	13,000	-	-	13,000
2. RAINFED AREA STUDY	(Ha)	1,200	-	-	1,200
3. DETAILED DESIGN					
Topo Survey	(Ha)	2,703	-	499	2,204
Detailed Design	(Ha)	3,932	-	1,745	2,187
4. PIPE SYSTEM DESIGN & CONST.(Nos)		6	-	-	6
5. CANAL LINING MINI-TRIAL					
Installation		(0)	-	-	-
Monitoring/Assessment		(1)	-	-	1
6. DRILLING CAMPAIGN					
Production Well	(Nos)	66	27	2	37
7. TERTIARY DEVELOPMENT					
New Distribution System	(Ha)	5,376	1,798	1,686	1,892
Canal Lining	(Km)	212.6	39.6	86.6	86.4
Pump Installation	(Nos)	140	41	45	54
8. HIPPA ORGANIZATION	(LOC)	140	41	45	54

Progress of this program including evaluation of the results are reported and discussed as the followings.

### 3.2.1 Procurement of Equipment & Material

#### (1) Procurement of Pumpsets

A total amount of 70 pumpsets of the second procurement of equipment & supplies had been tendered and evaluated. The pumps supplied will provide the following duties.

Type of Pump	Pumpset (Nos)	Discharge (L/S)	Static Discharge Head (m)	Length of Column Pipe (M)
A	10	45	35	39
B	19	45	20	24
C	6	60	40	45
D	15	60	30	33
E	20	60	20	24

Three units of Torque Sensors are included in this package. It is an electronic transducer of self contained type in which the brush assembly is mounted on the torque shaft by ball bearings. A digital electronic readout instrument for measuring the torque will be coupled with connector ended cable.

#### (2) Procurement of Casing, Screen and Drilling Tool

To complete the primary necessities of materials to be used for the well constructions, the following items have been processed.

Description	Unit	Quantity
Well Casing		
- Pump chamber casing 12" API Std	m	300
- Liner blank casing 6" API Std	m	1410
Well Screen 6" API Std	m	1260
Drilling Tools		
- Stabilizer	pcs	2
- Tricone bit for hard formation with fluid circulation		
5 5/8" rock bit	pcs	8
8 3/4" rock bit	pcs	4
12 1/4" rock bit	pcs	8
- Tricone bit for medium formation with air drilling		
5 5/8" rock bit	pcs	5
8 3/4" rock bit	pcs	5
12 1/4" rock bit	pcs	6
16" rock bit	pcs	4

#### (3) Procurement of Monitoring and Maintenance Equipment

For the future maintenance and monitoring of the operational irrigation wells, procurement of the following equipments have been processed.

Description	Unit	Quantity
Salinity warning system		
- Pumping station unit	units	15
- Repeater station unit	units	2
- Central station unit	units	2
Mobile service unit for maintenance of water (Each unit consists of 4 WD Pick Up Van, Down-hole TV System, Caliper, Gamma-Ray, EC Logger, Generator Set, Air Compressor and Field Water Quality Testing Set).	units	2

Due to technical reason the bids evaluation have been canceled and a re-tender will be held in August 1988. As per Project request Consultant had prepared revised technical specifications for procurement of Monitoring and Maintenance Equipment. Especially for the monitoring equipment, a change from fully automatic to simple monitoring salinity warning system have been proposed.

#### (4) Procurement of Precast Concrete

The tenders of Precast Concrete Parabolic Segment have been awarded to 2 contractors, namely PT. Wijaya Karya, and PT. Waskita Karya. Totally 212.6 km or 106,500 pcs of Precast Concrete will be supplied, of which consist of 24,150 pcs of type A (60 l/s) and 82,350 pcs of type B (45 l/s) as per drawing Fig. IRR-01 will be supplied.

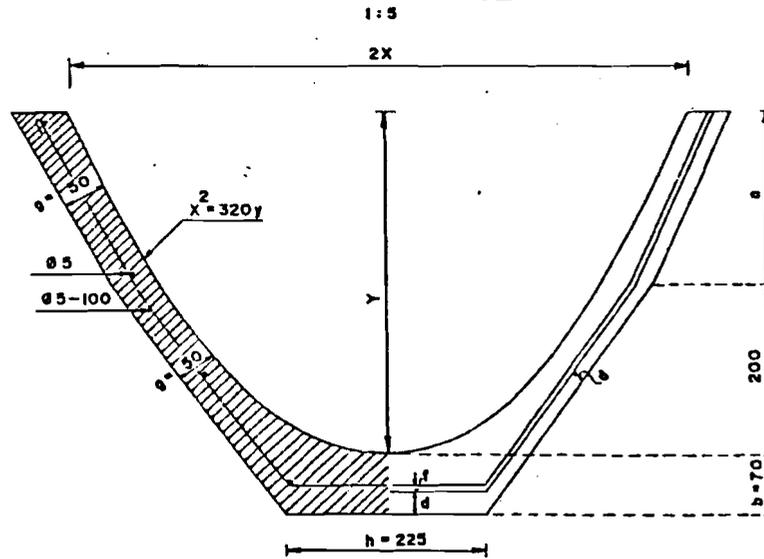
The following table shows the number and type of precast concrete segment which should be delivered by the Contractors with respect to their packages.

Package Contractors	Type A (psc)	Type B (psc)
<u>A. Package I</u>		
- PT.Wijaya Karya	-	7,600
- PT.Waskita Karya	6,150	-
<u>B. Package II</u>		
- PT.Wijaya Karya	-	74,750
- PT.Waskita Karya	18,000	-
<b>Total</b>	<b>24,150</b>	<b>82,350</b>

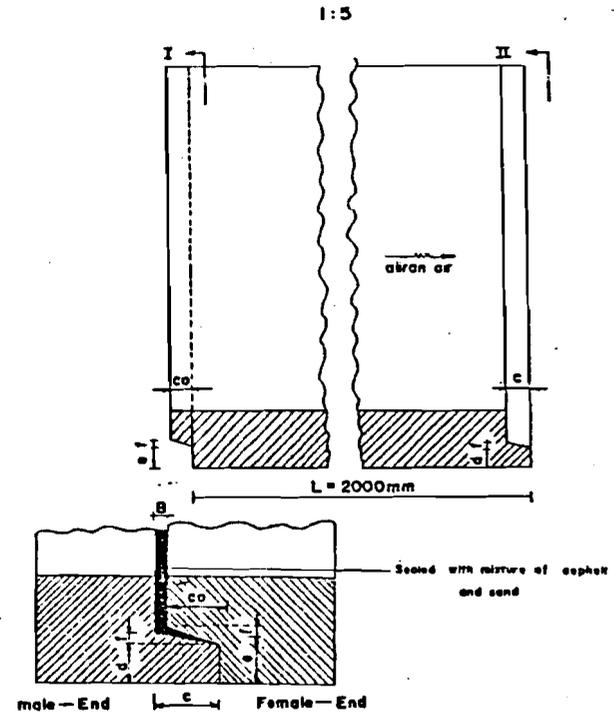
#### 3.2.2 Well Construction

The program of drilling 54 test/production wells distributed under the Part-Project of Madiun (15 wells), Kediri (2 wells) and Surabaya (37 wells) within the FY.1986/1987 and FY.1987/1988 had been completed. Most wells constructed under the Part-Project of Surabaya and Kediri were drilled to the depth of 100-125 m whereas under the Madiun Part-Project they were drilled on the average depth of 200 m. The following table describes the total depths of drilling and installation in each Part-Project.

POTONGAN-MELINTANG  
CROSS-SECTION



POTONGAN-MEMANJANG  
LONGITUDINAL-SECTION



UKURAN mm

TYPE	Profile	Y	2X	L	a	b	c	d	e	f	g	h	co
A	400/716	400	716	2000	200	70	30	18	26	5	50	225	22
B	300/620	300	620	2000	150	70	30	18	26	5	50	225	22

Profile 400/716 → Weight = 337 kg/2m<sup>2</sup>

300/620 Weight = 286 kg/2m<sup>2</sup>

Detail spanning sambungan  
Detail of joint groove 1:2

REPUBLIC INDONESIA DEPARTEMEN PEKERJAAN UMUM DIREKTORAT JENDERAL PENGAIRAN				
PROYEK PENGEMBANGAN AIR TANAH JAWA TIMUR JAWA TIMUR GROUNDWATER DEVELOPMENT PROJECT				
PRECAST REINFORCED CONCRETE K300 PARABOLIC				THE ASSOCIATED CONSULTING ENGINEERS BIDAH KARYA - WURATMAN ELECTROCONSULT-NIPPON KENKI
DIGAMBAR DRAWN	DIPERIKSA CHECKED	DISETUIH APPROVED	TANGGAL DATE	

Table 1.3.2 DRILLING AND INSTALLATION DEPTH OF DRILLING CAMPAIGN  
FY.1986/1987 & 1987/1988

Part-Project District	FY.1986/1987			FY.1987/1988		
	Well (Nos)	Drilled depth (m)	Installed depth (m)	Well (Nos)	Drilled depth (m)	Installed depth (m)
<u>Madiun</u>						
- Ngawi	1	179	134	4	767	675
- Madiun	2	420	368	3	615	591
- Magetan	-	-	-	3	624	570
- Ponorogo	1	185	148	1	191	179
<u>Kediri</u>						
- Blitar	-	-	-	2	254	251
<u>Surabaya</u>						
- Tuban	7	838	838	5	593	557
- Pasuruan- Probolinggo	4	533	527	13	1,628	1,563
- Situbondo	8	1,048	1,014	-	-	-
<b>Total</b>	<b>23</b>	<b>3,203</b>	<b>3,029</b>	<b>31</b>	<b>4,672</b>	<b>4,386</b>

(1) Well Design

The construction of a production well had been so designed that it will give the desired discharge at minimum cost. Under the East Java Ground Water Development Project the design of well construction had been standardized as shown in the drawing GH-01.

Within the Surabaya and Kediri Part-Projects the well construction was designed for a production well yielding not more than 60 l/s with an average depth of about 125 m, while in Madiun area it was designed for a well producing up to 100 l/s and drilled down to 200 m deep. This big capacity well constructed under Madiun Part-Project was initially designed to developed groundwater in conjunctive use with surface water covering a command area of about 100 ha.

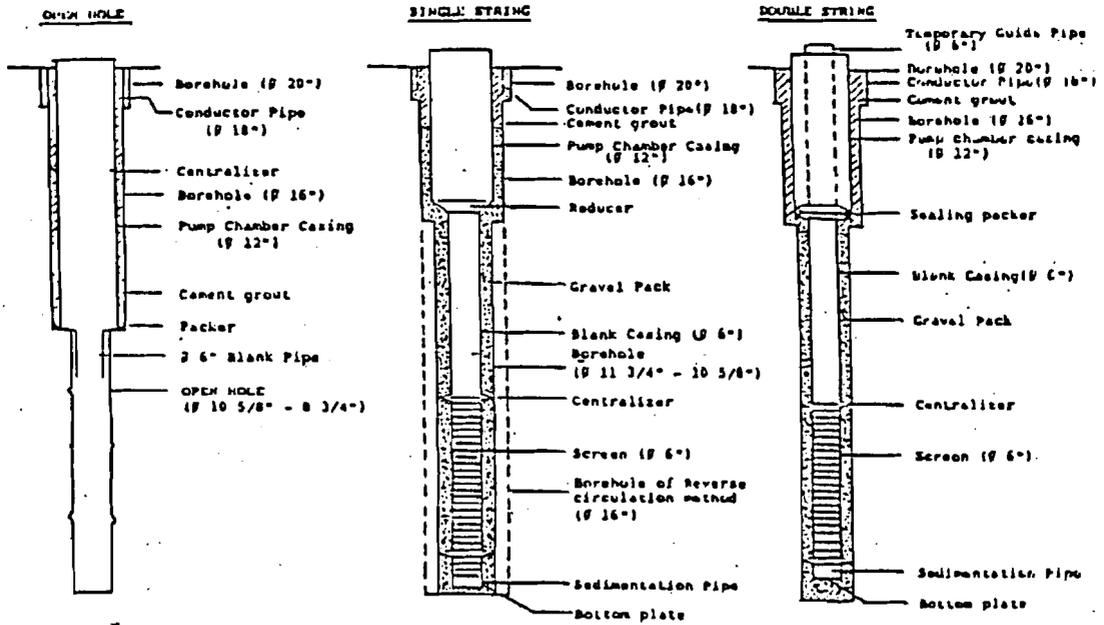
The present situation, however, prevails that priorities had been given to develop groundwater irrigation in rainfed areas, where the command areas will be rather small and the required yield of each well becomes therefore less than the initially designed. Modification of well construction designed under Madiun Part-Project should be therefore considered to adopt this design with the required water discharge and the available data of aquifer characteristic of the rainfed areas.

(2) Aquifer Properties and Well Characteristics

Different type of pumping tests had been performed to determine both the aquifer properties and the well characteristic of the constructed wells. Results of evaluation of those tests are tabulated in Table 1.3.3.

TUBAN, PASURUAN - PROBOLINGGO, SITUBONDO, MOJOKERTO ZONE AND KEDIRI - NGANJUK

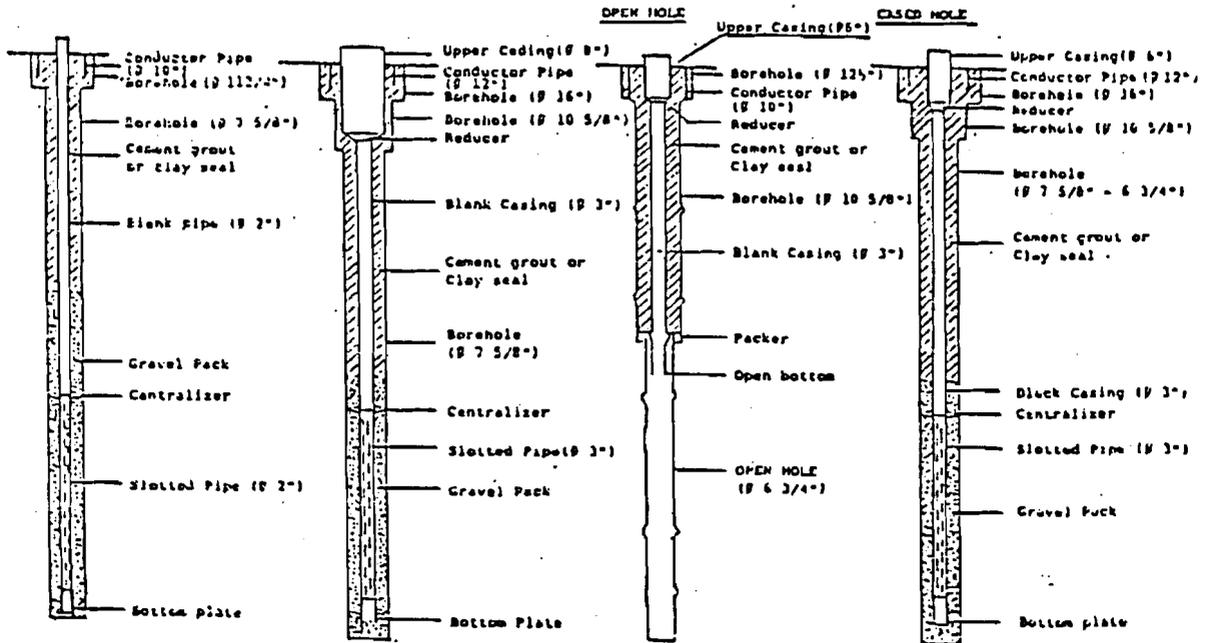
TEST/PRODUCTION WELL



PIEZOMETER HOLE

OBSERVATION WELL

EXPLORATION HOLE



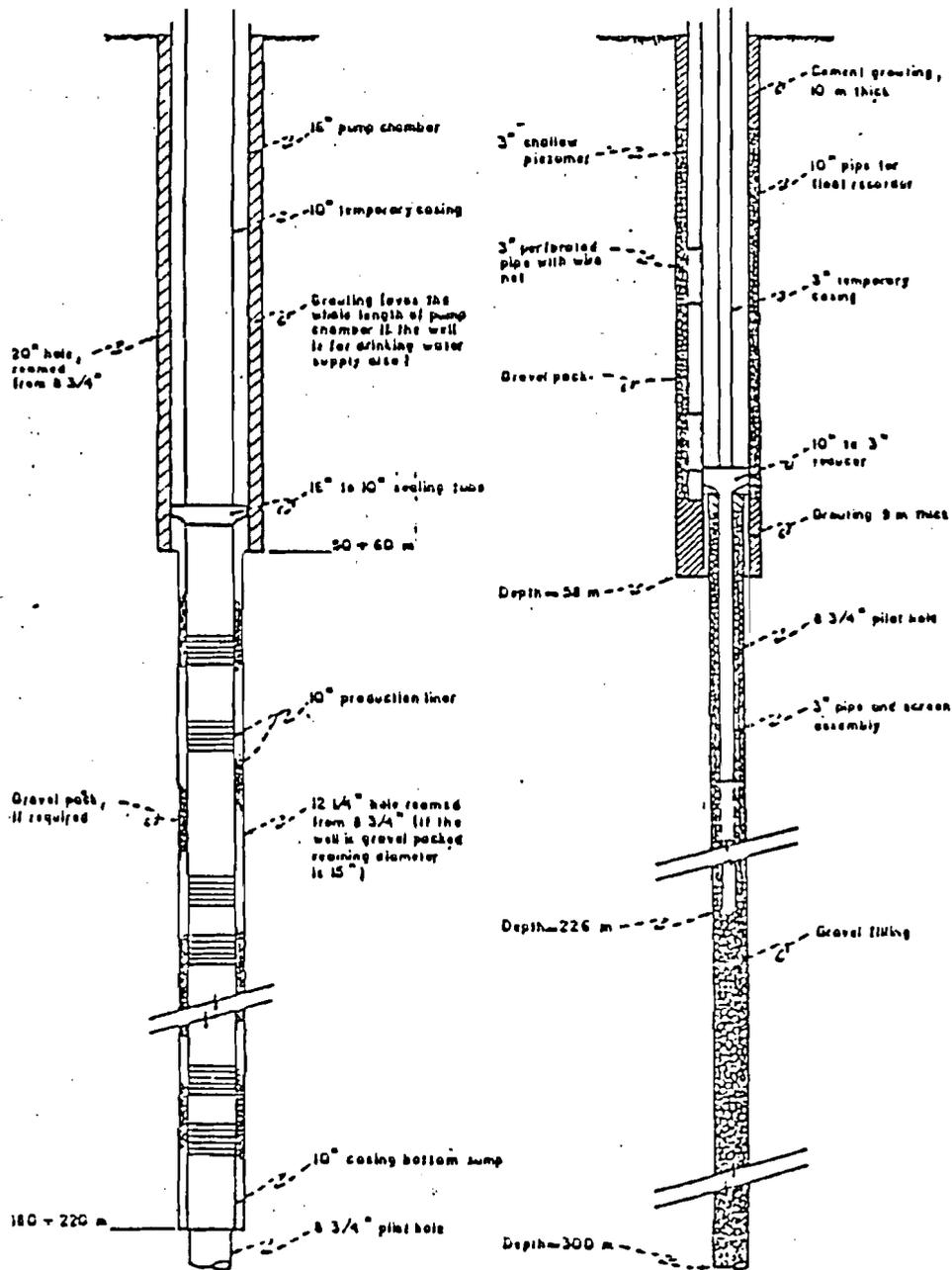
GH - 01

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# MADIUN AREA

**PRODUCTION WELL**  
(Telescoping design)

**DUAL PIEZOMETER**



GH - 01

43

It is worthwhile to note that different methods had been used for computing the well characteristics as applied under the Madiun Part-Project on the one side and the Surabaya as well as the Kediri Part-Projects on the other side. For not high yielding wells, however, the conventional Jacob's method is still applicable.

Well losses can be a substantial fraction of the total drawdown when pumping rates are high. With proper design and construction, however, the well loss can be minimized. As shown in the following table, most the wells constructed in Madiun and Kediri are properly designed and developed.

Zonal Area	Well Condition				Number of Wells
	A*)	B*)	C*)	D*)	
- Madiun	14	-	1	-	15
- Kediri	2	-	-	-	2
- Tuban	5	-	4	2	11
- Pasuruan-					
Probolinggo	7	6	4	-	17
- Sampean Baru	2	2	3	1	8
Total of wells	30	8	12	3	53
Percentage (%)	56.6	15.1	22.6	5.7	100

\*) A = properly designed and developed

B = mild deterioration or clogging

C = severe deterioration or clogging, redevelopment is needed

D = severe deterioration or clogging, throughout improvement is needed

Severe deterioration or clogging were recorded from three wells constructed under Surabaya Part-Project. It is suggested that thorough improvement are needed before installation of the pumps, especially for TW 133 EJ constructed in Sampean Baru.

### (3) Water Suitability for Irrigation

A better method of expressing the suitability of water for irrigation is plotting the values of sodium absorbtion ratio (SAR) against the conductance (EC) on a standard classification diagram as shown in Fig 1.3.1.

According to this classification it is determined that most of the water samples analyzed fall in group of  $C_2 - S_1$  of low sodium hazard. High sodium hazard is recorded from water samples of TW 131, 132, 133 EJ and SMD 99 which fall into the  $C_3 - S_1$  and  $C_3 - S_2$  groups respectively.

Within the Jawa Timur Groundwater Development Project, irrigation wells are operated during dry season only, especially in most of the rainfed areas. In other areas, surface water with low salinity are used during the rest of the year. This situation will encourage a leaching process, so that the use of groundwater of group  $C_3 - S_1$  (TW 131, 132, TW 133 EJ) according this classfication should cause no problem (Guideline BP11, 1984).

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WELL NO	STATIC WATER LEVEL (m)	CONSTANT DISCHARGE (1/sec)	SPECIFIC CAPACITY (1/s/m)	TRANSMISSIVITY (JACOB)	WELL CHARACTERISTIC (n = 2)	WELL CONDITION	WELL EFFICIENCY (%)
				Tot.dd (m2/d)	Res.dd (m2/d)	Aquifer Loss Coeff	Well Loss Coeff
1	7.94	35.16	1.84	1390	1112	0.4044	0.0038
2	10.10	33.11	1.56	902	872	0.5358	0.0023
3	14.10	31.12	1.69	2640	2640	0.4548	0.0044
4	7.10	56.62	5.13	1377	1169	0.1470	0.0013
5	16.40	55.19	3.98	876	793	0.2051	0.0006
6	23.15	18.20	1.46	261	230	0.4504	0.0097
7	16.75	25.24	1.76	1995	1596	0.4690	0.0033
8	17.44	13.16	0.86	269	269	0.2965	0.1006
9	14.12	25.24	3.86	2660	2660	0.1319	0.0055
10	13.64	40.07	8.73	3959	4223	0.0346	0.0017
11	11.70	40.07	4.46	452	422	0.1435	0.0016
12	3.10	50.11	2.58	776	435	0.3552	0.0004
13	13.55	53.71	7.20	2426	-	0.1319	0.0004
14	36.06	25.55	365.00	-	26930	-	-
15	32.15	25.24	2.08	1995	16	0.2465	0.0082
16	17.70	55.19	33.24	29085	10906	0.0121	0.0002
17	10.10	60.19	28.66	6344	4758	0.0050	0.0004
18	24.26	25.24	2.54	6139	1814	0.0262	0.0146
19	8.50	60.19	136.79	8651	-	0.0027	0.0002
20	11.00	20.82	0.96	2532	1316	0.1096	0.0412
21	18.85	41.02	4.27	1621	1060	0.0636	0.0038
22	3.55	60.19	18.87	4758	4758	0.0168	0.0061
23	14.05	30.08	1.97	9331	9331	0.3501	0.0082
24	11.80	60.19	12.86	9510	8651	0.0045	0.0012
25	10.55	44.45	2.90	4685	1527	0.2485	0.0017
26	12.50	40.07	3.76	2754	2534	0.1469	0.0028
27	8.64	30.14	1.64	733	501	0.4120	0.0051
28	20.42	32.91	4.45	3469	3469	0.1566	0.0019
29	4.70	44.01	3.63	2319	1546	0.1720	0.0023
30	5.73	60.03	4.85	1898	1725	0.1626	0.0004
31	+1.64	53.04	5.06	8385	1863	0.0713	0.0023
32	14.09	55.08	5.33	8708	8708	0.1410	0.0005
33	7.06	45.33	2.28	367	349	0.1572	0.0056
34	+3.50	55.08	1.66	1583	414	0.4944	0.0013
35	+6.45	22.00	0.56	290	232	1.3579	0.0103
36	5.58	60.03	7.32	3163	3163	0.0945	0.0006
37	5.25	60.03	2.63	1096	302	0.2688	0.0020
38	1.82	40.07	7.55	1408	1122	0.1053	0.0003
39	5.23	30.08	3.38	279	279	0.2340	0.0006
40	9.23	60.00	6.81	1823	1935	0.0653	0.0013
41	6.22	50.00	3.21	273	289	0.2332	0.0004
42	14.19	50.00	3.89	568	849	0.1017	0.0009
43	9.14	55.00	5.09	587	712	0.1194	0.0010
44	11.81	50.00	2.72	304	304	0.2732	0.0003
45	8.61	70.00	5.39	567	651	0.1148	0.0004
46	5.31	60.00	2.98	332	412	0.2214	0.0012
47	4.30	90.00	7.90	981	1094	0.0988	0.0001
48	1.59	100.00	8.48	878	988	0.0643	0.0002
49	2.46	90.00	5.64	677	790	0.1213	0.0001
50	8.55	90.00	21.63	3162	3162	0.0296	0.0001
51	8.00	60.00	6.50	632	654	0.1023	0.0001
52	25.44	35.00	6.37	851	885	0.1228	0.0003
53	12.12	110.00	7.47	1087	1122	0.0923	0.0001
54	16.52	20.44	1.24	150	131	0.5718	0.0045

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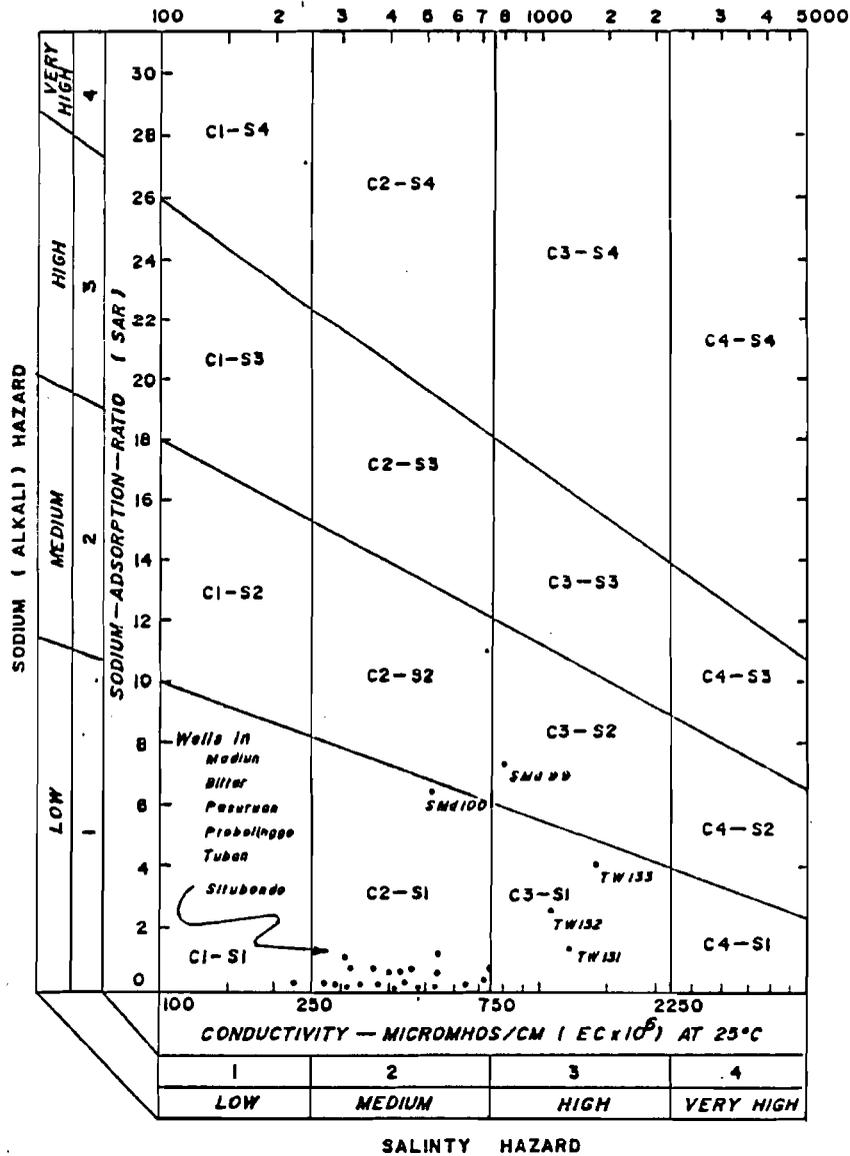


Fig. 1.3.1 Diagram for the Classification of Irrigation Water

#### (4) Well Deterioration Hazard

Some correlation between water quality and well deterioration problem can be drawn by applying the results of water chemical analyses. Well deterioration problems include the possible tendency of the tapped water well to corrode or encrustate either the casing or the screen.

According to the water quality criteria, groundwater from the constructed irrigation wells seems to indicate a moderate trend towards the encrustation due to the slightly high content of silicates, more than 40 mg/l. Furthermore, tendency of the tapped water drilled in the central part of Situbondo Zone (TW 131, 132 and 133 EJ) to corrode the well structures should be taken into account, due to their high contents of sulphates.

#### (5) Proposed Operation Discharge

The operation discharge is proposed on the basis of the well characteristics and the environmental effects due to the regional lowering of groundwater. Table 1.3.4 gives the list of the proposed operation discharge as calculated based upon those assumptions.

#### 3.2.3 Civil Works Construction

The construction of groundwater irrigation facilities as defined in the revised Terms of Reference was programmed to cover the development areas of about 5,376 ha. This program was commenced since August 1986 and the progress achieved as of July 1988 by each Part-Project is summarized in the following table.

Table 1.3.5 PROGRESS OF CIVIL WORKS CONSTRUCTION AS OF JULY 1988

WORK Item	Madiun		Kediri		Surabaya		Total Achievement	
	86/87	87/88	86/87	87/88	86/87	87/88		
DETAILED DESIGN								
- Topo Survey (Ha)	-	-	693	-	430	2,240	3,363	
- Detailed Design (Ha)	-	-	903	685	618	1,261	3,467	
(Nos)	-	-	20	15	15	33	83	
TERTIARY DEVELOPMENT								
- Distribution system (Ha)	-	718	842	685	631	532	3,408	
(Nos)	-	12	20	15	15	13	75	
- PVC Pipe System (Ha)	-	-	97	-	134	-	231	
(Nos)	-	-	3	-	3	-	6	
(m)	-	-	5,012	-	7,072	-	12,084	
- Earth Canal (Ha)	-	718	745	685	497	532	3,177	
(Nos)	-	12	17	15	12	13	69	
(m)	-	30,435	33,915	30,911	21,823	21,293	138,377	
PUMP INSTALLATION								
(Nos)	14	4	9	20	6	15	68	

#### (1) Detailed design

Topographical survey for mapping of 3,363 ha required for the preparation of the design drawing for the construction works accomplished within the FY.1986/1987 and FY.1987/1988 had been completed as of December 1987. Design works including canal route survey, however, are still required to complete the new schemes construction of 12 wells to be drilled under the

Table 1.3.4. PROPOSED OPERATION DISCHARGE

48

No. Well	Zonal Area	Static Water Level	Proposed Discharge rate (D) (l/s)	Aquifer Loss Coeff.	Well Loss Coeff.	Aquifer Loss (a)	Well Loss (a)	Annual fluctual level (a)	Pumping Water Level (a)	No. Well	Zonal Area	Static Water Level	Proposed Discharge rate (D) (l/s)	Aquifer Loss Coeff.	Well Loss Coeff.	Aquifer Loss (a)	Well Loss (a)	Annual fluctual level (a)	Pumping Water Level (a)										
II. SITUBONDO ZONE										IV. PASURUAN & PROBOLINGGO ZONES (CONTINUED)																			
1	TM 126 EJ	7.94	35	0.4044	0.0030	14.1540	4.6550	3	29.7490	27	TM 152 EJ	0.64	45	0.4120	0.0051	18.5400	10.3275	3	40.5075										
2	TM 127 EJ	10.10	35	0.5350	0.0023	18.7530	2.0175	3	34.6705	28	TM 153 EJ	20.42	45	0.1566	0.0019	7.0470	3.0475	3	34.3145										
3	TM 128 EJ	14.10	30	0.4540	0.0044	13.6440	3.9600	3	34.7040	29	TM 154 EJ	4.70	60	0.1720	0.0023	10.3200	0.2000	3	26.3000										
4	TM 129 EJ	7.10	50	0.1470	0.0013	7.3500	3.2500	3	20.7000	30	TM 155 EJ	5.73	60	0.1626	0.0004	9.7560	1.4400	3	19.9260										
5	TM 130 EJ	16.40	50	0.2051	0.0006	10.2550	1.5000	3	31.1550	31	TM 156 EJ	+ 1.64	60	0.0713	0.0023	4.2700	0.2000	3	13.9100										
6	TM 131 EJ	23.15	20	0.4504	0.0097	9.0000	3.0000	3	39.0300	32	TM 157 EJ	14.09	60	0.1410	0.0005	0.4600	1.0000	3	27.3500										
7	TM 132 EJ	16.75	25	0.4690	0.0033	11.7250	2.0625	3	33.5375	33	TM 158 EJ	7.86	50	0.1572	0.0056	7.0600	14.0000	3	31.9200										
8	TM 133 EJ	17.44	15	0.2965	0.1006	4.4475	22.6350	3	47.5225	34	TM 159 EJ	+ 3.50	60	0.4944	0.0013	29.6640	4.6000	3	33.0440										
III. PASURUAN & PROBOLINGGO ZONES										V. BLITAR ZONE																			
9	TM 134 EJ	14.12	45	0.1319	0.0055	5.9355	11.1375	3	34.1930	35	TM 160 EJ	+ 6.45	25	1.3579	0.0103	33.9475	6.4375	3	36.9350										
10	TM 135 EJ	13.64	60	0.0346	0.0017	2.0760	6.1200	3	24.8360	36	TM 161 EJ	5.50	60	0.0945	0.0006	5.6700	2.1600	3	16.4100										
11	TM 136 EJ	11.70	60	0.1425	0.0016	0.6100	5.7600	3	29.0700	37	TM 162 EJ	5.25	60	0.2600	0.0020	16.1200	7.2000	3	31.5700										
12	TM 137 EJ	3.10	60	0.3552	0.0004	21.3120	1.4400	3	20.8520	VI. RADJUN ZONE																			
III. TUBAN ZONE										13	TM 138 EJ	13.55	60	0.1319	0.0004	7.9140	1.4400	3	25.9040	40	SHD 90	9.23	00	0.0653	0.0013	5.2240	0.3200	3	25.7740
13	TM 138 EJ	13.55	60	-	-	ERR	ERR	3	ERR	41	SHD 91	6.22	50	0.2332	0.0004	11.6600	1.0000	3	21.0000										
14	TM 139 EJ	36.06	60	-	-	ERR	ERR	3	ERR	42	SPO 92	14.19	50	0.1017	0.0009	5.0050	2.2500	3	24.5250										
15	TM 140 EJ	32.15	25	0.2445	0.0002	6.1625	5.1250	3	46.4375	43	SHG 93	9.14	60	0.1194	0.0010	7.1640	3.6000	3	22.9040										
16	TM 141 EJ	17.70	60	0.0121	0.0002	0.7260	0.7200	3	22.1460	44	SHD 94	11.01	45	0.2732	0.0003	12.2940	0.6075	3	27.7115										
17	TM 142 EJ	10.10	60	0.0050	0.0004	0.3000	1.4400	3	14.0400	45	SHD 95	0.61	60	0.1140	0.0004	6.0000	1.4400	3	19.9300										
18	TM 143 EJ	24.26	25	0.0262	0.0146	0.6550	9.1250	3	37.0400	46	SHD 96	5.31	55	0.2214	0.0012	12.1770	3.6300	3	24.1170										
19	TM 144 EJ	0.50	60	0.0027	0.0002	0.1620	0.7200	3	12.3020	47	SHG 97	4.30	60	0.0500	0.0001	5.9200	0.3600	3	13.5000										
20	TM 145 EJ	11.00	20	0.1096	0.0412	2.1920	16.4000	3	32.6720	48	SHG 98	1.59	95	0.0643	0.0002	6.1005	1.0050	3	12.5025										
21	TM 146 EJ	10.05	60	0.0636	0.0030	3.0160	13.6000	3	39.3460	49	SHG 99	2.46	80	0.1213	0.0021	9.7040	0.6400	3	15.0040										
22	TM 147 EJ	3.55	35	0.0160	0.0061	0.5600	7.4725	3	14.6105	50	SHG 100	0.55	60	0.0296	0.0001	1.7760	0.3600	3	12.0060										
23	TM 148 EJ	14.05	40	0.3501	0.0082	14.0040	13.1200	3	44.1740	51	SHG 101	0.00	55	0.1023	0.0001	5.6265	0.3025	3	16.9290										
24	TM 149 EJ	11.00	60	0.0045	0.0012	0.2700	4.3200	3	19.3900	52	SHG 102	25.44	50	0.1220	0.0003	6.1400	0.7500	3	35.3300										
IV. PASURUAN & PROBOLINGGO ZONES										53	SHG 103	12.12	100	0.0923	0.0001	9.2300	1.0000	3	25.3500										
25	TM 150 EJ	10.53	60	0.2405	0.0017	14.9100	6.1200	3	34.5000	54	SPO 104	16.52	20	0.5710	0.0045	11.4360	1.0000	3	32.7560										
26	TM 151 EJ	12.50	60	0.1469	0.0020	0.0140	10.0000	3	34.3940																				

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Madiun Part-Project within the FY.1988/1989.

Detail design drawing for the installation of precast concrete lining was started since October 1987 and will be completed in July 1988.

## (2) Tertiary Development

Within the last two fiscal years, a total number of 75 groundwater irrigation facilities had been constructed completely to irrigate the areas of about 3,408 ha. Most of the irrigation distribution system are constructed with open unlined canals which will be converted in the FY.1988/1989 into a precast canal lining system.

During the FY.1986/1987, six (6) buried pipe groundwater system was constructed in Blitar (TW 211, 212, 214 EJ), Gresik (TW 034 EJ), Pasuruan (TW 118 EJ) and in Probolinggo (TW 96 EJ). A total units of 31 pump houses had been constructed during the FY.1986/1987 and 40 units of those in FY.1987/1988. Detailed information of these constructial works are shown in Table 1.3.6.

### 3.2.4 Pump Installation and Maintenance

A total number of 68 turbine pumpsets had been installed during the FY.1986/1987 and FY.1987/1988. They are installed under the Part-Projects of Madiun (18 sets), Kediri (29 sets) and Surabaya (21 sets).

Typical installation of those pumpsets is shown in Fig 1.3.2, while detail information concerning this pump installation is given in Table 1.3.6

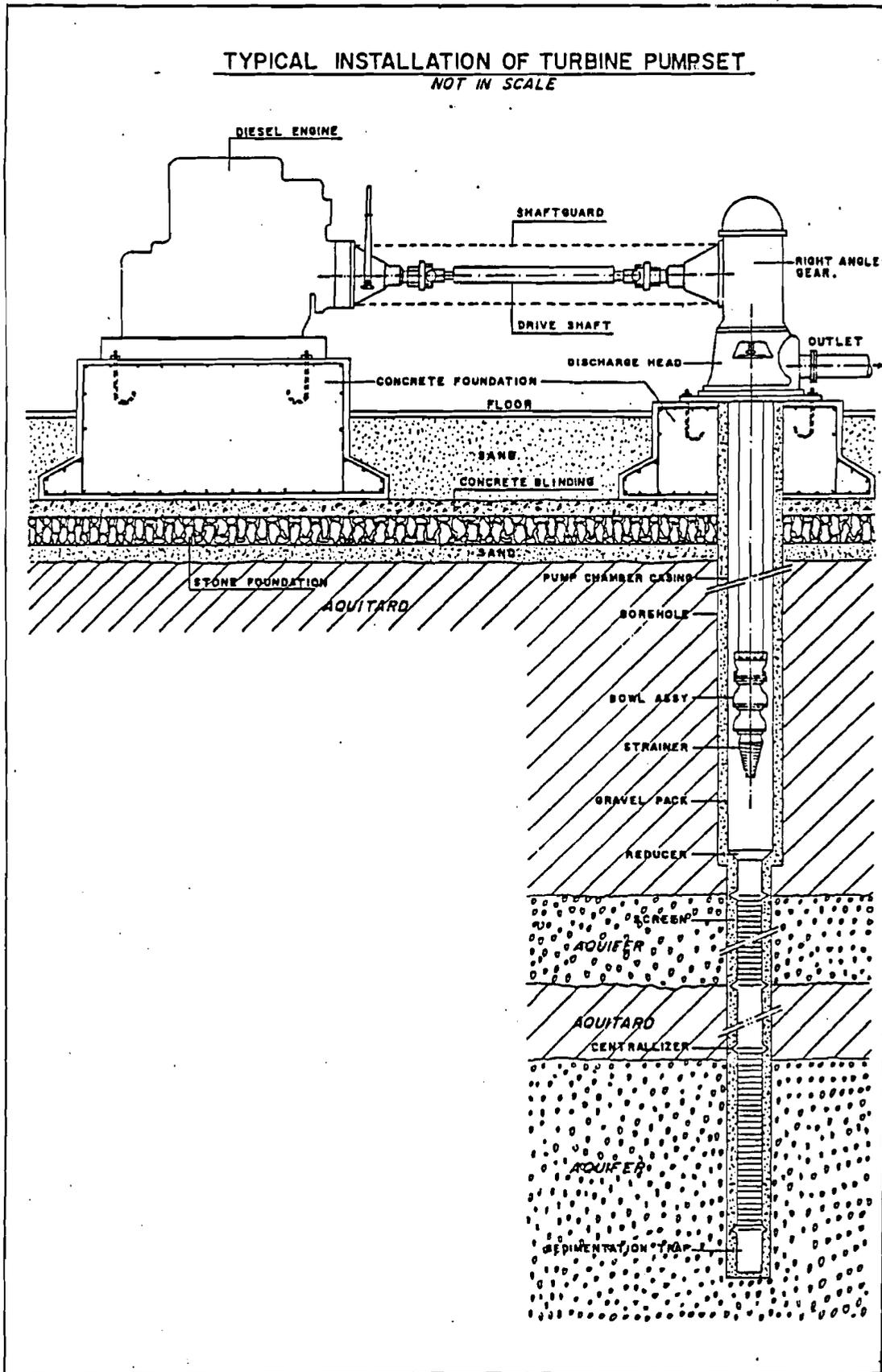
At present 339 pumpsets have been installed since 1972, out of which 130 sets are installed under the ongoing project and 209 sets have been operated since the previous stage. If the pump is installed in plumb, straight and free of sand discharge, a good quality vertical turbine pump can be expected to operate of about 10,000 hours without pulling the pumpsets out of the well. Pumpset repairs should be therefore scarcely.

The following table provides a list of pumpset repairs carried out by the Part-Project concerned since 1986.

From this table, it is shown that pump repairs are relatively high. It is due to the inferior quality of the pump component; perfectioning of these components should be therefore given into priority along with the possible substitution using the local made component should be considered.

Item	Madiun	Kediri	Surabaya	Total
- Installed Pumpset	42	43	45	130
- Engine Overhaul	-	-	-	-
- Engine Repair	2	1	2	5
- Pump Repair	8	6	10	24
- Replacement of Gear Box	1	-	1	2
- Repair of Gear Box	-	1	-	1
- Repair of Drive Shaft	3	4	6	13

Fig. 1.3.2



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TABLE 1.3.6 IRRIGATION DISTRIBUTION WORKS CONSTRUCTED  
IN F.Y. 1986/1987

NO 1/3

No	TW	Location	Command	Pump	Canal Length (m)			
No		Village	Area	Discharge	Unlined	Lined	Pipe	Total
		Sub District	(Ha)	(l/s)				
		District						
: SURABAYA PART-PROJECT :								
1	034	Banyutengah	52.92	60	-	-	3268	3268
		Pancang, Gresik						
2	096	Jrebeng kidul	44.27	45	-	-	2397	2397
		Wonoasih, Probolinggo						
3	118	Watesani	39.78	45	-	-	1467	1467
		Nguling, Pasuruan						
4	083	Sawo	46.13	60	1841	-	-	1841
		Dukun, Gresik						
5	101	Petung	41.55	60	1599	-	-	1599
		Pancang, Gresik						
6	103	Lasem	32.13	45	1665	-	-	1665
		Sidayu, Gresik						
7	111	Kintelan	47.06	60	2048	-	-	2048
		Puri, Mojokerto						
8	113	Meranggal	45.61	60	2173	-	-	2173
		Mojosari, Mojokerto						
9	086	Pucangan	41.52	45	1470	-	-	1470
		Montong, Tuban						
10	087	Montong sekar	31.61	45	660	-	-	660
		Montong, Tuban						
11	090	Jetak	34.44	45	1708	-	-	1708
		Montong, Tuban						
12	100	Jetak	46.26	60	2378	-	-	2378
		Montong, Tuban						
13	102	Trutup	51.61	60	2606	-	-	2606
		Plumpang, Tuban						
14	119	Wotogalih	35.16	45	1738	216	-	1952
		Nguling, Pasuruan						
15	122	Kropak	41.36	60	1348	375	-	1723
		Bantaran, Probolinggo						
: TOTAL FOR SURABAYA PART-PROJECT : 631.41 : : 21232 : 591 : 7072 : 28895 :								
: KEDIRI PART-PROJECT :								
1	211	Satrian	46.00	60	-	-	2200	2200
		Kanigoro, Blitar						
2	212	Godo Geso	20.50	30	-	-	940	940
		Kanigoro, Blitar						
: KEDIRI PART-PROJECT (CONTINUED) :								
3	214	Suntenrejo	30.46	45	-	-	1872	1872
		Sanankulon, Blitar						
4	193	Janti	45.54	60	1979	-	-	1979
		Papar, Kediri						
5	185	Gampolan	34.80	45	1225	-	-	1225
		Curah, Kediri						
6	186	Klampitan	53.00	45	2515	-	-	2515
		Purwasari, Kediri						
7	188	Kempleng	37.30	45	1456	-	-	1456
		Purwasari, Kediri						
8	200	Mayangan	34.80	45	1343	-	-	1343
		Jogoroto, Jombang						
9	210	Jogoroto	53.30	45	2807	-	-	2807
		Jogoroto, Jombang						
10	199	Plemahan	46.30	45	1999	-	-	1999
		Surobita, Jombang						
11	202	Palrejo	46.96	45	2144	-	-	2144
		Surobita, Jombang						
12	195	Mancilan	46.40	60	2243	-	-	2243
		Mojoagung, Jombang						
13	196	Betek	61.30	60	2190	-	-	2190
		Mojoagung, Jombang						
14	198	Segadirejo	44.00	60	2756	-	-	2756
		Surobita, Jombang						
15	203	Murukan	43.30	45	1145	-	-	1145
		Mojoagung, Jombang						
16	187	Ketawang	41.80	60	2020	-	-	2020
		Purwasari, Kediri						
17	189	Wanomarto	38.00	60	2756	-	-	2756
		Purwasari, Kediri						
18	190	Maduretno	40.50	60	1936	-	-	1936
		Papar, Kediri						
19	191	Jambangan	35.00	60	1442	-	-	1442
		Papar, Kediri						
20	192	Ngampel	42.80	60	1959	-	-	1959
		Papar, Kediri						
: TOTAL FOR KEDIRI PART-PROJECT : 842.06 : : 33915 : - : 5012 : 38927 :								

TABLE 1.3.6 IRRIGATION DISTRIBUTION WORKS CONSTRUCTED  
IN F.Y. 1987/1988

NO 2/3

No	TW	Village Sub District	Command Area	Proposed Pump	Canal Length (m)			
					Disch. (l/s)	Unlined	Lined	PVC Pipe
PART-PROJECT : M A D I U N								
1	Snd 90	Sobrah	79.39	80	1766	-	-	1766
		Wungu, Madiun						
2	Snd 91	Tulung I	48.20	60	1103	-	-	1103
		Saradan, Madiun						
3	SPo 92	Kedung benteng	55.40	60	1600	-	-	1600
		Sukarejo, Ponorogo						
4	Sng 93	Sidolaju	45.35	60	417	269	382	1068
		Widodaren, Ngawi						
5	Snd 94	Tulung II	59.73	70	3868	-	-	3868
		Saradan, Madiun						
6	Snd 95	Sambirejo	72.20	80	1814	9	-	1823
		Saradan, Madiun						
7	Snd 96	Sumbersari	53.00	60	3187	-	-	3187
		Saradan, Madiun						
8	Sng 101	Dukuh	48.20	60	3412	-	-	3412
		Lembayan, Magetan						
9	Sng 97	Karang sono	59.40	70	4179	13	-	4192
		Kwadungan, Ngawi						
10	Sng 98	Kersoharjo I	56.00	70	2314	-	-	2314
		Geneng, Ngawi						
11	Sng 99	Kersoharjo II	51.20	60	3418	13	-	3431
		Geneng, Ngawi						
12	Sng 100	Pleset	90.33	100	2671	-	-	2671
		Pangkur, Ngawi						
TOTAL FOR MADIUN PART-PROJECT			718.40		29749	304	382	30435
PART-PROJECT : K E D I R I								
1	210 KN	Bangle	37.67	30	1614	76	-	1690
		Kanigoro, Blitar						

No	TW	Village Sub District	Command Area	Proposed Pump	Canal Length (m)			
					Disch. (l/s)	Unlined	Lined	PVC Pipe
PART-PROJECT : K E D I R I (CONTINUED)								
2	221 KN	Bendosari	51.92	60	2829	25	-	2854
		Senankulon, Blitar						
3	099 EJ	Wringinpitu	35.18	40	780	45	-	835
		Mojowarno, Jombang						
4	194 KN	Johowinong	53.37	45	2900	-	-	2900
		Mojosungung, Jombang						
5	206 KN	Banyakan	35.35	45	1306	-	-	1306
		Grogol, Kediri						
6	207 KN	Ceze	45.25	45	2392	-	-	2392
		Grogol, Kediri						
7	208 KN	Godean	36.60	30	1480	14	-	1494
		Looreet, Nganjuk						
8	197 KN	Karobelah	47.20	60	1782	25	-	1807
		Mojosungung, Jombang						
9	204 KN	Curah malang	51.53	45	1606	48	-	1654
		Sumbito, Jombang						
10	205 KN	Plemahan II	41.64	45	1266	37	-	1303
		Sumbito, Jombang						
11	209 KN	Looreet	50.82	45	1556	19	-	1575
		Looreet, Nganjuk						
12	216 KN	Balong rejo	44.94	45	2314	39	-	2363
		Berbek, Nganjuk						
13	217 KN	Bulu	46.12	45	2424	23	-	2447
		Berbek, Nganjuk						
14	218 KN	Sumber urip	50.61	45	2650	10	-	2660
		Berbek, Nganjuk						
15	220 KN	Kalihoto	57.05	45	3599	32	-	3631
		Tarokan, Kediri						
TOTAL FOR KEDIRI PART-PROJECT			685.35		30518	393	-	30911

TABLE 1.3.6 IRRIGATION DISTRIBUTION WORK CONSTRUCTED  
FY.1987/1988

Surabaya Part-Project

NO 3/3

No	TW No	Location Village Sub District District	Command Area (Ha)	Proposed Pump Discharge (L/S)	Canal Length (m)			
					Unlined	Lined	PVC Pipe	Total
1	091	Tebas Gondang Wetan Pasuruan	35.41	45	1890	-	-	1890
2	117	Randu Gong Kejayan, Pasuruan	50.78	60	1545	-	-	1545
3	080	Kertosono Sedayu, Gresik	34.60	60	1335	-	-	1335
4	112	Kepuh Pandak Kutorejo, Mojokerto	55.44	60	1868	14	-	1882
5	120	Tanjung Rejo Tongas, Probolinggo	36.43	40	1696	37	-	1733
6	121	Kropak Bantaran, Probolinggo	36.34	40	1369	-	-	1369
7	105	Karang Asem Jenu, Tuban	43.03	45	1249	-	-	1249
8	107	Sumur Jalak Plumpang, Tuban	49.02	60	2053	-	-	2053
9	108	Kesamben Plumpang, Tuban	45.65	60	1783	-	-	1783
10	109	Banjar Agung Rengel, Tuban	45.43	60	2242	-	-	2242
11	110	Pucangan Montong, Tuban	36.48	60	1882	-	-	1882
12	123	Talun Montong, Tuban	24.75	30	754	-	400	1154
13	138	Sumber Agung Plumpang, Tuban	38.75	60	1233	-	-	1233
Total for Surabaya Part Project			532.11		20899	51	400	21350

PART PROJECT	Well No.	PUMP SPECIFICATION					ENGINE SPECIFICATION				
		Manufacturer	Model	Capacity (L/S)	Total Head (m)	Brake Horse Power (HP)	Rotation (RPM)	Manufacturer	Model	Power (HP)	Rotation (RPM)
F.Y. 1986/1987											
MADITUN	SMD 89	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SPO 85	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SPO 86	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SPO 87	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SPO 88	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 76	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 77	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 78	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 79	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 80	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 81	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 82	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 83	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SHg 84	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
KEDIRI	TW 179	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 180	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 182	Johnston	-	45	42	36	1800	Ruston	-	47	1800
	TW 183	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 184	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 185	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 186	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 188	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 193	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
SURABAYA	TW 92	Turbindo	5-1204	35	30	21	1800	Deutz	FZL912	23	1800
	TW 93	Turbindo	5-1204	35	30	21	1800	Deutz	FZL912	23	1800
	TW 94	Turbindo	5-1204	35	30	21	1800	Deutz	FZL912	23	1800
	TW 95	Turbindo	5-1204	35	30	21	1800	Deutz	FZL912	23	1800
	TW 97	Turbindo	5-1204	35	30	21	1800	Deutz	FZL912	23	1800
	TW 98	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
F.Y. 1987/1988											
MADITUN	SMD 90	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SMD 91	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SMD 92	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800
	SMD 93	Lee Howl	5-1404	100	45	86	1800	Deutz	FSL413FR	103	1800

PART PROJECT	Well No.	PUMP SPECIFICATION					ENGINE SPECIFICATION				
		Manufacturer	Model	Capacity (L/S)	Total Head (m)	Brake Horse Power (HP)	Rotation (RPM)	Manufacturer	Model	Power (HP)	Rotation (RPM)
F.Y. 1987/1988 (CONTINUED)											
KEDIRI	TW 187	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 189	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 190	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 191	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 192	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 195	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 196	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 198	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 199	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 200	KN:F.M.L.	11M	60	20	21	1800	Deutz	FZL912	23	1800
	TW 201	KN:F.M.L.	11M	60	20	21	1800	Deutz	FZL912	23	1800
	TW 202	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 203	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 211	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 212	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 214	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 206	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 207	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 210	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 221	KN:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
SURABAYA	TW 83	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 86	Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 87	Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 90	EJ:Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 96	EJ:Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 100	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 101	EJ:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 102	EJ:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 103	EJ:Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 112	EJ:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 113	Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 118	Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800
	TW 118	EJ:Lee Howl	5-1204	60	20	22	1800	Deutz	FZL912	23	1800
	TW 119	Turbindo	-	35	30	21	1800	Deutz	FZL912	23	1800

Notes : F.M = Fairbanks Morse

### 3.2.5 Operation in the Irrigation Units

#### (1) Pump Boards in Operation

The irrigation units whose construction was financed, even partially, from funds made available by IBRD Loan 2119-IND amount to 132. These irrigation units can be subdivided into a number of categories depending on the type of works financed by the Loan proceedings as follows :

- A : all construction components funded by Loan 2119-IND
- B : canal construction only financed by Loan 2119-IND
- C : pump installation only financed by Loan 2119-IND
- D : canal construction and pump installation funded by Loan 2119-IND.

The works executed for categories B, C and D above were carried over from previous Project stages. The following table provides a summary of all units in operation under Loan 2119-IND as of December 31st, 1987.

PART PROJECT	TOTAL		CATEGORY A		CATEGORY B		CATEGORY C		CATEGORY D	
	Units Command Area		Units Command Area		Units command Area		Units Command Area		Units Command Area	
	No	(Ha)	(No)	(Ha)	(No)	(Ha)	(No)	(Ha)	(No)	(Ha)
Kediri	50	1,931.3	34	1,415.4	10	363.9	4	92.5	2	59.5
Madiun	38	3,431.6	38	3,431.6	-	-	-	-	-	-
Surabaya	44	1,956.4	30	1,339.9	-	-	1	48.5	13	567.9
Total	132	7,319.3	102	6,186.9	10	363.9	5	41.0	15	627.4

The above table indicates that 102 production wells (serving 6,186.9 ha) were executed in the framework of Loan 2119-IND for the 132 irrigation units in operation under the Loan itself. The complete list of these irrigation units with the respective works financed by the Loan is given in Table 1.3.7. Out of the above 132 units were established by the Executing Agency (P2AT) during the present Project stage as of December 31st, 1987.

The operations of the above pump units were however, assisted by P2AT in their activities. Some statistical indicators concerning the operation pump units are given in the following table.

ITEM	UNIT	PART PROJECT			PROJECT
		KEDIRI	MADIUN	SURABAYA	
Number of Units Financed by IBRD Loan 2119-IND	(No)	50	38	44	132
Total Command Area	(Ha)	1,931.3	3,431.6	1,956.4	7,319.3
Average Command Area	(Ha)	38.6	90.2	44.5	55.4
Total Number of Farmers	(No)	4,480	7,734	5,955	18,169
Average Number of Farmers per Command Area	(No)	90	240	135	138
Average Land Tenure per Farmer	(Ha)	0.43	0.44	0.33	0.40

TABLE 1.3.7 LIST OF PUMP BOARD & OPERATION HOURS MADISON PART-PROJECT

PART - PROJECT	TUBEWELL NUMBER	YABUPATEM - KECAMATAN	COMMAND AREA (HA)	WORKS UNDER LOGAN 2119	START OF OPERATIONS (DATE)	MANAGED BY	MEMBERS OF HIPPA (NO)	OPERATION FEES (Rp/MOOR)	PUMP OPERATION HOURS					
									1983	1984	1985	1986	1987	1983-1987
KEDIRI	029	KEDIRI - KERAS	69.1	CANALS	JAN 1977	HIPPA	137	1,650	1,240	891	985	983	1,575	5,674
	091	KEDIRI - KERAS	38.9	CANALS	OCT 1978	HIPPA	45	1,750	524	396	748	323	544	2,525
	112	KEDIRI - WATES	32.7	CANALS	MAY 1981	HIPPA	77	2,000	496	215	313	151	218	1,393
	131	KEDIRI - NGADILUMIH	20.1	CANALS	FEB 1983	HIPPA	62	750	1,225	323	385	946	1,646	4,527
	133	KEDIRI - NGADILUMIH	26.9	CANALS	APR 1983	HIPPA	76	750	896	718	623	768	1,394	4,589
	049	KEDIRI - PLEMAHAN	50.1	CANALS	JUL 1977	HIPPA	96	1,400	1,507	389	1,301	939	2,801	6,937
	052	KEDIRI - PLEMAHAN	36.8	CANALS	JUL 1977	HIPPA	111	1,400	658	154	1,062	572	2,359	4,745
	066	KEDIRI - PLEMAHAN	35.4	CANALS	AUG 1978	HIPPA	77	1,400	702	541	856	811	2,028	4,938
	170	KEDIRI - PLEMAHAN	25.1	CNLS+PUMP	JUN 1983	HIPPA	65	1,650	959	257	742	668	2,100	4,746
	173	KEDIRI - PLEMAHAN	32.7	ALL	OCT 1985	HIPPA	70	1,000	-	-	523	910	2,522	2,955
	179	KEDIRI - PLEMAHAN	56.8	ALL	AUG 1986	PZAT	127	1,500	-	-	-	645	1,950	2,595
	182	KEDIRI - PLEMAHAN	42.2	ALL	DEC 1986	HIPPA	103	1,500	-	-	-	1,880	3,124	5,014
	185	KEDIRI - GURAH	33.1	ALL	JUN 1986	PZAT	95	1,400	-	-	-	609	1,575	2,184
	166	KEDIRI - PURWASRI	34.4	CNLS+PUMP	DEC 1984	HIPPA	63	1,800	-	9	206	317	585	1,117
	186	KEDIRI - PURWASRI	44.8	ALL	SEP 1986	PZAT	116	1,400	-	-	-	163	2,039	2,202
	188	KEDIRI - PURWASRI	35.5	ALL	JUN 1986	PZAT	122	1,400	-	-	-	425	2,628	3,053
	171	KEDIRI - KUNJANG	41.6	ALL	DEC 1985	HIPPA	224	1,500	-	-	30	281	1,456	1,767
	180	KEDIRI - KUNJANG	40.2	ALL	MAY 1986	PZAT	118	1,500	-	-	-	986	2,615	3,691
	175	KEDIRI - PARE	55.5	ALL	NOV 1985	HIPPA	85	1,500	-	-	109	1,408	3,522	5,049
	183	KEDIRI - PARE	45.9	ALL	MAY 1986	PZAT	134	1,500	-	-	-	1,596	3,736	5,242
	184	KEDIRI - PARE	44.4	ALL	OCT 1986	PZAT	92	1,500	-	-	-	123	1,655	1,776
	193	KEDIRI - PAPAR	42.6	ALL	AUG 1986	PZAT	107	1,500	-	-	-	139	1,267	1,406
	187	KEDIRI - PURWASRI	37.0	ALL	JUN 1987	PZAT	82	1,500	-	-	-	-	766	766
	189	KEDIRI - PURWASRI	41.4	ALL	JUN 1987	PZAT	46	1,500	-	-	-	-	1,448	1,448
	190	KEDIRI - PAPAR	43.1	ALL	JUL 1987	PZAT	92	1,500	-	-	-	-	1,066	1,066
	191	KEDIRI - PAPAR	35.0	ALL	JUL 1987	PZAT	90	1,500	-	-	-	-	1,823	1,823
	192	KEDIRI - PAPAR	39.1	ALL	JUL 1987	PZAT	63	1,500	-	-	-	-	1,415	1,415
	017	NGANJUK - PACE	21.0	CANALS	JUL 1975	HIPPA	25	800	1,360	575	71	277	726	2,119
	153	NGANJUK - PACE	32.9	CANALS	JUL 1982	HIPPA	79	1,500	1,111	891	1,199	453	255	2,609
	155	NGANJUK - PACE	30.2	PUMP INST	AUG 1984	HIPPA	77	1,500	-	1,515	1,646	758	653	4,952
	117	NGANJUK - LUCCERET	21.6	PUMP INST	NOV 1983	HIPPA	38	700	555	815	1,267	1,065	1,130	4,852
	119	NGANJUK - LUCCERET	20.2	PUMP INST	JUN 1983	HIPPA	81	700	122	131	940	889	511	2,593
	129	NGANJUK - LUCCERET	26.5	PUMP INST	JAN 1983	HIPPA	30	700	891	520	1,523	356	804	4,094
	169	NGANJUK - GONDANG	46.3	ALL	OCT 1985	HIPPA	109	1,600	-	-	275	842	1,552	2,669
	174	NGANJUK - GONDANG	44.1	ALL	OCT 1985	HIPPA	91	1,400	-	-	109	612	903	1,624
	176	NGANJUK - GONDANG	41.8	ALL	NOV 1985	HIPPA	54	1,500	-	-	389	1,420	1,756	3,765
	177	NGANJUK - GONDANG	41.6	ALL	NOV 1985	HIPPA	103	1,400	-	-	392	928	1,859	3,689
	178	NGANJUK - GONDANG	35.9	ALL	NOV 1985	HIPPA	62	1,400	-	-	224	1,172	1,959	3,255
	172	NGANJUK - LEMGAMB	39.9	ALL	DEC 1985	HIPPA	128	1,400	-	-	104	1,079	1,453	2,626
	203	JOMBANG - HOJDAGUNG	29.1	ALL	JUL 1987	PZAT	125	1,500	-	-	-	-	798	798
	196	JOMBANG - HOJDAGUNG	55.6	ALL	JUL 1987	PZAT	51	1,600	-	-	-	-	399	399
	195	JOMBANG - HOJDAGUNG	51.5	ALL	AUG 1987	PZAT	80	1,600	-	-	-	-	420	420
	198	JOMBANG - SUMORITO	44.4	ALL	JUL 1987	PZAT	81	1,500	-	-	-	-	958	958
	199	JOMBANG - SUMORITO	44.8	ALL	JUL 1987	PZAT	89	1,500	-	-	-	-	452	452
	200	JOMBANG - JOGOROTO	35.5	ALL	AUG 1987	PZAT	57	1,750	-	-	-	-	789	789
	201	JOMBANG - JOGOROTO	53.1	ALL	AUG 1987	PZAT	91	1,850	-	-	-	-	1,091	1,091
	202	JOMBANG - SUMORITO	46.3	ALL	AUG 1987	PZAT	139	1,600	-	-	-	-	376	376
	214	BLITAR - SAMAN KULON	35.5	ALL	JUL 1987	PZAT	72	1,250	-	-	-	-	1,413	1,413
	211	BLITAR - KANIGORO	43.1	ALL	AUG 1987	PZAT	78	1,500	-	-	-	-	657	657
	212	BLITAR - KANIGORO	18.0	ALL	AUG 1987	PZAT	75	1,500	-	-	-	-	374	374

SUMMARY FOR KEDIRI PART-PROJECT

ESTABLISHMENT INDICATORS				PUMP OPERATION HOURS						
NUMBER OF UNITS	50	AVERAGE OPERATION FEE	1,422 Rp/HOUR	TOTAL	12,236	8,340	16,072	25,704	71,489	123,841
TOTAL IRRIGATED AREA	1,931.3 HA	NUMBER OF FARMERS	4,490	AVERAGE	1,064	582	1,619	881	1,737	1,194
AVERAGE COMMAND AREA	38.6 HA/UNIT	AVERAGE FARMERS/C.A.	90 FARMERS/UNIT	NOTE :	The yearly average has been computed based on the number of months of recorded operation. A tubewell with six months of operation in a certain year will therefore account for 1/2 of that specific year.					
		AVERAGE LAND TENURE	0.43 HA/FARMER							

TABLE 1.3.7 LIST OF PUMP BOARD & OPERATION HOURS SURABAYA PART-PROJECT

PART - PROJECT	TUBEWELL NUMBER	KABUPATEN - KECAMATAN	COMMAND AREA (HA)	WORKS UNDER LOAN 2119	START OF OPERATIONS (DATE)	MANAGED BY	MEMBERS OF HIFPA (NO)	OPERATION FEES (RP/HOUR)	PUMP OPERATION HOURS						
									1983	1984	1985	1986	1987	1983-1987	
SURABAYA	035	GRESIK - DUKUH	48.5	PUMP INST	MAY 1984	P2AT	193	1,000	-	1,428	764	1,025	794	4,011	
	075	GRESIK - DUKUH	51.4	ALL	MAY 1984	P2AT	215	1,000	-	713	734	1,103	1,151	3,703	
	076	GRESIK - DUKUH	43.4	ALL	MAY 1984	P2AT	240	1,000	-	257	713	1,620	1,190	3,780	
	085	GRESIK - DUKUH	46.2	ALL	SEP 1987	P2AT	146	1,500	-	-	-	-	811	811	
	081	GRESIK - SIDAYU	42.6	ALL	JUL 1986	P2AT	188	1,000	-	-	-	695	1,351	2,046	
	084	GRESIK - SIDAYU	38.9	ALL	JUL 1986	P2AT	138	1,000	-	-	-	614	835	1,449	
	103	GRESIK - SIDAYU	55.0	ALL	SEP 1987	P2AT	132	1,250	-	-	-	-	-	0	
	082	GRESIK - PAMCENG	60.1	ALL	MAY 1986	P2AT	76	1,000	-	-	-	-	873	1,619	2,492
	101	GRESIK - PAMCENG	41.6	ALL	SEP 1987	P2AT	186	1,250	-	-	-	-	408	408	
	078	MOJOKERTO - BANGSAL	40.2	ALL	JUL 1986	P2AT	309	1,000	-	-	-	934	2,379	3,313	
	090	MOJOKERTO - BANGSAL	46.1	ALL	AUG 1986	P2AT	170	1,000	-	-	-	1,212	2,177	3,389	
	097	MOJOKERTO - KUTOAJED	43.1	ALL	SEP 1986	P2AT	160	1,000	-	-	-	542	1,193	1,735	
	111	MOJOKERTO - PURI	47.1	ALL	SEP 1987	P2AT	191	1,500	-	-	-	-	545	545	
	113	MOJOKERTO - MOJOSARI	45.6	ALL	SEP 1987	P2AT	198	1,500	-	-	-	-	549	549	
	092	PASURUAN - BONGANGMETAN	44.4	ALL	SEP 1986	P2AT	167	1,000	-	-	-	57	1,993	2,050	
	093	PASURUAN - NGULING	38.6	ALL	SEP 1986	P2AT	76	1,000	-	-	-	714	2,673	3,387	
	118	PASURUAN - NGULING	39.8	ALL	SEP 1987	P2AT	108	1,000	-	-	-	-	1,080	1,080	
	119	PASURUAN - NGULING	35.2	ALL	SEP 1987	P2AT	90	1,500	-	-	-	-	1,104	1,104	
	094	PROBOLINGGO - SUMBERASIN	41.2	ALL	SEP 1986	P2AT	150	1,000	-	-	-	1,079	2,787	3,866	
	095	PROBOLINGGO - SUMBERASIN	47.1	ALL	SEP 1986	P2AT	118	1,000	-	-	-	827	1,344	2,171	
	096	PROBOLINGGO - WONDASIN	44.3	ALL	SEP 1987	P2AT	89	1,000	-	-	-	-	1,544	1,544	
	122	PROBOLINGGO - BANTARAN	43.6	ALL	SEP 1987	P2AT	126	1,000	-	-	-	-	803	803	
	038	TUBAN - PALANG	38.9	CNLS+PUMP	JUL 1984	P2AT	77	1,250	-	-	-	-	714	714	
	073	TUBAN - PALANG	32.5	ALL	APR 1984	P2AT	70	1,250	-	-	-	-	597	597	
	054	TUBAN - MERAKURAK	43.5	CNLS+PUMP	JUN 1985	P2AT	113	1,250	-	-	580	303	681	1,564	
	055	TUBAN - MERAKURAK	24.8	CNLS+PUMP	JUN 1985	P2AT	68	1,250	-	-	1,028	402	480	1,910	
	056	TUBAN - MERAKURAK	41.0	CNLS+PUMP	JUN 1985	P2AT	69	1,250	-	-	666	395	1,433	2,494	
	057	TUBAN - MERAKURAK	38.0	CNLS+PUMP	JUN 1984	P2AT	57	1,250	-	895	1,896	1,176	2,163	6,130	
	058	TUBAN - MERAKURAK	35.2	CNLS+PUMP	JUN 1985	P2AT	46	1,250	-	-	989	1,032	2,213	4,234	
	059	TUBAN - MERAKURAK	54.9	CNLS+PUMP	JUN 1985	P2AT	89	1,250	-	-	1,210	1,034	1,846	4,090	
	060	TUBAN - MERAKURAK	43.4	CNLS+PUMP	JUN 1985	P2AT	88	1,250	-	-	948	893	2,554	4,395	
	061	TUBAN - MERAKURAK	35.1	CNLS+PUMP	JUN 1984	P2AT	99	1,250	-	491	1,495	853	2,017	4,856	
	062	TUBAN - MERAKURAK	39.5	CNLS+PUMP	JUN 1985	P2AT	94	1,250	-	-	796	778	1,541	3,115	
	065	TUBAN - MERAKURAK	56.5	CNLS+PUMP	JUN 1985	P2AT	82	1,250	-	-	687	181	357	1,225	
	063	TUBAN - JENU	49.8	CNLS+PUMP	JUN 1985	P2AT	142	1,250	-	-	605	649	1,484	2,738	
	064	TUBAN - JENU	67.3	CNLS+PUMP	JUN 1985	P2AT	152	1,250	-	-	837	326	1,044	2,207	
	070	TUBAN - REWEGEC	47.1	ALL	AUG 1986	P2AT	245	1,250	-	-	-	179	1,154	1,333	
	071	TUBAN - REWEGEC	41.4	ALL	JUN 1985	P2AT	155	1,250	-	-	1,154	440	1,980	3,582	
	072	TUBAN - PLUMPANG	56.2	ALL	SEP 1986	P2AT	157	1,250	-	-	-	69	2,131	2,290	
	102	TUBAN - NONTONG	55.8	ALL	SEP 1987	P2AT	187	1,500	-	-	-	-	16	16	
	086	TUBAN - NONTONG	41.5	ALL	SEP 1987	P2AT	226	1,500	-	-	-	-	-	0	
	087	TUBAN - NONTONG	31.6	ALL	SEP 1987	P2AT	104	1,500	-	-	-	-	234	234	
	090	TUBAN - NONTONG	33.4	ALL	SEP 1987	P2AT	93	1,500	-	-	-	-	21	21	
	100	TUBAN - NONTONG	46.2	ALL	SEP 1987	P2AT	90	1,500	-	-	-	-	72	72	

SUMMARY FOR SURABAYA PART-PROJECT

ESTABLISHMENT INDICATORS				PUMP OPERATION HOURS					
NUMBER OF UNITS	44	AVERAGE OPERATION FEE	1,210 RP/HOUR	TOTAL	3,784	15,104	20,013	53,062	91,963
TOTAL IRRIGATED AREA	1,956.4 HA	NUMBER OF FARMERS	3,955	AVERAGE	1,892	1,304	1,049	1,769	1,467
AVERAGE COMMAND AREA	44.5 HA/UNIT	AVERAGE FARMERS/C.A.	135 FARMERS/UNIT						
		AVERAGE LAND TENURE	0.33 HA/FARMER						

SUMMARY FOR JAWA TIMUR PROJECT

ESTABLISHMENT INDICATORS				PUMP OPERATION HOURS						
NUMBER OF UNITS	132	AVERAGE OPERATION FEE	2,011 RP/HOUR	TOTAL	12,236	18,743	44,386	68,236	161,322	304,923
TOTAL IRRIGATED AREA	7,319.3 HA	NUMBER OF FARMERS	18,169	AVERAGE	1,064	1,013	1,202	999	1,501	1,256
AVERAGE COMMAND AREA	55.4 HA/UNIT	AVERAGE FARMERS/C.A.	138 FARMERS/UNIT							
		AVERAGE LAND TENURE	0.40 HA/FARMER							

NOTE: The yearly average has been computed based on the number of months of recorded operation. A tubewell with six months of operation in a certain year will therefore account for 1/2 of that specific year.

TABLE 1.3.7 LIST OF PUMP BOARD & OPERATION HOURS MADJUN PART-PROJECT

PART - PROJECT	TUBEWELL NUMBER	KABUPATEN - KECAMATAN	COMMAND AREA (HA)	WORKS UNDER LOAN YEAR	START OF OPERATIONS (DATE)	MANAGED BY	MEMBERS OF NIPPA (MO)	OPERATION FEES (RP/HOUR)	PUMP OPERATION HOURS					
									1983	1984	1985	1986	1987	1983-1987
MADJUN	052	MADJUN - PILANGKENCENG	110.2	ALL	OCT 1984	P2AT	215	3,000	-	571	1,294	1,342	1,566	4,773
	053	MADJUN - PILANGKENCENG	101.8	ALL	OCT 1984	P2AT	221	3,250	-	653	798	642	1,924	4,017
	054	MADJUN - PILANGKENCENG	110.0	ALL	OCT 1984	P2AT	272	3,000	-	810	1,230	991	1,509	4,540
	055	MADJUN - PILANGKENCENG	103.0	ALL	OCT 1984	P2AT	217	3,000	-	920	1,794	1,546	1,990	6,250
	056	MADJUN - PILANGKENCENG	123.0	ALL	OCT 1984	P2AT	282	2,400	-	595	838	1,119	1,303	3,855
	057	MADJUN - PILANGKENCENG	100.0	ALL	OCT 1984	P2AT	140	2,600	-	789	1,778	1,158	1,819	5,544
	058	MADJUN - PILANGKENCENG	112.8	ALL	MAR 1986	P2AT	239	3,000	-	-	-	645	1,134	1,781
	059	MADJUN - PILANGKENCENG	106.6	ALL	OCT 1984	P2AT	181	3,200 (8)	-	449	1,187	1,236	1,562	4,434
	060	MADJUN - PILANGKENCENG	111.4	ALL	OCT 1984	P2AT	269	3,200 (8)	-	884	1,983	1,337	1,463	5,667
	061	MADJUN - PILANGKENCENG	115.8	ALL	OCT 1984	P2AT	195	3,350 (8)	-	948	2,046	1,344	1,812	6,150
	069	MADJUN - PILANGKENCENG	90.0	ALL	APR 1987	P2AT	214	3,000	-	-	-	-	1,643	1,643
	062	NGAWI - PARDI	112.1	ALL	NOV 1985	P2AT	263	3,850 (8)	-	-	189	1,043	560	1,762
	063	NGAWI - PARDI	43.8	ALL	NOV 1985	P2AT	215	3,850 (8)	-	-	73	1,310	815	2,198
	064	NGAWI - PARDI	100.6	ALL	NOV 1985	P2AT	224	4,500 (8)	-	-	-	1,551	811	2,362
	065	NGAWI - PARDI	105.4	ALL	MAY 1986	P2AT	234	6,000	-	-	-	551	573	1,124
	066	NGAWI - PARDI	91.4	ALL	NOV 1985	P2AT	198	2,950 (8)	-	-	-	1,373	119	1,492
	067	NGAWI - PARDI	70.9	ALL	MAY 1986	P2AT	267	4,500 (8)	-	-	-	537	427	964
	068	NGAWI - PARDI	108.8	ALL	MAY 1986	P2AT	223	4,500 (8)	-	-	-	679	1,005	1,684
	069	NGAWI - PARDI	118.8	ALL	MAY 1986	P2AT	287	4,500	-	-	-	640	525	1,165
	070	NGAWI - KEDUNGALAR	97.1	ALL	NOV 1985	P2AT	209	3,000	-	-	-	827	371	1,198
	071	NGAWI - KEDUNGALAR	129.3	ALL	MAY 1985	P2AT	289	4,000	-	-	-	614	366	980
	072	NGAWI - KEDUNGALAR	85.7	ALL	MAY 1986	P2AT	195	4,000	-	-	-	376	204	580
	073	NGAWI - KEDUNGALAR	65.7	ALL	MAY 1986	P2AT	154	4,000	-	-	-	822	167	989
	074	NGAWI - KEDUNGALAR	105.6	ALL	MAY 1986	P2AT	244	4,000	-	-	-	300	154	454
	075	NGAWI - KEDUNGALAR	105.2	ALL	MAY 1986	P2AT	256	4,000	-	-	-	359	107	466
	076	MAGETAN - BENDI	57.0	ALL	APR 1987	P2AT	126	4,500	-	-	-	-	1,094	1,094
	077	MAGETAN - BENDI	46.0	ALL	APR 1987	P2AT	153	4,000	-	-	-	-	509	509
	078	MAGETAN - BENDI	98.4	ALL	APR 1987	P2AT	196	4,500	-	-	-	34	1,515	1,549
	079	MAGETAN - BENDI	79.0	ALL	APR 1987	P2AT	169	4,500	-	-	-	-	1,023	1,023
	080	MAGETAN - BENDI	82.6	ALL	APR 1987	P2AT	201	4,000	-	-	-	4	1,037	1,041
	081	MAGETAN - MADSPATI	64.2	ALL	APR 1987	P2AT	171	4,000	-	-	-	10	1,191	1,201
	082	MAGETAN - MADSPATI	77.6	ALL	APR 1987	P2AT	193	4,000	-	-	-	13	544	557
	083	MAGETAN - MADSPATI	74.0	ALL	APR 1987	P2AT	203	4,000	-	-	-	18	1,115	1,133
	084	MAGETAN - MADSPATI	98.6	ALL	APR 1987	P2AT	231	4,000	-	-	-	-	455	455
	085	PONDORO - SIMAN	60.0	ALL	APR 1987	P2AT	108	2,300	-	-	-	6	1,244	1,250
	086	PONDORO - SIMAN	63.6	ALL	APR 1987	P2AT	94	2,300	-	-	-	162	2,142	2,304
	087	PONDORO - SIMAN	60.0	ALL	APR 1987	P2AT	99	4,000	-	-	-	-	470	470
	088	PONDORO - SIMAN	46.0	ALL	APR 1987	P2AT	91	4,000	-	-	-	-	493	493

(4) : Flat yearly rates converted into hourly rates based on average farmers' water request.

SUMMARY FOR MADJUN PART-PROJECT

ESTABLISHMENT INDICATORS				PUMP OPERATION HOURS					
NUMBER OF UNITS	38	AVERAGE OPERATION FEE	3,712 RP/HOUR	TOTAL	6,619	13,210	22,519	36,771	79,119
TOTAL IRRIGATED AREA	3,431.6 HA	NUMBER OF FARMERS	7,734	AVERAGE	3,055	1,403	1,121	1,012	1,164
AVERAGE COMMAND AREA	90.3 HA/UNIT	AVERAGE FARMERS/C.A.	204 FARMERS/UNIT	NOTE :	The yearly average has been computed based on the number of months of recorded operation. A tubewell with six months of operation in a certain year will therefore account for 1/2 of that specific year.				
		AVERAGE LAND TENURE	0.44 HA/FARMER						

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The above indicators relevant to each Pump Board in operation under Loan 2119 are also contained in Table 1.3.7.

(2) The Water Users' Association (HIPPA)

The operation in the ground water irrigation units are carried out by the farmers (water users) organized in associations called HIPPA (Himpunan Petani Pemakai Air).

According to Presidential Instruction 2/1984, HIPPA are established on a village (desa) basis under the administrative jurisdiction of the Pronpinsi-Kabupaten-Kecamatan-Desa system. They are responsible for the operations and maintenance of all the tertiary units of the irrigation schemes (surface as well as fed by ground water) located in the territory of the respective desa. The ground water facilities are operated by an emanation of the HIPPA which is referred to as Pump Board.

The organizational structure of a Ground Water Users Association is shown in Fig.1.3.3.

(3) Establishment, Training and Assistance by P2AT

The initial step in the establishment of a new Pump Board after the construction of a tubewell irrigation system is completed, including well drilling and installation of the pump and engine, consists of a survey on the land ownership of the whole command area carried out by P2AT.

After the land ownership survey and in consultation with the village chief, P2AT formally established the new Pump Board with a function usually attended by the sub-district chief and other officer. In that occasion the members of the Pump Board appoint their own leader, secretary, treasurer, operator, water master and heads of the tertiary blocks.

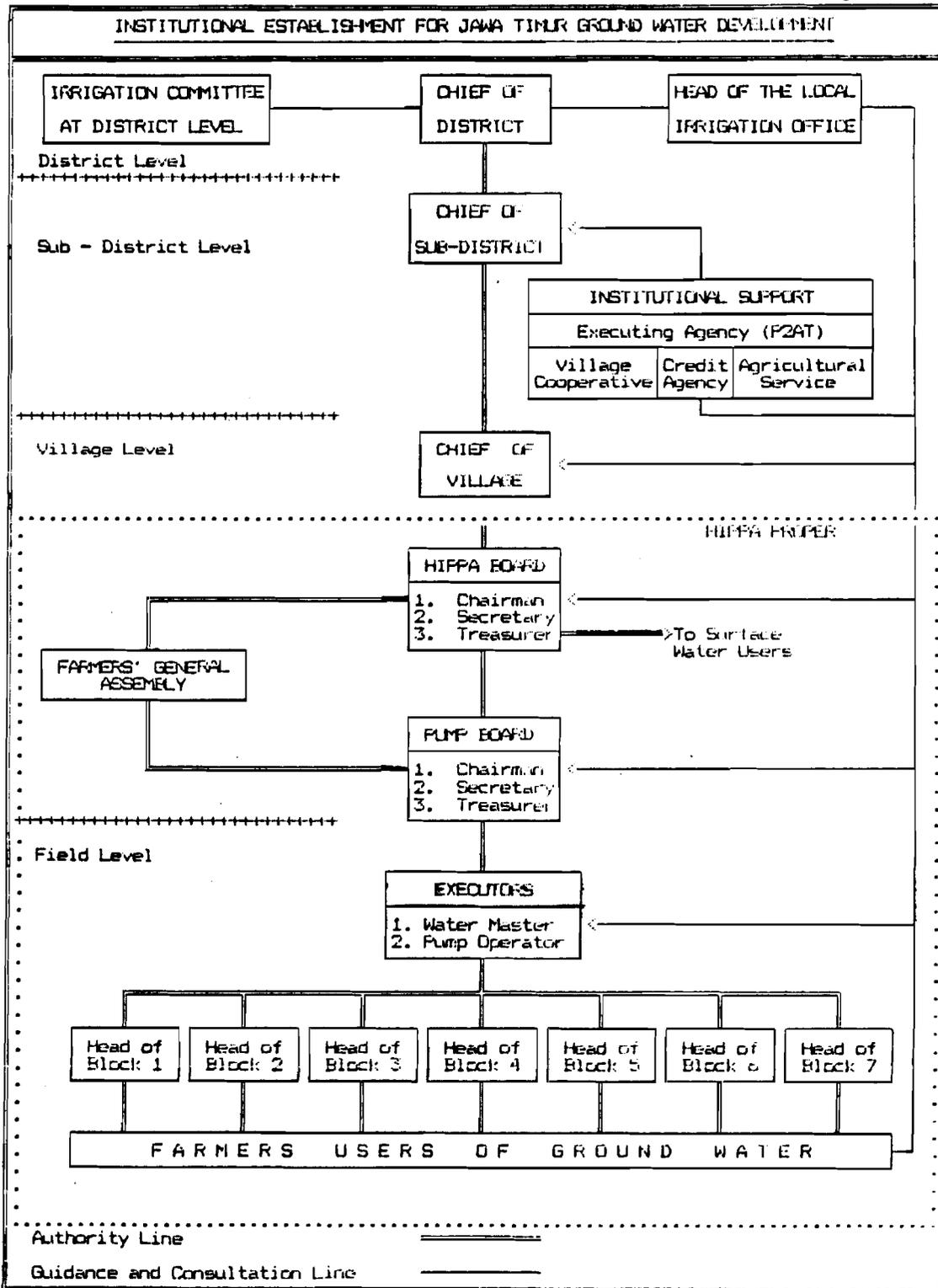
A short training courses for the farmers and Pump Board officers is then held by P2AT concerning several operational and administrative subjects.

With this training course the Pump Board establishment proper is completed. However, in order to continue the training and guidance until the farmers become reasonably acquainted with all aspects of the operations, P2AT retains overall management responsibility for a certain period (formerly two years, now one year only) after the Pump Board establishment. In this period P2AT bears the cost of fuel and lubricants and takes care of all needed repairs and maintenance of the entire tubewell. After this period the facilities are handed over to the Pump Board for direct management.

(4) Rotation Schedules

Two types of rotation schedules are enforced in Kediri-Surabaya and Madiun Part-Project and they differ in the time required to complete a rotation, number of daily pumping hours, number of blocks served and time allocated for maintenance.

Fig 1.3.3



The differences between the two adopted schedule are summarized below:

	Kediri - Surabaya	Madiun
Average Command Area (ha)	42	90
Average Design Discharge (l/s)	45	100
Number of Blocks in the Command Area	7	9 to 15
Duration of a Complete Rotation (days)	7	14
Daily Irrigation Hours	18	21
Daily Pump Stoppage Hours	23.00 - 5.00	5.00 to 6.00 13.00 to 14.00 21.00 to 22.00
Maintenance	During Pump Stoppage Hours	During Pump Stoppage Hours and at the End of the Rotation for a Full Day

Different local conditions, size of command areas, pump capacity and other consideration lie behind the selection of the two rotation schedules in the different Project areas. It should be however clarified that with the unification of the management, development strategies and size of irrigation units all throughout the development area no reason appeared to support the adoption of different schedules in the Project area. It was therefore decided that the even-day, seven-block, eighteen hour rotation schedule should be enforced in all the irrigation units developed in the rainfed areas since year 1986.

#### (5) Pump Operation Hours and Fees

The summary of operation hours and fees for the 132 tubewells financed under Loan 2119 since their establishment is shown in Table 1.3.7. The review on the record indicates that year 1987 registered a remarkable increase in the total number of pumping hours with respect to the previous year. The trend is general with a few exceptions due to local conditions or contingent circumstances. The following table provides a summary of the average operation hours recorded in the part-projects of Kediri, Madiun and Surabaya since 1983.

Part-Project	Year 1983	Year 1984	Year 1985	Year 1986	Year 1987
Kediri	1,064	582	1,010	881	1,737
Madiun	-	3,055	1,403	1,121	1,012
Surabaya	-	1,892	1,304	1,049	1,769
Average	1,064	1,013	1,202	999	1,501

The operation fees as given in Table 1.3.7 appear rather dis-uniform. An attempt has been made to correlate them with the size of the respective command areas. The results are graphically shown in Figure 1.3.4.

From the analysis it appears that no correlation exists between the two parameters and, therefore, the operation fees in the different Part-Projects should be investigated to give reason of the criteria adopted by the Pump Boards in establishing the said operation fees.

#### (6) Water Use

A study was conducted on the actual water use in the field as an attempt to evaluate the farmers' performance for the cultural cycle 1986-1987. The investigation was carried out in a number of sub-areas where the available information appeared sound enough to allow reliable conclusions.

The study consisted of a comparison between the theoretical water requirements relevant to the crops grown in the command areas during the already mentioned cultural cycle and the amount of water actually supplied by the farmers to the field during the same period. The computation methodology has been discussed in Annex-D of "Operational Aspect of Water Management", to which the reader is addressed for further details. The outputs of the study are represented by the following three main indicators computed on a monthly and yearly basis :

- percentage of the crop water requirements covered by the surface water supply;
- percentage of the crop water requirement satisfied by the abstracted ground water;
- overall water deficit expressed as a percentage of the crop water requirements.

A summary of these three indicators (monthly and Yearly values) is provided in Table 1.3.8 for each investigated Sub-Area.

The study still indicates an underusage of the ground water facilities. In fact, although the water deficits with respect to the theoretical crop water requirements have decreased by 50% after the tubewell implementation, they average now 22% on a yearly basis for the entire Project and their distribution during the year varies from Sub-Area to Sub-Area (see Table 1.3.8).

A summary of the water use (yearly values) in the Project area for the cultural cycle 1986-1987 is provided in the table of the following page.

# OPERATION FEES V/S COMMAND AREAS

JAWA TIMUR PROJECT

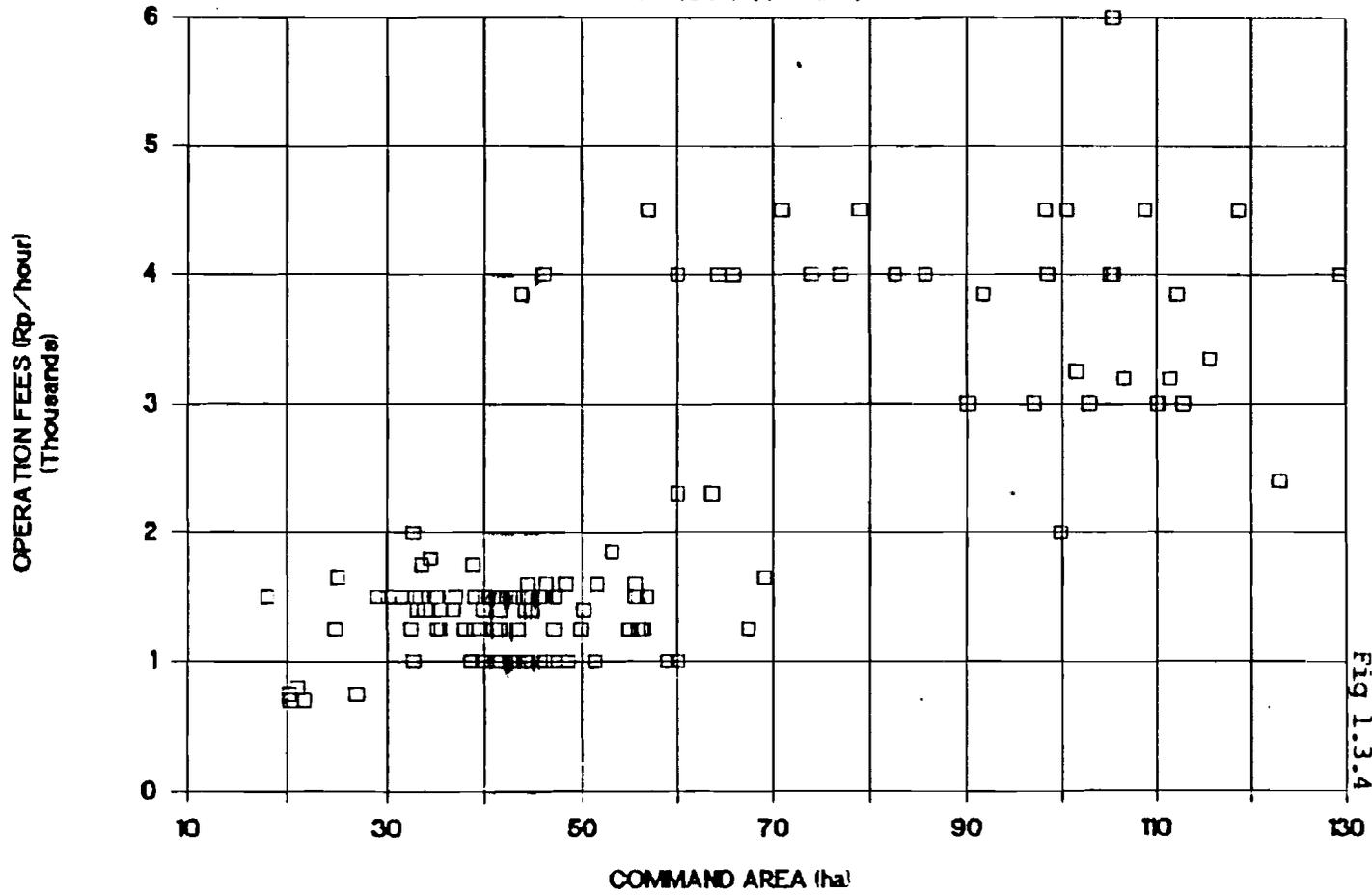


Fig 1.3.4

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Part-Project	Sub-Area	Surface Water (%)	Ground Water (%)	Overall Deficit (%)
Kediri	Pace	39	43	18
	Plemahan	56	43	1
	Average for Kediri	47	43	10
Madiun	Caruban	29	40	31
	Magetan	55	30	15
	Ngawi	63	20	16
	Average for Madiun	46	31	22
Surabaya	Gresik	-	42	58
	Mojokerto	-	71	29
	Pasuruan	-	71	29
	Probolinggo	-	46	54
	Tuban	-	54	46
	Average for Surabaya	-	53	47
Average for the Project		41	38	22

### 3.2.6 Agricultural Development

#### (1) Cropping Patterns for Year 1987

Beside the Government overall policy for agricultural development, the aspect prevailing from the technical point of view in the establishment of the cropping patterns for year 1987 was represented by the type of soil.

The planned cropping patterns were mutually agreed upon by the farmers, Pump Boards, Agricultural Service and Executing Agency at the beginning of the cropping cycle and were supposed to be strictly binding on all cultivators of a certain command area.

Table in the following page summaries the actual versus planned cropping pattern in the investigated Project Sub-Areas for the cultural cycle 1986-1987.

SUMMARY OF WATER USE FOR CULTURAL CYCLE 1986 - 1987

TABLE 1.3.8

PART - PROJECT	SUB-AREA	TN (NO)	SOURCE OF WATER USE AND DEFICIT	COVERAGE OF THE CROP WATER REQUIREMENTS EXPRESSED IN PERCENTAGE OF THE SAME													TOTAL		
				OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT		NOV	DEC
KEDIRI	Pace	5	Surface Water	---	---	---	66	73	36	39	100	23	14	5	2	3	100	91	39
			Ground Water	---	---	---	9	1	1	7	100	55	77	63	79	100	100	10	43
			Deficit	---	---	---	25	26	63	55	0	22	9	33	19	0	0	0	18
	Pleahan	4	Surface Water	---	---	---	100	100	100	98	44	46	58	57	63	62	100	100	56
			Ground Water	---	---	---	2	2	2	42	44	60	54	100	100	100	100	100	43
			Deficit	---	---	---	0	0	0	0	12	0	0	0	0	0	0	0	1
	Average		Surface Water	---	---	---	81	85	64	65	75	33	34	28	29	29	100	95	47
			Ground Water	---	---	---	6	1	1	23	75	57	67	79	88	100	100	50	43
			Deficit	---	---	---	14	14	35	31	5	12	5	18	11	0	0	0	10
MADIUN	Caruban	4	Surface Water	5	22	100	100	100	96	2	8	1	0	0	---	---	---	29	
			Ground Water	100	41	100	100	100	7	27	30	19	31	24	27	---	---	---	40
			Deficit	0	36	0	0	0	0	70	62	80	69	76	73	---	---	---	31
	Magetan	2	Surface Water	100	100	100	100	75	100	30	25	27	23	37	30	---	---	---	55
			Ground Water	0	0	0	3	5	100	13	22	22	48	95	100	---	---	---	30
			Deficit	0	0	0	0	20	0	57	54	51	29	0	0	---	---	---	15
	Ngawi	3	Surface Water	23	88	93	100	100	100	54	54	75	55	37	74	---	---	---	63
			Ground Water	7	13	3	100	9	35	7	3	12	30	27	26	---	---	---	20
			Deficit	70	0	4	0	0	0	39	43	12	15	36	0	---	---	---	16
	Average		Surface Water	32	61	98	100	94	98	26	27	31	23	21	31	---	---	---	46
			Ground Water	47	23	45	78	49	37	17	19	17	34	41	43	---	---	---	31
			Deficit	23	16	1	0	4	0	57	54	51	42	46	32	---	---	---	22
SURABAYA	Gresik	3	Surface Water	---	0	0	0	0	0	0	0	0	0	0	0	---	---	0	
			Ground Water	---	40	51	21	10	32	38	48	37	19	60	73	79	---	---	42
			Deficit	---	60	49	79	90	68	62	52	63	81	40	27	21	---	---	58
	Mojokerto	1	Surface Water	---	---	0	0	0	0	0	0	0	0	0	0	0	---	---	0
			Ground Water	---	---	43	58	30	3	36	100	83	100	100	100	100	100	---	71
			Deficit	---	---	57	42	76	97	64	6	17	0	6	6	6	---	---	29
	Pasuruan	1	Surface Water	---	---	0	0	0	0	0	0	0	0	0	0	0	---	---	0
			Ground Water	---	---	54	22	4	33	40	100	100	100	100	100	100	100	---	71
			Deficit	---	---	46	78	96	67	60	0	0	0	0	0	0	---	---	29
	Probolinggo	1	Surface Water	---	---	0	0	0	0	0	0	0	0	0	0	0	---	---	0
			Ground Water	---	---	40	21	29	8	100	14	18	32	100	43	38	73	---	43
			Deficit	---	---	60	79	71	92	0	86	82	68	0	57	62	27	---	57
	Tuban	4	Surface Water	---	0	0	0	0	0	0	0	0	0	0	0	---	---	0	
			Ground Water	---	50	42	6	4	25	100	36	48	48	100	100	93	---	---	54
			Deficit	---	50	58	94	96	75	0	64	52	52	0	0	7	---	---	46
	Average		Surface Water	---	0	0	0	0	0	0	0	0	0	0	0	0	---	---	0
			Ground Water	---	46	46	19	11	24	69	50	50	48	88	86	85	91	---	53
			Deficit	---	54	54	81	89	76	31	50	50	52	12	14	15	9	---	47
AVERAGE FOR THE PROJECT		Surface Water	32	48	57	57	61	58	37	24	29	25	20	25	23	50	66	41	
		Ground Water	47	26	26	21	14	15	31	31	37	44	59	60	71	49	34	38	
		Deficit	23	26	17	21	26	27	32	45	34	30	21	15	6	1	0	22	

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**SUMMARIZES OF THE PLANNED VERSUS ACTUAL CROPPING PATTERNS IN THE  
INVESTIGATED SUB-AREAS (1986-1987)**

Part Project	Sub-Area	Type of Soil	Planned Cropping Pattern	Actual Cropping Pattern
Kediri	Pace	Havy	1.Wet Season Paddy	1.Wet Season Paddy
			2.Dry Season Paddy	2.Polowijo
			3.Polowijo	3.Polowijo
	Plemahan	Medium	1.Wet Season Paddy	1.Wet Season Paddy
		2.Dry Season Paddy/ Polowijo	2.Polowijo	
		3.Polowijo	3.Polowijo	
Madiun	Caruban	Heavy	1.Wet Season Paddy	1.Wet Season Paddy
			2.Dry Season Paddy	2.Dry Season Paddy
			3.Polowijo	3.Polowijo
	Magetan	Light	1.Wet Season Paddy	1.Wet Season Paddy/Sugar Cane
			2.Polowijo	2.Dry Season Paddy/ Polowijo/Sugar Cane
			3.Polowijo	3.Polowijo/Sugar Cane
Ngawi	Heavy	1.Wet Season Paddy	1.Wet Season Paddy/Sugar Cane	
		2.Dry Season Paddy	2.Dry Season Paddy/Sugar Cane	
		3.Polowijo	3.Polowijo/Sugar Cane	
Surabaya	Gresik	Medium	1.Wet Season Paddy	1.Wet Season Paddy
			2.Polowijo	2.Dry Season Paddy/Polowijo
			3.Polowijo	3.Polowijo
	Mojokerto	Medium	1.Wet Season Paddy	1.Wet Season Paddy/Sugar Cane
			2.Dry Season Paddy/ Polowijo	2.Dry Season Paddy/ Polowijo/Sugar Cane
			3.Polowijo	3.Polowijo/Sugar Cane
	Pasuruan	Medium	1.Wet Season Paddy	1.Wet Season Paddy
			2.Dry Season Paddy/ Polowijo	2.Polowijo
			3.Polowijo	3.Polowijo
	Probolinggo	Medium	1.Wet Season	1.Wet season Paddy
			2.Dry Season Paddy/ Polowijo	2.Polowijo
			3.Polowijo	3.Polowijo
Tuban	Medium	1.Wet Season Paddy	1.Wet Season Paddy	
		2.Dry Season Paddy/ Polowijo	2.Dry Season Paddy/ Polowijo	
		3.Polowijo	3.Polowijo	

It should also be noticed that, according to the established cropping calendar, the cultural cycle in all the Project Sub-Areas, was planned to start in October/November and last until the next September/October. That was not always the case recorded in the field and different cropping calendars were enforced. More precisely the land preparation took place in the month of January in Kediri Part-Project, October in Madiun Part-Project and November/December in Surabaya Part-Project.

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## (2) Crop Intensity

The crop intensities and agricultural production in 52 out of 132 irrigation units were directly or indirectly monitored in year 1987 as shown by Table 1.3.9.

The monitored cropping intensities in the Project in year 1987 are summarized herebelow :

Crop Intensity : (%)	Part-Project			Project
	Kediri	Madiun	Surabaya	
	Min Max Ave	Min Max Ave	Min Max Ave	Min Max Ave
Year 1987	243 358 287	129 300 234	257 303 290	129 358 265

The above figure are worth some comment and interpretations.

The average crop intensity for the Project has reached 265% only due to the surprisingly low values recorded in the Madiun area which averaged 234% in 1987. The figure of 234% relevant to Madiun Part-Project has been established based on the following average crop intensity in the Madiun Sub-Areas :

- Caruban 285% (6 surveyed tubewells)
- Ngawi 243% (8 surveyed tubewells)
- Ponorogo 274% (2 surveyed tubewells)
- Magetan 168% (7 surveyed tubewells)

The evaluation of the crop intensity in the other Part-Project shows a good performance in Kediri and, to a lesser extent, in Surabaya.

## (3) Agricultural Production

The availability of round the year irrigation made possible by the installation of ground water facilities, is not always accompanied by proper land preparation methods, appropriate use of High Yield Variety seeds, accurate application of fertilizers and pesticides and timely wedding. This situation, combined with some shortcomings in the tubewell operations and farmers' attitude appears to affect in particular the outputs of the polowijo crops.

This seems to be confirmed by the monitored crop yields in the Project Area. In fact, while the achievement for paddy production appears satisfactory (5.7 tons/ha on the average), the polowijo yields indicate a need for an improved performance.

In order to give full reason for this statement the agricultural yields recorded in 1987 have been compared to the expected ultimated yields in both rainfed and fully irrigated areas valid for small holdings similar in size to the ones prevailing to the Project. The reference yields shown herebelow are adopted by The Royal Tropical Institute of Amsterdam in order to determine the feasibility of agricultural projects (see Agricultural Compendium for Rural Development in the Tropics and Subtropics, Amsterdam, 1981, section 6.4.2).

PART - PROJECT	SUB-AREA	CROP INTENSITY	C R O P Y I E L D S ( T o n s / H a )								
			Paddy	Soya Beans	Maize	Ground Nuts	Green Peas	Onions	Sugar Cane	Tobacco	Sweet Potatoes
KEDIRI	Pace	257	5.0	0.7	5.4	---	---	---	---	---	---
	Plemahan	310	6.2	0.8	4.5	1.0	---	11.5	---	---	---
	Average	287	5.7	0.7	4.9	1.0	---	11.5	---	---	---
MADIUN	Caruban	285	6.0	0.4	---	---	0.3	---	---	0.6	---
	Magetan	168	4.8	0.2	---	0.3	---	---	91.5	---	7.7
	Ngawi	243	6.7	0.3	1.0	0.1	---	---	61.6	---	---
	Ponorogo	274	5.3	0.6	---	---	---	---	---	---	---
	Average	234	6.1	0.4	1.0	0.3	0.3	---	74.9	0.6	7.7
SURABAYA	Bresik	289	5.6	---	2.6	0.8	0.8	---	---	---	---
	Mojokerto	280	6.3	1.1	3.6	1.3	0.8	---	71.0	---	---
	Pasuruan	295	4.9	0.5	4.8	0.6	0.6	---	73.0	---	---
	Probolinggo	300	5.7	0.9	3.4	0.7	0.7	---	---	---	---
	Tuban	290	5.2	0.9	3.3	1.0	0.6	---	---	---	---
	Average	290	5.5	0.9	3.4	1.0	0.6	---	71.7	---	---
AVERAGE FOR THE PROJECT		265	5.7	0.6	3.6	0.7	0.6	11.5	58.0	0.6	7.7

Kind of Crop	Average Yield for Project (Year 1987)	(unit : Tons/Ha)	
		Ultimate Rainfed	Expected Yields Irrigated
Paddy (unhusked grain)	5.7	1.5	6.5
Soya Beans	0.6	0.8	1.5
Maize	3.6	1.5	4.5
Ground Nuts	0.7	1.0	1.5
Green Peas	0.6	0.7	1.2
Onions	11.5	5.0	15.0
Sugar Cane	58.0	40.0	100.0
Tobacco	0.6	1.0	1.5
Sweet Potatoes	7.7	5.0	12.0

It should, however, be clarified here that the above ultimate yields are expected to be attained only after a number of years (generally in the order of five) of full irrigation. The yields obtained during the initial years of agricultural projects usually range between 40 and 60 % of the ultimate yields.

Considering that the first Projects areas financed by Loan 2119 were equipped with ground water facilities starting from year 1983, it is safe to assume that the conditions for optimum production are still being established and that the potential inherent to ground water developments has not been fully exploited yet by the farmers. Seen under this light the polowijo yields recorded in 1987 appear therefore in line with the average expectations for newly established irrigation projects.

#### (4) Crop Budget and Farmers' Income for Year 1987

A monitoring of the 1987 farm management covering farming costs (land preparation through harvest) and farmers' income from crop was carried out by the Project with the assistance of the Agricultural Office.

The monitoring exercise was conducted by interviewing samples of farmers with the help of questionnaires dealing with production, seeds application, use of fertilizers and pesticides as well as labour requirements.

The monitoring has allowed to establish the production cost, farmers' income from harvest and consequent benefits in the agricultural cycle 1986 - 1987 for six different crops, namely wet-season paddy, dry-season paddy, soy beans, ground nuts, maize and onions. The results of the investigation, representing average value for the Project, are shown in Table 1.3.10.

From the following summarized table it can be seen that if we exclude onions the most profitable cropping patterns for the entire 1987 cultural cycle can be identified as wet-season paddy/dry-season paddy/maize and wet-season paddy/soy beans/maize for heavy and medium-to-light soils, respectively. wet-season paddy/soy beans/onions, by far the most profitable of all cropping patterns, is prevailing in Plemahan Sub-area of Kediri Part-Project only.

TABLE 1.3.10 CROP BUDGET FROM YEAR 1987

WET - SEASON PADDY

ITEMS OF COST	Unit	Quantity (Unit/ha)	Unit Price (Rp/Unit)	Total (Rp/ha)
Seeds	kg	50	337	16,839
Fertilizers	kg	525	125	65,625
Pesticides	l	5	2,325	11,763
Hired Labour				
- Man	day	53	1,189	63,097
- Woman	day	58	899	51,767
- Cattle	day	19	2,461	47,862
Ground Water Irrigation	hour	20	1,320	26,780
<b>TOTAL COST</b>				<b>282,733</b>
INCOME FROM YIELD (Rp)	Rp 160,000 @ Ton		5.7 =	912,000
<b>BENEFIT (Rp/Ha)</b>				<b>629,267</b>

SOY BEANS

ITEMS OF COST	Unit	Quantity (Unit/ha)	Unit Price (Rp/Unit)	Total (Rp/ha)
Seeds	kg	18	733	13,253
Fertilizers	kg	51	125	6,354
Pesticides	l	1	2,783	2,978
Hired Labour				
- Man	day	24	1,189	28,060
- Woman	day	8	899	7,087
- Cattle	day	0	2,461	0
Ground Water Irrigation	hour	6	1,320	7,920
<b>TOTAL COST</b>				<b>65,652</b>
INCOME FROM YIELD (Rp)	Rp 600,000 @ Ton		0.6 =	360,000
<b>BENEFIT (Rp/Ha)</b>				<b>294,348</b>

DRY - SEASON PADDY

ITEMS OF COST	Unit	Quantity (Unit/ha)	Unit Price (Rp/Unit)	Total (Rp/ha)
Seeds	kg	22	337	7,551
Fertilizers	kg	410	125	51,250
Pesticides	l	5	2,325	11,763
Hired Labour				
- Man	day	50	1,189	59,425
- Woman	day	37	899	33,276
- Cattle	day	10	2,461	24,608
Ground Water Irrigation	hour	10	1,320	13,200
<b>TOTAL COST</b>				<b>201,073</b>
INCOME FROM YIELD (Rp)	Rp 160,000 @ Ton		5.1 =	816,000
<b>BENEFIT (Rp/Ha)</b>				<b>614,927</b>

GROUND NUTS

ITEMS OF COST	Unit	Quantity (Unit/ha)	Unit Price (Rp/Unit)	Total (Rp/ha)
Seeds	kg	80	1,242	99,917
Fertilizers	kg	58	125	7,188
Pesticides	l	2	2,750	6,463
Hired Labour				
- Man	day	67	1,189	79,035
- Woman	day	14	899	12,780
- Cattle	day	16	2,461	38,954
Ground Water Irrigation	hour	18	1,320	23,404
<b>TOTAL COST</b>				<b>267,740</b>
INCOME FROM YIELD (Rp)	Rp 741,667 @ Ton		0.7 =	519,167
<b>BENEFIT (Rp/Ha)</b>				<b>251,427</b>

CROPS	PRODUCTION COST (rp/ha)	FARMERS INCOME (Rp/ha)	FARMERS BENEFIT (Rp/ha)
Wet-Season Paddy	282,733	912,000	629,267
Dry-Season Paddy	201,073	816,000	614,927
Soy Beans	65,652	360,000	294,348
Ground Nuts	267,740	519,167	251,427
Maize	209,233	736,200	526,967
Onions	790,459	2,587,500	1,797,041

The main indicators for the above three cropping patterns in year 1987 are shown below :

CROPPING PATTERNS	TYPE OF SOIL	PRODUCTION COST (Rp/ha)	FARMERS INCOME (Rp/ha)	FARMERS BENEFIT (Rp/ha)
Wet-Season Paddy/Dry- Season Paddy/Maize	Heavy	693,039	2,464,200	1,771,161
Wet-Season Paddy/Soy Beans/Maize	Medium Light	557,618	2,008,200	1,450,582
Wet-Season Paddy/Soy Beans/Onions	Heavy	1,138,844	3,859,500	2,720,656

Considering that the average land tenure for the Project amounts to 0.40 ha it can be seen that the 1987 harvest has entailed for an average family living in the Project area benefits ranging from 580,000 to 710,000 Rp/year. Plemahan area, showing a benefit of 1,090,000 Rp/year, is a fortunate, isolate exception.

These figures are situated slightly above the per-family income of the entire country (about 550,000 Rp/year) and do not depose in favour of the farmers' capability to repay the cost of the Project or part of it.

### 3.2.7 Rainfed Areas Development Study

The feasibility study for further implementation of groundwater development had been completed under the previous stage of Madiun Groundwater Development Project and in the framework of the ongoing East Jawa Groundwater Project. As a result the following 24,480 ha and 14,210 ha of land respectively had been selected as priority areas for the next groundwater development program.

#### (1) Madiun Plain

According to the available data, the total area of rainfed sawah and tegal in Madiun plain is estimated at 8,700 ha and 35,000 ha respectively. Out of such total area, rainfed sawah and tegal distributed within the potential area of deep and shallow groundwater irrigation is estimated as follows :

Location	Rainfed Sawah		Tegal Area	
	Shallow (Ha)	Deep (Ha)	Shallow (Ha)	Deep (Ha)
Ngawi	-	4,810	-	6,760
Magetan	370	75	95	915
Madiun	-	2,250	1,230	5,220
Ponorogo	140	110	1,300	1,210
Total (Ha)	510	7,240	2,625	14,105

The dry area located in the potential area of shallow groundwater irrigation, that is in the low flat plain along the Madiun River between the town of Ponorogo and Madiun, will be proposed as the shallow groundwater development in the next construction program.

For deep groundwater development, larger rainfed sawah block covering more than 45 ha should be defined, and the result is the following :

Location	Rainfed Sawah Block (more then 60 ha)
Ngawi	3,330
Magetan	150
Ponorogo	-
Total (ha)	4,040

The above rainfed sawahs are located outside the shallow groundwater potential area and should be served therefore by deep tube well irrigation system.

#### (2) Kediri - Nganjuk Area

Most groundwater irrigation developed in Kediri-Nganjuk area is located in the area of the existing surface water irrigation facility, and groundwater is used to supplement irrigation water for a year round as a conjunctive use water. It was concluded therefore, that groundwater development in the Kediri-Nganjuk area is to be limited and shifted to Blitar area.

#### (3) East Jawa's Other Areas

Outside of the above two areas, a total of 14,020 ha of land in East Jawa has been selected as priority area fo the next construction program. With this land the irrigated sawah are included for the next construction program, because it suffers from high shortage of surface water during the dry season. For immediate construction program, however, the irrigated sawah with low income should be of first priority.

Such low income irrigated sawah is located under the sub-area of Tuban (1,216 ha) and part of the sub-area Pasuruan (900 ha). Hence, the total of shortage irrigated area with low income which should be immediately developed within the next construction program is 4,306 ha including the Sampean Baru area of 2,100 ha.

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Sub Area	Rainfed Sawah (ha)	Irrigated Sawah (ha)	T o t a l (ha)
Tuban	3,064	1,216	4,280
Mojokerto	-	2,820	2,820
Pasuruan	-	1,360	1,360
Probolinggo	1,150	410	1,560
Sampean Baru	-	2,100	2,100
Lumajang	1,900	-	1,900
Total (ha)	6,114	7,906	14,020

Out of the 1,900 ha of rainfed sawah in Lumajang area, 661 ha should be given as first priority for possible inclusion in the extended program of work of Surabaya Part-Project to maintain the Project target of 13,000 ha as stipulated by the Loan Agreement.

#### (4) Prospective Rainfed Areas

On the basis of the above discussion and irrespective of the Government policy, the following table gives the figures of rainfed areas in East Java where groundwater is potentially developed for irrigation supply either by constructing shallow or deep tube wells.

Sub area	Shallow Well (ha)	Deep Well		T o t a l
		Rainfed (ha)	Irrigated	
Madiun	3,135	4,040	-	7,175
Kediri	-	-	-	-
Tuban	-	3,064	1,216	4,280
Mojokerto	-	-	-	-
Pasuruan	-	-	900	900
Probolinggo	-	1,150	-	1,150
Sampean Baru	-	-	2,100	2,100
Lumajang	-	1,239	-	1,239
Total (ha)	3,135	9,493	4,216	16,844

The total area mentioned in this table is excluding the total area programmed to be developed by the ongoing project, that is 13,000 ha as stipulated by the Loan Agreement of IBRD - 2215 IND.

### 3.3 Extension Program

This program deals with monitoring and assessment the effects of project implementation and operation of the constructed facilities to the natural, social and economic environments surrounding the Project. The main works of this program to be carried out by the Project consists of the following items :

- (1) Monitoring/studies on the physical and economic project effects including changes in water requirement, ground water level and quality, aquifer behaviour as well as the cropping pattern and farmer's income;

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- (2) Investigate/study on the diversification of groundwater irrigation techniques including the utilization of spring/artesian aquifer, demonstration command area, O & M up-grading with the involvement of private sector to the project implementation.

It should be noticed that the monitoring activity for technical aspects has been carried out since the previous Project stage. A comprehensive monitoring system covering the entire project area was already in existence and in operation at the starting of the present engineering services.

The aspects considered by the Technical Monitoring are basically the followings :

Aspects	Items	Monitoring Method
Aquifer Behaviour	Water Level	- Observation wells with 21 AWLR and points to be periodically measured
Environmental Effects	Water Quality	- Periodical measurement of electric conductivity and water sampling/ laboratory tests
Water Requirements and Use	Pumping Hours	- Carpet monitoring of all pumps
	Pumping Discharge	- ditto
	Irrigation Efficiency	- Periodical field measurement by samples
Agriculture	Cropping Patterns	- ditto
	Types of Crops	- ditto
	Crop Intensity	- ditto
	Crop Yields	- ditto

The progress of this program as of July, 1988 includes the selection of the wells to be monitored, preparation of the monitoring forms and establishment of a standard data base to contain the information collected.

Due to the already mentioned budget constraints no organized data collection and field campaign could so far take place. Only separate efforts, carried out on a good will basis, could be undertaken by the different Part-Project by availing of the practices and organization established during the previous development stages.

### 3.4 Preparatory Program

This program deals with preparatory activities for the future ground water project in Palu (Central Sulawesi), Tuban, Gresik, Ngajuk, Magetan and Sampean Baruzones, scheduled with the forthcoming Sub-Sector Loan Irrigation

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Project. Main works to be done by the Project in this preparatory stage are to monitor and inventory the potential aquifer in Palu and Sampean Baru area as well as to assess the shallow aquifer potential for small size irrigation schemes in the area of Nganjuk-Pace, Palang and Sedayu, Ngawi, Magetan.

To support the above activities, the Consultant has provided a technical assistance to carry out inventory survey on the existing wells in the proposed development area in the Palu area and monitoring survey on ground water use, aquifer behaviour and ground water quality in the Sampean Baru area.

As part of this preparatory program, a field trip to Palu area and study on groundwater quality distribution in Asembagus Zone had been conducted by the Consultants.

#### 3.4.1 Inventory and Monitoring in Palu Area

In October 1987 the Consultants had visited the proposed groundwater development sites in Marawola and Tawaeli areas to inspect the site condition and make some inventories of the existing groundwater facilities. Meeting was held with the Head Officer of the Regional Office of Public Works Central Sulawesi and the Senior Staff of the Water Resources Division of this office. A series of intensive discussion was held with Project Manager of Parigi - Poso Irrigation Project. Complete report of this field visit had been submitted to the Project Manager BP.P2AT Jatim in November 1987.

As a result, an overall work item and execution schedule of this forthcoming Part-Project had been prepared tentatively in October 1988 as shown in the following page.

#### 3.4.2 Assessment of Shallow Aquifer Potential for Small-sized Irrigation Scheme in Nganjuk/Pace, Palang & Sedayu Ngawi and Magetan.

In many areas of East Java, shallow groundwater utilization for irrigation purpose has been developed by private sector. Most of the wells were constructed using poor design, material and drilling method.

To improve the productivity and income of small farmers, such shallow small well irrigation which need only small capital investment, will be promoted with some improvements on the quality of the wells. This will be done through close guidance and supervision to the small local drilling contractors and farmers.

Within the area of Ngawi, Magetan and Pace (Nganjuk) as well as Palang and Sedayu (Gresik) phreatic or shallow groundwater was found and the local farmers have been familiar with the small scale shallow groundwater irrigation systems. Such area will be nominated as an area for demonstrating the above mentioned program.

TENTATIVE WORK ITEM AND EXECUTION SCHEDULE OF THE PROPOSED  
GROUNDWATER DEVELOPMENT IN PALU AREA

Work Item	:FY.1987/88:					FY.1988/89					: FY.1989/90					
	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
<b>1. Preparatory:</b>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
<u>Works</u>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Topo Survey	=====o	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Geo-electric sounding	o===o	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Setting of Wells	o=o	20 wells	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Detailed Design	o=====o	20 wells	:	:	:	:	:	:	:	:	:	:	:	:	:	:
<b>2. Construction:</b>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Drilling Tendering	:	:	:	:	:	o===o	:	:	:	:	:	:	o==o	:	:	:
	:	:	:	:	:	:	:	10 wells	:	:	:	:	10 wells	:	:	:
- Drilling of Well	:	:	:	:	:	o=====o	:	:	:	:	:	:	o=====o	:	:	:
- Distribution System Tendering	:	:	:	:	:	o===o	:	:	:	:	:	:	o==o	:	:	:
	:	:	:	:	:	:	:	10 wells	:	:	:	:	10 wells	:	:	:
- Distribution System Construction	:	:	:	:	:	o=====o	:	:	:	:	:	:	o=====o	:	:	:
	:	:	:	:	:	:	:	10 sets	:	:	:	:	10 sets	:	:	:
- Pump Installation	:	:	:	:	:	o==o	:	:	:	:	:	:	o==o	:	:	:
<b>3. Operation</b>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- HIPPA Organization	:	:	:	:	:	:	:	:	:	:	:	:	10 groups	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	o==o	:	:	:
- Operation	:	:	:	:	:	:	:	:	:	:	:	:	10 schemes	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	o=====o	:	:	:
<b>4. Monitoring &amp; Evaluation:</b>	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
- Monitoring	:	:	:	:	:	:	:	:	:	:	:	:	10 schemes	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	o=====o	:	:	:
- Evaluation	:	:	:	:	:	:	:	:	:	:	:	:	o=o	:	:	:

The technical specification for a small scale groundwater irrigation system will be as follows :

- Average discharge rate =  $\pm$  5 l/s
- Average well depth =  $\pm$  30 m
- Pumping system = 2-3 inch, self priming centrifugal pump (portable)
- Method of drilling = man power (manually)
- Command area =  $\pm$  5 ha

In case the available funds are limited to support the above mentioned program, activities will be confined to carry out some pumping test

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program. This program will be conducted on each sub-area by pumping the existing farmer's small well with centrifugal pump to assess the shallow aquifer potential of the sub-area concerned.

### 3.4.3 Sampean Baru Area Monitoring

Sampean Baru area is a new area to be promoted as additional development area for groundwater development under Jawa Timur Groundwater Development Project.

Originally, this area was scheduled to be irrigated by the Sampean Baru irrigation project, but after re-evaluation of the full supply of available irrigation water during dry season, some area of around 2,100 ha located at the tail-end will suffer of irrigated water shortage. This area then was switched to be irrigated by the groundwater irrigation.

During the F.Y 1986/87, eight (8) Test Wells have been completely drilled at Sampean Baru area by P2AT. This result indicates that further well drilling program in Sampean Baru can be proceeded.

Program for monitoring of water use, changes in groundwater level and quality in the Sampean Baru Project area will be carried out for the wells constructed by other agencies such as sugarcane factories, private wells etc and new eight wells.

Monitoring of groundwater utilization and behaviour is proposed to be concentrated in coastal area of Asem Bagus where a lot of wells constructed by P2AT or other agencies exist, and saline water intrusion is possibly occurred.

### 3.5. Project Budget

The following tables provide the budget of IBRD Loan 2119-IND as of August 1, 1988. The allocation of each work item within the framework of the total allocation will require some minor adjustment. It is due mainly to the increase of equipment and supplies costs which is caused by the overall of adoption of precast canal lining proposed to be distributed under the category of Equipment & Supplies. As of August 1, 1988 the estimated balance of loan allocation and disbursement expressed in US\$ million will be as follows :

Item	Estimated Disbursement (Accumulated up to August 1, 1988)	Revised Loan Allocation (1986)	Balance (Aug.1, 1988)
- Civil Works	3.75	3.46	- 0.29
- Drilling & Installation	2.55	2.71	+ 0.16
- Equipment & Supplies	17.76	18.44	+ 0.68
- Consultant	7.70	8.10	+ 0.40
- Training	0.20	0.20	+ 0.00
<b>T o t a l</b>	<b>31.96</b>	<b>32.91</b>	<b>+ 0.95</b>

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EAST JAVA GROUND WATER DEVELOPMENT PROJECT  
SEVENTEENTH IRRIGATION PROJECT : GROUNDWATER COMPONENT

TABLE 1.3.11

SCHEDULE OF PROCUREMENT OF EQUIPMENTS & SUPPLIES							SCHEDULE OF CONSULTING SERVICES (Expressed in US\$ 1,000) Aug. 1st 1988					
ITEM	SPECIFICATION OUTLINE	REQUIRED QUANTITY	UNIT	ESTIMATED UNIT PRICE (Rp.1,000)	TOTAL COST (Rp.1,000)	US \$ EQUIVALENT (US\$ 1,000)	REMARKS	PROGRAM	LOCAL (Rp.Mil)	LOCAL (Eq.US\$)	FOREIGN (US\$)	TOTAL (US\$)
1. VERTICAL TURBINE PUMPEET	Q = 45 L/S, TDH = 35 M	10	Sets	19,200	192,000	120.36		FY 1987/88				
	Q = 45, TDH = 20	19	Sets	18,000	342,000	207.90		Engineering Services				
	Q = 60, TDH = 40	6	Sets	23,100	138,600	94.26		- On-going	308.87	187.76	231.15	418.91
	Q = 60, TDH = 30	15	Sets	21,000	315,000	191.49		- Preparatory EJ & Sulawesi	127.32	77.40	0.00	77.40
	Q = 60, TDH = 20	20	Sets	20,500	410,000	249.24		- Preparatory Loebok	86.03	52.30	0.00	52.30
	SUB-TOTAL	70	Sets	102,400	1,402,600	853.25	FY1988/89	Subtotal for E/S	522.21	317.45	231.15	548.60
2. MONITORING EQUIPMENTS	SALINITY & WELL MONITORING SYSTEM	L.S.			400,000	245.16	FY1988/89	Survey				
								- On-going	118.20	71.85	0.00	71.85
3. CASING & SCREEN	N.D. 16" - 8" BLANK CASING	1,820	M	90.00	162,800	99.57		- Preparatory EJ & Sulawesi	80.64	49.02	0.00	49.02
	N.D. 8" - 6" WIREWOUND SCREEN	780	M	150.00	117,000	71.12		- Preparatory Loebok Aerophoto	250.00	151.98	0.00	151.98
	SUB-TOTAL	2,600	M	240.00	280,800	170.70	FY1988/89	Subtotal for Survey	448.84	272.85	0.00	272.85
4. PRECAST CANAL SEGMENT	Type-A Package I	6,150	PCS	36.90	226,935	138	FY1988/89	Subtotal FY 1987/88	971.05	590.30	231.15	821.45
	Type-A Package II	18,900	PCS	36.80	662,400	403		FY 1988/89				
	Subtotal	24,150			889,335	541		Engineering Services				
	Type-B Package I	7,000	PCS	34.80	264,480	161		- On-going	308.87	187.76	231.15	418.91
	Type-B Package II	74,750	PCS	34.40	2,571,400	1,563		- Extension	0.00	0.00	0.00	0.00
	Subtotal	82,750			2,835,880	1,724		- Preparatory EJ & Sulawesi	127.32	77.40	0.00	77.40
								- Preparatory Loebok	86.03	52.30	0.00	52.30
	SUB-TOTAL	106,500	PCS		3,724,215	2,263		Subtotal for E/S	522.21	317.45	231.15	548.60
TOTAL PROCUREMENT COST					5,809,613	3,532		Survey	0.00	0.00	0.00	0.00
								- Extension	0.00	0.00	0.00	0.00
								Subtotal FY 1988/89	522.21	317.45	231.15	548.60
								FY 1989/90				
								Engineering Services				
								- Extension	0.00	0.00	0.00	0.00
								Survey	0.00	0.00	0.00	0.00
								Subtotal FY 1989/90	0.00	0.00	0.00	0.00
								Total	1493.26	907.76	462.30	1370.05

SEVENTEENTH IRRIGATION PROJECT (IBRD LOAN 2119 IND). GROUNDWATER COMPONENT  
 UPDATED COST ESTIMATE AND SCHEDULE OF EXPENDITURE  
 (Expressed in Million Rp. & Million US\$, 1 US\$ = Rp.1,645)

TABLE 1.3.12

Aug. 1st 19

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ITEM	: PLANNED TOTAL EXPENDITURE :			: ACTUAL EXPENDITURE :			: SCHEDULED EXPENDITURE UP TO MAR. 1989 :						: ESTIMATED TOTAL EXPENDITURE :			: REVISED :	: BALANCE :			
	:(Staff Appraisal Report) :			:(as of Mar. 1987) :			: FY 1987/88 (IMPLEMENTED) :			: FY 1988/89 :			: Subtotal FY 1987/88-88/89 :			: (1988) :			: (US \$) :	
	: Local :	: Foreign :	: Total :	: GDI :	: IBRD :	: Total :	: GDI :	: IBRD :	: Total :	: GDI :	: IBRD :	: Total :	: GDI :	: IBRD :	: Total :	: GDI :	: IBRD :	: Total Cost :	: (US \$) :	
: (US\$) :	: (US\$) :	: (US\$) :	: (Rp.) :	: (US\$) :	: (Eq. US\$) :	: (Rp.) :	: (US\$) :	: (Eq. US\$) :	: (Rp.) :	: (US\$) :	: (Eq. US\$) :	: (Rp.) :	: (US\$) :	: (Eq. US\$) :	: (Rp.) :	: (US\$) :	: (Eq. US\$) :	: (US\$) :	: (US \$) :	
1. CIVIL WORKS																				
East Java	0.94	0.95	1.89	0.73	0.50	1.33	36.35	0.16	0.18	128.21	0.57	0.65	164.56	0.73	0.83	0.83	1.33	2.16		
Madura	1.01	1.02	2.03	1.01	0.65	1.66	51.19	0.23	0.26	110.54	0.49	0.56	161.73	0.72	0.82	1.11	1.37	2.48		
Kediri-Nganjuk	1.78	1.78	3.56	0.58	0.52	1.10	40.68	0.18	0.21	75.51	0.34	0.38	115.99	0.52	0.59	0.65	1.04	1.69		
Base Cost	3.73	3.75	7.48	2.32	1.77	4.09	128.22	0.57	0.65	314.06	1.40	1.59	442.28	1.97	2.24	2.59	3.74	6.33	US\$ 2.20	
Physical Contingencies	0.37	0.38	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	SDR 1.00	
Expected Price Increase	1.59	1.20	2.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	TTL	
Subtotal	5.69	5.33	11.02	2.32	1.77	4.09	128.22	0.57	0.65	314.06	1.40	1.59	442.28	1.97	2.24	2.59	3.74	6.33	US\$ 3.46	-0.28
2. DRILLING AND INSTALLATION																				
East Java	0.69	1.04	1.73	1.14	0.91	2.05	75.60	0.34	0.38	6.53	0.03	0.03	82.13	0.37	0.42	1.19	1.28	2.47		
Madura	0.63	0.95	1.58	0.72	0.51	1.23	74.68	0.29	0.25	60.71	0.27	0.31	135.39	0.47	0.55	0.80	0.98	1.78		
Kediri-Nganjuk	0.38	0.57	0.95	0.56	0.26	0.82	6.22	0.03	0.03	3.17	0.01	0.02	9.38	0.04	0.05	0.57	0.30	0.87		
Base Cost	1.70	2.56	4.26	2.42	1.68	4.10	156.50	0.56	0.66	70.42	0.31	0.36	226.91	0.88	1.02	2.56	2.56	5.12	US\$ 1.70	
Physical Contingencies	0.17	0.26	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	SDR 0.80	
Expected Price Increase	0.69	0.66	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	TTL	
Subtotal	2.56	3.48	6.04	2.42	1.68	4.10	156.50	0.56	0.66	70.42	0.31	0.36	226.91	0.88	1.02	2.56	2.56	5.12	US\$ 2.71	0.15
3. MATERIAL & EQUIPMENT																				
Base Cost	3.60	20.42	24.02	0.28	13.88	14.16	0.00	0.00	0.00	0.00	3.53	3.53	0.00	3.53	3.53	0.28	17.41	17.69	US\$ 13.40	
Physical Contingencies	0.36	2.04	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.00	0.35	0.35	0.00	0.35	0.35	SDR 4.00	
Expected Price Increase	0.69	2.75	3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	TTL	
Subtotal	4.65	25.21	29.86	0.28	13.88	14.14	0.00	0.00	0.00	0.00	3.88	3.88	0.00	3.88	3.88	0.28	17.76	18.04	US\$ 18.44	0.68
4. CONSULTANTS																				
Foreign	0.60	3.34	3.94		3.78	3.78	0.00	0.23	0.23	0.00	0.23	0.23	0.00	0.46	0.46	0.00	4.24	4.24		
Local	0.72	0.08	0.80		2.54	2.56	40.00	0.44	0.46	0.00	0.32	0.32	40.00	0.76	0.78	0.02	3.32	3.34		
Aerial Survey Lombok	-	-	-	0.00	0.00	0.00	0.00	0.15	0.15	0.00	0.00	0.00	0.00	0.15	0.15	0.00	0.15	0.15		
Base Cost	1.32	3.42	4.74	0.00	6.33	6.33	40.00	0.82	0.85	0.00	0.55	0.55	40.00	1.37	1.39	0.02	7.70	7.72	US\$ 8.10	
Physical Contingencies	0.13	0.34	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	SDR	
Expected Price Increase	0.36	0.72	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	TTL	
Subtotal	1.81	4.48	6.29	0.00	6.33	6.33	40.00	0.82	0.85	0.00	0.55	0.55	40.00	1.37	1.39	0.02	7.70	7.72	US\$ 8.10	0.40
5. TRAINING	0.01	0.29	0.30	0.00	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	US\$ 0.20	0.00
6. ADMINISTRATION & OVERHEAD																				
Base Cost	2.56		2.56	6.53		6.53	643.00	0.00	0.39	707.30	0.00	0.43	1350.30	0.00	0.82	7.35	0.00	7.35		
Physical Contingencies	0.26		0.26	0.00	0.00	0.00	0.00	0.00	0.00	70.73	0.00	0.04	70.73	0.00	0.04	0.04	0.00	0.04		
Subtotal	2.82	0.00	2.82	6.53	0.00	6.53	643.00	0.00	0.39	778.03	0.00	0.47	1421.03	0.00	0.86	7.39	0.00	7.39		
TOTAL COST	17.54	38.79	56.33	11.55	23.86	35.41	967.72	1.96	2.35	1162.90	6.15	6.85	2130.22	8.10	9.40	12.84	31.96	44.81		
TAXES				0.76		0.76	212.37	0.00	0.13	692.92	0.00	0.42	905.29	0.00	0.55	1.31	0.00	1.31		
TOTAL WITH TAXES				12.31	23.86	36.17	1180.09	1.96	2.67	1855.42	6.15	7.28	3035.51	8.10	9.95	14.16	31.96	46.12	32.91	0.94
IRRIGATION AREA IN HA	Target	13,000 ha	Progress	5,429 ha	Progress	1,940 ha	Schedule	1,968 ha	Schedule	3,908 ha	Total Achieved	9,337 ha								
PROJECT COST / HA (US \$)		4333 /ha		6,662 /ha		1,379 /ha		3,697 /ha		2,546 /ha		4,940 /ha								

TA

EAST JAVA - MADJUM BROUND WATER DEVELOPMENT PROJECT  
 (GROUND WATER COMPONENT OF IRRIGATION VIII PROJECT, IBRD LOAN 2119 IND)  
 WORK COMPLETION PROGRAM AND BUDGET SCHEDULE

TABLE 1.3.13  
 Aug. 1st 1988  
 (UNIT: MILLION RP.)

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SUB PROJECT	MADJUM SUB-PROJECT						KEDIRI SUB-PROJECT						SURABAYA SUB-PROJECT						TOTAL							
	DRILL. & INSTALL.			CIVIL WORKS			DRILL. & INSTALL.			CIVIL WORKS			DRILL. & INSTALL.			CIVIL WORKS										
	PRODUC-TION	PUMP	WELL	CANALIZATION	ACCESS/	OPENING	PRODUC-TION	PUMP	WELL	CANALIZATION	ACCESS/	OPENING	PRODUC-TION	PUMP	WELL	CANALIZATION	ACCESS/	OPENING								
	(MOS)	(MOS)	(MOS)	(SCM)	(SCH)(KM)	(KM)	(MOS)	(MOS)	(MOS)	(SCM)	(SCH)(KM)	(KM)	(MOS)	(MOS)	(MOS)	(SCM)	(SCH)(KM)	(KM)								
ORIGINAL TARGET	69	68		30	79	91	(6,750)	107	107			107		(7,609)	120	100	65		65	(2,659)	HA	(13,009)				
PROGRESS BY MARCH, 1986	38	24		0	38	46	(1,459)	53	14			27		(1,187)	90	52	24		30	(1,310)		(3,956)				
BALANCE OF PROJECT TARGET	30	44		30	0	45	(5,291)	54	93			80		(2,422)	30	48	41		35	(1,349)		(9,044)				
UNIT COST IN FY1986/87 W/O TAX	35.45	1.62					(HA)	1.49				19.83	24.68	(HA)	29.47	1.40			15.78	32.37	(HA)	TOTAL BUDGET EXECUTED				
FY.1986/87 EXECUTED PROGRAM	4	14					(01)	9				17	3	(242)	19	6			12	3	(611)		(1,473)			
COST W/O TAX	141.80	22.73	164.53	0.00	45.63	0.00	48.63	0.00	12.60	12.60	337.14	74.05	0.00	411.19	0.00	559.23	8.40	567.63	185.37	97.10	0.00	282.47	746.29	744.76	1491.05	
- TAX (10%)	17.58	3.76	16.95	0.00	4.84	0.00	4.84	0.00	1.26	1.26	32.71	5.95	0.00	39.66	0.00	53.17	0.94	54.01	11.47	11.41	0.00	22.89	67.40	72.21	129.62	
- RUPIAH (20%)	28.36	4.55	32.91	0.00	22.81	0.00	22.81	0.00	12.60	12.60	67.43	14.81	0.00	82.24	0.00	111.85	8.40	120.25	37.87	19.42	0.00	57.29	162.35	165.75	326.10	
- SOI TOTAL (22%)	41.95	7.91	49.85	0.00	27.65	0.00	27.65	0.00	13.86	13.86	101.14	20.76	0.00	121.90	0.00	165.01	9.24	174.25	49.35	30.83	0.00	80.17	229.75	237.97	467.72	
- LOAN (88%)	111.44	16.16	131.62	0.00	25.82	0.00	25.82	0.00	0.00	0.00	169.71	59.24	0.00	328.95	0.00	447.39	0.00	447.39	151.49	77.68	0.00	229.17	565.94	579.91	1162.95	
TOTAL COST (110%)	155.39	26.09	181.48	0.00	53.49	0.00	53.49	0.00	13.86	13.86	376.85	80.00	0.00	450.85	0.00	612.40	9.24	621.64	200.84	108.51	0.00	309.35	813.69	816.98	1630.67	
UNIT COST IN FY1987/88 W/O TAX	37.40	1.50		23.70	(7.10)	23.70	(HA)	19.70	0.72			22.60	3.10	(HA)	34.40	0.72		23.30	3.10	(HA)	TOTAL BUDGET					
FY.1987/88 EXECUTED PROGRAM	11	4		12		6	(674)	2	20			15		(713)	18	15			13						(1,740)	
COST W/O TAX	367.40	6.00	373.40	294.40	0.00	142.20	426.60	37.40	14.40	51.80	329.00	0.00	0.00	339.00	0.00	619.20	10.80	630.00	392.90	0.00	0.00	302.90	1068.50	1058.20	2123.70	
- TAX (10%)	36.74	0.60	37.34	29.44	0.00	14.22	42.66	3.74	1.44	5.18	32.90	0.00	0.00	33.90	0.00	61.92	1.08	63.00	39.29	0.00	0.00	30.29	104.85	105.52	212.37	
- RUPIAH (20%)	44.09	0.72	44.81	34.13	0.00	17.06	51.19	4.49	1.73	6.22	40.68	0.00	0.00	40.68	0.00	74.30	1.30	75.60	36.35	0.00	0.00	36.35	128.72	136.50	284.72	
- SOI TOTAL (22%)	80.83	1.32	82.15	62.57	0.00	31.28	93.85	8.23	3.17	11.40	74.58	0.00	0.00	74.58	0.00	136.22	2.38	138.60	66.64	0.00	0.00	66.64	235.07	232.14	467.21	
- LOAN (88%)	323.31	5.28	328.59	250.27	0.00	125.14	375.41	32.91	12.67	45.58	299.32	0.00	0.00	299.32	0.00	544.90	9.50	554.40	266.55	0.00	0.00	266.55	845.28	829.58	1688.86	
TOTAL COST (110%)	404.14	6.60	410.74	312.94	0.00	156.42	469.26	41.14	15.84	56.98	372.90	0.00	0.00	372.90	0.00	681.12	11.98	693.00	333.19	0.00	0.00	333.19	1175.35	1160.72	2336.07	
UNIT COST IN FY1987/88 W/O TAX	39.00	1.65		29.57	6.00	24.00		19.89	1.65		27.00	27.00	6.00			35.78	1.65		27.50	42.00	6.00					
FY.1988/89 EXECUTION PROGRAM	12	23		15	(39.6)	10.00	(1,080)	0	16			4		(159)	0	33			20						(1,968)	
COST W/O TAX	448.00	37.95	595.95	443.55	237.60	240.00	921.15	0.00	26.40	26.40	108.00	0.00	519.60	627.60	0.00	0.00	54.45	54.45	550.00	0.00	0.00	518.40	1068.40	2617.15	586.80	3203.95
- TAX (10%)	46.80	3.80	50.60	44.36	23.76	24.00	92.12	0.00	2.64	2.64	10.80	0.00	51.96	62.76	0.00	0.00	5.45	5.45	55.00	0.00	0.00	51.84	106.84	261.72	58.68	320.40
- RUPIAH (22%)	56.16	4.55	60.71	53.23	28.51	28.80	110.54	0.00	3.17	3.17	12.96	0.00	62.35	75.31	0.00	0.00	6.53	6.53	66.00	0.00	0.00	62.21	128.21	314.06	70.42	394.47
- SOI TOTAL (22%)	102.96	8.35	111.31	97.56	52.27	52.80	202.65	0.00	5.81	5.81	23.76	0.00	114.31	138.07	0.00	0.00	11.98	11.98	121.60	0.00	0.00	114.65	235.65	575.77	129.10	704.87
- LOAN (88%)	411.84	33.40	445.24	390.32	209.09	211.20	810.61	0.00	23.23	23.23	95.04	0.00	457.25	552.29	0.00	0.00	47.92	47.92	484.00	0.00	0.00	456.19	940.19	2303.09	516.38	2819.48
TOTAL COST (110%)	514.90	41.75	556.55	487.91	261.36	264.00	1013.27	0.00	29.04	29.04	118.80	0.00	571.55	690.36	0.00	0.00	59.89	59.89	605.00	0.00	0.00	570.24	1175.24	2878.87	645.48	3524.35
FY.1986/87 - FY.1989/90 TOTAL																										
- TAX	97.12	7.76	104.88	72.90	28.62	38.22	139.64	3.74	5.34	9.98	78.41	5.95	51.96	96.66	0.00	115.09	7.37	122.45	96.76	11.41	51.84	160.91	435.97	236.41	672.38	
- RUPIAH	128.61	9.82	138.43	87.35	51.33	45.86	184.54	4.49	17.50	21.98	121.07	14.81	62.35	115.99	0.00	186.15	16.23	202.38	149.22	19.42	62.21	221.85	604.62	392.66	997.29	
- SOI TOTAL	225.73	17.58	243.31	160.15	79.95	84.08	324.18	8.23	22.84	31.06	199.46	20.76	114.31	212.65	0.00	301.24	23.60	324.83	256.98	30.87	114.05	381.86	1040.59	599.21	1639.80	
- LOAN	948.59	56.86	995.45	640.60	334.90	336.34	1211.84	32.91	35.90	68.92	663.07	59.24	457.25	850.61	0.00	992.28	57.42	1049.70	802.05	77.66	456.19	1435.92	3827.31	2023.97	5851.28	
TOTAL	1074.33	74.44	1148.76	800.75	314.85	420.42	1536.02	41.14	58.74	99.98	963.55	80.00	571.56	1063.26	0.00	1293.52	81.02	1374.53	1139.03	108.51	570.24	1817.78	4867.91	2623.18	7491.08	
EXECUTION QUANTITY	27	41		27	-40	16	(1,774)	2	45			36	3	87	(1,714)	0	37	54		45	3	36	(1,893)			(5,281)
PROJECT TOTAL ACHIEVEMENT	65	65		27		62	(7,233)	55	59			63	3	86.6	(2,901)	90	89	78		75	3	86.4	(3,203)	TOTAL HA	(9,337)	
TARGET CARRIED OVER	3	3		3		29	3517	52	48			44	-3	-87	699	30	11	-13		-10	-3	-86	-553			3,663

(1) CANALIZATION : OPEN = OPEN CHANNEL WITHOUT LINING, PIPE = LOW PRESSURE PIPE SYSTEM.

TOTAL CANAL LENGTH TO BE LINED (KM) = 212.60

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EAST JAVA GROUND WATER DEVELOPMENT PROJECT  
SEVENTEENTH IRRIGATION PROJECT, EFFLUENT WATER COMPONENT

ACTUAL EXPENDITURE ACCUMULATED & TOTAL PROJECT COST ESTIMATE  
(Expressed in Million US \$)

August 1ST 1987

Work Item	ACTUAL EXPENDITURE															SCHEDULED EXPENDITURE UP TO MAR, 1989			ESTIMATED TOTAL COST	REVISED LOAN ALLOC-ATION (1988)	BALANCE ESTIMATE												
	FY 1981/82		FY 1982/83		FY 1983/84		FY 1984/85		FY 1985/86		FY 1986/87		SUE-TOTAL		FY 1987/88	FY 1988/89		SUB-TOTAL															
	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total	GOI	IBRD Total				GOI	IBRD Total										
1. Civil Works	0.00	0.36	0.15	0.51	0.81	0.54	1.35	0.61	0.39	1.00	0.43	0.28	0.71	0.11	0.41	0.52	2.32	1.77	4.09	0.08	0.58	0.66	0.19	1.40	1.59	0.27	1.98	2.25	2.59	3.75	6.34	3.46	-0.29
2. Drilling & Installation	0.00	0.50	0.15	0.65	0.76	0.48	1.24	0.71	0.46	1.17	0.36	0.23	0.59	0.09	0.36	0.45	2.42	1.69	4.10	0.10	0.56	0.66	0.04	0.31	0.35	0.14	0.87	1.01	2.56	2.55	5.11	2.71	0.16
3. Equipment & Supplies	0.00	0.00	0.18	0.18	0.00	0.22	0.22	0.20	4.81	5.01	0.05	4.90	4.95	0.03	3.77	3.80	0.28	13.89	14.16	0.00	0.00	0.00	0.00	3.88	3.88	0.00	3.88	3.88	0.28	17.76	18.04	18.44	0.68
4. Consultant	0.00	0.00	0.81	0.81	0.00	1.33	1.33	0.00	1.37	1.37	0.00	2.09	2.09	0.00	0.73	0.73	0.00	6.33	6.33	0.02	0.82	0.84	0.00	0.55	0.55	0.02	1.37	1.39	0.02	7.70	7.72	8.10	0.40
5. Training	0.00		0.00	0.01	0.01	0.00	0.06	0.06	0.00	0.04	0.04	0.00	0.09	0.09	0.00	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.00		
6. Administration & Overhead	0.00	2.17	0.90	2.13	0.82	0.60	0.82	0.59	0.90	0.99	1.77	0.00	1.77	0.62	0.00	0.62	6.57	0.00	6.57	0.39	0.00	0.39	0.47	0.00	0.47	0.26	0.00	0.86	7.39	0.00	7.39		
7. Land Acquisiti	0.00	0.02	0.09	0.02	0.13	0.09	0.13	0.02	0.00	0.02	0.01	0.00	0.01	0.06	0.00	0.06	0.24	0.00	0.24	0.07	0.00	0.07	0.08	0.00	0.08	0.14	0.00	0.14	0.38	0.00	0.38		
Total Cost	0.00	3.01	1.29	4.30	2.52	2.58	5.10	2.53	7.09	9.62	2.62	7.54	10.16	1.11	5.36	6.47	11.79	23.86	35.65	0.66	1.96	2.62	0.78	6.14	6.92	1.44	8.10	9.54	13.23	31.96	45.19	32.91	0.95
Taxes on Civil Wks	0.00	0.03	0.00	0.03	0.06	0.00	0.06	0.44	0.00	0.44	0.13	0.00	0.13	0.10	0.00	0.10	0.76	0.00	0.76	0.13	0.00	0.13	0.42	0.00	0.42	0.55	0.00	0.55	1.31	0.00	1.31		
Total with Taxes	0.00	3.04	1.29	4.33	2.58	2.58	5.16	2.97	7.09	10.06	2.75	7.54	10.29	1.21	5.36	6.57	12.55	23.86	36.41	0.79	1.96	2.75	1.20	6.14	7.34	1.99	8.10	10.09	14.54	31.96	46.50		
Total Accumulati	0.00	3.04	1.29	4.33	2.62	3.87	9.49	8.59	10.96	19.55	11.34	16.50	29.84	12.55	23.86	36.41				13.34	25.82	39.16	14.54	31.96	46.50								
Loan Proportion to Total Cost		29.8%			40.8%			56.1%			62.0%			45.9%						65.9%			68.7%										
Command Area (ha)																																	
- Constructed		456			1784			709			1008			1472			5429			1940			1743			3683							
- Accumulation		456			2240			2949			3957			5429			5429			7369			9112			9112							
Cost/ha (US\$/ha)																																	
- GOI Portion		6667			2509			2913			2866			2312						1810			1596			1596							
- Loan Portion		2829			1728			3717			4675			4395						3504			3507			3507							
- Total			9496			4237			6629			7541			6707					5314			5103			5103							

PART - II

RECOMMENDED PROGRAM IN  
F.Y. 1988/1989

## PART II - RECOMMENDED PROGRAM IN FY.1988/1989

### CHAPTER 1 PLAN OF WORK

#### 1.1 General Situation

The project situation at the end the Consulting Services has been discussed on the previous chapter and explained more in detail as described in Volume II of this report. As to the progress of the major work items of the completion program, it can be summarized as follows :

Work Item	Program revised	Progress (1986/87-1987/88)	Balance
Production Wells (Nos)	66	54	12
Distribution System (Ha)	5,112	3,390	1,722
Pump Installation (Nos)	140	68	72

The problem encountered basically during the project implementation is dealing with the unavailable budget to facilitate the Project staff in conducting field survey and monitoring activities required for the execution of the Project's Extension Program. Such condition has affected to the Consultant's scope of activities which was set-up in the original Contract. Revision in the original program and schedule are therefore required.

In addition, some more revisions are necessary at the later stage of the project implementation (September 1987), when the Government decided to adopt the new system of tertiary canal lining for the Project by installing the precast concrete segment of about 213 km in length within the fiscal year of 1988/1989.

The introduction of the precast concrete segment implies that the Project and Consultant's attention should be constantly concentrated on this item of work. It is due to the fact that from technical point of view this adopted lining system represents a milestone for the country, and contractors already experienced with this subject are lacking so far. Continuous monitoring and support to the contractor's effort is therefore expected to be required, which can only be provided by the Project and Consultant. Finally the very high installation paces are required to comply with the present schedule to install the precast canal lining completely before the forthcoming rainy season. This situation constitutes an argument in favor of an intensified organization and quality control.

#### 1.2 Implementation Schedule

Following the consideration described above and the balance of works to be completed as well as the validity of the IBRD Loan 2119-IND, the implementation schedule of construction works in FY.1988/1989 is recommended as described in Figure 2.1.1

Fig 2.1.1

JAWA TIMUR GROUND WATER DEVELOPMENT PROJECT (IBRD LOAN 2119 IND, SEVENTEENTH IRRIGATION PROJECT)

July 26, 1988

WORK ITEM	FY. 87/88 (ADVANCE)		1988									1989		
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
<b>PROCUREMENT</b>			15km-451/s 12km-601/s	LI	Remaining all 186 km									
- PC Canal Segments (213 km)					LI									
- PVC Pipes (15 km)	TN			LI										
- Turbine Pumps (70 units)														
<b>1. MADIUN PART-PROJECT</b>														
- Drilling of Production Well Package-1 (7 wells)														
- Drilling of Production Well Package-2 (5 wells)														
- Pump House & Canalization Pk-1(P/H + PC/Canal 7 loc)														
- Pump House & Canalization Pk-2(P/H+Pipe System 5 loc)														
- Pump House & Canalization Pk-3(P/H + FC/Canal 3 loc)														
- Canal Lining Installation Pk-1 (PC 24.7 km)														
- Pump Installation (23 units)														
- Access Road (4.8 km)														
- Access Road (5.2 km)														
<b>2. KEDIRI PART-PROJECT</b>														
- Pump House & Canalization Pk-1(P/H + PC/Canal 4 loc)														
- Canal Lining Installation Pk-1 (PC 80.1 km)														
- Pump Installation (16 units)														
<b>3. SURABAYA PART-PROJECT</b>														
- Pump House & Canalization Pk-2(P/H + PC/Canal 10 loc)														
- Pump House & Canalization Pk-2(P/H + PC/Canal 9 loc)														
- Pump House & Canalization Pk-3(P/H + FC/Canal 1 loc)														
- Canal Lining Installation Pk-1 (PC 54.2 km)														
- Canal Lining Installation Pk-2 (FC 0.16 km)														
- Pump Installation (33 units)														

Note : TN: Tender Notice, BD: Bidding and Evaluation, LI: Letter of Intent, CW: Completion of Works.  
PC: Precast Concrete Segment. FC: Ferroement Canal Lining.

P2AT JATIM 1988

As it is described in this implementation schedule, procurement of material and equipments will be the key aspects for successful implementation in FY.1988/1989. To date the pumpsets have been tendered and are expected to be delivered to the sites at about November 1988.

Among the material to be purchased, the precast canallet segments are the most crucial item for the construction of distribution system implemented within this fiscal year. Casing, screen and PVC pipes could be locally purchased and it will not form the critical path of the schedule.

CHAPTER 2 PROJECT COMPLETION PROGRAM

2.1 General Situation

The present Project Completion Program to be executed in FY.1988/89 as illustrated in the "Revised Overall Work Program and Target", consists of the following work items :

Table 2 2.1 PROJECT COMPLETION PROGRAM

Work Item		:Progress by: Program in		:T o t a l
		:FY.1987/88	: FY.1988/89	:
<b>1.PROCUREMENT</b>		:	:	:
CASING & SCREEN	(M)	37,000	2,970	39,970
PUMPSET	(UNITS)	176	70	246
MAINTENANCE UNIT	(LS)	0	1	1
OTHER EQUIPMENTS	(LS)	0	1	1
PRECAST CANAL SEGMENTS	(KM)	-	212.6	212.6
<b>2.RAINFED AREA STUDY</b>	(HA)	6,000	0	6,000
<b>3.DETAILED DESIGN</b>		:	:	:
TOPO-SURVEY	(HA)	14,042	240	14,282
DETAILED DESIGN	(HA)	12,909	1,071	13,980
<b>4.PIPE SYSTEM DESIGN &amp; CONST.</b>	(NOS)	6	5	11
<b>5.CANAL LINING MINI-TRIAL</b>		1	0	1
<b>6.DRILLING CAMPAIGN</b>		:	:	:
EX./OB.WELL	(NOS)	134	0	134
PRODUCTION WELL	(NOS)	197	12	209
- MADIUN		(53)	(12)	(65)
- KEDIRI		(55)	(0)	(55)
- SURABAYA		(89)	(0)	(89)
<b>7.TERTIARY DEVELOPMENT</b>		:	:	:
ACCESS ROADS - MADIUN	(KM)	52	10	62
DISTRIBUTION SYSTEM	(HA)	7,364	1,968	9,332
NEW - MADIUN		718	1,080	1,798
- KEDIRI		2,714	159	2,873
- SURABAYA		2,473	729	3,202
EXISTING - MADIUN		(1,459)	(0)	(1,459)
CANAL LINING (PRECAST)	(KM)	0	212.6	212.6
- MADIUN		(0)	(39.6)	(39.6)
- KEDIRI		(0)	(86.6)	(86.6)
- SURABAYA		(0)	(86.4)	(86.4)
PUMP INSTALLATION	(NOS)	130	72	202
- MADIUN		(42)	(23)	(65)
- KEDIRI		(43)	(16)	(59)
- SURABAYA		(45)	(33)	(78)
<b>8.HIPPA ORGANIZATION</b>	(LOC)	130	72	202
- MADIUN		(42)	(23)	(65)
- KEDIRI		(43)	(16)	(59)
- SURABAYA		(45)	(33)	(78)

Major item in the completion program is to construct the complete distribution system including precast canal lining for the wells previously drilled and to equip pumpsets and to put the total facilities into operation

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before the 1989 dry season. In the same time the five schemes of PVC pipe distribution system will be constructed in the Madiun area for trial. Drilling of production well will be limited only in rainfed areas in the Madiun.

The critical path in FY 1988/89 execution schedule will be the installation of 212.6 Km of precast canal lining. Pump installation of 72 sets and subsequent HIPPA organization are also crucial item for the Project completion.

## 2.2 Procurement of Material & Equipment

Procurement being processed and scheduled are as follows :

Item	Quantity	Situation	Tender	Delivery
Pumpset	70 Set	Pending	ICB	-
Precast Canalette Segments	212.6 Km	Awarded	LCB	First delivery June 1988
Casing & Screen	2,970 m	Specifications prepared being processed in GOI	ICB	September 1988
Monitoring Equipment	L.S	- ditto as above -	ICB	Retendered, Specifications Revised
PVC pipes	13,000 m	Awarded	LCB	Delivered in June 1988

### (1) Pumpsets

Since some 12 sets with air-cool type diesel engine are presently available in stock, the 60 sets out of 72 sets required for the installation in FY 1988/89 will be furnished from the new procurement of which 10 sets will be preserved as the stand-by pump for future.

The Consultant Mechanical Engineer will assist the Project in the factory test and the field test run of the pumpsets prior to the acceptance of delivery to the site. He will also give recommendation for some minor modification of mechanical parts of pumpsets based on the result of the factory and field test run.

### (2) Precast Concrete Canal Lining Segments (Precast Canalette Segments)

Production, transportation and installation of the canalette segments are the most crucial aspect in the execution program in FY 1988/89 which is the final year of the IBRD Loan 2119 IND. During the production period the Consultant Irrigation and Construction Engineer have assist the Project in inspection of the factory, establishing method of quality control, adjusting the production and delivery schedule to avoid huge stock in

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the stock yard.

Figure 2.2.1 shows a tentative schedule of production and delivery of the precast canal segments in FY.1988/89 in compliance with the contract agreements. The procurement consists of two packages, the first package was locally tendered for small quantity in order to avoid any risk of delay in delivery during the international competitive bid for the second package for the remaining large quantity. It should be noted that after the contracts, the latest delivery of the canalletes will be in the mid of December 1988.

### (3) Casing & Screen

The casing & screen for the project have been periodically purchased during the past five years and the project staff were already skilled in preparation of the specifications, tendering and acceptance. The Consultant will assist the project staff if some technical advise is required.

### (4) Monitoring Equipment

Monitoring equipments consist of the mobile well maintenance system and the salinity warning system. Mobile well maintenance system is to detect deterioration of well casing and screen in the site using well logger and downhole TV camera with field analysis devices for water quality. In the project area some 400 wells are presently operated and the mobile well monitoring system will be dispatched if any anomaly of pumping water level or water quality including sand pumping are reported.

The salinity warning system is to protect the production wells in the coastal areas from saline water intrusion from the sea by means of recording of electric conductivity of water in the well.

### (5) PVC Pipes

For the five pipe distribution system in Madiun to be implemented in FY 1988/89, some 13,000 m of PVC pipes were purchased and delivered by the supplier to the Project in June 1988.

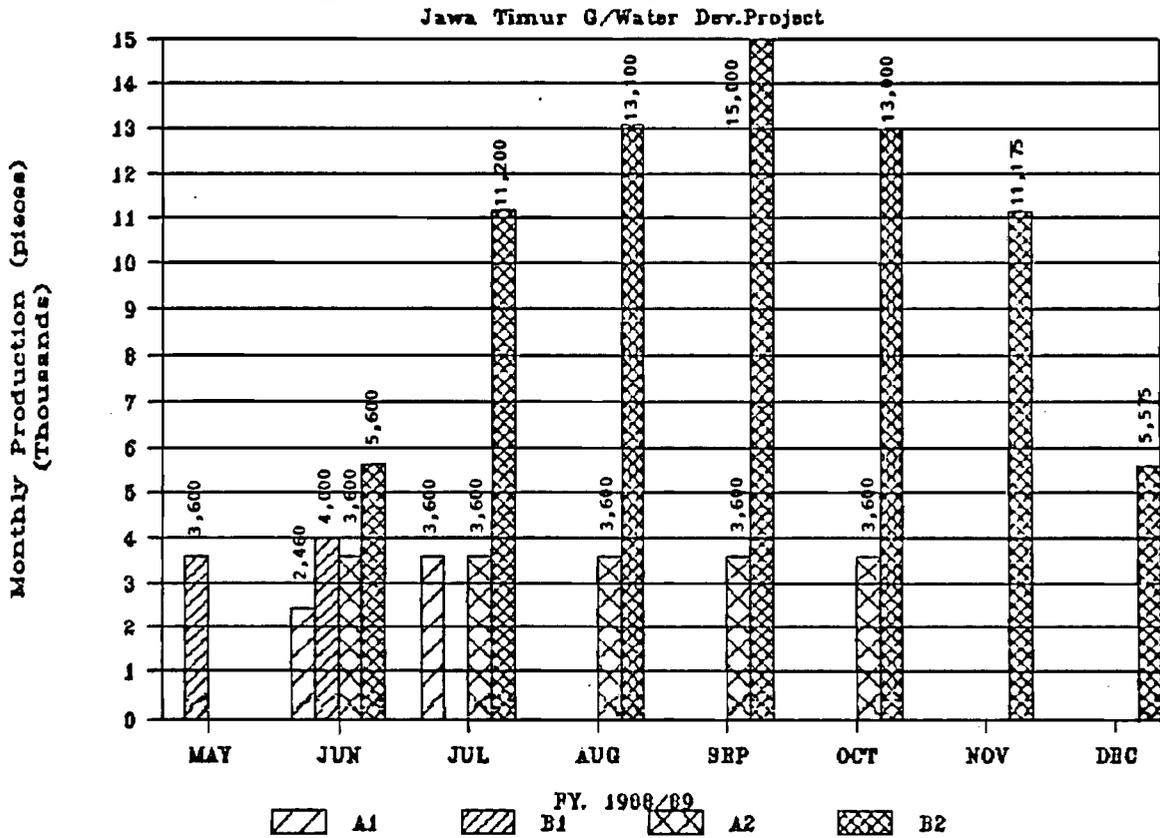
## 2.3 Detailed Design

Topographical survey for mapping of 3,363 ha required for the preparation of the design drawings for the Completion Program had been completed as of December 1987.

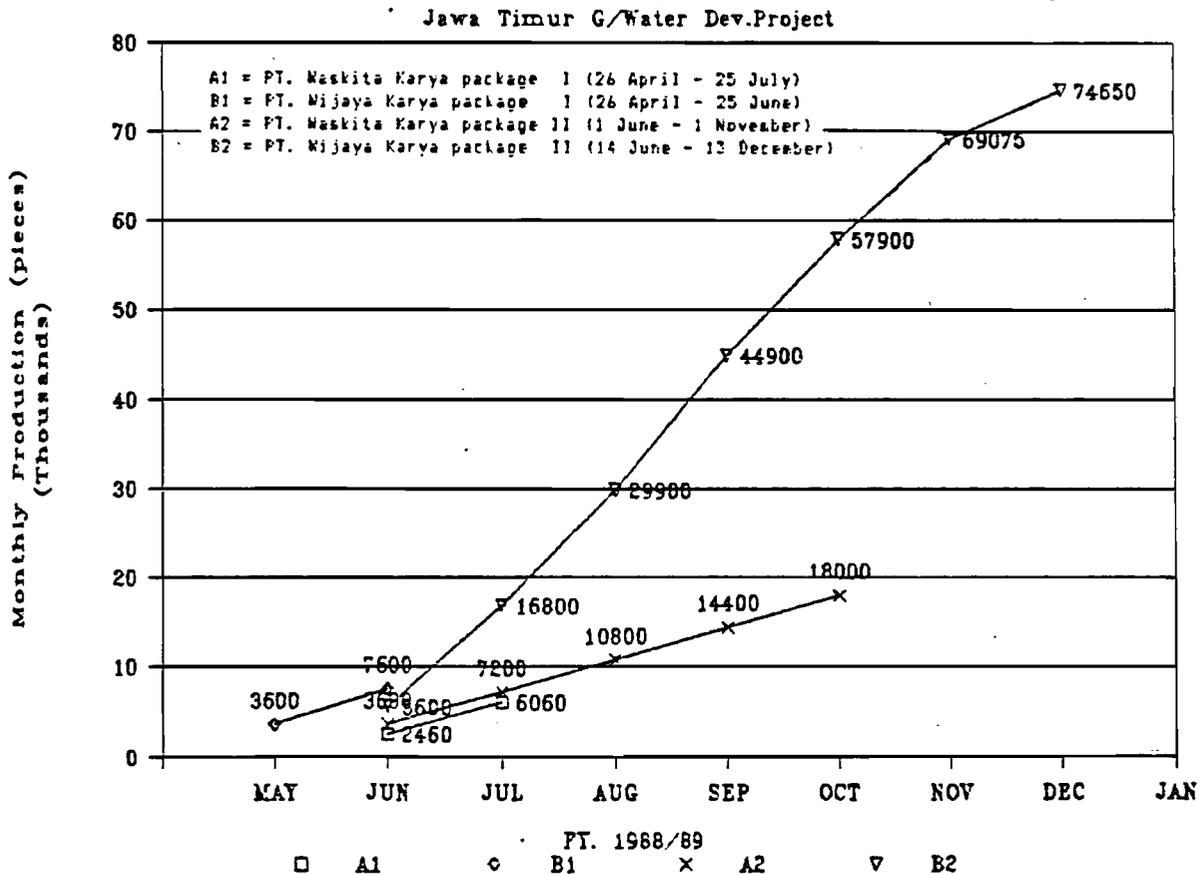
Topo-maps under Madiun Part-Project are available, but it still need for design works for 15 TW units. This preparation works should be financed by GOI. All design works for the above distribution units should be with unlined canals. The lining will be constructed in FY. 1988/89, with Parabolic Precast Canal Lining and a small part with Ferro Cement or PVC pipe distribution system.

Fig 2.2.1

### PC Segment Monthly Production Q'ty



### PC Segment Monthly Production Q'ty



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## 2.4 Well Construction

The construction of production wells in FY 1988/89 is planned in Madiun area only consisting of 12 wells as listed in Table 2.2.3.

Table 2.2.3 PRODUCTION WELLS CONSTRUCTED IN MADIUN DURING FY.1988/1989

No.	Well No.	LOCATION (Desa, Kecamatan, Kabupaten)	ELEVA- TION (m)	DRILLING DEPTH (m)	DISC. RATE (l/sec)	ESTIMTD COMMAND AREA(ha)
1.	SMd. 105	Plumpungrejo, Wonoasri, Madiun.	83.93	200	60	55
2.	SMd. 106	Kaliabu, Mejayan, Madiun.	78.13	200	60	45
3.	SMd. 107	Sumbersari, Saradan, Madiun.	85.50	200	50	60
4.	SMd. 108	Sirapan, Wungu, Madiun.	69.76	200	70	82
5.	SNg. 109	Guyung, Geneng, Ngawi.	67.76	200	60	70
6.	SNg. 110	Kedungputri, Paron, Ngawi.	65.11	200	60	60
7.	SNg. 111	Gandri, Pangkur, Ngawi.	51.50	160	60	80
8.	SNg. 112	Babadan, Pangkur, Ngawi.	58.60	180	60	79
9.	SMg. 113	Pingkuk, Bendo, Magetan.	116.84	200	70	87
10.	SMg. 114	Belotan, Bendo, Magetan.	135.15	220	40	60
11.	SMg. 115	Klagen-Gambiran, Maospati, Magetan.	77.37	200	80	72
12.	SMg. 116	Lemahbang, Bendo, Magetan.	98.12	200	70	68

Each wells will be 200 m in the average depth, cased with 16" pump chamber casing for 55 m in depth, completed with 10" production liner with average length of 42 m of wire-wound continuous screen and the riser pipes of equal diameter up to the designated depth.

The wells drilled in FY 1988/89 is planned to be completed with canalization and pump installation. They should be ready for operation by the end of this fiscal year. Hence, the execution period for the drilling should be as short as possible. For this reason the available 4 drilling rigs in Madiun Part-Project are now operated. Estimated time required for the drilling is :

$$(12 \text{ wells}) / (1 \text{ well/month/rig}) / (4 \text{ rigs}) = 3 \text{ months.}$$

The field work of drilling has been started since mid of June and will be completed by mid of September including pumping tests and yield evaluation. The canalization of the drilled well will immediately follow from the beginning of October expecting to be completed with pump installation by February 1989.

## 2.5 Construction & Installation of Distribution System

The program of new scheme canalizations in FY.1988/89 as shown in Table 2.2.4 will be constructed under the Part-Project of Madiun(15schemes), Kediri (4 schemes) and Surabaya (20 schemes) and was summarized as follows :

Part-Project Distribution System	Madiun		Kediri		Surabaya		Total
	New Schemes	Existing Schemes	New Schemes	Existing Schemes	New Schemes	Existing Schemes	
Precast Concrete	7	19	4	41	19	37	127
Ferrocement	3	-	-	-	1	-	4
PVC Pipe	5	-	-	-	-	1	6
<b>Total</b>	<b>15</b>	<b>19</b>	<b>4</b>	<b>41</b>	<b>20</b>	<b>38</b>	<b>137</b>

The preparation of those canalization including detailed design, construction drawings and tender document was completed by April 1988. All the canalization of new schemes will be immediately followed by pump installation within the FY 1988/89.

The first lot of tender packages consisting of drillings of 12 production wells in Madiun, ferrocement lining and pipe distribution system including pump house construction had been awarded to the Contractors by mid of June. Completion of the drillings is planned by mid of September and will be immediately followed by canalization which should be completed by February 1988. One package of ferrocement lining installed in Surabaya will be started earlier to test the system within the 1988 dry season as the first trial of ferrocement lining in East Java.

The second lot of tender packages consist of two packages of the construction of new schemes and one package of canal lining installation for the existing schemes. Those packages had been tendered by April 1988 to enable to be started the implementation by May 1988 and to be completed by September 1989.

The third lot of tender packages constitute the major part of FY.1988/89 implementation consisting two packages of canal lining installation in Kediri and Surabaya in total length of 134 km, one package (10 schemes) of pump house and canalization in Surabaya, and of two packages of canalization of newly drilled schemes in Madiun to be implemented from September 1988 immediately after the completion of drillings of those wells.

It is anticipated that there will be no problem in the physical capacity of the Contractor and the Project Staff in implementing those packages if the adequate number of supervisor in each Part-Project is available and the progress of the execution is well managed by the Project Staff.

The Consultant Irrigation Engineer as well as the Construction Engineer has supported the Project Staff in the initial period of the preparation of the tender document at around April-June 1988 including the assistance in bid evaluation. Supports for the supervision of execution however, will not be possible due to the contract validity of this consulting services.

TABLE 2.2.4 PROGRESS AND PROGRAM OF CIVIL WORKS CONSTRUCTION  
(1986/1987 - 1988/1989)

Works Item	Total Progress by March 1986	Madiun			Kediri			Surabaya			Total Progress by March 1988	Total Achievement by March 1989
		86/87	87/88	88/89	86/87	87/88	88/89	86/87	87/88	88/89		
<b>DETAILED DESIGN</b>												
Topo maps (Ha)	10,679.00	-	-	-	693	-	240	430	2,240	-	14,042	14,282
Detailed Design (Ha)	9,442.00	-	-	912	903	685	159	618	1,261	-	12,909	13,980 (*)
(Nos)	103.00	-	-	12	20	15	4	15	33	-	186	202
<b>TERTIARY DEVELOPMENT</b>												
Distribution system (Ha)	3,956.00	-	718	1,080	842	685	159	631	532	729	7,364	9,332
(Nos)	88.00	-	12	15	20	15	4	15	13	20	163	202
Precast Concrete Lining (Ha)	-	-	-	1,877	-	-	1,968	-	-	2,250	-	6,095
(Nos)	-	-	-	26	-	-	45	-	-	56	-	127
(M)	-	-	-	39,696	-	-	84,198	-	-	80,732	-	204,626
- New schemes (Ha)	-	-	-	608	-	-	159	-	-	685	-	1,452
(Nos)	-	-	-	7	-	-	4	-	-	19	-	30
(M)	-	-	-	14,960	-	-	4,104	-	-	26,506	-	45,570
- Existing schemes (Ha)	-	-	-	1,269	-	-	1,809	-	-	1,565	-	4,643
(Nos)	-	-	-	19	-	-	41	-	-	37	-	97
(M)	-	-	-	24,736	-	-	80,094	-	-	54,226	-	159,056
PVC pipe system (Ha)	-	-	-	272	97	-	-	137	-	-	234	506
(Nos)	-	-	-	5	3	-	-	3	-	-	6	11
(M)	-	-	-	13,625	5,012	-	-	7,072	-	-	12,084	25,709
Ferrocement Lining (Ha)	-	-	-	200	-	-	-	-	-	44	-	244
(Nos)	-	-	-	3	-	-	-	-	-	1	-	4
(M)	-	-	-	7,690	-	-	-	-	-	1,267	-	8,957
Earth Canal (Ha)	3,956	-	718	-	745	685	-	494	532	-	7,130	2,487
(Nos)	88	-	12	-	17	15	-	12	13	-	157	60
(M)	158,400	-	30,435	-	33,915	30,911	-	21,823	21,350	-	296,834	137,778
Pump Installation (Nos)	62	14	4	23	9	20	16	6	15	33	130	202

(\*) Change in government's policy caused a surplus of 4,648 ha

As to the installation of the precast canalletes, it should be executed under close cooperation between the Manufacturer, the Contractor and the Transportation Companies. The P2AT will be requested to precisely adjust the schedule of manufacturing, transportation and installation. Monthly coordination meeting between the P2AT and those contractors is strongly recommended.

Fig. 2.1.3 shows the actual weekly production quantity of the precast segments by the first week of July 1988. This figure indicates that the total production quantity is far behind the scheduled. Installation of the precast canal linings has been started in Mojokerto (TW 112, 113 EJ) and in Tuban (TW 102, 107, 138 EJ).

## 2.6 Pump Installation

The pump installation program in FY 1988/89 is as follows :

Part-project	Madiun	Kediri	Surabaya	Total
Existing Schemes	8	12	13	33
New Schemes	15	4	20	39
Total	23	16	33	72

Installation schedule will much depend on the progress of construction works and delivery of pumpsets newly purchased as the second procurement under the present IBRD Loan.

Since the first delivery of the pumpsets will be possibly at about November 1988, commencement of installation is set at December 1988. It starts from installation to the existing schemes and, upon completion of new schemes at about December - January, continued to new schemes to be completed by mid-March 1988.

The Contractors and the Project staff have been already well skilled for such type of installation with enough support from the project workshop. There will be no problem in the installation of pumps.

## 2.7 Establishment of New HIPPA

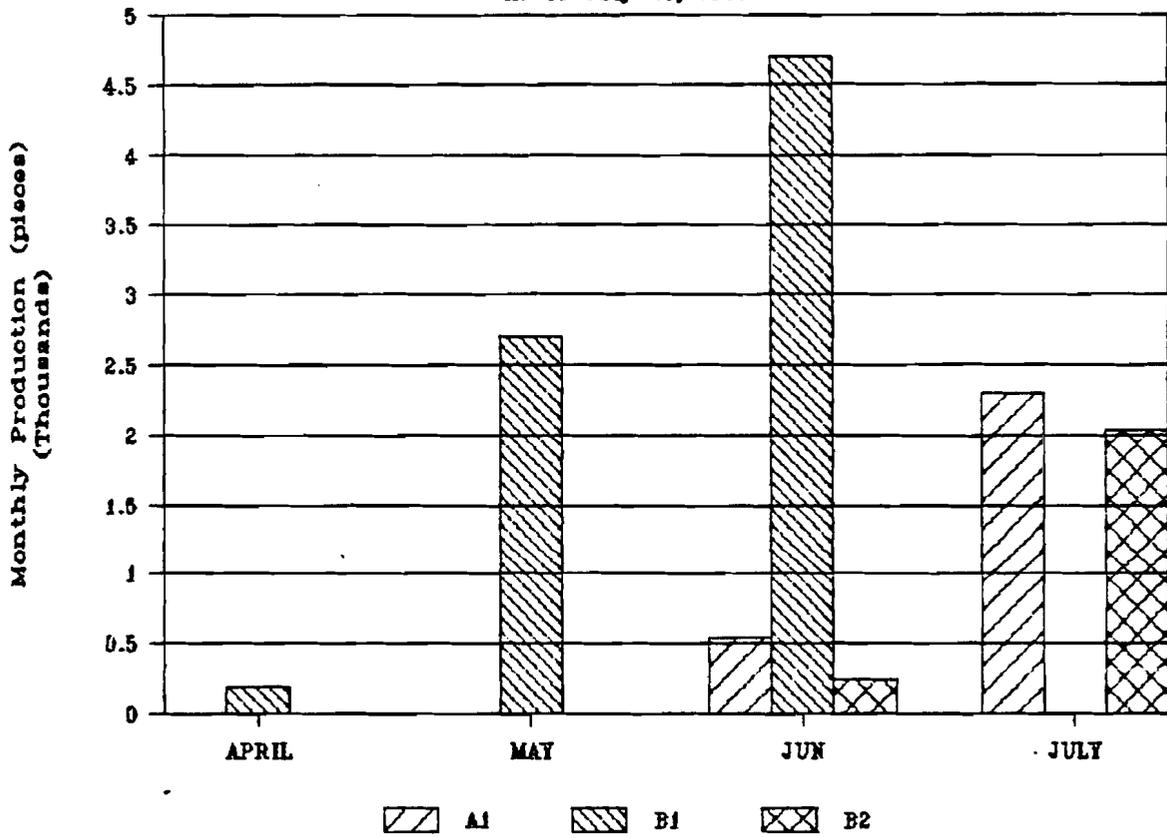
The program of new HIPPA's establishment in FY 1988/89 is as follows:

Part-project	Project Target Revised	Progress by the end of FY 1987/88	Balance to be completed in FY 1988/89
Madiun	65	42	23
Kediri	59	43	16
Surabaya	78	45	33
Total	202	130	72

Fig 2.2.2

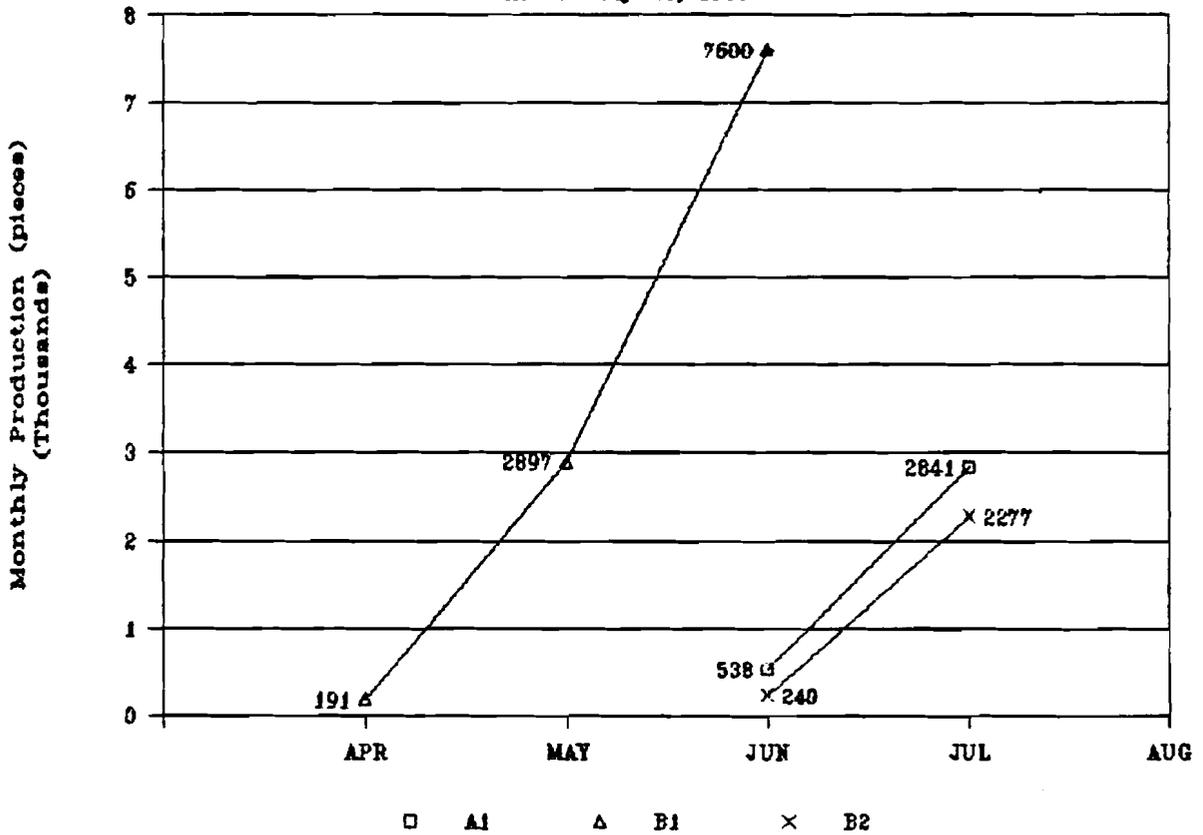
# Monthly Precast Segment Production

As of July 23, 1988



# Monthly Precast Segment Production

As of July 23, 1988



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The balance in the above table will be the program of new HIPPAs establishment which should be completed within the FY 1988/89, the last year of the Project.

A continuous activity to form the HIPPAs in the sites of schemes to be newly constructed in FY 1988/89 will be carried out by the Project Staff after the termination of Consultant Assignment by the end of July. Some 72 HIPPAs should be newly established by March 1989 by this activity. In consideration of schedule of construction of pump house, distribution system and pump installation, the peak of activity will be November 1988 - February 1989.

In this period all the Staff of Agricultural Section of each Part-Project will be required to concentrate into field works to carry out the land ownership survey, consultation with the village chief then to the formal establishment of HIPPAs.

Preparation of rotation irrigation schedule and suggestion of cropping pattern are the essential task of the project office to support technically the establishment of HIPPAs beside the organization aspects which is usually undertaken by the Local Government.

## CHAPTER 3. PROJECT EXTENSION PROGRAM

### 3.1 General Situation

The progress of the Extension Program to date is at a very slow pace, although the necessary work schedule, guidelines and criteria for the different activities have already been prepared by the Consultant. The main constraint affecting to the implementation of the extension program is represented by the project budget limitation.

The essential items to be monitored such as fluctuation of ground water table, pumping discharge and hour, cropping pattern and crop production / intensities, have been still monitored in a very limited scale. Monitoring for other important items such as water quality, water requirement, and socio-economic aspects have been, since FY 1986/87, suspended due to the reason as above. To correct the current situation, the Project office is now preparing the annual project budget proposal for accommodating the necessary fund to resume the monitoring system in the full scale. This is also to follow-up a strong recommendation from the IBRD expressed in the occasion of their review mission visit to the site in September 1987.

The plan of works for the extension program covering mainly technical and economical monitoring activities are discussed in hereinafter on a assumption which the minimum requirement for the budget will be accommodated in the annual project budget.

### 3.2 Project Effects Monitoring

The plan of works previously proposed with the Interim Report prepared by the Consultant in January 1988 is considered as still being effective. With some minor modification to suit with the current situation, the monitoring program is discussed hereinafter.

The subjects of technical monitoring under the extension program are planned as shown in Table 2.3.1.

#### (1) Monitoring of Aquifer Behavior & Environmental Effects

On the basis of available equipment and staff, the locations shown in the Table 2.3.2, which have been monitored since 1982, are proposed to be re-monitored continuously.

The initial action to be taken by the project upon receiving the budget for the monitoring will be to make a general maintenance of AWLR in the site and, if it is not functioning due to personal/mechanical/budgetary reason, to provide necessary measures to resume the continuous measurement as soon as possible. Monthly round survey for the manual measurement of water level, electric conductivity as the indication of water quality and temperature should follow immediately.

Table 2.3.1

## TECHNICAL MONITORING PROGRAM

Subjects	Item	System
Aquifer behavior	Water Level	Observation wells with 21 AWLR and 257 periodical measurement points.
Environmental effects	Water Quality	Periodical measurement of electric conductivity and water sampling & laboratory test.
Water requirement	Pumping hour & discharge	Operation record of all the pumps installed.
	Irrigation efficiency	Periodical field measurements in the sample schemes.
	Cropping pattern & intensity	- ditto as above -

Table 2.3.2

## LIST OF GROUNDWATER MONITORING POINTS

Area Name	Zone (kabupaten)	Well No. by AWLR Measurement	Well No. by Measurement
Surabaya	Mojokerto	EX178	2-PZ, 20-TW, 4-OB, 8-EX
	Tuban	OB22, EX99, EX194	9-PZ, 21-TW, 4-OB, 16-EX
	Gresik	EX190	9-TW, 4-OB, 7-EX
	Pasuruan	OB15	11-TW, 4-OB, 6-EX
	Probolinggo	OB17	14-TW, 2-OB, 6-EX
	Situbondo	-	12-TW
	Subtotal	7	11-PZ, 87-TW, 18-OB, 43-EX
Kediri	Nganjuk	OB19, OB82	6-PZ
	Jombang	-	1-PZ, 1-TW
	Kediri	OB36, OB73, OB74, OB83	7-PZ
	Blitar	OB46, EX79	3-PZ
	Tulungagung	-	1-PZ - - -
	Subtotal	8	18-PZ, 1-TW - - -
Madiun	Ngawi	OW03, OW09	17-TW
	Madiun	OW11, OW12	26-TW
	Magetan	OW10	9-TW
	Ponorogo	OW18	27-TW
	Subtotal	6	- 79-TW - -
<b>Total</b>		<b>21</b>	<b>29-PZ, 167-TW, 18-OB, 43-EX</b>

With the above action, it is expected that the monitoring of aquifer behavior and environmental aspects will be resumed at the beginning of 1988 dry season.

(2) Monitoring of Water Requirement

The progress of water requirement monitoring in the current Consulting Services has been quite little being far from the original plan. This situation is mainly caused on the insufficient budget which narrowly covers the monitoring of pumping hour only.

In the FY 1988/89 the monitoring of the water requirement should not be suspended anymore because such situation is already appeared as the lack of information on the performance of the irrigation facilities which have been operated in the last dry season. Hopefully making an assumption that the proposed budget by the project office for the FY 1988/89 including necessary fund for resumption of monitoring system would be agreed, the original program on the water requirement monitoring will be re-started with exactly one-year delay in the execution.

In accordance with the original plan, the following activities will be made :

- The monitoring should be conducted by samples, amounting to ten (10) command areas for each Part-Project for a total of thirty (30) samples to be monitored;
- The selection should be carried out based on a few parameters including, among others, amount and reliability of the available data, willingness of the concerned Water User's Association to contribute to the monitoring with basic data collection and representativeness of the wells with respect to the prevailing situation in the different Sub-Areas;
- For the identified tubewells data and information should be collected by the Government personnel using the appropriate forms prepared by the Consultant after consultation with P2AT and the concerned HIPPA's. These forms are easily interpreted and provide exhaustive monthly data on the aspects to be monitored;
- The collected basic data should contain information gathered at HIPPA, P2AT and other Government Agencies level. In order to involve the HIPPA's themselves in all possible Project aspect, the relevant sections of the forms (data collected at HIPPA level) should be filled in by appointed officers of the HIPPA's themselves under the initial guidance of P2AT. The remaining sections of the forms, dealing with data collected from the various Government Agencies, should be filled in by the P2AT staff.
- The basic data provided by the above forms should be integrated by the information gathered through a field campaign meant to establish the irrigation efficiency in the monitored tubewells. The campaign should be carried out by the Project.
- The data above and information should be organized, for each monitored tubewell, in a "data base" system to be continuously (at

least with a monthly frequency) kept updated and constituting the starting point for the successive step of data processing and elaboration, performed with the help of the already available computer facilities;

- Once the activity of data processing and elaboration is terminated the evaluation of the tubewell performance should take place. The evaluation should be based, among others, on the following parameters :
  - overall system irrigation efficiency;
  - system maintenance practices;
  - type of crops grown;
  - cropping intensity;
  - use of good quality agricultural inputs;
  - actual versus theoretical water use;
  - HIPPA management practices.
- The evaluation should provide an overall picture of how the ground water facilities are being used and permit to identify possible shortcomings in the tubewell operations which need to be eliminated. Recommendation in that sense should then be issued followed by the enforcement of the proposed remedial measures.

The progress of this activity includes the selection of the wells to be monitored, preparation of the monitoring forms and establishment of a standard data base to contain the information collected.

Due to the already mentioned budget constraints no organized data collection and field campaign could so far take place. Only separate efforts, carried out on a good will basis, could be undertaken by the different Part-Project by availing of the practices and organization established during the previous development stages.

### 3.3 Monitoring of Sea Water Intrusion

#### (1) General Situation

As it has been pointed out by the Consultant at the starting of the East Java Ground Water Development Project in 1982, the possible of sea water intrusion to the potential aquifer in a certain area being developed under the Project may occur particularly in the zone of Tuban, Probolinggo, Pasuruan and Situbondo where these zones are bounded by the sea coast.

To investigate the present situation of sea water intrusion to the potential aquifer and to study some possible countermeasures to avoid further contamination, an extensive monitoring system for salinity of ground water has been established in 1984/85 with alignments of monitoring wells located between the development areas and the sea coast. The monitoring system had been operated through FY 1984/85 to FY 1985/86 and obtains lots of data on movement of fresh/saline water interface. In FY 1986/87 and FY 1987/88 however, the monitoring system have been not in operational condi-

tion due to largely budgetary constraints.

In consideration of the importance of monitoring activity for the sea water intrusion which should have a fatal effect to the feasibility of the Project, the Project office is again proposing to obtain the necessary budget to resume those monitoring system. The program proposed hereinafter is established on the assumption that the budgetary requirement would be fulfilled, and it is basically the one which has been proposed at the starting of the current Engineering Services with some minor modification referring to the limited time until the Loan expiry.

(2) Original Program

The T.O.R. of the Contract is stating the following items to be undertaken by the Project :

- Monitoring on sea water intrusion in the coastal Project areas (Tuban, Pasuruan, Probolinggo, Situbondo and Banyuwangi) and study of the most appropriate measures to be taken to protect the aquifer from the saline contamination.

To implement the above program, the Consultant shall :

- Investigate the present condition of ground water contamination in the coastal Project area, with inventory survey, field investigation and interpretation of water quality data to be collected by the Government from the existing monitoring system for sea water intrusion (Environmental Aspects);
- Assist the appointed Agency in analyzing the mechanism of sea water intrusion and ~~establishing the~~ mathematical model to enable to predict future condition;
- Study on the appropriate preventive measures for the above mentioned sea water intrusion and proposed counter measures to maintain ground water quality in the project area under future development.

(3) Field Works and Data Interpretation

As a realistic plan in reference to the present situation ground water level fluctuation have been monitored in a very limited extent as a part of the regional ground water monitoring system. The first step to be taken during the FY 1988/89 will be to make an overall round survey simply and quickly checking the condition of wells/holes, measuring water table, electric conductivity and water temperature for the whole monitoring points which are proposed in the Table 2.3.1.

The precise monitoring will be concentrated, as the first priority, into the Tuban zone where the intensive pumping of the ground water in the dry season for the irrigation might have a considerable effects to the regional ground water level which possibly causes an intrusion of sea water

from the coast to the karstic limestone aquifer and resulting regional ground water contamination. The monitoring activity in FY 1988/89 will be commenced from the following field works :

- Round survey for ground water level, electric conductivity and temperature in the monitoring points in Gresik, Palang, and Merak Urak areas;
- Water level measurements should be repeated monthly and continued until the end of the Project. Electric conductivity logging in the selected holes/wells will be carried out for three times with interval of 3 months. Water quality analyses will be made for the water samples taken in two times for the comparison of the salinity in the dry season and rainy season.

The field data obtained through the above monitoring will be tabulated and arranged in an annual monitoring report which should be published in the end of the fiscal year 1988/89. The annual report will also include some basic interpretation of data for the following aspects :

- Water level hydrograph of each monitoring point;
- Water table contour map;
- Electric conductivity logs of each logged well;
- Analysis on fresh/saline interface;

(4) Mathematical Modeling & Study on Preventive Measures

Since the monitoring will be made only for one year and there will be no more time allocated for the mathematical modeling within FY 1988/89, this item will be canceled from the program. The criteria for control the pumping intensity and depth of production wells in the possible sea water intrusion areas will remain the same with the one proposed in 1986 with the "Progress of the Project and Feasibility Study Report" under the previous Engineering Services.

3.4 O & M Upgrading and Private Sector Involvement

The total number of the operational pumpsets in the project area by the end of the present program by March 1989 will be around 410 sets. If each pumpset is operated annually for 1,500 hours and, for example, overhaul maintenance will be made in every 5,000 hours of operation, some 120 sets of pump and engine will be overhauled in every year. If such maintenance works will be solely undertaken by the Project Workshop as it is now, the capacity of this workshop which is presently about 75 sets/year in total (20 in Surabaya, 30 in Kediri, 25 in Madiun) should be almost doubled in terms of facility and personnel. This idea is quite unacceptable referring to the current policy on groundwater irrigation development to lighten the Government of its financial burden.

Since the item of work is not included in the scope of works of the services, the Consultant would like to express an opinion that the upgrading of O & M practices and facilities is required not only for the

Government owned facilities but also for such small private repairshops to be involved in the maintenance of machineries.

Back to the principle of maintenance that the beneficiaries should be responsible, it is recommended that the maintenance of pumpsets should be entirely made in the private workshop in a contract-base between HIPPA and the private workshop, and the P2ATs will provide technical guidance to the HIPPA in the contract arrangement. From the above point of view the up-grading of O & M practices and facilities should be focused into how the P2ATs will organize such private sector oriented maintenance system and how the capability of private workshop should be up-graded.

The status of private sector involvement for the Project at present and future could be summarized as Table 2.3.3.

Table 2.3.3. STATUS OF PRIVATE SECTOR INVOLVEMENT IN THE PROJECT

Work Item	Present			Future		
	Public	Private		Public	Private	
	Project	HIPPA	Contr'tor	Project	HIPPA	Contr'tor
Production Well	:			:		
- Siting/Design	: M/E	-	-	: A	M	E
- Drilling	: M	-	E	: A	M	E
- Rehabilitation	: M/E	-	-	: M	-	E
Distribution System:	:			:		
- Survey & Design	: M	-	E	: A	M	E
- Construction	: M	-	E	: A	M	E
- Maintenance	: M	E	-	: -	M/E	-
- Rehabilitation	: M	-	E	: -	M	E
Pumpset	:			:		
- Procurement	: M	-	E	: A	M	E
- Installation	: M	-	E	: -	M	E
- Operation	: M	M/E	-	: -	M/E	-
- Maintenance	: M/E	-	-	: A	M	E
- Replacement	: M	-	E	: M	-	E

Remarks : M : Financing & Management

E : Execution, A : Technical Assistance

It is recommended therefore, that a study on possible involvement of private sector in the operation and maintenance of the groundwater irrigation facilities should be conducted.

The study will focus on the assessment of the present situation of potential private sector possibly to be involved in the project in future. The following items of major study should be included :

- Assessment of the private contractor / repairshops in terms of the available technologies, market potential, financial capability and credit availability;
- Assessment of HIPPA's willingness to sublet the maintenance works to the private repairshops;

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- Study on the appropriate support to promote the private contractor / repairshops for operation and maintenance of ground water irrigation facilities.

As the end product of this study, it will recommend the possible and appropriate involvement of private contractor/repairshops mainly for the maintenance of pumpsets which will, most probably, in the form of annual maintenance contract between the HIPPAs and such private repairshops.

An adequate standard form of the contract and preliminary cost estimate including the Bill of Quantity will be prepared and discussion between HIPPAs will be held to have inputs from the users side to make those system more realistic and widely applicable.

After having such talks with HIPPAs, the Project will initiate the legal and institutional arrangements for the commencement of the work.

### 3.5 Institutional Arrangement of Groundwater Development

Water Resources development and management have been regulated in Indonesia accordance with the provisions defined on the Water Resources Development Low No. 11 of 1974 and the Water Resources Management Regulation No. 22 of 1982. As regards to groundwater, its development and management have been arranged according to the ministerial regulation No.03/P/M/Pertamben /1983 of the Minister of Mines and Energy Completed with guidelines of its implementation issued by the Directorate General of Geology and Mineral Resources.

After this arrangement, the management of groundwater is directed towards the conservation of this resource. It covers all activities related to groundwater inventory and utilization, as well as licence issuance, controls, and supervision of groundwater abstraction, execution. In the cases of controls and supervision of groundwater abstraction, execution is carried out by the Directorate of Environmental Geology/or Regional Office of Ministry of Mines and Energy in cooperation with the Provincial Administration/or other authorized Governmental Agencies.

Besides the Directorate of Environmental Geology, research, investigation and development of groundwater can be conducted by other governmental agencies such as the Working Units of Ministry of Public Work and Ministry of Health, etc. An assignment for carrying out those activities is issued by the Directorate General of Geology and Mineral Resources. As regards to this terms of assignment, for long range projects such as the Jawa Timur Groundwater Development Project, the duration of assignment will be defined separately after taking the operation program into consideration.