BASIC DESIGN STUDY REPORT

ON

THE DEMONSTRATION PROJECT

FOR

FLOATING DESALINATION PLANT SYSTEMS

BASIC DESIGN STUDY REPORT

ON

THE REHABILITATION PROJECT FOR FLOATING IRRIGATION PUMP STATIONS IN UPPER EGYPT IN THE ARAB REPUBLIC OF EGYPT

MARCH 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a basic design study on the Rehabilitation Project for Floating Irrigation Pump Stations in Upper Egypt in the Arab Republic of Egypt and entrusted the study to the Japan International Cooperation Agency(JICA).

JICA sent to Egypt a study team headed by Mr.Itaru Minami, Official, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from November 19 to December 22, 1991.

The team held discussions with the officials concerned of the Government of Egypt, and conducted a field study at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement to friendly relations between our two countries.

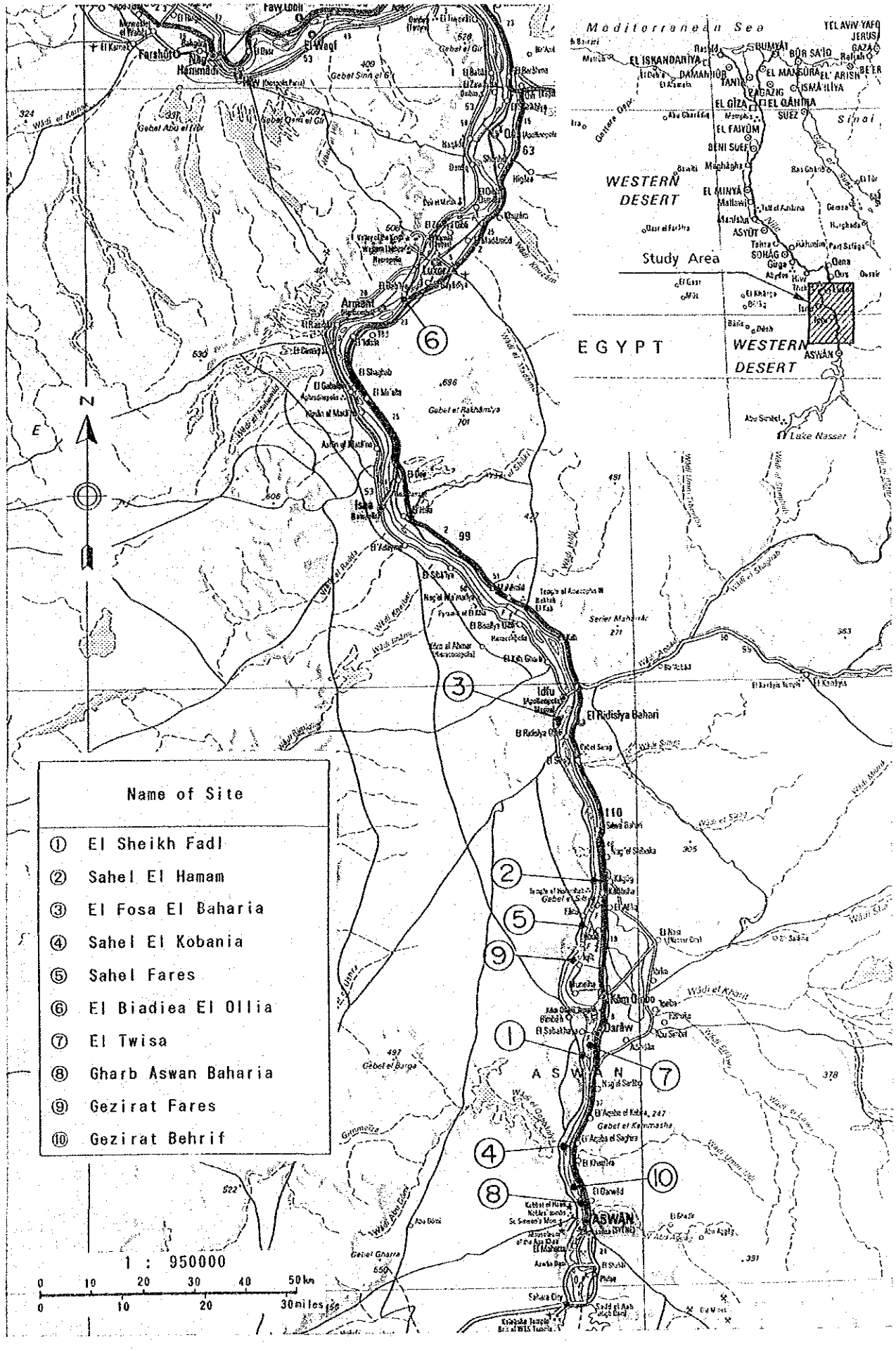
I wish to express my sincere appreciation to the officials concerned of the Government of the Arab Republic of Egypt for their close cooperation extended to the team.

March, 1992

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

LOCATION MAP



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SUMMARY

Agriculture sector of Egypt which accounts for only 20.2% of GDP, employs 33.8% of the nation's manpower. Agricultural production of Egypt had rapidly increased in 1960s, but has been stagnant since 1970s; thus leading to the decline of self-supporting rate of food and increase of the amount of expenditure of foreign currency to import food. On the other hand, the population has been sharply increasing from 38.8 million in 1977 to 51.3 million in 1987, showing an annual growth rate of 2.8% over the period. This high rate of the population increase has put considerable pressure on the country's food security.

Toward this, the increase of food production is necessary for Egypt from the national point of view. Realization of the target of agriculture sector's growth will influence directly on the economic growth of the whole country. The growth rate of agriculture sector on the First Five-Year Plan(1982/83-1986/87) has decreased at 2.5% from the targeted 3.3%. The Government of Egypt formulated the Second Five-Year Plan (1987/88~1991/92) and gave utmost importance to enforcement of agriculture sector providing the targeted growth rate of 4.1%. In order to realize this growth rate, programs were initiated for a horizontal expansion by increasing the cultivation areas and a vertical expansion by increasing the productivity of the cultivated areas, especially with the improvement of irrigation facilities.

The Ministry of Public Works and Water Resources is promoting the rehabilitation/renovation projects for irrigation pump stations situated along the Nile River, which have many problems such as damages and/or obsolescence of equipment and parts. These projects would contribute to solving the deficiency of irrigation water, to increasing the agricultural productivity and to raising the people's standard of living. At present, the implementation of their projects is not progressing due to serious economic problems.

Under the above conditions, the Government of Egypt has requested the Government of Japan for a grant-aid for rehabilitation of the floating irrigation pump stations in Upper Egypt. Based on this request, Japan International Cooperation Agency (JICA) decided to conduct a basic design study on the above project and dispatched a study team in November 1991 and conducted field surveys and studied the contents of the request.

The study team discussed with the officials concerned of Egypt, and studied the existing conditions of each pump station, irrigation facilities, irrigation area and management of operation and maintenance. As a result of the survey, the project was found viable for a grant-aid assistance

from the Japanese government, taking into account the importance of agriculture, necessity of increasing the agricultural productivity, vitalization of regional and national industries as well as immediate response to farmer's needs. In respect of environmental aspect, stable water supply obtained by the project through the year would give rich vegetation as well as conserve the forest resources for Egypt, and hence improve natural and social environments of the area.

After the analysis and examination of the results of the study, the team worked out the basic design of the pump facilities and equipment in Japan. Accordingly, the team prepared the final report of the basic design study including the selection of equipment and operation & maintenance plan.

The executing agency of the project will be the Mechanical and Electrical Department under the Ministry of Public Works and Water Resources. The pump station and its equipment and materials will consist of the following;

(1) 10 floating pump stations of the project which are located from the downstream of Aswan Dam to Luxor, 200 km north of the dam. Transmission lines are provided near the pump stations.

(2) Pump equipment and materials of the project are composed of pump with prime mover, priming pump, sluice valve, check valve, pipes and hoses, switchboards, barge with shed and wall, connecting pipe and spare parts.
Summary of pump stations and its equipment and materials selected in the basic design stage is shown in Table 1, Table 2-1 and 2-2.

The project will be implemented into two phases, as follows ;

Phase I	Detailed design, preparation of tender document	6 month
	Procurement of facilities and equipment	5 month
Phase II	Detailed design, preparation of tender document	5 month
	Procurement of facilities and equipment	5 month

The project implementation cost to be borne by the Egyptian government is estimated as follows;

Phase I Internal transportation and remuneration cost and labor cost

LE 27,600

Phase II Internal transportation and remuneration cost and labor cost

LE 32,300

Total LE 59,900

The annual operation and maintenance costs of pump stations are estimated to be about LE 1.35 million. This cost will be covered by current budget of operation and maintenance for 10 pump stations. After the completion of the project the agricultural productivity will be increased and regional socio-economy activites in Upper Egypt will be vitalized and thus contribute to the country's food self-sufficiency and to the national economy. The Government of Egypt, being fully aware of the significance of the project, has sufficient organization and management system to implement the project, and the immediate implementation of the project is being requested by the Government of Egypt. The project, as mentioned above, justifies an urgent need for grant-aid cooperation from the Government of Japan.

Existing discharge pipelines in No.6 floating pump station, El Biadiea El Ollia should be replaced and connected to the existing new pipelines of the fixed land based pump station before the implementation of the project.

In order to execute the project efficiently, the following is recommended;

- Training of one engineer who will be engaged in operation and maintenance. This engineer will study the methods of operation, regular inspection and repair during his training.

- Training of one engineer for water management and facilities. This engineer will study the water management technology of the whole irrigation systems covering pump station, canal, and agricultural field.

Table 1 List of Proposed Pumping Stations

Name of Floating Pump Station	Service Area (feddan)	Water Requirement (m^3/s)	Total Pump Capacity (m^3/s)	Unit Pump Capacity (m^3/s)	Number of Pump (set)
1. El Sheikh Fadl	310	0.49	0.50	0.25	2
2. Sahel El Hamam	200	0.30	0.30	0.15	2
3. El Fosa El Bahria	150	0.25	0.30	0.15	2
4. Sahel El Kobania	400	0.66	0.70	0.35	2
5. Sahel Fores	630	0.92	1.00	0.50	2
6. El Biadiea El Ollia	3,800	3.90	3.90 1/	1.30	2
7. El Twisa	290	0.46	0.50	0.25	2
8. Gharb Aswan Baharia	660	0.97	1.00	0.50	2
9. Gezirat Fares	620	0.91	1.00	0.50	2
10.Gezirat Berif	475	0.69	0.70	0.35	2

Remarks :

Figures of service area are obtained from Aswan Irritation Department, except those of No.8 and No.9 stations which are based on the existing cultivated areas listed in statistics by agricultural cooperatives under the Ministry of Agriculture in Aswan.

1/ : Deficiency of capacity (3.90-2.60) = 1.30 cu.m/s will be supplemented by the existing floating pumps.

Table2-1 Pump Facilities and Equipment Plan (Phase I)

Item \ Pump Station and No.	1. El Sheikh Fadl Pump Station		2. Sahel El Hamam Pump Station		3. El Fosa El Baharia Pump Station		6. El Biadiea El Ollia Pump Station		7. El Twisa Pump Station	
	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity
1. Pump (with prime mover)	Double suction volute type, Flow rate 0.25m³/s Total head 12m, Motor 45kw	2sets	Double suction volute type, Flow rate 0.15m³/s Total head 12m, Motor 30kw	2sets	Double suction volute type, Flow rate 0.15m³/s Total head 12m, Motor 30kw	2sets	Double suction volute type, Flow rate 1.3m³/s Total head 28m, Motor 460kw	2sets	Double suction volute type, Flow rate 0.25m³/s Total head 12m, Motor 45kw	2sets
2. Priming Pump (with prime mover)	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 25mm Motors 0.75kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 25mm Motors 0.75kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 25mm Motors 0.75kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Motors 1.5kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 25mm Motors 0.75kw×2	1set
3. Sluice Valve	Dia. 350mm	2units	Dia. 300mm	2units	Dia. 300mm	2units	Dia. 700mm	2units	Dia. 350mm	2units
4. Check Valve	Dia. 350mm	2units	Dia. 300mm	2units	Dia. 300mm	2units	Dia. 700mm	2units	Dia. 350mm	2units
5. Pipes and Hoses	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set
6. Switchboards	With power and control cables between switchboards and motors	1set	With power and control cables between switchboards and motors	1set	With power and control cables between switchboards and motors	1set	With power and control cables between switchboards and motors	1set	With power and control cables between switchboards and motors	1set
7. Barge (with shed and wall)	13m×5.5m×1.5m Height of eaves 4.0m	1unit	13m×5.5m×1.5m Height of eaves 4.0m	1unit	13m×5.5m×1.5m Height of eaves 4.0m	1unit	18m×7.5m×1.6m Height of eaves 6.0m	1unit	13m×5.5m×1.5m Height of eaves 4.0m	1unit
8. Connecting pipe (with ball joints, short exhaust pipe)	Dia. 500mm Length 6m	1unit	Dia. 400mm Length 6m	1unit	Dia. 400mm Length 6m	1unit	Dia. 700mm Length 6m	2units	Dia. 500mm Length 6m	1unit
9. Spare parts		1set		1set		1set		1set		1set

Table2-2 Pump Facilities and Equipment Plan (Phase II)

Item \ Pump Station and No.	4. Sahel El Kobania Pump Station		5. Sahel Fares Pump Station		8. Gharb Aswan Baharia Pump Station		9. Gezirat Fares Pump Station		10. Gezirat Behrif Pump Station	
	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity	Specifications	Quantity
1. Pump (with prime mover)	Double suction volute type, Flow rate 0.35m³/s Total head 12m, Motor 55kw	2sets	Double suction volute type, Flow rate 0.5m³/s Total head 12m, Motor 80kw	2sets	Double suction volute type, Flow rate 0.5m³/s Total head 12m, Motor 80kw	2sets	Double suction volute type, Flow rate 0.5m³/s Total head 12m, Motor 80kw	2sets	Double suction volute type, Flow rate 0.35m³/s Total head 12m, Motor 55kw	2sets
2. Priming Pump (with prime mover)	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Moters 1.5kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Moters 1.5kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Moters 1.5kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Moters 1.5kw×2	1set	Vacuum pumps with one supplemtary water reservoir, Pipe dia. 35mm Moters 1.5kw×2	1set
3. Sluice Valve	Dia. 450mm	2units	Dia. 500mm	2units	Dia. 500mm	2units	Dia. 500mm	2units	Dia. 450mm	2units
4. Check Valve	Dia. 450mm	2units	Dia. 500mm	2units	Dia. 500mm	2units	Dia. 500mm	2units	Dia. 450mm	2units
5. Pipes and Hoses	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set	For pumping suction and delivery	1set
6. Switchboards	With power and control cables between swithboards and motors	1set	With power and control cables between swithboards and motors	1set	With power and control cables between swithboards and motors	1set	With power and control cables between swithboards and motors	1set	With power and control cables between swithboards and motors	1set
7. Barge (with shed and wall)	14m×6.5m×1.5m Height of eaves 4.5m	1unit	14m×6.5m×1.5m Height of eaves 4.5m	1unit	14m×6.5m×1.5m Height of eaves 4.5m	1unit	14m×6.5m×1.5m Height of eaves 4.5m	1unit	14m×6.5m×1.5m Height of eaves 4.5m	1unit
8. Connecting pipe (with ball joints, short exhaust pipe)	Dia 600mm Length 6m	1unit	Dia 600mm Length 6m	1unit	Dia 600mm Length 6m	1unit	Dia 600mm Length 6m	2units	Dia 600mm Length 6m	1unit
9. Spare parts		1set		1set		1set		1set		1set

CHAPTER 1 INTRODUCTION

Egypt is afflicted with the decline of self-supporting rate of food due to the stagnation of agricultural production and to the population increase. Moreover, consumption of foreign currency to import food has brought a deficit of the trade balance. Toward this, the Government of Egypt gave a great importance to the increase of food production in the Second Five-Year Plan (1987/88-1991/92)and established policies for enforcement of the agriculture sector and investment for rehabilitation and renovation of existing facilities. The Ministry of Public Works and Water Resources has been promoting the improvement of irrigation facilities as the most important project in order to carry out horizontal and vertical expansions of the cultivated areas based on the above national policies.

In Upper Egypt, irrigation water for crop cultivation only depends upon the Nile River, considering the amount of annual rainfall at 3 mm. There exists 45 floating pump stations in Upper Egypt, which have been operated for more than 40 years under the decline of pump efficiency by super-annuated facilities and equipment. Thus sufficient irrigation water has not being supplied to agricultural fields.

Under the above conditions, the Government of Egypt has requested the Government of Japan for a grant-aid assistance for the rehabilitation of 10 floating pump stations urgently.

In response to the request, the Government of Japan decided to conduct a basic design study for the project and JICA dispatched to Egypt a basic design study team headed by Mr. Itaru Minami, Official, Grant Aid Division, Economic Cooperation Bureau, the Ministry of Foreign Affairs for a period of 34 days from November 19 to December 22, 1991.

The basic design study team fully exchanged views on the project with the officials concerned of Egypt, on the contents and the scale of the necessary and appropriate equipment and materials to be provided. The team conducted a field study, and finalized the contents of the project, including the organizational arrangement, data collection, and visit to the project sites. The field survey was conducted in respect of deterioration of 10 floating pump stations/other irrigation facilities, existing capacity of pumps and canals, present situation of irrigation areas including crop cultivation, management of operation and maintenance system. Further studies were made after the team's return to Japan.

This Report is compiled based on the basic design of pump facilities, selection of equipment and study on operation and maintenance made by the team. (Member list of the study team, survey schedule, member list of related personnel to the study in Egypt and minutes of discussion are attached in Appendices.)

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Economic Overview of Egypt

(1) Gulf War and Economic Influence on Egypt

Gulf War in 1991 brought a huge damage on Egyptian Economy. Firstly, revenue of foreign currency has decreased remarkable including the following:

Remittance of labor abroad has been declined by $1 billion, compared with that of last year.

Revenue of Suez canal was decreased by 50%, compared with that of last year.

Secondly, postpone the newly programmed investment and economic renovation. The damaged amount has been variable by criteria adapted. But it is estimated at $24 billion based on the report to the United Nations.

(2) Actual Economy

In 1991, the Second Five-Year Plan (1987/88~1991/92), the target of growth rate was recorded at 5.3%. Even though Egyptian economy was greatly damaged from Gulf War, Egyptian economy has recovered from debt burden in view of assistance extended by foreign countries, through rescheduling and annuation of debt.

Saudi Arabia and Kuwait continued their cooperation to Egypt to finance projects and investment to Egypt has increased its number.

Tourism has registered its revenue in the estimated amount of $2.6 billion in Egypt and Suez Canal $1.7 billion. Revenues from employment in Saudi Arabia, Oman, UAE and Libya have again boosted the country's economy.

(3) Economic Renovation and Policy

1) Economic reforms consists of major items: (i) implementation of IMF's conditionalities (ii) reforms aiming at Free Market System.

(i) Implementation of IMF's conditionalities

- Integration of exchange rate
- Reduction of budget deficit
- Increase of Interest rate
- Upgrading of energy price to international market price

(ii) Reform at Free Market System

- Introduction of market mechanism
- Revitalization of private sector and privatisation
- Revitalization of public sector
- Liberation of economic structure
- Reform of education and family planning

The Government of Egypt has executed the following policies:

- Participation by private sector to barter trade in Oct 90
- Privatisation of import of 13 specific items in Nov 90
- Open the free market for exchange of currency in Feb 91
- Improvement of trade tariff in May 91
- Introduction of sales tax in May 91
- Improvement of trade law in May 91
- Legalization of new public sector in June 91

At the same time, the market prices of foods, electric appliances, and energy had increased by 20-60% in 1990 and 1991.

2) Economic policies are summarized as follows;

- Negotiation of rescheduling with 17 countries will be terminated by March 1992.
- The Third Five-Year Plan will commence from July 1992 including the policies on privatisation and export encouragement.
- Reform the close economic relation with Gulf countries.

2-2 Trade and Balance of Payment

(1) Trade

Since 1974, Egypt has been suffering trade imbalance. Although the trade balance was favorable in 1981, the international balance of payments has maintained by compensating for the trade and current account deficits with a long-term capital balance (See Table 2-1). Agricultural products account for more than 90% of the total exports (excluding petroleum), and approximately 50% of the total imports.

The main cause of the adverse trade balance lies in the increase of import of wheat, which is staple food of the Egyptians. The growing demand for wheat was due to the population increase and shortage of production.

In order to improve the total balance, the Egyptian Government has established a series of policies. For instance, foreign investment and aid was sought. It has also introduced economic policies for establishing and promoting free-zone for processing export products and facilities for minor industries respectively.

Under such economic circumstances, the Egyptian trade balance can be improved by promoting export of agricultural products and reducing the import burden. The international markets for primary industries, especially agricultural products, fluctuate and prices are unstable. However, since Egypt has the most suitable agricultural conditions among the Arab countries, it is important for Egypt to reduce its trade imbalance first by promoting the export of agricultural products.

In recent years, the record indicated that trade deficit balance was compensated by Services & Transfers and Grants & Borrowing from foreign countries.

Table 2-1 (1) Trend of Trade Balance

(Unit:Million US$)

Year	Export	Import	Balance
73	427.4	717.2	-289.8
74	1,818	3,618	-1,800
75	1,875	4,608	-2,733
76	2,169	4,659	-2,490
77	2,346	5,110	-2,764
78	2,558	5,998	-3,440
79	3,987	7,817	-3,830
80/81	5,617	10,334	-4,717
81/82	5,779	10,380	-4,601
82/83	5,405	9,820	-4,515

Source: Central Bank of Egypt

Table 2-1 (2) Summary of Balance of Payments

(Unit:Million US$)

	FY82	FY83	FY84	FY85	FY86	FY87	FY88
Exports	7,962	7,852	8,482	8,711	7,840	7,271	8,278
of which oil	(4,669)	(4,164)	(4,532)	(4,781)	(3,995)	(2,679)	
Imports	11,665	11,515	13,414	13,648	12,881	10,629	12,622
Resource Gap	-3,703	-3,663	-4,932	-4,973	-5,041	-3,358	-4,343
Factor Services & Transfers (net) of which	202	1,313	1,894	238	-284	-399	1,496
workers' remittances	(1,935)	(3,165)	(3,931)	(3,496)	(2,973)	(2,845)	(3,386)
Interest (gross)	(-912)	(-1,539)	(-1,567)	-2,437)	(-2,408)	(-2,740)	(-1,247)
Current Account Deficit	-3,501	-2,350	-3,038	-4,735	-5,325	-3,756	-2,847
Grants & Direct Investments	1,280	1,641	2,035	2,460	2,562	1,921	1,953
Borrowings (net) 1/2/	1,035	1,146	657	-132	-102	-1,566	1,785
Gross Borrowings	(2,514)	(2,491)	(2,253)	(1,948)	(2,380)	(1,604)	(2,113)
Amortization 1/	(-1,479)	(-1,345)	(-1,596)	(-2,080)	(-2,482)	(-3,170)	(327)
Capital Account Balance	2,315	2,787	2,692	2,328	2,460	355	3,739
Net Errors and Omissions 2/	1,203	452	-1,385	1,536	2,119	1,409	-861 3/
Arrears	-	-	1,870	1,271	1,146	2,593	376 3/
Changes in Reserves	-17	-889	-139	-400	-400	-600	-406
Memorandum Items (In Percentage)							
Current Account Deficit / GDP	-13.7	-8.4	-9.9	-13.6	-15.2	-10.4	-7.7
MLT Disbursed Debt/GDP 1/	60.8	64.1	64.1	91.5	95.0	99.7 4/	103.6
MLT Debt service Ratio 5/	26.6	27.1	28.6	37.0	48.4	60.2	10.5

1/ Including estimated military borrowing; excluding short-term debt and IMF credits.

2/ For lack of historical data, short-term capital is included under "net errors and omissions".

3/ Excluding amortizations that might have fallen due on deposits made by a number of foreign central banks with CBE in earlier years.

4/ The ratio of total debt to GDP is 112.

5/ Exports include workers' remittances but exclude exports of foreign oil companies (FOC).

Source: Central Bank of Egypt, IMF and Mission Estimates.

(2) Balance of Payment and its Perspectives

Based on the report prepared by the IBRD's Mission, the overall balance of payment in recent year as well as its perspective in future are summarized below.

The import amount including raw materials and foods increased again in FY 89 which brought a deficit of $5.6 billion of the trade balance. The accumulated debt burden also brought Egypt on amount of $2.7 billion for interest and $3.0 billion for capital which formed a debt service ratio (DVR) of 46.2% seemingly difficult to execute their obligations.

After a long period of negotiation with the IMF group, the Egyptian pound to one dollar was pegged at LE 2.23-2.24.

After the devaluation of exchange rate, trade liberization and encouragement of export would improve the trade balance, especially augmentation of export of industrial goods; namely, textile would be expected. On the other side, the oil export will be decreased after FY 91/92 (peak period).

At the initial stage of structure adjustment, the import of equipment and materials will be increased in accordance with industrial growth. The import of consumable goods will be increased slowly especially the import of goods shall be increased by 2% annually during the period of 1992 to 1997.

Remittance from overseas as well as grant-aids by foreign countries is increasing, but the direct investments of private capital from foreign countries are expected to be remarkably increased.

Borrowings from foreign loans will be kept at the level not exceeding the repayment amount, therefore, the net disbursement will have negative figure according to the program. During the next five-year development plan, the balance of payment will be completely improved at the later year of the Plan, including those of the perspectives and recommendation made by the Mission of IBRD (See Table 2-2).

Table 2-2 Egypt Balance of Payments:Reform Scenario

(Unit:Millions of US$)

	FY87	FY88 a/	FY89	FY92	FY94	FY96
	Acutuals		Projected			
Exports GNFS	7,271	8,278	7,980	11,008	12,948	15,032
Imports GNFS	10,629	12,622	13,573	14,541	16,654	19,282
Net Workers' Remittances	2,845	3,386	3,691	4,649	5,125	5,651
Interest Payments	2,740	1,247	2,684	3,139	3,487	3,867
Current Acc.Deficit	-3,756	-2,847	-4,851	-2,569	-2,456	-2,695
Current account Deficit	1,052	980	1,038	1,052	1,069	1,123
Grants	869	973	1,097	1,392	1,689	2,111
Direct Foreign Investment (Net)	-2,225	1,994	3,303	321	-90	-276
Borrowings (net) c/	1,859	2,321	6,391	4,030	5,015	5,330
Gross Disbursements	4,084	327	3,088 b/	3,709	5,105	5,606
Amortization						
Capital Account Balance	-304	3,947	5,438	2,765	2,668	2,958
Net Errors & Omissions	2,067	-1,071	-1	1	-	1
Arrears	2,593	376	-	-	-	-
Changes in Reserves d/	-600	-406	-588	-195	-212	-262
Reserves/Months of Imports	2.0	1.8	2.0	2.0	2.0	2.0
Memorandum Items						
Current Account GDP	-10.4	-7.7	-11.8	-8.9	-7.2	-6.7
Current Account Net of Interest/GDP	-2.8	-4.4	-5.3	1.9	3.1	3.0
Debt Service Ratio b/	63.3	12.1	46.2	41.1	44.7	43.2

a/ After debt rescheduling.
b/ Assuming no further debt rescheduling beyond FY88.
c/ Including net short-term capital and IMF drawings.
d/ Minus signs mean an increase in reserves.

Source: Central Bank of Egypt, Mission Estimates.

2-3 Development Plan

(1) Achievements of the First Five-Year Plan (1982/83-1986/87)

The following basic principles were provided in the First Five-Year Plan;

- To continue the realization of high rates of growth within the framework of a sectorial-structrual reform.
- To make development depend basically on commodity sectors as they are fundamental to the continuity of development and providing employment opportunities.
- To work toward the gradual correction of the deficit in the balance of payments.

Under the First Five-Year Plan, the following were achieved;

1) 62.9% of total investment expenditure was directed to the completion of on-going projects and 12.4% toward certain essential new projects.

2) Foreign credits facilities i.e. foreign loans, contributed about 25.4% of total public sector investments.

These tendencies have been observed in the current development plan. Table 2-3 shows the result of analysis of each industrial sector's growth rate for as well as share in the First Five-Year Plan and target of the Second Five-Year Plan.
The growth rate of agriculture sector on the First Five-Year Plan was lower than the target rate. Since the growth rates of all sectors were lower than the target rate in the past, the growth rate in the current development plan was fixed as 5.7% (conservative figure), but the agriculture sector maintains a high targeted growth rate of 4.1%. In 1987, the share of agriculture sector in GDP occupies more than 20%, the highest sector.

Considering the above elements, realization of the target of agriculture sector's growth will influence directly on the economic growth of the whole country even though there exists many economic problems at present. Furthermore, the relationship between the growth target and investment program should be reviewed (See Table 2-4). Under the First Five-Year Plan public investment shows that the share of commodity sector itself has narrowed and agriculture & irrigation sector also has slightly decreased its share. In the current Second Five-Year Plan, the share of industry & mining sector has increased

since the country urgently required to complete the infrastructure by acquiring the equipment and materials for the other productive industries.

(2) Investment Policies in the Current Second Five-Year Plan (1987/88-1991/92)

The major policies of the current Second Five-Year Plan consist of monetary and credit policies, fiscal policies, price ad imcome policies, manpower policy, investment policies, the policy of promoting the performance of the public sector and the policy of dealing with the outside world.

Among the above seven major development policies, the Egyptian government formulated the investment policies in order to distribute investments in the following sectors;

52.0% : agriculture, industry, electricity petroleum and construction (Agriculture sector occcupies 10.5% of the total investment of which irrigation and drainage sub sector occupies 3.1%.)

32.0% : housing, utilities and other services

16.0% : transports, communication and other sectors of production

The Government also emphasized the importance of widening the range of economic cooperation between Egypt and outside world in order to provide Egypt with a greater capability for obtaining the most suitable forms of foreign assistance.

(3) Investment Expenditure in the Current Five-Year Plan

Under the development plan, it was presumed that 25.2% of the total public sector investments for LE 7.2 billion, would be financed by foreign sources.

Details of the above figures are as follows;

1) LE 1.8 billion (6.3% of total public sector investment) is to be raised through grants and aid.

2) LE 3.3 billion (11.5%) through long term public loans.

3) LE 2.1 billion (7.4%) through facilities.

Table 2-3 Performance of The First Plan
and Framework of The Second Plan

	Average Annual Growth			Percent of GDP In Current Prices			
	First Plan FY83-87		Second Plan FY87-92	Actual	Planned	Actual	Planned
	Planned	Actual	Planned	FY82	FY87	FY87	FY92
GDP	8.6	5.1	5.7	100.0	100.0	100.0	100.0
Agriculture	3.3	2.5	4.1	18.9	19.2	20.2	18.1
Industry	9.9	5.8	5.7	31.4	25.6	23.9	27.0
Oil	12.0	6.6	2.3	12.8	3.8	5.4	3.3
Manufacturing	10.3	5.5	8.4	12.8	16.0	13.3	17.9
Others	8.2	4.5	4.7	5.8	5.8	5.2	5.8
Services	7.3	5.6	4.7	46.4	55.2	51.6	54.9
Consumption	5.7	4.4	4.5	84.8	90.8	91.6	87.0
Public	7.9	4.0	5.0	17.8	14.3	14.5	13.9
Private	5.1	4.5	4.4	67.0	76.5	77.1	73.1
Gross Investment	10.5	-1.2	4.8	30.1	18.1	19.3	17.7
Fixed Investment	11.0	-1.1	6.0	29.6	18.1	20.3	17.7
Exports GNFS	9.2	4.9	6.0	27.0	14.2	15.1	14.4
Imports GNFS	3.5	-1.4	0.3	41.9	23.1	26.0	19.1
Domestic Savings	23.6	-6.6	12.1	15.2	9.2	8.4	13.0
Resource Gap				14.9	8.9	10.9	4.7

Source: Ministry of Planning and Mission Estimates.

Table 2-4 Fixed Investments in The First and Second Five Year Plan

(unit:%)

	Second Plan 1/ 1987/88 to 1991/92			First Plan 1982/83 to 1986/87					
	Planned			Planned 2/			Actual 1/		
	Total	Public	Private	Total	Public	Private	Total	Public	Private
Agriculture, Irrigation & Drainage	10.5	8.0	14.7	10.9	9.4	15.5	9.1	7.9	12.8
Industry & Mining	26.4	20.3	35.6	22.5	23.0	20.7	21.4	22.3	18.6
Petroleum & Products	2.4	3.9	0.0	4.1	5.5	0.0	3.8	5.1	0.0
Electricity	10.2	16.7	0.0	7.5	9.7	0.6	7.3	9.7	0.4
Construction	2.5	2.2	3.1	2.2	2.1	2.8	2.8	2.8	2.9
Commodity Sectors, Total	52.0	51.2	53.3	47.2	49.7	39.6	44.5	47.8	34.7
Transport, Communications & storage	13.1	16.5	7.8	15.9	19.9	3.8	20.8	26.6	4.0
Suez Canal	0.5	0.8	0.0	0.9	1.3	.0.	1.0	1.4	0.0
Trade	0.7	0.8	0.4	1.2	1.3	0.6	1.3	1.6	0.5
Finance & Insurance	0.3	0.5	0.0	0.4	0.5	0.2	0.3	0.3	0.2
Tourism	0.9	0.7	1.2	1.5	1.1	2.9	1.2	1.0	1.6
Productive Services Sectors, Total	15.5	19.4	9.4	19.9	24.1	7.5	24.7	30.9	6.6
Housing	14.6	0.6	36.7	13.2	0.8	50.5	15.2	1.0	56.6
Public Utilities	8.6	14.1	0.0	7.6	10.2	0.0	7.9	10.7	0.0
Education	3.6	5.7	0.2	2.5	3.2	0.2	2.1	2.7	0.2
Health	1.8	2.8	0.3	2.0	2.6	0.3	1.4	1.7	0.3
Other Services Sectors, Total	2.4	3.8	0.1	3.2	4.1	0.3	2.4	3.1	0.1
Social Services Sectors. Total	31.0	27.0	37.3	28.5	20.9	51.4	29.0	19.2	57.6
Mini Investments	0.0	0.0	0.0	2.4	2.7	1.5	1.8	2.1	1.1
Unallocated	1.5	2.4	0.0	2.0	2.6	0.0	0.0	0.0	0.0
GRAND TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Memorandum Item Grand Total in billion LE	46.5	28.5	18.0	34.43	25.85	8.58	48.83	36.72	12.11

1/ 1986/87 prices.

2/ 1981/82 prices.

Source: Ministry of Planning.

2-4 Outline of Agriculture Sector

(1) Current State of Agriculture Sector

Agriculture sector which accounts for only 20.2% of GDP, employs 33.6% of the nation's manpower. The Egyptian government has given a great importance to the agriculture sector in the current Second Five-Year Plan (1987/88-1991/92) following the First Five-Year Plan. One of the constraint factors has contributed to the decline of self-supporting rate of food against the increasing population due to the limited arable land per capita. The Second Five-Year Plan is putting high priority on the increase of agricultural production before improvement of marketing of products.

Egyptian agriculture depends mostly on the Nile River for irrigation water supplies. To meet the current water requirements, irrigation facilities are required to improve the basic infrastructure.

Facilities have been deteriorated. Because of this, the efficiency of the pump had declined or the operation had been interrupted and thus the agricultural productivity had declined.

There are approximately 1,000 pumping stations with various station discharges. The Egyptian government has continued to improve and repair pump stations and canals over a long period, but not completed yet due to lack of foreign currency in the allocated budget.

(2) Outline of Development Plan of the Sector

In the Current Five-Year Development Plan, agriculture sector has been emphasized. The basic objectives of this sector are summarized as follows:

1) Producing the greater part of food requirements.

2) Contributing to the increase in exports especially major export crops.

3) Providing raw materials and intermediate goods to a large number of basic industries.

4) Achieving optimum utilization of all available agricultural resources as well as applying various advanced agricultural methods.

5) Giving priority to the development of new areas through land reclamation and raising the rates of such reclamation, as well as introduction of the newly reclaimed areas under cultivation.

6) Promoting water resources and rationalizing their use.

7) Attaining an optimum crop structure(composition) which would maximize and economic return at the lowest possible cost.

8) Increasing animal and poultry production.

9) Raising the level of fish production.

10) Providing substantial job opportunities to Egyptian manpower.

Based on the above objectives, the plan was formulated to increase the value of agricultural production from LE12.2 billion in 1986/87 to about LE14.7 billion in 1991/92 representing an average annual rate of about 3.7%. Investments totaling about LE 4.9 billion in agriculture sector was also planned. This figure corresponds to 10.5% of total investment. These investments were focused on:

1) Improvement of infrastructure for agricultural land (public, 490 thousand and private, 137 thousand feddan).

2) Land reclamation, agricultural mechanization, optimal utilization of water resources. In particular, rehabilitation and renovation of pumping station and irrigation canal occupies an important role in agriculture sector.

The Ministry of Public Works and Water Resources accords a high priority to horizontal expansion by increasing the cultivation areas and vertical expansion by increasing the productivity of the cultivated areas with the improvement of irrigation facilities. Especially, if the projects require a large amount of foreign currency such as equipment, the Ministry expects to obtain foreign assistance to save foreign currency reserves(See Table 2-5).

Table 2-5 Budget for Ministry of Public Works and Water Resources

(Unit : LE 1,000)

	Total	Foreign Currency (Cash)	Foreign Currency (Non Cash)	Local Currency
Ministry (MPWWR)	1,124,449 (100%)	69,675	259,189	975,585
Irrigation Department (ID)	537,205 (47.8%)	7,310	157,225	372,670
Mechanical & Electrical Department (MED)	91,752 (8.2%)	22,910	9,929	58,915
Drainage Authority	335,250 (29.8%)	0	56,500	52,500
Others	160,290	39,455	35,535	311,500

Source: The Second Five-Year Plan (1987/88-1991/92)

2-5 Background and Outline of the Request

(1) Background of the Request

Agricultural production of Egypt had rapidly increased in 1960s, but has been stagnant since 1970s. Because of this, the self-supporting rate of food is declining but the amount of expenditure of foreign currency to import food is increasing. On the other hand, the population has been sharply increasing from 38.8 million in 1977 to 51.3 million in 1987, showing an annual growth rate of 2.8% over the period. This high rate of the population has put considerable pressure on the country's food security.

Toward this, the increase of food production is urgently necessary for Egypt from the national point of view. The Government of Egypt formulated the Second Five-Year Plan (1987/88-1991/92) and gave a great importance to the increase of agricultural production in this plan.

In order to realize the Five-Year Plan, programs were initiated for a horizontal expansion by increasing the cultivation areas and a vertical expansion by increasing the productivity of the cultivated areas, especially with the improvement of irrigation facilities.

The Ministry of Public Works and Water Resources (MPWWR) is promoting the rehabilitation/renovation projects for irrigation pump stations situated along the Nile River, which have many problems such as damages and/or deteriorated equipment and parts. These projects will contribute to solving the deficiency of irrigation water, to increase of agricultural productivity, and to raise the people's standard of living. At present, the implementation of projects is not progressing due to serious economic problems.

Under these conditions, the Government of Egypt has requested the Government of Japan for a grant-aid for the rehabilitation project of floating irrigation pump stations in Upper Egypt.

In response to the request, the Government of Japan decided to conduct a basic design study on the above project and sent a study team in November 1991 and conducted field surveys of the project area.

(2) Outline of the Request

The request made by the Government of Egypt calls for the rehabilitation of 10 floating pump stations as outlined below:

Outline of the Request

1) Project Title — The Rehabilitation Project for Floating Irrigation Pump Stations in Upper Egypt in the Arab Republic of Egypt

2) Objectives — To secure reliable and firm water sources for farmland irrigation so as to contribute to stable agricultural production and thus to self-sufficiency of food.

3) Project Sites — 10 floating pump stations located at the area between Aswan and Luxor

4) Responsible/ Executing Agency — Ministry of Public Works and Water Resources (MPWWR), Mechanical and Electrical Department (MED)

5) Items requested — After discussions with the study team, items are listed below;

a) Pumps
b) Motors
c) Priming Pumps and Motors
d) Valves
e) Pipes and Hoses for pumping suction and delivery up to discharge tower
f) Switchboards
g) Power and Control Cables between panel to motors
h) Barges
i) Spare Parts

The outline of service area and pump capacity for each pump station are shown in Table 2-6.

6) Works by Egyptian Side — Internal transportation and installation of the pump equipment and materials

Table 2-6 Outline Service Area and Pump Capacity in the Request

No	Name of Pump Station	Service Area (Feddan)		Pump Capacity (cu. m/s) Existing		Proposed	
		Existing	Proposed	Set	Capacity/set	Set	Capacity/set
1	El Sheikh Fadl	320	1000	1	0.5	2	0.5
2	Sahel El Hamam	200	1000	1	0.5	2	0.5
3	El Fosa El Baharia	150	1000	1	0.5	2	0.5
4	Sahel El Kobania	350	1000	1	0.5	2	0.5
5	Sahel Fares	800	2250	2	0.75	2	0.75
6	El Biadiea El Ollia	4700	6800	2	1.3	2	1.3
7	El Twisa	290	980	2	0.25	2	0.5
8	Gharb Aswan Baharia	350	1000	2	0.5	2	0.5
9	Gezirat Fares	250	1500	2	0.5	2	0.75
10	Gezirat Behrif	550	1500	2	0.75	2	0.75

CHAPTER 3 OUTLINE OF THE PROJECT AREA

3-1 Location and Socio-Economic Conditions

The project area is situated at the downstream of Aswan Dam 800 km south of Cairo, and 200 km north of Aswan Dam, where 10 floating pump stations are installed. These stations are supplying irrigation water to agricultural fields developed along the Nile River. Out of 10 floating pump stations, 4 stations are installed on the left bank of the Nile River and 3 stations are on the right bank. The remaining 3 stations are installed at several islands in the middle of the Nile.

Administratively, out of the 10 stations 9 stations belong to Aswan Governorate and the one to Quena Governorate in Upper Egypt.

According to statistics in 1986, each Governorate has a population of 0.81 million and 2.36 million respectively, which corresponds 1.7 % and 4.7 % of the total population in Egypt. In the project area, 0.5 million people are living.

Main source of economic activities are obtained by production of sugarcane and tourism. Large scaled industries have not been developed in Upper Egypt.

3-2 Natural Conditions

The climate of the project area is classified as arid zone type. Temperature ranges from 32-35°C in summer season and 12°C in winter. Seasonal and daily variations are high with the maximum record at 50°C the minimum at 2°C. Rainfall is scarce, which registers at 3 mm per annum, only in winter season. Relative humidity in the area shows slight variations with 34% on the average and 45% at maximum.

The hinterland of agricultural fields developed along the Nile is a vast desert. The area is affected by sand storms which occurs once a month. The strong wind having the maximum record of 120 km/h with sand blows against floating pump stations.

Soil in Upper Egypt is generally fertile although soil is not so fine and thick. After construction of Aswan High Dam, sediments containing organic materials once brought by floods of the Nile are deposited in the bottom of lake which becomes deficient in nitrogen and phosphate.

The Nile River is the only water resource for agricultural, drinking, and industrial uses in the project area and its periphery.

3-3 Social Environment

The project area is crowded with many tourists from foreign countries visiting world-famous, historic spots and beautiful scenery in the Nile. International airports are provided in both Aswan and Luxor cities which will take only one to two hours from Cairo by air. The national road and railway passing along the right bank of the Nile are major measures of traffic and transportation connecting the Cairo Metropolitan with Aswan, which is an important city in the southern part of Egypt. On the contrary, trunk roads and railway are not provided in the left bank of the downstream of Aswan Dam where only villages are developed with agriculture. In the middle and northern part of the project area, a bridge and a weir are installed across the Nile in the cities of Edfu and Esna are crowded with passers-by.

Power supply from Aswan High Dam is distributed to cities and villages. Transmission lines are provided near floating pump stations. Telephones are available in Aswan, Komombo and Luxor cities. Public offices, high schools, hospitals, private enterprises and markets, etc. are located on the right bank of the Nile. On the left bank, small-scaled facilities are found only in villages.

3-4 Outline of Agriculture Sector

According to data obtained from the Irrigation Department, the Ministry of Public Works and Water Resources, the cultivated area in Upper Egypt is 1,107,000 feddan (465,000ha) and cropped area is 1,867,000 feddan (784,000ha). Cropping intensity amounts to 169 percent. Cropping pattern in Upper Egypt is characterized by three season-crops i.e summer crops (May to August), Nile crops (June to October), winter crops (October to April) and perennial crops. Summer crops are maize, sorgo, beans, sesame, groundnut, onion, vegetables, and Nile crops are maize, sorgo, vegetables. Winter crops are wheat, beans, berseem, onion, vegetables and perennial crops are fruit trees and sugarcane. The annual production of the whole crops in Upper Egypt is estimated at 18 million tons.

The cultivated area of sugarcane which requires abundant irrigation water has been remarkably increasing since the completion of Aswan High Dam due to stable water supply to fields. The area of maize cultivation in summer and berseem in winter including the promotion of livestock breeding has also increased.

Crop cultivation in Upper Egypt is conducted with a three-year rotation. The field area is divided into three plots where the following

crops are planted by rotation in each plot.

First plot : sorgo or maize after berseem
Second plot : maize after broad bean or lentil bean
Third plot : maize after wheat

Since the completion of Aswan High Dam, the cropping intensity has been heightened with the extension of perennial irrigation by applying modern irrigation facilities, removing the transitional irrigation method, however, farmers are dissatisfied due to lack of irrigation water, which is due to the deteriorated facilities. Moreover, improvement of cropping intensity induces waste of land fertility and requires chemical fertilizer and pesticide.

There exist 210 pump stations and related irrigation facilities in Upper Egypt, of which 45 floating pump stations are installed at South and Middle Upper Egypt. 36 floating pump stations in South Upper Egypt command 18,310 feddan (7,858 ha) of irrigation area where maize, wheat, berseem, sorgo and sugarcane are cultivated. However, those stations are supplying only about 50% of the required irrigation water to the fields due to deterioration of their facilities and equipment. In respect of irrigation canals, main lined canals have sufficient capacity to deliver irrigation water, but branch canals made of earth materials require regular maintenance in order to keep the capacities of canals.

Farmers in the area have one to two feddan of farm land per farm household while the agrarian reform law limits their farm size to 50 feddan for an individual and 100 feddan for a family. With the increase of the population, their land areas have become more smaller. Extension of farmland and improvement of irrigation facilities is therefore expected in this regard.

3-5 Existing Condition of Irrigation Facilities

Out of 36 floating pump stations in South Upper Egypt, 10 stations were selected by the Egyptian government as the urgent and high priority project, where 5 stations had constructed in 1933 and the other 5 stations in 1952. Irrigation canals connecting with those pump stations are distributed to fields, although some parts of canals are damaged or deteriorated.

Present situation of each pump station and irrigation area are summarized in Table 3-1 and Table 3-2 (Details of each pump station are shown in Appendix 5.4).

Based on the field survey, the degree of deterioration of these stations are summarized as follows;

1) Pump efficiency is declining at 50 to 60 percent of the initial design capacity.

2) Motors, switchboards, cables, pipes and hoses for pumping suction and delivery up to discharge tower and valves are cracked or being cut or are eaten away with rust. Unusual noises are heard during operation.

3) As shown in Appendix 5.5, the expenditure for operation and maintenance are increasing year by year.

4) Water is leaking through discharge towers, discharge pipes and canals which were installed 40-60 years ago.

The total irrigation area by 10 pump stations is 6,755 feddan (2,837 ha). The supply of irrigation water to the area is not sufficient due to the great decline of pump efficiency.

Discharge measurement during the site survey and the checking document prepared by MED show that the pump efficiency has greatly lowered at 50 to 60 percent of the original design capacity. To supplement this deficiency of existing pump capacities, two sets of pump are installed at some stations, however, irrigation water is still insufficient. At present, each pump station has no stand-by pump.

Relation between Water Requirement and Delivered Water

Pump Station No.	Existing Area (feddan)	Existing Pump Capacity (m^3/s/set)	Number of Pump (set)	Delivered Water (m^3/s)	Water Requirement (m^3/s)
1	310	0.5	1	0.3	0.49
2	200	0.5	1	0.3	0.30
3	150	0.5	1	0.3	0.25
4	400	0.5	1	0.3	0.66
5	630	0.75	2	0.9	0.92
6	3,800	1.3	4	2.0	3.90
7	290	0.25	2	0.3	0.46
8	660	0.5	2	0.3	0.97
9	620	0.5	2	0.3	0.91
10	475	0.75	2	0.5	0.69

Remarks : delivered water pump capacity*60% (No.6 sta. 50%)

Considering climatic and soil conditions prevailing in the project area, farms require much irrigation water. This unstable supply water has thus resulted in the decline of agricultural production.

The project sites have been suffering from flood damages since the completion of Aswan High Dam which stored floods in the reservoir. Controlled outflow through the dam has given stable water resources for the project sites. However, the water level of the Nile River is still fluctuating as shown in Table 3-3.

The floating pump facilities provided by the project will be installed at the site similar to the existing one. As recognized during the site survey, weeds under the pump hinder after the operation, and at some stations the river depth becomes shallow due to excessive sediments.

Table 3-1 Present Situation of Each Pump Station

NO.	Name, Address	Pump			Motor Capa	Dia. of Discharge Pipe	Length of Connecting Pipe	Tower		Discharge Pipe		Actual Head	Capa. of Trans-mission
		Year	Quantity	Capa/unit				Dia. of Suction Mouth	Dia. of Body	Dia.	Length		
1.	El Sheikh Fadl ; Aswan Draw Benban El Sheikh Fadl	1952	1	0.5	66	500	6.7	700	1,000	700/500①	39.6+15 =54.6	9.8	250
2.	Sahel El Hamam ; Edfu El Hamam	1932	1	0.5	100	500	7.7	500	1,000	700	80.6	8.8	300
3.	El Fosa El Baharia ; Edfu El Fosa	1932	1	0.5	100	500	5.5	(no tower)		600	28.8	7.5	200
4.	Sahel El Kobania ; Aswan Sahel El Kobania	1933	1	0.5	100	500	5.6	500	1,000	600	59.3	8.0	300
5.	Sahel Fares ; Kom Ombo Fares	1952	2	0.75	110	500	6.45	500	1,000	700	55.4	7.3	500
			②							④		③	
6.	El Biadiea Ollia ; Naga El Wehda Luxor	1952	2+2=4	1.3	440	700	7.5	700/700	1,000/1,500	700/700 ; −1,000	1,000/1,000	21/16.4	2,500
7.	El Twisa : Kom Ombo Gezirat El Garbiab	1932	2	0.25	40	500	5.3	500	1,000	500	30.1	8.6	100
8.	Gharb Aswan Bahary ; Gharb Aswan Bahery	1932	2	0.5	110	400	5.8	500	1,000	700	61.2	8.2	500
9.	Gezirat Fares ; Kom Ombo Eklect Gezirat Fares	1952	2	0.5	110	500	5.6	500	1,000	500	44.0	6.0	300
10.	Gezirat Behrif ; Aswan Gezirat Behrif	1952	2	0.75	110	500	6.9	500	1,000	600	64.4	9.0	500

Remarks ; ① Dia of Pipe becomes smaller at 39.6M point from the Tower.
② 2 sets of pump stations is at this site.
③ Supply to upper and lower canals.
④ Become into 1,000 mm dia of one pipe at 150 M point from the Tower.

Source : Site survey by Basic Design Team.

Table 3-2 Present Situation of Each Irrigation Area

Pump station No.	Name of Pump station	1) Location	Name of Handasa	Area Name by F.P	Total Area	Name of Irrigation Canal	Length of Canal	Served Area by Canal	Number of Farm household
1	El Sheikh Fadl	km 38.25	Aswan	El Sheik Fadl	feddan 310	Bahary Kebly	4,120(m) 2,380	230feddan 80	329
2	Sahel El Hamam	80	El Selsella	Sahel El Hamam	200	Bahary Kebly	3,580 430	150 50	212
3	El Fosa El Bahria	113.0	Edfu Sharh	El Fosa El Bahria	150	Bahary Kebly	200 200	100 50	159
4	Sahel El Kobania	25.5	Aswan	Sahel El Kobania	400	Kebly Bahary	1,950 2,430	120 280	2) 319
5	Sahel Fares	71.0	El Selsella	Sehel Fares	630	Sehel Fares	5,550	630	668
6	El Biadiea El Ollia	–	El Biadiea	El Biadiea	3,800	Lower Upper El Welyah	12,500 4,500 2,660	2,500 1,000 300	1,000
7	El Twisa	39.5	Aswan	El Twisa	290	Bahary Kebly West	1,315 400 350	70 180 40	307
8	Gharb Aswan Baharia	12.7	Aswan	El Baharia	250	El Baharia	3,300	250	2) 435
9	Gezirat Fares	67.8	El Selsella	Gezirat Fares	250	Bahary Kebly	1,000 550	150 100	2) 503
10	Gezirat Behrif	15.6	Aswan	Gezirat Behrif	475	Gezirat Behrif Rebly Gezirat Behrif Bahray East Gezirat Behrif	1,630 2,310 595	180 225 70	2) 338

Remarks: 1) : Distance from Aswan Dam.

2) : Obtained from agricultural cooperatives.
Other figures are estimated by interviewing with farmers.

Table 3-3 Discharge and Water Level of the Nile River

Item	1987	1988	1989	1990	1991
Maximum Discharge (million cum/day)	230	225	245	240	245
Minimum Discharge (million cum/day)	80	75	75	75	65
Maximum Water Level (El-m)	83.60	83.70	84.00	83.90	84.00
Minimum Water Level (El-m)	81.00	81.40	81.30	80.90	80.60
Difference (m)	2.60	2.30	2.70	3.00	3.40

Remarks : Records of water level are those of El Gaafra Kila 34.

CHAPTER 4 OUTLINE OF THE PROJECT

4-1 Objectives of the Project

The objectives of the project are as follows;

Short-term objectives

1) To secure reliable and stable water source for irrigating the farmland of 7,535 feddans (3,165 ha).

2) To cope with additional irrigation demand by changing the cropping pattern.

3) To secure more farm cash income through expansion of cultivation area of sugarcane, wheat and other convertible cash crops.

Medium and long-term objectives

1) To avoid the outflow of population from the project area and to promote agriculture in the project area.

2) To contribute to the country's food self-sufficiency.

3) To contribute to the national economy.

4-2 Study and Examination of the Request

(1) Review of Appropriateness and Necessity of the Project

In Upper Egypt, most of agricultural areas depend on pump irrigation system. Lack of irrigation water will be experienced due to the deteriorated/old pump stations and affect major crop cultivation such as sugarcane and wheat. Because of these factors, the Ministry of Public Works and Water Resources has accorded top priority to this rehabilitation program.

Upon completion of the project, 4,300 farm households will obtain benefits from 7,535 feddan (3,164 ha), in which stable water will be supplied throughout the year when pumps are renovated. Also, renovation of pump facilities and equipment and supply of spare parts will result in decrease of expenditure for repairing and replacement of equipments. Maintenance of pump facilities will be well improved and power cost will be reduced when 2 pumps are fully operated.

When cropping intensity from present 169% to 200% is increased, the extension of cropping area for cash crops such as sugarcane, fruit trees and vegetables will be expected to obtain the following economic and social effects.

1) To obtain incremental agricultural benefits of 5,200 tons from 78,800 tons to 84,000 tons in the project area.

2) To activate regional industries to the area by means of absorption of surplus labor in processing and treatment of agricultural products.

Under the above conditions, the project is viable for a grant-aid assistance in order to deal with farmer's needs rapidly. In respect of environmental aspect, stable water supply throughout the year would give rich vegetation as well as conserve the forest resources for Egypt, and hence improve the natural and social environments of the country.

(2) Review of Implementation Plan of the Project

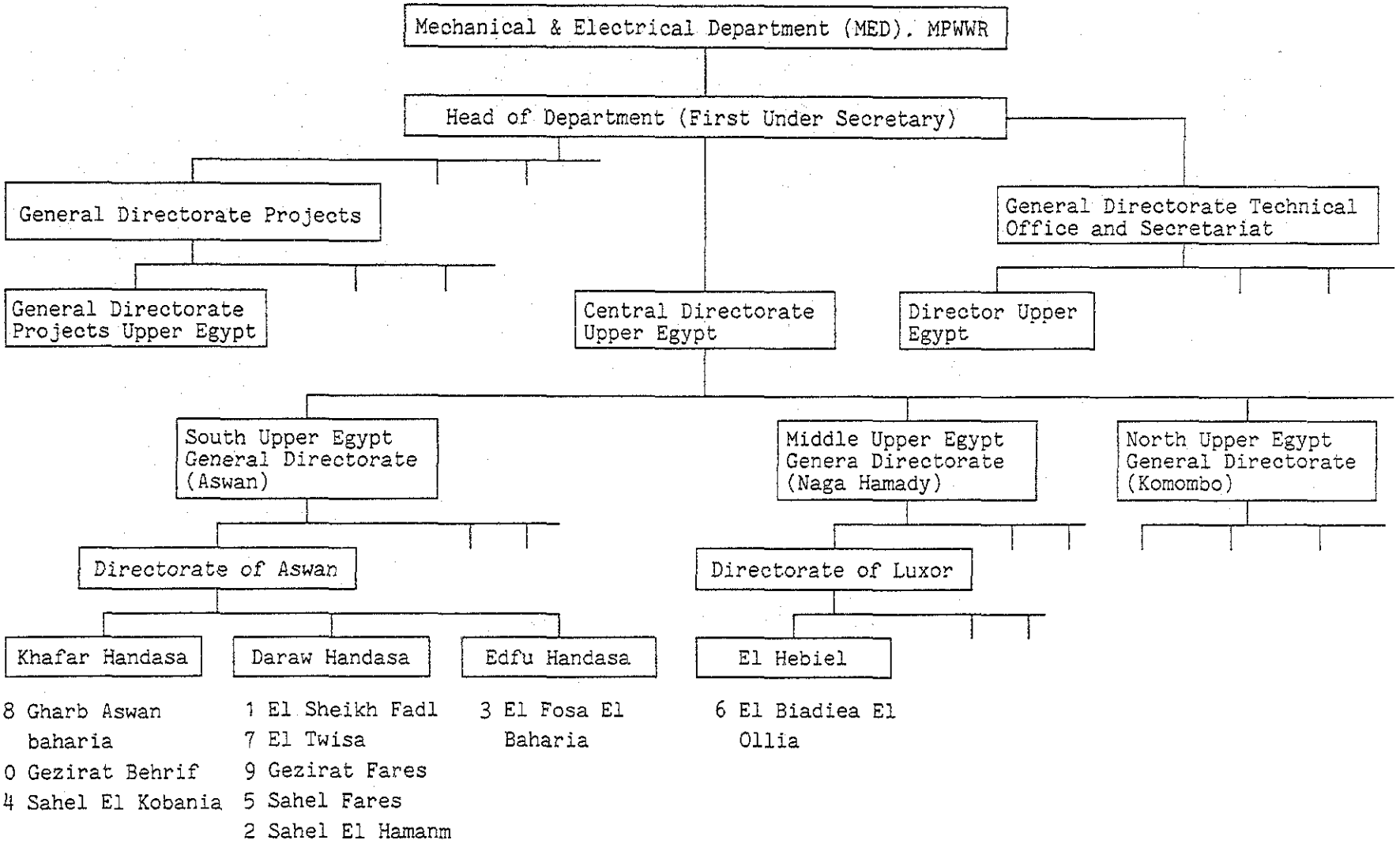
1) Implementation Agency

There are two organizations which will act as the implementing agency of the project viz., the 9 pump stations will be executed by the Directorate of Aswan which manages Khafar, Daraw, Edfu, administration and technical offices called "Handasa". Khafar, Daraw, Edfu offices will be directly responsible for each station as shown in Figure 4-1. The remaining one pump station (No.6 station) will be executed by the Directorate of Luxor which manages El Hebiel Handasa.

In each pump station, about 10 skilled workers under the supervision of an engineer will be operating the pump stations. Skilled workers who have a long experience in the operation and maintenance are maintaining the stations in good conditions. Thus, through the introduction of new equipment and materials they would master operation and maintenance in view of their capabilities in operation.

The day-to-day record of operation of each station is being kept at respective Handasa and from Handasa to the regional office once a month after classifying well the records. When problems arise, Handasa will send the technical staff in due course of time to take necessary measures and in case of serious problem, the Directorates or regional office will give support by sending their staffs to the respective Handasa.

Figure 4-1 Organization Chart of the Project



2) Budget Allocation

The operation and maintenance cost for the 10 pump stations in 1990 amounted to LE 1.21 million. This included maintenance, electrical power & fuel, wages & salaries, oil & grease as well as repair cost. Based on the cost for the 9 pump stations in charge of the Directorate of Aswan, each annual increasing rate from 1987 to 1990 was obtained as follows;

Year	Operation and Maintenance Cost (unit : LE 1,000)	Growth Rate
1987	246	-
1988	327	1.33
1989	438	1.34
1990	598 (612)	1.37

Remarks: Figure in parenthesis shows the cost for No.6 station in Luxor.

Based on the above figures, the cost is expected to increase yearly.

a) Cost allocated by the Egyptian side

The cost allocated by the Egyptian side for internal transportation and installation is approximately LE 60,000. This cost accounts to 4 % of the total operation and maintenance cost for 10 stations and will be covered by the budget allocated to MED.

b) Operation and Maintenance Cost

The operation and maintenance cost required for the project will be composed of the same items as the current ones.

MED will take charge of the local budget allocated for this project after implementation of the project. As mentioned in 4-3(4) "Operation and Maintenance Plan", the operation and maintenance cost is estimated at LE 1.35 million. Based on the increasing rate for 4 years, an amount of LE 1.63 million will be allocated by the Egyptian government. On this basis, no additional budget will be required for operation and maintenance.

(3) Review of International Cooperation related to the Project

Pumping Stations Rehabilitation Project II formulated by the World Bank is the only similar project in Upper Egypt.

This World Bank project includes the rehabilitation of 50 pumping stations, of which 19 stations are located in Upper Egypt.

There is no overlap between the World Bank project and the present project. Features of rehabilitation covering 19 stations are summarized as follows;

Item	Number of Stations
New Station replacing Existing	1
Replace Floating with Land-based	9
Equipment Replacement only	3
Spare Parts and Repair only	4
Electrification of Cranes	1
New Cranes	1
Total	19

The disbursement schedule is projected over a seven-year period from 1991 to 1997.

(4) Review of Project Components

The major component of the project is the irrigation facilities which included pump equipment, discharge tower, discharge pipeline, discharge pond and canal. These facilities excluding pump equipment could be used in order to deliver irrigation water even after the completion of the project, although these are already deteriorated.

(5) Review of Requested Equipment and Materials

1) Selection of the Pump Station

In Upper Egypt, 36 floating pump stations covering 18,710 feddan (7,858 ha) were installed. Out of these stations, 10 stations were selected by the Egyptian government. Based on the field survey, following facts were confirmed:

a) Operation and maintenance cost is increasing year by year due to deterioration of equipment. Annual amount of water discharge is only 50 to 60 % of the initial design capacity. Farmers are dissatisfied due to lack of irrigation water. Consequently, 10 stations will require rehabilitation/renovation of equipments urgently.

b) Provision of an access road to the site as well as acquisition of land for construction are difficult. Furthermore, the stations cannot be easily replaced with land-based types due to small scaled-irrigation areas.

c) The Egyptian government requires only a low cost and short period of construction viz., by simple installation of pump facilities and easy operation using the existing electrical power lines.

Considering the above facts, selection of pump stations is considered to be justifiable.

2) Irrigation Area

The proposed irrigation area based on the request covered 18,030 feddan (7,573 ha), however, only 7,535 feddan (3,164 ha) was determined after the field survey and considering the data obtained from the Aswan Irrigation Department.

3) Advantages of Floating Pump

Comparison of floating pump with other fixed-type pump was made as shown in Table 4-1, taking into account advantages and disadvantages on river conditions, topographic conditions, structure, operation, maintenance and pump efficiency. Based on this comparison, floating pump has more advantages than the other types of pump, particularly in respect to topographical adaptability and construction cost. Moreover, the floating pump can be used for the fluctuation of the water level of the Nile River with maximum 3.4 m.

On the other hand, MED considers that the existing floating pump stations covering small irrigation areas should be rehabilitated. If all these stations are replaced with land-based types, it will take 20 years to complete the whole construction. This long construction period will not meet the farmers' urgent needs for water supply.

4) Equipment and Materials

Equipment and materials requested by the Egyptian side are floating pump equipment and connecting pipes up to discharge tower.

Table 4-1 Comparison of Pump Type

	Item	Floating Pump	Incline Pump	Vertical Pump	Horizontal Pump
1.	River Condition				
(1)	Fluctuation of Water Level	A	A	A	C
(2)	Flood Water Level	B	A	A	B
(3)	Flow Velocity	B	A	A	A
(4)	Minimum Water Level	A	B	B	C
2.	Topographic Condition				
(1)	Cross Section of River	A	B	C	C
(2)	Erosion of River Bank	A	C	B	B
(3)	Sediment	A	C	C	B
(4)	Pump Foundation	A	B	C	B
3.	Structure				
(1)	Total Cost	A	B	C	B
(2)	Durability	A	B	B	A
(3)	Scale of Capacity	B	B	A	A
4.	Operation & Maintenance				
(1)	Operation	C	A	A	B
(2)	Maintenance	B	C	B	A
5.	Pump Efficiency				
(1)	Cavitation	A	B	B	C
(2)	Load	B	A	A	B
(3)	Fluctuation of Discharge	B	A	A	B

Remarks) A : Optimum B : Common C : not suitable

Floating pump equipment consists of pumps, motors, priming pump, valves, switchboards, power and control cables between panel to motors, barges and spare parts. As shown in Figure 4-2, double suction volute pumps connected directly with motors are mounted on the barge.

Existing floating pump stations have been operating for the past 40 to 60 years. These stations are superannuated therefore water and oil leakage, vibration, and unusual noise occurs at most parts of the equipment. Pumps were driven by diesel engines during the initial stage, but have been driven by electric motors for the past 11 years. Pumps and motors were imported from many countries and facing difficulties due to various types of equipment and spare parts. Valves are also superannuated and worn out, occurring water leakage through the shaft. Switchboards are provided with on-off switches, ammeters, and voltameters. Electric cables are not covered properly.

Barges with old-types and damaged floors are unstable due to unbalanced allocation of equipment mounted on bases of diesel engines. Roof and wall and cranes are necessary for protecting of equipment and materials from sand storm and for inspection and repairing.

Discharge pipes from a discharge tower are also old and water leakage is found at connecting points. The internal sections of discharge pipes are worn away with dust and loss of water head become high. According to the survey result, discharge pipes are temporarily available except those of No.6 station.

As shown in Appendix 5.6, the capacities of pipelines at No.6 station are so small which measures only 700 mm and 1000 mm diameters. The total head requires 56 m and pumps 950 kw of power. Velocity of flow in pipelines exceed more than 3 m/s and safety of pipes itself can not be kept. Therefore, it is necessary to replace present pipelines and change the pipe route as shown in Appendix "Outline of Newly Required Pipelines" in order to deliver required water discharge by reducing the total head and power.

The present situation of each pump station listed in Table 3-1 indicates that the capacities of pump actual head and motor vary greatly.

As a result of studies, an efficient operation of pumps and reduction of maintenance cost can not be obtained by replacement of only a part of equipment. Therefore, renovation of the whole pump stations and discharge pipes upto discharge tower is considered justifiable.

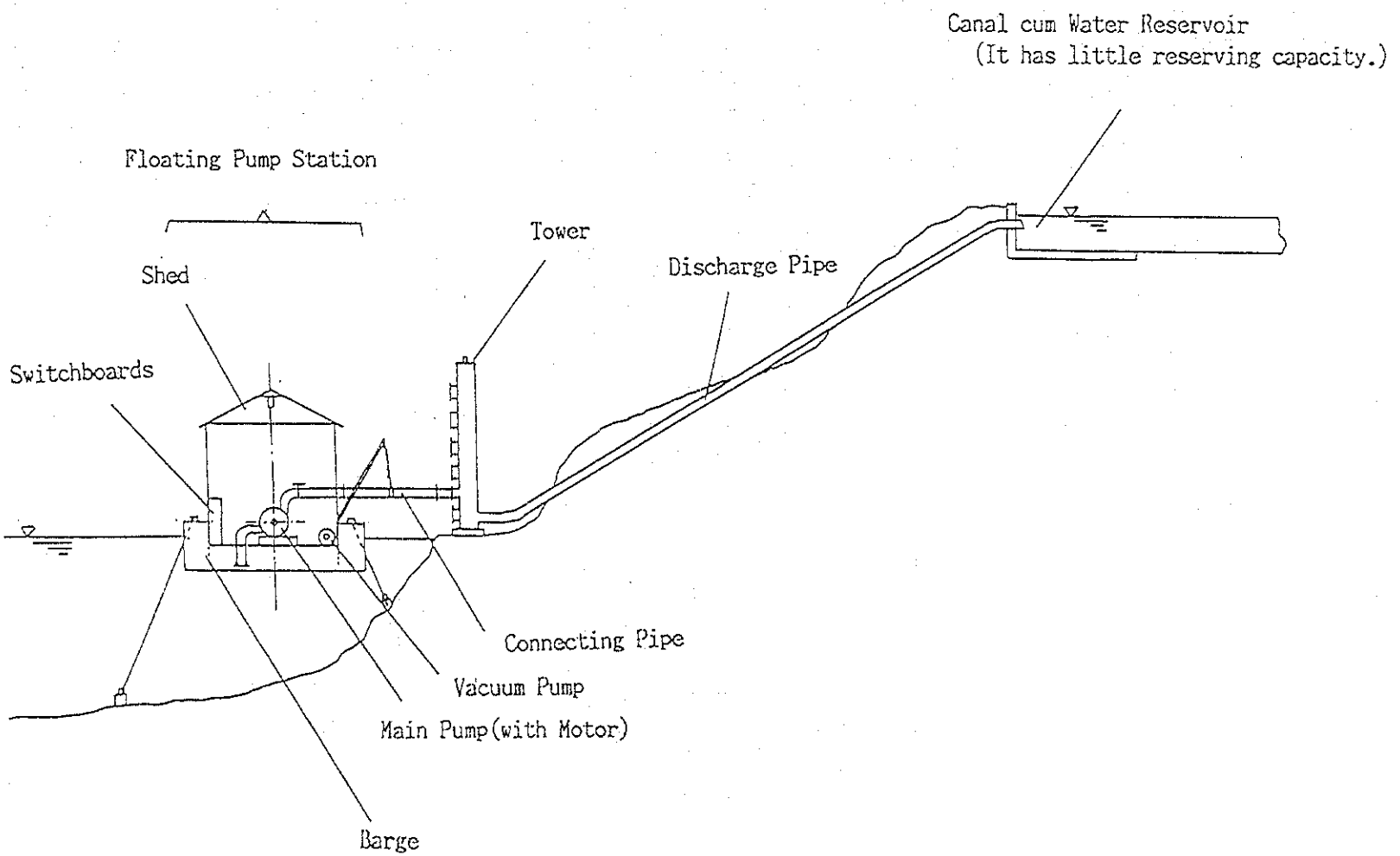


Figure 4-2 Present General Layout of Floating Pump Station

5) Workshop, Floating Dock Repair and Tug Boat

The World Bank Project mentioned in paragraph 4-2 would carry out upgrading of MED workshop facilities, overhauling of the existing Aswan floating dock and two tug boat engines. This World Bank Project will strongly support the operation and maintenance when the project is implemented.

(6) Review of the Need of Technical Cooperation

Technical cooperation related to the project was not clearly mentioned in the request. Toward this, MED emphasized during the field survey the need of technical cooperation on installation and operation of new pump facilities.

Pump operators who engages in the existing floating pump stations for 20 years have carefully maintained those super-annuated facilities which had been manufactured in 1930s and 1950s. However, these operators will not be well acquainted with the method of operation, repair and inspection on new equipment. Therefore, technical training of a responsible personnel in the Directorate of Aswan will be necessary in Japan. A trainee should understand the overall operation and maintenance method of a pump. Based on this understanding, the trainee will master causes and remedies for troubles of the pump.

Water management technology on overall irrigation systems including irrigation canal, gate and field will be required for efficient use of new pumps by the project.

The project implementing agency, MED, would strengthen software programs on water management as well as maintenance of equipment through technical training.

(7) Basic Principle for Implementation of Cooperation

The project aims at improvement of agricultural productivity, economic activities of Upper Egypt and contribution to the national economy through acceleration of farmers' needs and self-subsistence effort in production by obtaining the stability of water supply.

As described above, the training and enforcement of personnel will be supported through technical cooperation.

Based on the above studies, the project is considered appropriate to be implemented, taking into consideration the economic and social viabilities of the project.

4-3 Outline of the Project

(1) Executing Agency and Management

1) Executing Agency

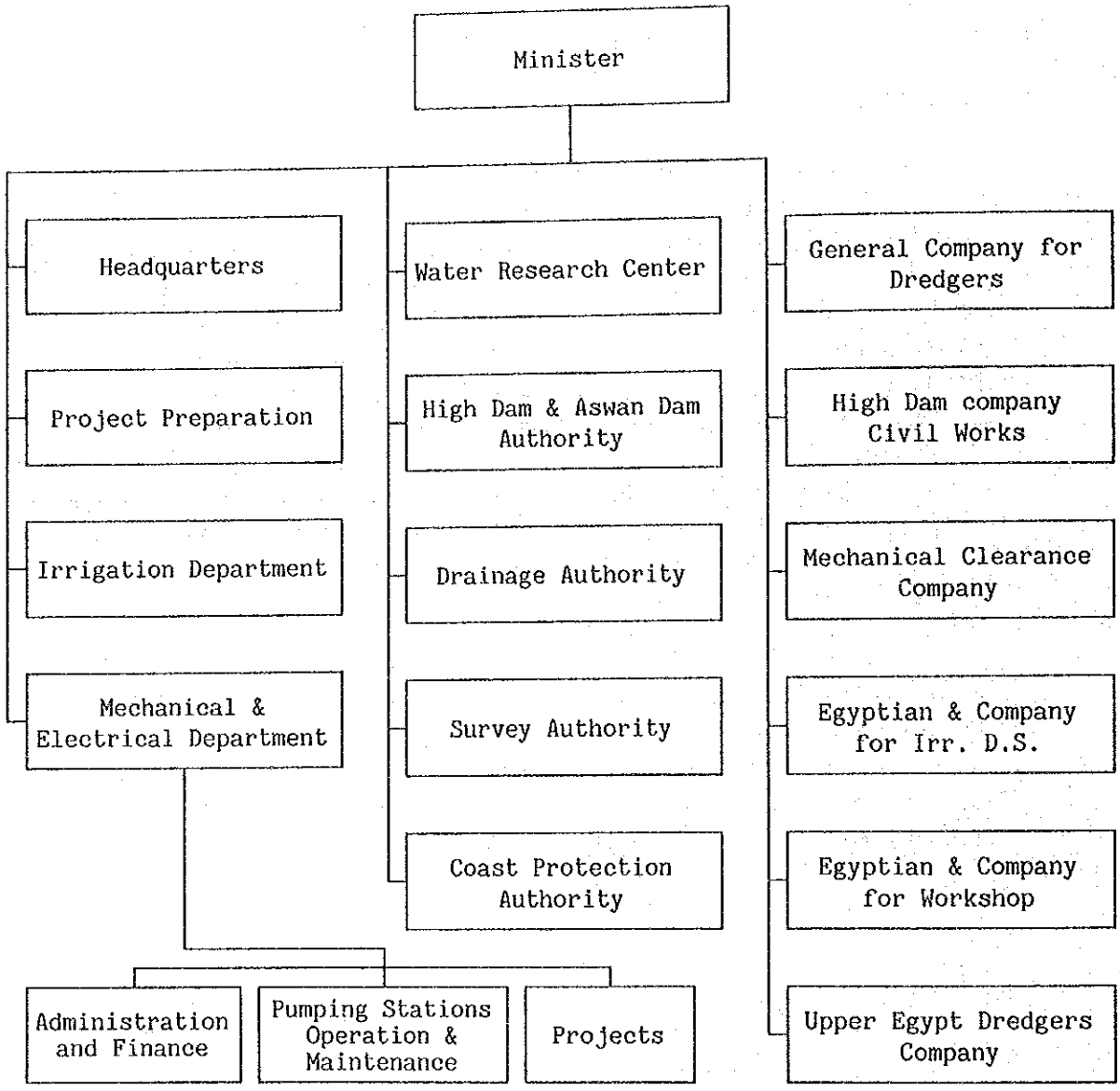
The Mechanical and Electrical Department (MED) of the Ministry of Public Works and Water Resources (MPWWR) is the direct executing agency of the project. MPWWR is solely responsible in administering all the services related to irrigation in Egypt (The Organizational Chart of MPWWR is shown in Figure 4-3). MED is only taking charge of construction, operation and maintenance of pump stations in the entire country. The central organization and pump stations is under the Head of Department (First Under Secretary). The Central Directorate of Upper Egypt manages the three regional offices in Upper Egypt (South, Middle and North) under which Directorates of Aswan and Luxor manage 10 pump stations of the project (please refer to Figure 4-1).

2) Management

Out of the 10 pump stations of the project, the Directorate of Aswan which manages Khafar, Daraw and Edfu Handasa administration and technical offices will takes charge of 9 pump stations. While the Directorate of Luxor manages El Hebiel Handasa, which controls one pump station related to the project. The number of personnel allocated to each Directorate and Handasa is shown in the following;

Office	Engineer	Staff	Total
Directorate of Aswan	4	66	70
Khafar Handasa	1	112	113
Daraw Handasa	2	173	175
Edfu Handasa	2	159	161
Directorate of Luxor	3	53	56
El Hebiel Handasa	1	82	83

Figure 4-3 Organization of the Ministry of Public Works and Water Resources



An engineer and about 10 other staffs will be assigned to each pump station from the above allocated personnel.

(2) Plan of Irrigation Project

The objectives of the irrigation project are to conduct stable water supply to the agricultural field covering 7,535 feddan (3,165 ha) through the year and to increase the agricultural production. The proposed crops are maize, vegetables, berseem as summer crops, wheat, beans, vegetables, berseem as winter crops, sugarcane, fruit trees as perennial crops, considering the present cultivated crops. Typical cropping pattern and cropping intensity applied for the project is as follows;

Cropping Pattern	Crop Intensity(%)
Summer Crop	
Maize	37
Vegetables	4
Berseem	13
Others	21
Winter Crop	
Wheat	47
Beans	2
Vegetables	5
Others	21
Perennial Crop	
Sugarcane	12
Fruit Trees	13

Total 175……excluding perennial crop
(200)……including perennial crop

(3) Outline of Facilities and Equipment

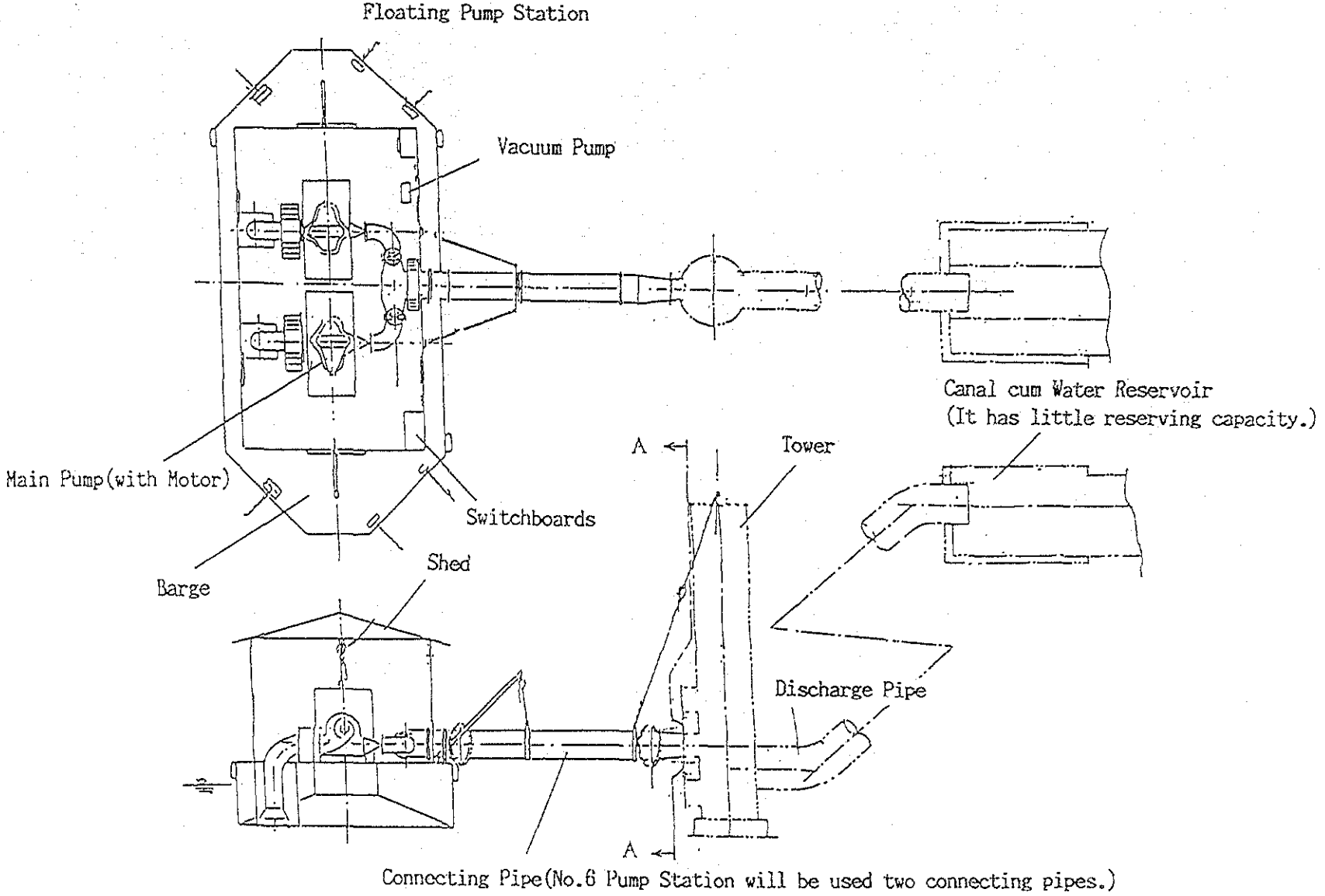
General plan of pump facilities and equipment is shown in Table 4-2 and Figure 4-4.

Table 4-2 Summary of Pump Planning

NO. and Name of Pump station	Pump capacity per one set (m^3/s)	Number of Pump (set)	Total Capacity of Pump (m^3/s)	Actual Head observed (m)	Total Head Loss computed (m)	Total Head (m)	Total Head planned (m)
1. El Sheikh Fadl	0.25	2	0.5	9.8	2.18	11.98	12
2. Sahel El Hamam	0.15	2	0.3	8.8	1.49	10.29	12
3. El Fosa El Baharia	0.15	2	0.3	7.5	1.51	9.01	12
4. Sahel El Kobania	0.35	2	0.7	8.0	2.97	10.97	12
5. Sahel Fares	0.5	2	1.0	7.3	2.75	10.05	12
6. El Biadiea El Ollia	1.3	2	2.6	21/16.4	6.98	27.98	28
7. El Twisa	0.25	2	0.5	8.6	2.22	10.82	12
8. Gharb Aswan Baharia	0.5	2	1.0	8.2	2.75	10.95	12
9. Gezirat Fares	0.5	2	1.0	6.0	6.00	12.00	12
10. Gezirat Behrif	0.35	2	0.7	9.0	2.77	11.77	12

Remarks: (1) Actual Head is based on the measurement of head by the study team.

(2) Total head planned means estimated total head loss. In case of No.6 station, computation of loss is based on the proposed pipeline.



Remarks: Scope of procurement is within the A-A in the Drawing.

Figure 4-4 General Plan

(4) Operation and Maintenance Plan

After the implementation of the project, operation and maintenance of 10 pump stations will be executed under the organization and staff allocated mentioned in paragraph 4-3 (1) "Executing Agency and Management". Renovated pump stations will be maintained and operated in accordance with the following manner.

1) Type, structure and efficiency of the pump should be understood at the time of implementation. This understanding will help daily maintenance and finding of unusual noises from the pump. Each Handasa should provide technical specifications of pump facilities, operation manual, instruction manual of equipments, list of spare parts, lubricating oil and daily operation.

2) Daily Operation

When pumps are installed, a daily check list should be prepared, and results of checking and constant repair be made in accordance with the items to be checked such as suction head, discharge head, discharge, current, voltage, electric power, suction water level, vibration etc.

3) Provision of spare parts, packing, lubricating oil, and tools.

4) Maintenance of pump

When pumps are also installed, the following items with short intervals should be checked periodically in order to maintain its fitness of each equipment and stability of barges and pipe fitting:

one month	:	check the alignment of the direct coupled pump and prime mover and lubricating oil
three month	:	change the lubricating oil of bearings, supplement grease, and measure vibration and noise
six month	:	change the grease in bearings and packing.

one year : disassemble, check and clean each machinery such as pump, valve, speed change gears, motor and auxiliary

Operation and maintenance cost excluding replacement cost was estimated at LE 1,335,000. Compared with the current cost of LE 1,211,000, the repair cost will be decreased.

Operation and Maintenance Cost

(Unit: LE)

Item	Cost	
	Current	Project
Maintenance	6,000	7,000
Electric power	649,000	960,000
Wages and salary	227,000	264,000
Lubricating and oil	3,000	4,000
Checking and repairing	325,000	100,000
Total	1,210,000	1,335,000

The above current cost represents the actual expenditure in 1990 and the cost for project was estimated, as shown in Appendix 5.7.

4-4 Technical Cooperation

In order to execute the project efficiently, the following technical cooperation will be required:

1) Training of one engineer who will be engaged in operation and maintenance (viz., method of operation, regular inspection and repair).

2) Training of one engineer for water management and facilities on water magement technology of the whole systems covering pump station, canal, field.

CHAPTER 5 BASIC DESIGN

5-1 Design Concept

Taking into account the natural conditions of the project area as well as characteristics of this project, the following design concepts are to be applied.

(1) Natural Conditions

The Project area is located on the southern part of Egypt and each pump station is floating on the Nile river which flows through the desert. The temperature is very high and drastically changes during all year-round. Sandstorm occurs once a month in the project area. and there is little rainfall through the year. The water flow of the Nile River have been regulated for the past 30 years. The fluctuation of the water level is approximately 3 meters during the year.

The following concepts are to be undertaken:

a) Pump station should be equipped with shed with wall for protecting equipment,
b) Wall sheds have large openings (windows, etc.) to introduce natural breeze and ventilation as much as possible,
c) Shed should be designed so as to protect from direct sunlight,
d) Upper ventilation should be provided to cope with the severe heat exposure.

(2) Procurement of Equipment and Materials

Since equipment and materials are not available in Egypt and that the structures will be made in one pump house, such equipment and materials, therefore, be procured from Japan.

(3) Operation and Maintenance Capabilities of the Implementing Agency

The implementing agency (MED) recognizes its importance of pump stations in the project area and employ 7 to 8 operators for each station including many skilled workers who have long years experience on pump station. MED will manages four workshops and two maintenance docks for repair and maintenance on floating pumps in Upper Egypt.

This project will be designed taking into consideration the compatibility and availability of maintenance and in accordance with the MED's capabilities of operation and maintenance.

(4) Equipment and Materials of Pump Stations

Equipment and materials will be selected based on the general plan of pump facilities and equipment as described in paragraph 4-3.

(5) *Implementation Schedule*

This project calls for procurement of equipment and materials. Equipment and materials for each station will be installed in one pump house. Ten (10) pump stations will be divided into 5 types in terms of scale of the pump. However, the manufacturing as well as assembling and test run period before the shipment will require about 6 to 8 months.

Based on these conditions, it will be difficult to procure equipment and materials for 10 pump stations simultaneously in one fiscal year. Therefore, it is required to procure them into 2 phases.

5-2 Study on the Design Criteria

(1) Criteria and Standards of Specifications

Following criteria and standards will be applied for designing the equipment and materials:

a) Japanese Industrial Standards.... (JIS)	To select material and design of pump, motor, switchboard, barge etc.
b) The Standard of the Japanese..... Electrical Committee (JEC) The Standard of Japan Electrical Manufacturers' Association (JEM)	Electrical equipment such as motor and switchboard.

Furthermore, hull structure of barge will be provided according to Rules for the Survey and Construction of steel ships, issued by Nihon Kaiji Kyokai.

The flange of the connecting pipe shall be conformed to the Deutche Industrie Norman (DIN), therefore, the suction end of the tower is made based on the DIN Standard.

(2) Scale of Pump

As a result of studies on the contents of the request, scale of pump is determined as follows;

1) Water Requirement

a) Cropping Pattern

Data on present cropping patterns in summer and winter seasons for recent three years from 1989 to 1991 are obtained from agricultural cooperatives under the Ministry of Agriculture in Aswan. Among those data, the typical cropping patterns in No.1 and No.9 floating pump stations are available which will be applied for other pump stations.

b) Unit Water Requirement (U)

Unit water requirement of each crop is estimated in accordance with those in Upper Egypt provided by the Ministry of Public Works and Water Resources.

c) Service Area (A)

Service area irrigated by each pump station is based on data presented by the Irrigation Department in Aswan, except those of No.8 and No.9 stations which are obtained from the existing cultivated areas in summer season, during peak water requirement based on the statistics prepared by agricultural cooperatives under the Ministry of Agriculture.

d) Irrigation Efficiency (E)

The following ratio used in FAO and ICID was applied in estimating the overall irrigation efficiency taking into consideration the irrigation conditions of each pump station.

Field application efficiency	(Ea)	=0.65 (furrow)
Distribution efficiency	(Ed)	=0.55~0.65 (varies depending upon canal structure and maintenance condition)
Overall irrigation efficiency	(E)=(Ea)*(Ed)	=0.36~0.40

e) Pump Operation Hours

Pump operation hours are 16 hours per day. (two shifts)

f) Water Requirement at Pump Station (WR)

Water requirement at each floating pump station is computed by the following equation:

$$WR=U*1/E*24/16*A$$

2) Scale of Pump

All pumps will be renovated under this basic design plan. In case of No.6 station, deficit of capacity, 1.30 cu.m/s will be supplemented by the existing floating pumps.

The total pump capacity is given in Table 5-1 in order to cover water requirements as well as the interchangeability among floating pump stations in terms of supply of spare parts and operation and maintenance; namely, the pump capacity is grouped in nearest capacity as much as possible. Two sets of pump are provided at each station from the following viewpoints.

a) Water will be delivered to the service area depending upon seasonal variation of irrigation water requirements.

Table 5-1 List of Proposed Pumping Stations

Name of Floating Pump Station	Service Area (feddan)	Water Requirement (m^3/s)	Total Pump Capacity (m^3/s)	Unit Pump Capacity (m^3/s)	Number of Pump (set)	Type of Pump
1. El Sheikh Fadl	310	0.49	0.50	0.25	2	B
2. Sahel El Hamam	200	0.30	0.30	0.15	2	A
3. El Fosa El Bahria	150	0.25	0.30	0.15	2	A
4. Sahel El Kobania	400	0.66	0.70	0.35	2	C
5. Sahel Fores	630	0.92	1.00	0.50	2	D
6. El Biadiea El Ollia	3,800	3.90	3.90 1/	1.30	2	E
7. El Twisa	290	0.46	0.50	0.25	2	B
8. Gharb Aswan Baharia	660	0.97	1.00	0.50	2	D
9. Gezirat Fares	620	0.91	1.00	0.50	2	D
10.Gezirat Berif	475	0.69	0.70	0.35	2	C

Remarks : Figures of service area were obtained from Aswan Irrigation Department, except those of No.8 and No.9 stations which are based on the existing cultivated areas. (Ref: Statistics by agricultural cooperatives under the Ministry of Agriculture in Aswan).

1/ : Deficiency of capacity (3.90-2.60) 1.30 cu.m/s will be supplemented by the existing floating pumps.

Type of Pump : A 0.15 $m^3/S \times 2$ sets B 0.25 $m^3/S \times 2$ sets

C 0.35 $m^3/S \times 2$ sets D 0.50 $m^3/S \times 2$ sets

E 1.30 $m^3/S \times 2$ sets

b) Electricity cost can be saved through the year.

c) Maintenance of one set of pump for inspection and repair.

3) Stand-by Pump

A stand-by pump has not been provided under this basic plan due to the following reason:

a) Two sets of pump are provided at each station.

One set of pump will be operated at each station while the other set will serve as a stand-by pump.

b) In case one set of pump malfunction during the peak operation, the other set of pump can supply 50 % of peak water requirement. Moreover, by extending the pump operation from 16 hours to 24 hours, 75 % of the peak water requirement will be supplied. Planted crops will not be affected under this condition.

c) In case two sets of pump malfunction at the same time, the existing floating pumps are to be available for stand-by pumps.

4) Calculation Criteria of Total Head and Required Power

The following formula are used for calculating the total head and required power.

a) Calculation of Total Head

$$H = Ha + Hl$$
$$= Ha + hl + V^2/2g$$

$$hl = f \times \frac{L}{D} \times \frac{V^2}{2g}$$

$$f = f \times \frac{134}{C^{1.85}} \times \frac{1}{D^{1/6} \times V^{0.15}}$$ ……William and Hazan's formula

Where,

H: Total head (m)
Ha: Actual head (m)
Hl: Total loss of head (m)
hl: Loss of head of pipe (m)
L: Overall length of pipe (m)
D: Diameter of pipe (m)

V: Velocity of flow (m/s)
g: Acceleration of gravity (m/s^2)
f: Coefficient value
c: Constant which varies with conditions

b) Required Power

Calculation of Shaft Horsepower

$$L = \frac{0.163 \times Q \times H \times r}{g/100}$$

Where,
Q: Capacity (m^3 /min)
H: Actual head (m)
r: Specific weight of pumped liquid
Specific weight of natural water is equal to one (1).
g: Pump efficiency
Pump efficiency is usually used 85%.

Power Required for Prime Mover

$$P = L(1 + A)/nt$$

Where,
P: Power required for prime mover
L: Pump horsepower
A: Excess
Excess of motor is usually used 0.1 - 0.2
nt: Transmission efficiency
Transmission efficiency of shaft coupling is usually used 1.0.

Designed total head and power required of each pump facility is shown in Table 5-2.

5) Pump Type and Material used for Pump

Volute pump having double suctions and a low center of gravity is determined, considering the conditions to be installed on a barge. As to the materials to be used for pump, pump shaft and sleeves will be made of stainless steel, taking into consideration a water quality, easy inspection, repair and procurement of spare parts.

Table 5-2 Pump Design, Total Head & Power Required

Pump Station No,. Name	No. of Pump	Capacity (m^3/s)	Actual Head (m)	Surroun-dings of Pump	Connecting Pipe	Tower	Discharge Pipe	Discharge Velocity	Calculated Total Head	Designed Total Head	Designed Dia. of Pipe(mm)	Designed Power required(kw)
1.El Sheckh Fadl	2	0.5 (0.25×2)	9.8	1.0	0.1	0.15	0.60	0.33	11.98	12.0	Φ350	45
2.Sahel El Haman	2	0.3 (0.15×2)	8.8	1.0	0.1	0.15	0.2	0.04	10.29	12.0	Φ300	30
3.El Fosa El Baharia	2	0.3 (0.15×2)	7.5	1.0	0.1	0.15	0.2	0.06	9.01	12.0	Φ300	30
4.Sahel El Kobania	2	0.7 (0.35×2)	8.0	1.0	0.1	0.15	1.4	0.32	10.97	12.0	Φ450	55
5.Sahel Fares	2	1.0 (0.5×2)	7.3	1.0	0.15	0.15	1.1	0.35	10.05	12.0	Φ500	80
6.El Biadiea El Ollia	2	2.6 (1.3×2)	21/16.4	1.0	0.1	0.4	5.21	0.27	27.97	28.0	Φ700	460
7.El Twisa	2	0.5 (0.25×2)	8.6	1.0	0.1	0.15	0.63	0.34	10.82	12.0	Φ350	45
8.Gharb Asban Baharia	2	1.0 (0.5×2)	8.2	1.0	0.15	0.15	1.1	0.35	10.95	12.0	Φ500	80
9.Gezirat Fares	2	1.0 (0.5×2)	6.0	1.0	0.15	0.15	3.4	1.3	12.0	12.0	Φ500	80
10.Gezirat Behrif	2	0.7 (0.35×2)	9.0	1.0	0.1	0.15	1.2	0.32	11.77	12.0	Φ450	55

(3) Prime Mover

All pump stations are supplied with sufficient capacities of electricity. Motor will be selected as the prime mover, and the method of connecting to the pump shaft will be a direct coupling taking into consideration the cost reduction for inspection, operation and maintenance. Pump and motor will be installed on one common bed.

The type of motor will be a totally-enclosed fan-cooled type taking into accounts consideration for the natural conditions, viz., the sites have high temperature and have heavy sandstorm once a month.

(4) Barge

1) Deck area

Minimum deck area is determined as deck area in consideration for working, operating and maintaining as ease. One meter width and seventy centimeter width of room will be required for working and operating space and maintenance space respectively.

2) Freeboard

Considering maximum wave height and flow of the Nile River, 700 mm is determined as a free board.

3) Full Load Draught (length from load water line to plate keel)

Full Load Draught is determined based on calculation of buoyancy. It is the length which generate the buoyancy equal to the total weight including facilities and equipment on the barge and the barge itself. However, considering balance of the barge, the place of the gravity center of the total weight will be put in the lower position so as to be strong against height of wave, water flow and wind pressure.

4) Hull structure is referred to from the Rules for the Survey and Construction of Steel Ships, Part Q Steel Barges, Nippon Kaiji Kyokai.

The main standards of this structures are as follows:

a) Thickness of Bottom Shell Plating
Not less than 4.7S Root (d+0.035L) + 2.5 (mm)
Minimum Thickness 0.04L + 5.6 (mm)

Where:
s: Spacing of transverse frames (m)
Standard spacing: S = 2L + 450 (mm)

L: Length of Barge (m)
d: Load Draught (m)

b) Thickness of Side Shell Plating
Not less than 4.1S Root (d+0.04L) + 2.5 (mm)
Minimum Thickness 0.044L + 5.6 (mm)

c) Thickness of Deck Plating
Not less than 1.47S Root (f) + 2.5 (mm) (longitudinal beams)

Where:
S = Spacing of longitudinal beams
h = Deck load (kN/m^2)

d) Other Rules

Chapter 23 of the Rules stipulates that the requirements of this Chapter are applicable to the barges intended to be classified as Limited Services.

Shell plating (including plate keel): Smooth water, Minimum 6mm.

Calculation of Buoyancy

TYPE	L	W	Total weight (WO)	Required depth (dl)	Designed (d)
A	13m	5.5m	Approx. 30t	0.42m	0.8m
B	14m	6.5m	Approx. 40t	0.44m	0.8m
C	18m	7.5m	Approx. 70t	0.52m	0.9m

Where:
L = Length of Barge (m)
W = Width of Barge (m)
dl = Required depth (m)
d = Designed Load Draught
WO = Total Weight including facilities, equipment and barges.

Following formula is applied for calculating the buoyancy:

$$dL = \frac{\text{Total Weight (WO) (t)}}{\text{Deck Area (m}^2\text{)}} \quad \text{(m)}$$

Wherein, Freeboard is determined 0.7 meter taking consideration conditions mentioned above, the Load Draughts of each barge are designed between 0.8 m and 0.9 m.

Therefore, the sizes of barges will be as follows:

TYPE	L	W	H
A	13m	5.5m	1.5m
B	14m	6.5m	1.5m
C	18m	7.5m	1.6m

Remarks:
TYPE A: Four (4) Pump Stations; No.1, No.2, No.3 and No.7.
TYPE B: Five (5) Pump Stations; No.4, No.8, No.9 and No.10.
TYPE C: One (1) Pump Stations; No.6

5) Shed on Barge

a) Shed will be equipped on the barge for protecting equipment.
b) Manual crane will be equipped on the ceiling of barge for repairing and maintaining the pump and motor.
c) Shed will be of steel frame, which is strong against the weight of pump or motor.
d) Wall will be of water-proof plywood protecting the splash of water.
e) Lighting system for working will be furnished in and out of shed.
f) Receptacles for garage lamp will be equipped at front and back side of shed.
g) Hangers for maintenance tools will be furnished.

(5) Priming Pump

Vacuum pump will be installed when the main pumps started.

This type of pumps serves well for the priming purpose. Also the displacement is large and it does not cause trouble even when it sucks water.

(6) Valves

Valves will be equipped with for the following purposes:

a) To shut off the flow.
b) To reduce the load of the prime mover when starting the pump,
c) To maintain airtight when evacuating by a vacuum pump,
d) To prevent a counter-flow.

(7) Pipes

Pipes from two pumps will be installed to one connecting pipe to simultaneously supply water from two pumps, except No.6 Pump Station.

No.6 Pump Station has a large capacity of water flow and high head of water, therefore, connecting pipes will be provided for pumps respectively.

(8) Switchboard

Switchboard will be of totally-closed type and provided with protecting system against short circuit considering the barge being set.

Also it will be provided with open-close door for maintenance purposed.

(9) Connecting Pipe

Connecting pipe to be used will be flexible rubber hose, to be efficient against vibration and pressure by the wind and wave of water.

(10) Others

Pumps and motors in some sites will be used to be overloaded by the waterweed and aquatic plant through the suction pipe. Grate will be equipped with the suction end for preventing.

5-3 Basic Plan

(1) Equipment and Materials Plan

This project calls for procurement of equipment and materials for irrigation pump stations.

Installation of equipment and materials will be executed by MED. Equipment and materials will be installed on the barge and then transported on the river. Therefore, these equipment and materials should be installed at the proper position, viz., by connecting the pipes of the pump to discharge the tower.

The pipes will then to required to dredge at some site, the river of which is very shallow, as well as to construct the supporting fence against the waterweed and aquatic plant.

Equipment and materials to be procured will be as follows:

Equipment and Materials Plan

PHASE I

No.1 El Sheikh Fadl Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.25 m^3/s Total head: 12m Motor: 45kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 25 mm Motor: 0.75 kw x 2	1 set
-3. Sluice valve	Dia: 350 mm	2 units
-4. Check valve	Dia: 350 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards		1 set

	(with power and control cables between switchboard and motors)		
-7.	Barge (with shed and wall)	13m x 5.5m x 1.5m Height of eaves: 4.0m	1 unit
-8.	Connecting pipe (with ball joint and short exhaust pipe)	Dia: 500 mm, Length: 6m	1 unit
-9.	Spare parts		1 lot

No.2 Sahel El Hamam Pump Station

* Equipment and Materials

	Description	Specifications	Quantity
-1.	Pump (with prime mover)	Double suction volute type, Flow rate: 0.15 m³/s Total head: 12m Motor: 30kw	2 sets
-2.	Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 25 mm Motors: 0.75 kw x 2	1 set
-3.	Sluice valve	Dia: 300 mm	2 units
-4.	Check valve	Dia: 300 mm	2 units
-5.	Pipes and Hoses for pumping suction and delivery		1 set
-6.	Switchboards (with power and control cables between switchboard and motors)		1 set
-7.	Barge (with shed and wall)	13m x 5.5m x 1.5m Height of eaves: 4.0m	1 unit
-8.	Connecting pipe (with ball joint and short exhaust pipe)	Dia: 400 mm, Length: 6m	1 unit
-9.	Spare parts		1 lot

No.3 El Fosa El Baharia Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.15 m³/s Total head: 12m Motor: 30kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 25 mm Motors: 0.75 kw x 2	1 set
-3. Sluice valve	Dia: 300 mm	2 units
-4. Check valve	Dia: 300 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	13m x 5.5m x 1.5m Height of eaves: 4.0m	1 unit
-8. Connecting pipe (with ball joints and short exhaust pipe)	Dia: 400 mm, Length: 6m	1 unit
-9. Spare parts		1 lot

No.6 El Biadiea El Ollia Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 1.3 m³/s Total head: 28m Motor: 460 kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 35 mm Motors: 1.5 kw x 2	1 set
-3. Sluice valve	Dia: 700 mm	2 units
-4. Check valve	Dia: 700 mm	2 units
-5. Pipes and Hoses		1 set

	for pumping suction and delivery		
-6.	Switchboards (with power and control cables between switchboard and motors)		1 set
-7.	Barge (with shed and wall)	18m x 7.5m x 1.6m Height of eaves: 4.0m	1 unit
-8.	Connecting pipe (with ball joints and short exhaust pipe)	Dia: 700 mm, Length: 6m	2 units
-9.	Spare parts		1 lot

No.7 El Twisa Pump Station

* Equipment and Materials

	Description	Specifications	Quantity
-1.	Pump (with prime mover)	Double suction volute type, Flow rate: 0.25 m³/s Total head: 12m Motor: 45 kw	2 sets
-2.	Priming pump (with prime mover)	Suction pumps with one supplementary water reservoir, Pipe dia: 25 mm Motors: 0.75 kw x 2	1 set
-3.	Sluice valve	Dia: 350 mm	2 units
-4.	Check valve	Dia: 350 mm	2 units
-5.	Pipes and Hoses for pumping suction and delivery		1 set
-6.	Switchboards (with power and control cables between switchboard and motors)		1 set
-7.	Barge (with shed and wall)	13m x 5.5m x 1.5m Height of eaves: 4.0m	1 unit
-8.	Connecting pipe (with ball joints and short exhaust pipe)	Dia: 500 mm, Length: 6m	1 unit
-9.	Spare parts		1 lot

PHASE II

No.4 Sahel El Kobania Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.35 m³/s Total head: 12m Motor: 55 kw	2 sets
-2. Priming pump (with prime mover)	Suction pumps with one supplementary water reservoir, Pipe dia: 35 mm Motors: 1.5 kw x 2	1 set
-3. Sluice valve	Dia: 450 mm	2 units
-4. Check valve	Dia: 450 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	14m x 6.5m x 1.5m Height of eaves: 4.5m	1 unit
-8. Connecting pipe (with ball joints and short exhaust pipe)	Dia: 600 mm, Length: 6m	1 unit
-9. Spare parts		1 lot

No.5 Sahel Fares Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.5 m³/s Total head: 12m Motor: 80 kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir,	1 set

	Pipe dia: 35 mm Motors: 1.5 kw x 2	
-3. Sluice valve	Dia: 500 mm	2 units
-4. Check valve	Dia: 500 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	14m x 6.5m x 1.5m Height of eaves: 4.5m	1 unit
-8. Connecting pipe (with ball joint and short exhaust pipe)	Dia: 600 mm, Length: 6m	1 unit
-9. Spare parts		1 lot

No.8 Gharb Aswan Baharia Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.5 m^3/s Total head: 12m Motor: 80 kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 35 mm Motors: 1.5 kw x 2	1 set
-3. Sluice valve	Dia: 500 mm	2 units
-4. Check valve	Dia: 500 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	14m x 6.5m x 1.5m Height of eaves: 4.5m	1 unit
-8. Connecting pipe (with ball joints and short exhaust pipe)	Dia: 600 mm, Length: 6m	1 unit
-9. Spare parts		1 set

No.9 Gezirat Fares Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.5 m³/s Total head: 12m Motor: 80 kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir, Pipe dia: 35 mm Motors: 1.5 kw x 2	1 set
-3. Sluice valve	Dia: 500 mm	2 units
-4. Check valve	Dia: 500 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	14m x 6.5m x 1.5m Height of eaves: 4.5m	1 unit
-8. Connecting pipe (with ball joints and short exhaust pipe)	Dia: 600 mm, Length: 6m	1 unit
-9. Spare parts		1 lot

No.10 Gezirat Behrif Pump Station

* Equipment and Materials

Description	Specifications	Quantity
-1. Pump (with prime mover)	Double suction volute type, Flow rate: 0.35 m³/s Total head: 12m Motor: 55 kw	2 sets
-2. Priming pump (with prime mover)	Vacuum pumps with one supplementary water reservoir,	1 set

	Pipe dia: 35 mm Motors: 1.5 kw x 2	
-3. Sluice valve	Dia: 450 mm	2 units
-4. Check valve	Dia: 450 mm	2 units
-5. Pipes and Hoses for pumping suction and delivery		1 set
-6. Switchboards (with power and control cables between switchboard and motors)		1 set
-7. Barge (with shed and wall)	14m x 6.5m x 1.5m Height of eaves: 4.5m	1 unit
-8. Connecting pipe (with ball joints and short exhaust pipe)	Dia: 600 mm, Length: 6m	1 unit
-9. Spare parts		1 lot