No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
FLOATING PUMP STATIONS
IN UPPER EGYPT (PHASE IV)
IN
THE ARAB REPUBLIC OF EGYPT

AUGUST 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

GRANT AID MANAGEMENT DEPARTMENT

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PREFACE

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

JICA sent to the Arab Republic of Egypt a study team from February 22nd to March 23rd, 2006.

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. Then, a mission was sent to Egypt in order to discuss a draft basic design, and as this result, the present report was finalized.

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

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

August 2006

Masafumi KUROKI
Vice-President
Japan International Cooperation Agency

August 2006

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (Phase Ⅳ) in the Arab Republic of Egypt.

This study was conducted by Sanyu Consultants Inc., under a contract to JICA, during the period from February to August 2006. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Egypt and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Fumimichi OBU
Project manager,
Basic design study team on the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (Phase Ⅳ)
Sanyu Consultants Inc.

Summary

The agricultural sector of Egypt has ever been playing the major role in the national economy by creating employment opportunities and acquiring foreign currency as well as securing food supply to the nation. The sector accounts for 16 % out of 82,924 million US$ of the total GDP in 2003, which placed the third following to the service sector (50%) and the industrial sector (34%).

Agricultural lands in Egypt occupy only 3% of national lands due to limited water resources for irrigation. On the other hand, current self-sufficiency ratios of major crops are achieved only 50% causing a great deal of anxiety for the food security of the nation, from the viewpoint of higher annual increase of population at 2%.

To recover from a slowdown in economic growth, then to gain its momentum speeding up the development path, the Government of Egypt has prepared the 5th Socio-Economy Development Plan (2002/2003 to 2006/2007) under the Plan titled 'Egypt and 21st Century (1997/98 to 2017/2018)', which is the 20 year-plan indicating long term-socio-economic development. In the 5th Plan, the target of the agricultural sector is to modernize agricultural structure, to raise self-sufficiency through increasing domestic production, to improve water resources by rationalizing current water use and applying new irrigation systems and to promote agricultural production for exports. In Upper Egypt having great potential to increase agricultural productivity, it is focused on activation of regional economy based on effective use of water resources by means of augmentation of crop yield and cropping intensity (vertical expansion) in existing cultivated land as well as developing a new available land (horizontal expansion).

Agriculture in Egypt is almost entirely dependent on irrigation from the River Nile where more than thousand pump stations are provided for supplying water for agricultural use. However, since the acute deterioration of the existing irrigation facilities is causing serious decrease of irrigation efficiency, the Government of Egypt has initiated the long-term rehabilitation and improvement project (1997 to 2017) to cope with the water shortage.

There are 103 pump stations along the River Nile in Upper Egypt. Of which 103 stations, 45 stations are designed as floating type pump stations. These floating pump stations can no longer function properly due to deterioration for more than forty years of operation after installation. To recover their function, 26 floating pump stations had been rehabilitated during the year 1991 to 1993, 1996 to 1998 and 2003 to 2004 under the Japan's Grant Aid Project, entitled the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (phase-1, phase-2 and phase-3). However,

remaining pump stations are still unimproved. The subject nine (9) pump stations of the project have especially declined its function due to deterioration and caused shortage of irrigation water. Therefore, those stations require urgent replacement and improvement of equipment.

The Government of Egypt recognized remarkable impacts through the former Grant Aid Project implemented in three phases and requested the government of Japan to carry out the rehabilitation project for the nine (9) pump stations and procurement of one (1) self-mobile maintenance ship, taking into consideration urgency for improvement and higher benefit.

In response to the request from the Government of Egypt, Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team from February to March 2006 and discussed with officials concerned to confirm the contents of the request and visit the sites to survey current irrigation conditions and operation and maintenance system of the nine (9) pump stations. As a result, the study team confirmed serious deterioration and declination of the function of the eight (8) pump stations which are affecting the stable supply of water to farmlands as well as the necessity for urgent improvement through the field survey. As for requested self-mobile maintenance ship, the ship is excluded from the scope of project. Instead, self-reliance of the government of Egypt is expected with full use of maintenance barge procured in phase-3 project. After the basic design works in Japan, the Draft Report Explanation Team was dispatched to Egypt to explain and to confirm the contents of the basic design with Egyptian officials concerned.

The objective of the project is to supply necessary pump equipment for improvement of eight (8) pump stations, in order to improve irrigation water supply caused by deterioration of the pump stations in the eight (8) areas. Outputs expected by the project are;

- Pumps are continuously operated in required periods for irrigation (sustainability),
- Irrigation water to meet demands corresponding to vertical expansion of farmlands is delivered from pump stations (quantitative improvement); and
- Driven power is effectively transferred to pump (qualitative improvement).

Those outputs will lead stable irrigation water supply to the farmlands, stable regional agricultural productivity and improvement of living standard of people in the areas.

The major components of the Project include replacement of pump stations, connection pipes, discharge towers, discharge pipes and discharge canals and rehabilitation of irrigation canals. The scope of the Project is planned to rehabilitate eight (8) pump stations until connection pipes which are used for connecting pump stations to discharge towers. Because of serious deterioration of the eight (8) pump stations, all of the existing facilities will be replaced with new ones. Scale of the

planned pump stations could be determined based on irrigation water requirement taking into account irrigation time, irrigation efficiency, characteristics of the beneficial area and farmer's intention on cropping under agricultural policy.

The Egyptian side shall implement rehabilitation of the remaining facilities such as discharge tower, discharge pipes, power transformers and irrigation canals. Implementing agency of the Project is MED of MWRI. However, construction, rehabilitation and O&M of irrigation canals at the downstream will be demarcated to the Irrigation Department of MWRI.

The general specifications of the facilities and equipment determined by the basic design are given as follows:

Irrigation Areas and Specifications of Pump Stations

(No.) Pump Stations	Irrigation Area (feddan)	General Specification of Pumps	
		Capacity (m^3/s) × units	Total Head (m)
(27) Gezeret El-Kobania Kebly	175	0.25 × 2	9
(29) Sahel El-Akab Bahary	440	0.35 × 2	10
(30) Gezeret Meneha	200	0.25 × 2	9
(31) El-Sarag	200	0.15 × 2	7
(32) Gezeret El-Fawaza El-Keblia	250	0.25 × 2	9
(33) Middle Fawaza	210	0.15 × 2	7
(34) Gezeret Abo Arafa	180	0.25 × 2	6
(35) El-Hegs El-Mostagda	600	0.55 × 2	11

The main equipment and materials for each pump stations are consisting of the following items:

Floating pump stations

pump equipment ・・・main pump, main electric motor, vacuum pump, discharge valve, check valve, suction & discharge pipes, control panel, connection pipe (including ball joints)

barge ・・・barge (with roof & wall), hoist, hand winch, bollard

Fixed pump station

pump equipment ・・・main pump, main electric motor, vacuum pump, discharge valve, check valve, suction & discharge pipes, control panel

pump house ・・・prefabricated materials

The implementation period for the project is estimated as shown below:

Procedures	Period (month)
Implementing Planning	3.5
Manufacturing • Procurement	11.5

The total project cost was estimated at 828 million Japanese Yen (share to Japanese side at 742 million Yen and Egyptian side at 86 million Yen)

The definite effects by the implementation of the project are expected as follows:

(1) Direct effect

1) Current pump efficiency at 30 to 40 % will be improved to 80%.
2) Total discharge delivered by eight (8) pump stations will be increased by 24 % of the current discharge at 28.6 million m^3/year.
3) Crop production will be increased by 27% of the current annual production at 19,500 tones.
4) O&M cost per unit volume of supply water by pump stations will be decreased.

(2) Indirect effect

1) Live stock number owned by farmers will be increased due to stable produce of feed crop.
2) Agricultural income of farmers will be increased.

O&M General Directorate of Upper Egypt (in Idfu) and O&M General Directorate of South Upper Egypt (in Kom Ombo) are responsible for execution and operation of the pump stations of the project under MED. Pump stations in Upper Egypt region have been managed and operated well for a long time. The present staffs have implemented the phase-1, phase-2 and phase-3 projects and their technique has improved. Thus, MED is capable of O&M by the existing organization under current budget. Hence, this project is evaluated feasible and viable as a Grant Aid Project of Japan.

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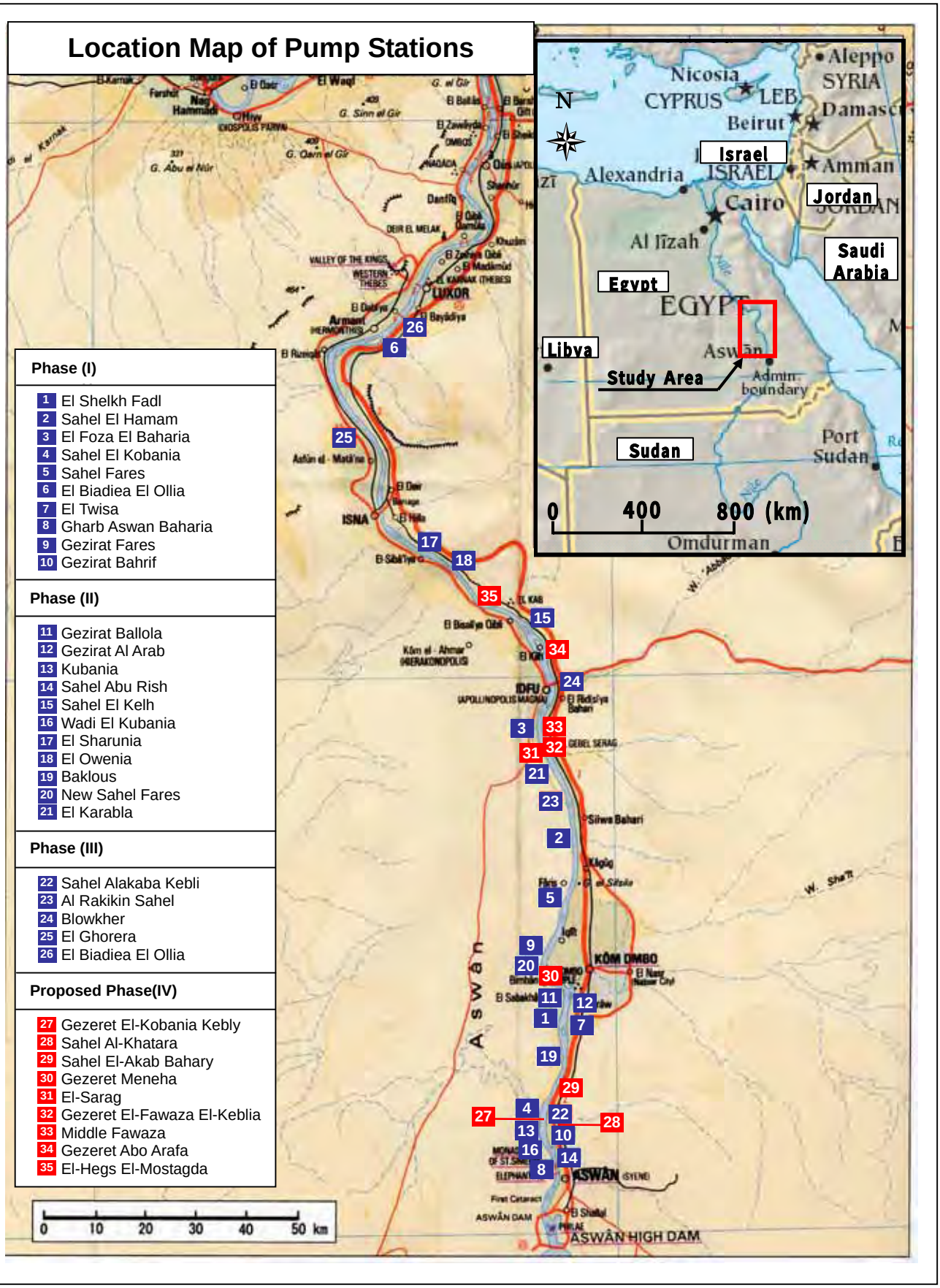
Location Map of Pump Stations



Phase (I)

1. El Shelkh Fadl
2. Sahel El Hamam
3. El Foza El Baharia
4. Sahel El Kobania
5. Sahel Fares
6. El Biadiea El Ollia
7. El Twisa
8. Gharb Aswan Baharia
9. Gezirat Fares
10. Gezirat Bahrif

Phase (II)

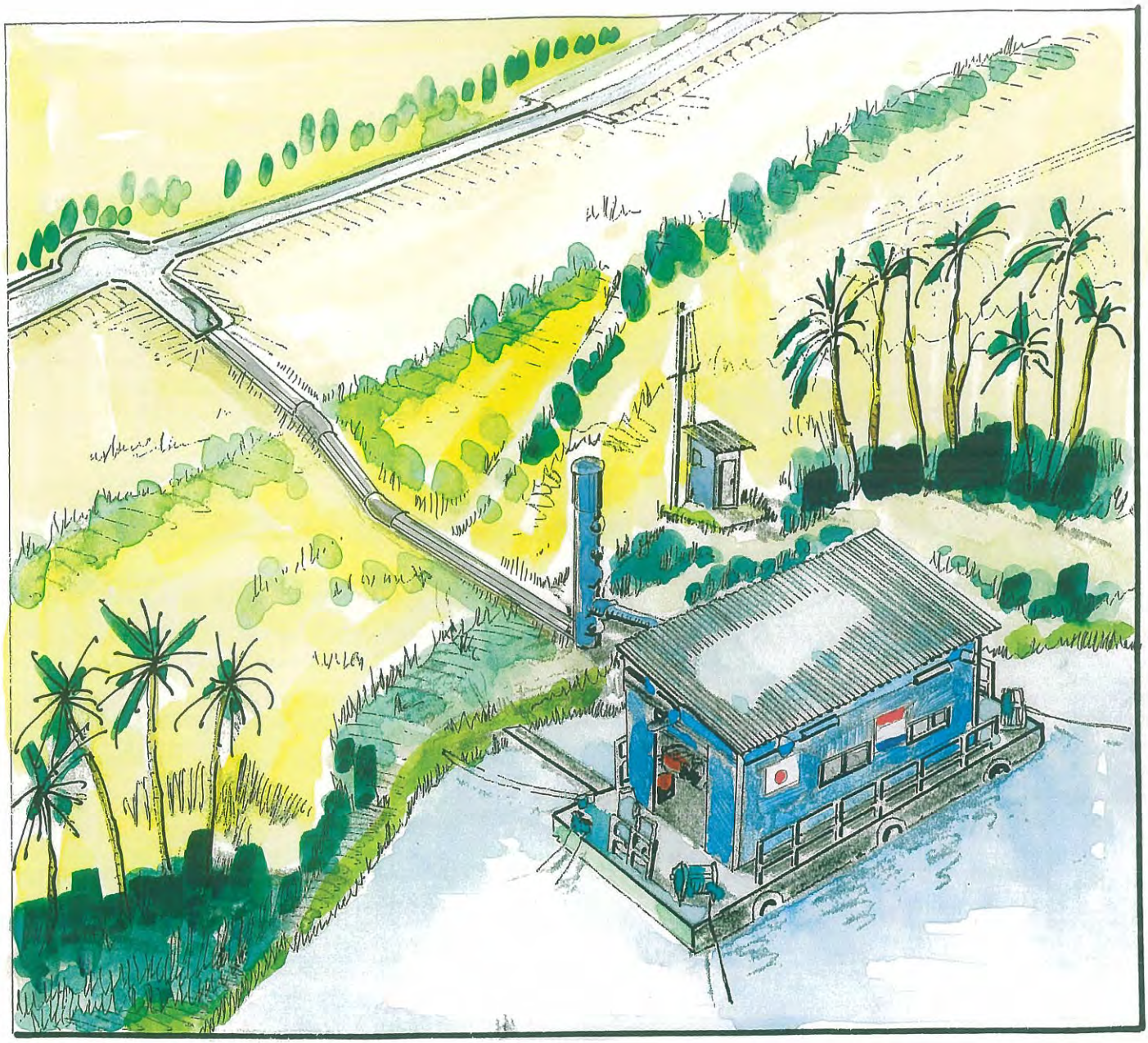
11. Gezirat Ballola
12. Gezirat Al Arab
13. Kubania
14. Sahel Abu Rish
15. Sahel El Kelh
16. Wadi El Kubania
17. El Sharunia
18. El Owenia
19. Baklous
20. New Sahel Fares
21. El Karabla

Phase (III)

22. Sahel Alakaba Kebli
23. Al Rakikin Sahel
24. Blowkher
25. El Ghorera
26. El Biadiea El Ollia

Proposed Phase(IV)

27. Gezeret El-Kobania Kebly
28. Sahel Al-Khatara
29. Sahel El-Akab Bahary
30. Gezeret Meneha
31. El-Sarag
32. Gezeret El-Fawaza El-Keblia
33. Middle Fawaza
34. Gezeret Abo Arafa
35. El-Hegs El-Mostagda



Perspective

The Project for Rehabilitation of
Floating Pump Stations in Upper Egypt
(Phase IV)
Arab Republic of Egypt

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ABBREVIATIONS

AC	Agricultural Cooperatives
ARE	Arab Republic of Egypt
CAMPAS	Central Agency for Public Mobilization and Statistics
FAO	Food and Agricultural Organization
GNP	Gross National Product
GDP	Gross Domestic Product
AHD	Aswan High Dam
ID	Irrigation Department
IDir	Irrigation Directorate
JICA	Japan International Cooperation Agency
MED	Mechanical and Electrical Department
MALR	Ministry of Agriculture and Land Reclamation
MWRI	Ministry of Water Resources and Irrigation
MFA	Ministry of Foreign Affairs
O/M or O&M	Operation and Maintenance
WMRI	Water Management Research Institute (WMRI)
WUA	Water User's Association

Units

cm	centimeter	℃	centigrade
cu.m	cubic meter	cms (m^3/sec)	cubic meter per second
fed.	feddan (= 0.42ha)	ha	hectare (=2.38 fed.)
hr	hour	kg	kilogram (=1,000 gram)
km	kilometer	km^2	square kilometer
lit	liter	lit/sec	liter per second
m	meter	MCM	million cubic meter
mg/lit	milligram per liter	meq/lit	milliequivalent per liter
m/s	meter per second	ppm	parts per million
t	ton (1,000 kg)	%	percent

Currency

LE	Egyptian Pound
Pt	Egyptian Piaster (1 LE = 100 Pt)
Yen or J¥	Japanese Yen
US$	US Dollar

Exchange Rate（June 2006）

LE	= ¥20.395
LE	= US$5.738
US$	= ¥117.44

Glossary

Sakia	Water wheel to lift water by animal to field ditch from lateral canal
Ardab	Weight unit for agricultural products (differing by products) 1 ardab = wheat (150kg), lentils (160kg), maize (140kg), sesame (120kg)
Meska	Small irrigation field canal constructed by the farmers themselves

Chapter 1 Background of the Project

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Agriculture in Egypt is almost entirely dependent on irrigation from the River Nile where more than thousand pump stations are provided for supplying water for agricultural use. However, since the acute deterioration of the existing irrigation facilities is causing serious decrease of irrigation efficiency, the Government of Egypt (GOE) has initiated the long-term rehabilitation and improvement projects to cope with the water shortage.

In Upper Egypt, there are 103 pump stations along the River Nile and out of them 45 stations are the floating type pump stations, which do not properly function due to aged deterioration and of more than forty years in operation after installation. Under such circumstances, GOE requested the government of Japan (GOJ) to entrust the rehabilitation project in Upper Egypt under Grant Aid. 26 floating pump stations were already rehabilitated as phase-1 (the year of 1991 to 1993, 10 stations), phase-2 (the year of 1995 to 1998, 11 stations) and phase-3 (the year of 2003 to 2004, 5 stations) to recover the function of the pump stations. Following these projects, GOE is planning to rehabilitate the remaining pump stations necessary for urgent rehabilitation due to frequent malfunction and water shortage for irrigation.

While, the Mechanical and Electrical Department (MED) of the Ministry of Water Resources and Irrigation (MWRI), the implementation agency of the project, has adequate know-how and skill on O&M of floating pump stations. And when repairing pumps, they must tow to the workshop on the River because of lack of access roads to the River Nile from main roads. This causes a long repairing period with troubles on farming due to non-availability of irrigation water when necessary.

Under the said conditions, GOE requested GOJ to implement a rehabilitation project of floating pump stations under the Japanese Grant Aid Scheme.

The contents of the request are as follows;

- Procurement of the equipments necessary for the improvement of the nine (9) pump stations, and
- Provision of a maintenance ship (self-mobile type) and O & M equipments

According to the request letter, beneficial area, capacity and unit of pumps necessary for each pump stations are as follows;

Table 1 Contents of the Request

(No) Pump Stations	Irrigation Area (feddan)	Specification of Pumps	
		Capacity (m^3/s) × units	Total Head (m)
(27) Gezeret El-Kobania Kebly	175	0.25 × 2 units	13
(28) Sahel Al-Khatara	2,000	1.35 × 2 units	23
(29) Sahel El-Akab Bahary	440	0.35 × 2 units	13
(30) Gezeret Meneha	200	0.23 × 2 units	11
(31) El-Sarag	200	0.15 × 2 units	16
(32) Gezeret El-Fawaza El-Keblia	250	0.23 × 2 units	12
(33) Middle Fawaza	150	0.15 × 2 units	10.6
(34) Gezeret Abo Arafa	180	0.25 × 2 units	13
(35) El-Hegs El-Mostagda	600	0.35 × 2 units	13
Maintenance Ship equipped self-mobile device	—	14m × 4.8m ×1.8m	-

Note. (1feddan 0.42 ha, 1ha=2.38 feddan)

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Objectives of the Project

To recover from a slowdown in economic growth, then to gain its momentum speeding up the development path, GOE has made the decision to set the target year of 2022 for the long-term socio-economic development plan titled 'Egypt and 21st Century'. The definite strategies of the Plan are ①to conserve natural resources and direct urban growth towards desert land, ②to reduce steadily current population growth rate, ③to achieve high and sustainable GDP growth, ④to remove gradually balance of payments deficit, ⑤to alleviate poverty and attenuate income disparities, ⑥to develop human capital and attain full employment and ⑦to improve social services.

Based on this long-term socio-economic development plan, GOE has prepared the 5th Socio-Economy Development Plan (2002/2003 to 2006/2007), in which the target of the agricultural sector is to modernise agricultural structure, to raise self-sufficiency through increasing domestic production, to improve water resources by rationalizing current water use and applying new irrigation systems and to promote agricultural production for exports. The project will be implemented in connection with the said ① to ③ and the development strategies of the agricultural sector in the 5th Plan.

The objectives of the project are to improve eight (8) pump stations in Upper Egypt, which require urgent implementation and to supply stable irrigation water. Outputs expected by the project are;

1) Pumps are continuously operated in required periods for irrigation (sustainability),
2) Irrigation water to meet demand corresponding to vertical expansion of farmlands is delivered from pump stations (quantitative improvement), and
3) Driven power is effectively transferred (qualitative improvement).

Those outputs will lead stable irrigation water supply for the farmlands, stable regional agricultural production and improvement of living standard of people in the areas.

2-1-2 Outline of the Project

The project will be implemented in Aswan Governorate in Upper Egypt to achieve the targets mentioned-above. The following eight (8) pump stations will be improved and rehabilitated.

・No.27　Gezeret El-Kobania Kebly floating pump station (keeping floating type)
・No.29　Sahel El-Akab Bahary floating pump station (keeping floating type)
・No.30　Gezeret Meneha fixed pump station (changing fixed type into floating type)
・No.31　El-Sarag fixed pump station (changing fixed type into floating type)
・No.32　Gezeret El-Fawaza El-Keblia fixed pump station (changing fixed type into floating type)
・No.33　Middle Fawaza fixed pump station (keeping fixed type)
・No.34　Gezeret Abo Arafa floating pump station (keeping floating type)
・No.35　El-Hegs El-Mostagda floating pump station (keeping floating type)

The project will secure stable irrigation water supply to the farmlands, raise regional agricultural production and improve living standard of the people in the areas. In addition, the project will contribute to improvement of food balance of the country and increase of agricultural production, which are stated in the national development targets.

The project is composed of equipment procurement necessary for replacement of eight (8) pump stations.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Criteria on Basic Conditions

In order to enhance the efficient use of water resources focusing primarily on rehabilitation of the deteriorated pumping functions, the basic design study aims to confirm the necessity of the rehabilitation at nine (9) pump stations. Scope and design policy of the project to rehabilitate targeted pump stations is made based on the following considerations.

1) Principally scope of the project is limited to rehabilitation of the deteriorated existing pump stations. Through the inspection of existing equipment and materials in detail regarding the levels of deterioration, frequency of breakdown and loss of pumping functions, the necessity of rehabilitation would be confirmed. If existing equipment is evaluated as functional, they should be continuously used without replacement. In addition, consistency with existing facilities as well as convenience of operation and maintenance should be taken into consideration for design of equipment and materials.

Definition on rehabilitation of pumping functions

Definition on the rehabilitation of pumping functions should be considered depending upon the various viewpoints. From the consumers' view, it is to increase the pumping capacities so as to meet the maximum water demands required for the desirable cropping pattern for the farmers. On the other hand, from the suppliers' view, it is to enable the pump to provide irrigation water to beneficial areas at the designed capacity of pumps.

2) Within the nine (9) existing pump stations in the study area, five (5) stations are of floating type and four (4) stations are of fixed type. According to the request letter for Japan's Grant Aid Assistance submitted by MED, it was stated to rehabilitate all the nine (9) pump stations into floating type. However, based on the specific conditions such as topography, width of the River Nile, fluctuation of water levels, the past changes of the pump station type from floating type to fixed type and the necessity to secure the navigation routes for large-scale cruising ships, it is recommended that one (1) pump station (No. 33 Middle Fawaza) should be kept as fixed type and others are to be replaced to floating type.

3) Since No.28 Sahel Al-Khatara pump station has been rehabilitated in 1999 with the bilateral loan and grant aid from Swiss Government, the two (2) sets of volute pumps and wound type motors are still functional and in good conditions and possible to utilize continuously. However, even though there are two (2) pumps installed, only one (1) pump can be operated due to the insufficient capacity of the discharge pipeline from the discharge tower to the discharge canal with a flap valve at the length of 550m. Accordingly, irrigation water cannot be sufficiently delivered to the commanded areas. After the complete installation works of the new pipeline on parallel with

the existing pipeline, the existing pump station can be utilized properly without rehabilitation of the pump station. Therefore, this pump station will be excluded from scope of the project.

4) Regarding No.33 Middle Fawaza pump station, since the works of dismantle of pump equipment and pump house materials, foundation, installation and test-run are planned, the temporary pump unit will be introduced by Egyptian side during the work period to compensate water supply.

5) Three (3) existing fixed type pump stations namely; No.30 Gezeret Meneha, No.31 El-Sarag and No.32 Gezeret El-Fawaza El-Keblia pump stations, will be dismantled and not be used in parallel with renewed floating pump stations.

6) Command areas of the pump stations are determined by current irrigated areas supplied by existing pump stations namely; the total of original irrigation planning areas set in 1980's when pumps had been installed and the expanded areas by December 2003 when the request letter was submitted.

7) The planned cropping patterns are set by adapted water balance between demands and supplies in irrigated command areas, considering farmers' intention through interviews and government agricultural policy based on the current crop pattern in each command area. Due to the geographic condition, land reclamation of cultivated area is rather difficult in the project areas. Since horizontal expansion is quite limited in the project areas, it should consider vertical expansion in terms of soil fertility preservation and introduction of cash crops for planning of cropping patterns.

8) The project will cover floating pump stations, connection pipes, discharge towers, discharge pipes, discharge canals and irrigation canals. Scope of works for Japanese side is rehabilitation of floating pump stations and connection pipes. From discharge towers, the Egyptian side is responsible for implementation of necessary rehabilitation works. With regards to the fixed type pump station, the government of Egypt is responsible for the dismantle of the existing facilities, foundation work and installation of the discharge pipes, and Japanese side is responsible for the procurement of pump sets, inner plumbing system including valves, suction pipes, control panel and materials for the pump house.

9) Standards of equipment are based on Japan Industrial Standard (JIS) applied for pumps, pipelines and materials for barge; applied for electric equipment such as motors and control panels is Japan Electrical Committee (JEC) and Japan Electrical Manufacturers Association (JEM); and applied for hull structure and design of the barge is Rules of Nippon Kaiji Kyokai (Rules for the Survey and Construction of Steel Ships and Steel Barges) as the same standards are applied for phase-1 to-3 projects.

10) Although a self-mobile maintenance ship is requested for appropriate operation and maintenance and reduction of time required for repairing, the ship is excluded from scope of the project. At first, GOE shall make maximum efforts to fully utilize maintenance ship procured in phase-3 project as well as the minor maintenance of ships possessed by MED.

11) Means of procurement is determined based on the criteria such as quality, terms of assembling, after-sale-service, etc. For setting the periods required for manufacturer's design, manufacturing, assembling, transporting and installation of pumps and barges, the most appropriate means should be decided including phasing of the project.

2-2-1-2 Criteria on Natural Conditions

(1) Consideration for High Temperature and Storm

The maximum temperature reaches 51℃ in summer in Upper Egypt. Moreover, sandstorm called "*Hamseen*" occurs in March to April. The following considerations are to be given;

1) Use of heat-insulated wall materials and equipment to shade from direct sunshine to lower temperature,
2) Adequate ventilation to emit the heat from induction motors by facilitating sliding doors and windows,
3) Prevention from the sandstorm,
4) Deterioration of paint materials on walls and sliding doors caused by direct sunshine, and
5) Avoid installation period from March to April.

Since all pump stations under phase-1 to phase-3 projects are sufficiently designed under the above matters, phase-4 project will also apply the same consideration.

(2) Consideration on Water Flow of the River Nile

1) Fluctuation of Water Level

The maximum and the minimum water level of the River Nile varied from two (2) to four (4) meters. Therefore, total head of the pumps and its shaft power of induction motors should be flexible for the changes of water levels, and connection flanges of the water tower are adjustable in horizontal levels according to the fluctuation of water levels.

2) Waterweeds

Pumps should be protected at suction parts from weeds and plastic wastes flowing in the River Nile so as to maintain the pumping performance.

3) Surges and Water Flow

Large-scale cruising ships frequently navigate in the River Nile between Aswan and Luxor, causing surges as the height of 0.3 to 1.0 m. Since the velocity at the upper stream in Aswan area reaches at 0.3 to 0.5 m/s, the fixing methods of barge should be considered.

4) Water Quality

Potential of hydrogen (pH) of water in the River Nile becomes lower toward the downstream due to pollution. It shows pH 8.1 to 8.4 at Aswan and pH 7.4 to 7.8 at Idfu surveyed in March, 2006. Since water quality shows almost neutral at the project areas, acid durable materials are not required for impellers, shafts and casing of pumps. The major problem in water quality for pumps is small sand particles as Suspended Solid (SS) in order to wear-out of rotating parts. Some pump stations are located in sand sedimentation islands in the river. Therefore, it is necessary to consider materials of shaft sleeves to protect main shafts and supply of other spare parts such as grand packing.

2-2-1-3 Criteria on Social Conditions

In the project area, since floating pump stations are the only irrigation water resources, frequent stoppage or long term suspension of pump operation due to breakdown should be avoided. Also, current operation and maintenance system should be carefully considered.

(1) Criteria on Current Operation and Maintenance System

In the current system, in order to manage pump stations, regional offices of MED or their branch offices send mechanical/electrical maintenance team after receiving the request from the pump station supervisor. The technical abilities of supervisors staying around pump stations affect maintenance status of pump equipment, therefore, capacity building for supervisors as well as the roles of regional and branch offices should be considered in the project.

(2) Criteria on Operation of Pumps

In terms of the operation period of pump stations, irrigation engineers in each area appointed by Irrigation Department provide written notices and order daily operating hours of pumps to the supervisors. In order to confirm and evaluate the situation of actual operation, it is recommended to be equipped with cumulative hour meters on the control panels of pump stations.

2-2-1-4 Criteria on Determination of Scale and Grade of Equipment

(1) Type of Pump Station

The types of pump stations will be either of floating type and fixed type. Technically floating type has more advantages than fixed pump type:

- It can correspond to fluctuation of water level and can avoid cavitations due to change of suction head.
- It is easy to install at the site.
- It does not require land acquisition.
- It is easy to maintain.

However, the fixed type should be applied for the site at narrow width of the river due to obstacle for navigation of ships with technical consideration against cavitations.

Table 2-1 Evaluation on Types of Pump Stations

Item		Current Situation and Issues to be solved	Evaluation		
			Floating Type	Fixed Type	Reasons
1	Adaptability on changes of water levels	It is necessary to cope with seasonal changes of water levels in River Nile, which reaches to approx. 4m. It is recorded the changes can reach up to 1.95m to 4.10m in upper Egypt.	Good	Poor	While floating type equipped on the barge is adjustable on water levels, fixed type is not adjustable on changes of suction head causing cavitations.
2	Difficulty on Installation	For floating type, it is possible to conduct performance tests in Japan and required works at site are only installation of a connection pipe and electrical wring with a control panel.	Good	Poor	While floating type is provided as a complete assembled set and can be easily installed connecting with the flanges of the water tower, fixed type requires the foundation work and the construction work of pump house at site.
3	Necessity for Land Acquisition	Land acquisition is required for fixed type.	Good	Poor	Floating type doesn't require land acquisition, since it is moored on the River Nile.
4	Difficulty on Operation and Maintenance	For complete overhaul of pumping sets, MED workshops are located in Aswan for floating type and in Kom Ombo for fixed type.	Rather Good	Rather Poor	In case of significant troubles and overhauls, floating type can be easily towed to the workshop by tugboat. Also, maintenance barge can deal with the trouble on the water. It is not easy to transport equipment of the fixed type.
5	Prevention from Sedimentation	Sedimentation occurs at banks or bottoms of the pump station.	Rather Good	Rather Poor	Dredging works can be easily conducted by means to move the barge for floating type. However, in the case of fixed type, it is necessary to furnish a suction pit at the stagnant points of river water with well maintenance. No.33, fixed type, is not required a suction pit due to comparatively fast water velocity at 0.4m/s.
6	Obstacle for Navigation of Large Ships	Floating type requires 20 m of allowance from the water tower.	Poor	Good	Since cruising ships often ply the river, a floating pump station can be an obstacle for their navigation.
Overall evaluation			Good	Poor	Floating type is better than fixed type in terms of adaptability for the project, but it has some limitation on navigation of ships.

(2) Necessity for Rehabilitation of Pump Stations

Since the project aims to rehabilitate pump stations, the current situation of equipment should be evaluated regarding deteriorating levels, breakdown frequency and functional depression as a pump station. In case that existing equipment is found to be in good conditions, they should be continuously utilized. The study had been conducted the functional diagnosis of existing equipment,

evaluation of relevance between pump capacity and irrigation command area/ water consumption, the scale of civil/mechanical/electrical works for MED and certainty on implementation within limited work schedule under the Japan's Grant Aid scheme.

Generally all equipment and materials have exceeded their own life greatly and deteriorated except No. 28 Sahel Al-Khatara pump station. Especially the existing fixed type pump stations have suction head at 3.0m or more, which causes cavitations. As the results, the most pump casings and impellers have damages. In addition, as there is no cover, there are dangerous situations for operators to contact with electrical wiring and parts in the control panel during operation and adjustment.

The results of the investigation of the existing equipment showing their deterioration can be summarized in Table 2-2.

Table 2-2 Level of Deterioration of the Existing Equipment

No. of Pump Station	Type	Unit No.	Pump				Motor					Control Panel	Status of Deterioration	Priority of Rehabilitation
			Make	Capacity, Total Head, RPM	Year	Vibra-tion (μm)	Make	Rated Output, RPM	Year	Vibra-tion (μm)	Noise (dB)	Current (A)		
No.27	Floating	No. 1	KBS	0.25m^3/s, 13m, 675rpm	1951	110	Russian	40kW, 735rpm	1965	85	87	68-70-50 (R-S-T)	Vibration on No.1 Unit is extremely huge and unusual noise is detected. These are caused by wear-out on bearing of pump impeller and eccentricity of motor shaft with pump shaft. The different current at each phase may cause deterioration of induction motor. There are risks of electrical short and fire due to poor conditions of control panel and wiring.	Extremely high
		No.2	KBS		1951	25	Abntate	54HP, 975rpm	1978	9	81	62-48-61 (R-S-T)		
No.28	Floating	No. 1	Sulzer	1.35m^3/s, 23m, 500rpm	1951	22	Yaskawa	(Wound type) 600HP, 490rpm	1978	38	78	Not available due to the risk of shock (input is 6,000 V)	Impeller, shaft sleeve and grand packing are replaced in 1999. However, only one unit is operable due to limited diameter of discharge pipes, which may also cause water hammer. The wound type induction motors are operated at 6000V inputs, which may cause shocks to human bodies. The pump station is designed double stage discharge, but it is not required.	Low (Installment of new discharge pipe in parallel)
		No.2	Sulzer		1951	—	Yaskawa		1978	—	—			
No.29	Floating	No. 1	Sulzer	0.35m^3/s, 13m, 1000rpm	1948	60	Reliance	135HP, 985rpm	1965	40	86	100-101-98 (R-S-T)	Motors have been deteriorated, and especially for No.2 motor has huge difference in current among the phases. Water leak is found at pump shaft and sluice valves, which are caused by vibration of pump and motors. Cracks are found at the covers of motors. Impeller can be easily damaged due to absence of a check valve.	High
		No.2	Sulzer		1948	85	Reliance		1965	45	83	105-76-82 (R-S-T)		
No.30	Fixed	No. 1	Sigma	3066GPM, 11m, 960rpm	1950	170	Reliance	60HP, 975rpm	1950	460	92	50 (MCCB)	Vibrations of pumps and motors are extremely large. The shaft of No.1 Unit has eccentric rotation and reamer bolts of the coupling are broken. There is typical noise of cavitations and it suffocates the durability of impeller and casing.	Extremely high
		No.2	Sigma		1950	70	Reliance	60HP, 975rpm	1950	220	90	40 (MCCB)		
No.31	Fixed	No. 1	Sigma	2083GPM, 16m, 1500rpm	1969	55	АСИНХРОННЫИ	40kW, 1470rpm	1969	110	86	80 (MCCB)	No.2 Unit has been not operated for long term due to deterioration of both pump and motor. No.1 Unit also has huge vibration due to the wear of rotor. Since backboard and terminals are not insulated, there is possibility of any electric short accident.	Extremely high
		No.2	Sigma		1969	—	АСИНХРОННЫИ	40kW, 1470rpm	1969	—	—	—		

No. of Pump Station	Type	Unit No.	Pump				Motor					Control Panel	Status of Deterioration	Priority of Rehabilitation
			Make	Capacity, Total Head, RPM	Year	Vibra-tion (μm)	Make	Rated Output, RPM	Year	Vibra-tion (μm)	Noise (dB)	Current (A)		
No.32	Fixed	No. 1	Sigma	3066GPM, 12m, 960rpm	1950	30	Reliance	60HP, 975rpm	1950	90	86	50 (MCCB)	In addition to vibration, remarkable wear-out at pump casing and shaft sleeve is expected due to suction of sand particles in water. Serious cavitations are also confirmed due to the high suction head. These problems cause the declination of the shaft. Since backboard and terminals are not insulated, there is possibility of any electric short accident.	Extremely high
		No.2	Sigma		1950	55	Reliance	60HP, 975rpm	1950	95	91	52 (MCCB)		
No.33	Fixed	No. 1	Sigma	2083GPM, 10.6m, 1500rpm	1969	55	АСИНХРОННЫИ	40kW, 1470rpm	1969	85	88	80 (MCCB)	Vibration of motors indicates deterioration. Abnormal noise is reported when the water level is low. Since some levels of cavitations occur, impeller is often replaced. Since backboard and terminals are not insulated, there is possibility of any electric short accident.	Extremely high
		No.2	Sigma		1969	50	АСИНХРОННЫИ	40kW, 1470rpm	1969	90	87	85 (MCCB)		
No.34	Floating	No. 1	KSB	0.25 m^3/s, 13m, 800rpm	1951	20	ЗВИ	40kW, 735rpm	1969	110	84	88 (MCCB)	The spare parts from Russia are not available, despite motor of No.2 Unit is broken. No. 1 Unit also has huge vibration. It is expected that enough rotation power cannot provide due to the wear of rotors in the motor. Water depth of this pump station is very shallow due to sedimentation, and it is necessary to remove waterweeds in the river bed.	Extremely high
		No.2	KSB		1951	—	СРЕДНЕ	40kW, 735rpm	1965	—	—	—		
No.35	Floating	No. 1	Sulzer	0.35 m^3/s, 13m, 1000rpm	1948	160	Reliance	135HP, 985rpm	1980	27	90	93-100-100 (R-S-T)	Vibration of the pump indicates abnormal levels and some reamer bolts have been removed. It can be caused by the excess power output of motors and decline of shafts. It is assumed that second-hand motors with high capacity had been introduced so as to secure more discharge volume and to adjust the rotation speed.	Extremely high
		No.2	Sulzer		1948	100	Reliance		1980	60	88	96-102-103 (R-S-T)		

Note: (1) Make: KBS (Kleinschanzlin Bestenbosotel GMBH) made in Bremen in the former West Germany; Sulzer Pumps Ltd. made in Switzerland; Sigma Hranice made in Czech; Yaskawa Electric Mfg. Co. made in Japan; Reliance Electric Co. made in Ohio in the U.S.A;3ВИ and СРЕДНЕ, АСИНХРОННЫИ made in former Soviet Union.

(2) Vibration is measured at a shaft of a pump and at a body of a motor. Noise is detected at 1m far from a side part of a motor.

(3) As of pump capacity, 1 impGPM (British imperial gallon per minute) is equivalent to 4.54609lit/min in metric system. Therefore, 2083impGPM is equivalent to 0.1578m^3/sec, and 3066impGPM is equivalent to 0.2323 m^3/sec.

(4) As of rated output of motors, 1 HP is equivalent to 0.746kW in metric system.

(5) Types of motors are three-phase squirrel cage induction motor except No.28.

(6) As of current of control panel, 'R-S-T' shows current at each phase and 'MCCB' (Magnet Control Circuit Breaker) shows current at input cables.

(3) Type and Capacity of Pump

Based on the seasonal water demands of irrigation and seasonal water levels of the River Nile as well as the result of topographic survey, type and capacity of pumps should satisfy the following requirements:

(a) Adaptability on changes of water levels of the River Nile.

(b) Capability on the maximum water demands of irrigation.

(c) In order to minimize costs for power consumption, pump efficiency should perform at the maximum water demands of irrigation between July and September, or design total head should not be taken at exceeding height.

(d) In order to cope with pumping operation flexibly and to meet water demands in winter season, operation of one (1) unit pump should be considered without adjustment by the sluice valve together with the countermeasure for cavitations. For the selection of pumps and motors, their suction capability should be high.

(e) The pumps should be selected by compact size and economical type due to limited space. Therefore, 'horizontal axis double suction single-stage centrifugal pump' is recommended.

(f) Two (2) units of pump sets will be installed to avoid stoppage by breakdown or periodical checks, but stand-by pump set is not installed.

(4) Calculation of Total Head and Required Power Output

Based on the result of topographic survey and water level data indicated by MED, total head and required power output of pump calculated adopting the following formula:

(a) Total Head

The total head is determined by the actual head and head losses with nominal bore, layout of suction and discharge pipes and other design structure. Various head losses can be calculated by sum of the pipeline friction losses, inflow and outflow losses, losses at water tower, losses in bend of discharge pipes, losses of refraction and confluence within the pump station and losses of valves. Pipeline friction loss is applied by Darcy Weisbach Formula for inside pump station and Hazen Williams Formula for discharge pipeline.

$$H = H_a + H_l$$

Where,

H : Total Head (m) H_a : Actual Head (m) H_l : Total Head Loss (m)

Pipeline Friction Loss for Inside Pump Station

$$h_f = \lambda \cdot \frac{L}{D} \cdot \frac{V^2}{2g} \quad \cdots\cdots\cdots\cdots\cdots\cdots \text{Darcy Weisbach formula}$$

Where,

h_f: Head loss (m)

λ: Coefficient of friction loss for steel pipe $\lambda = \{0.0144 + 9.5 / (1000 \cdot \sqrt{V})\} \cdot 1.5$

V: Velocity of water flow (m/s) L: Overall length of pipe (m)

D: Diameter of discharge pipe L g: Gravitational acceleration (m/s^2)

Pipeline Friction Loss for Discharge Pipes

$$h_f' = 10.666 \cdot \frac{Q^{1.85}}{C^{1.85} \cdot D^{4.87}} \cdot L \quad \cdots\cdots\cdots\cdots \text{Hazen Williams formula}$$

Where,

h_f': Pipeline Friction Loss for Discharge Pipes (m)

Q： Water discharge (m^3/s) L： Overall length of discharge pipes (m)

D： Diameter of pipes (m) C： Coefficient of water velocity for steel pipe 100

(b) Pump Shaft Output

$$L = \frac{0.163 \cdot Q \cdot H \cdot \gamma}{\eta/100}$$

Where,

L： Pump shaft output (kW) Q： Pump capacity (m^3/min)

H： Total head (m)

γ： Specific weight of pumped liquid (Natural water: specific weight = 1.0)

η： Pump efficiency (%)

(c) Prime Mover Power Output

$$P = L \cdot (1+A)/\eta_t$$

Where,

P： Prime mover power output (motor) (kW)

L： Pump shaft output (kW)

A： Safety factor (for electrical motor = 0.1～0.15)

η_t： Transmission efficiency (direct coupling = 1.0)

(5) Determination of Specifications of Equipment

Pump

The following considerations are to be taken for determining the specifications of pump.

(a) The capacity of pumps shall be based on the requested specifications by Egyptian government and also maximum water demands.

(b) From the view point of operation and maintenance, compatibility of equipment and spare parts between stations including those of rehabilitated in phase-1 to-3 shall be considered.

(c) Pumps shall be of typical type as much as possible due to cost effectiveness.

(d) Considering that water requirement is high but total head is low in summer and water requirement is low but total head is high in winter, pump specifications shall satisfy the

seasonal water requirements. Therefore, comparatively low revolution speed type pumps will be selected.

(e) To prevent from wear by sand particles in river water, the impeller of pump shall be made of cast bronze (BC2), and the pump shaft and sleeves shall be made with stainless steel (SUS403). Considering the costs, the pump casing shall be made of cast iron (FC 200), which is commonly produced.

(f) The specification point can be shown in the pump performance curve (Q-H curve) described in the following figure. The solid lines show the performance by both one (1) and two (2) units operation of pumps and its crossing points with pipeline resistance curve mean pump operating point for Q (Discharge) and H (Total Head). Therefore, the range of two (2) units operation of pumps can be between the point A and the point B on the performance curve. The specification point is the crossing points of the pump performance curve and the pipeline resistance curve in maximum water demand. If the total head in the low water level is adopted for the specification, there are disadvantages in the high water level to accelerate deterioration of motors due to excessive discharge from pumps, to operate at low pump efficiency and to consume power consumption as a result.

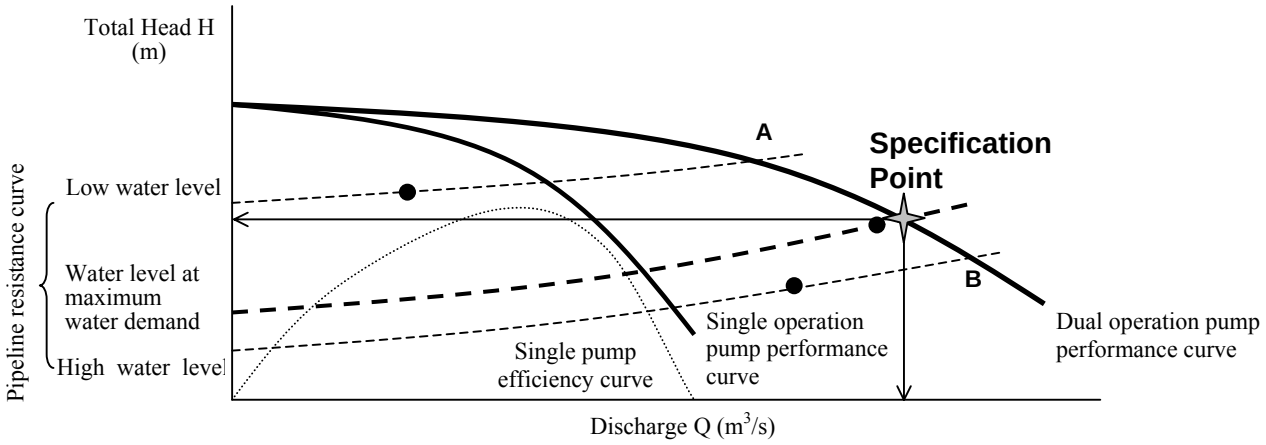


Figure 2-1 Diagram of Pump Performance Curve and Specification Point

Prime Mover (Main Motor)

The following shall be considered for determining specifications of prime mover:

(a) As the existing pump stations have been electrified since 1989, electrical motors are adapted and diesel engines shall not be introduced.

(b) Considering that the motors would be mounted on the barge, the typical type of 'three-phase squirrel cage induction motor' with compact size will be selected.

(c) For low head and low specific speed pump, number of poles shall be increased. Reduction gear box shall not be used because there are disadvantages in low power transmission ratio, costs, required space and more buoyancy for the barge by heavy weights. The pump and

motor are coupled directly and mounted on the common basement. The revolution speed of the motors is not controlled by the inverter.

(d) Motor insulation and frame type are determined considering high ambient temperature and heavy sandstorm.

Barge

The following considerations are to be taken for determining the barge specifications:

(a) Size of Barge

Based on required spaces for installment of equipment (pumps, motors, valves, control panel and others) and for their operation and maintenance the size of barge can be determined as follows:

- Operation space
- Maintenance space ---------- Approx. 1.0m in front and sides.
- Desk work space
- Walking space ---------- Approx. 0.7m in width
- Space for manual operated hoists and bollards

(b) Depth of Barge (height)

Depth of barge (H) = Freeboard (h) + Draft (d)

Freeboard (h) ----- Height of gunwale above water

The followings are to be considered for determining the freeboard:

- The maximum flow velocity (0.5m/s) of the River Nile and wave height (1.0m) by cruising ships,
- Reaction force against hydraulic force and its torque by suction and discharge, and
- Allowance for other factors (0.2m)

Draft (d) ----- Depth of barge bottom below water surface

The followings are to be considered for determining the draft:

- Draft height by buoyancy calculation,
- Draft height to secure buoyancy equivalent to the total weight of equipment and materials on the barge, and
- The center of gravity of overall weight balance to be lowered till the water line for durability against waves, water flow and wind.

Pump House

The pump house on the barge shall be designed taking into account the following installation methods and criteria in addition to natural condition such as temperature and wave height.

(a) The pump house shall be provided with a roof and walls to protect the equipment from wave splash, sand storm, etc.,

(b) Prevention of heat rise in the house and equipment from direct sunlight into the house,

(c) Natural air ventilation,
(d) The manual operated hoist with a rail shall be equipped with the ceiling beam for maintenance of pumps, motors, etc.,
(e) The structure of the house equipped with the hoist should be made of steel frame to bear the weight of single set of pump and motors. The height shall be determined considering with the allowance for hoisting the equipment.
(f) The steel frames of the pump house should bear the force of the connection pipe weight and the connecting works,
(g) The external walls material should be of water-proof plywood with protective paints,
(h) The roof made from durable materials for weight saving.
(i) The inside and outside of the house shall be equipped with a good lighting system for night-time operations.
(j) The receptacles should be equipped with tools and devices for maintenance, and
(k) The lockable shelf for the maintenance tool set should be furnished inside the pump station.
(l) Anti-theft measures should be considered.

Attachments of Pump Station

(a) To adapt changes of the river water levels, the connection pipe of pump station can be connected to the flanges of water tower every 1.0m height. The minor changes of water levels can be adapted by two ball joints with rubber flexible parts at both ends of the connection pipe. The parts of expansion and contraction shall be protected by stoppers with waning paints.
(b) To protect from the negative forces by waves and flow of the river, anchors (4 bollards and 2 winches) for the barge shall be furnished. Wires of winches shall be larger than φ20 mm (35.3kN).
(c) To counter against water weeds plugging strainer at pump suction, washer pump shall be equipped.
(d) To set the accurate operation and maintenance time for all the operators, a clock shall be equipped in the pump house. This enables the engineers of regional/branch offices to confirm the operating hours, which is recorded by supervisors of pump stations, cumulative hour meters shall be equipped in control panels. The operating hours will be one of the indicators from project evaluation.

(6) Criteria on Covering Range of Equipment

The covering range of equipment for Japan's grant is as follows:

Floating Pump Stations (7 sites)

With the same principle as phase-1 to phase-3 projects, equipment and materials to be procured by phase-4 project shall be pump stations and connection pipes.

- Pump Unit: Main pumps, main motors, vacuum pump unit, check valves, discharge valves, suction and discharge pipes in pump station, control panel and connection pipe including ball joints
- Barge: Pontoon body, pump house, hoist and anchors

Fixed Type Pump Station (1 site)

Dismantle of the existing pump units/ pipes and foundation work shall be carried out by MED.

- Pump Unit: Main pumps, main motors, vacuum pump unit, check valves, discharge valves, suction and discharge pipes in pump station and control panel
- Pump house： Prefabricated housing materials

2-2-1-5 Criteria on Self-mobile Maintenance Ship

Considering provision of suitable maintenance services and speedy repairs, self-mobile maintenance ship was requested. Maintenance works, such as repairing/ disassembling/ assembling equipment, transporting and changing spare parts and periodical checks, are planned by means to use self-mobile maintenance ship. The equipment and materials for the ship consist of barge body, engine, crane, workshop shed, workshop tools, measuring instruments, arc welder and stand-by generator. Functions of the maintenance ship are summarized in Table 2-3. Although cost-effectiveness can be admitted in emergent or periodical maintenance works, at first MED shall make maximum efforts to fully utilize maintenance ship procured in phase-3 project as well as the minor maintenance ships possessed by the MED.

Table 2-3 Evaluation on Functions of Self-mobile Maintenance Ship

Function	Works	Cost-effectiveness	Undertaking by MED	Urgent Necessity
Emergent maintenance of pump stations	Repair on breakage of pump shaft, impeller, inner pump casing, electrical circuits and connection pipe.	Since stoppage of pumping operation causes a lot of economic damage for farmers, cost-effectiveness is relatively high.	It is possible with the utilization of non self-mobile barge procured in phase 3. However, there are some constraints in distance from Daraw.	The pump procured in phase 1 project has been operated for 13 years and emergent maintenance is expected to be required. On the other hand, necessity of emergent maintenance is not expected within ten years for the equipment procured in the phase 4 project. There was a case that connecting pipe was disconnected from water tower, and maintenance barge had mobilized. So, the maintenance ship is required for unexpected accidents and troubles.
Periodical maintenance of pump stations	Disassemble and assemble (over- haul) of pumps and motors. Adjustment of shaft alignment within the tolerant level.	It can decrease frequency of breakdown in the future.	Although MED staff maintains enough skills, maintenance policy should be changed from 'trouble shooting style' to 'preventive maintenance style'. Although it is possible to use non self-mobile barge procured in phase-3, it is required to plan periodical maintenance systematically.	Periodical maintenance is required every 5 to 10 years. Therefore, if all floating pump stations should be maintained, there is a certain urgency to be procured.
Function diagnosis of pump stations (spot & periodical checks)	Diagnosis on deterioration by measuring instruments and replacement of spare parts.	It can decrease frequency of breakdown in the future.	After training to engineers of regional and branch offices with provision of the instruments, MED can handle.	Urgency is not recognized since measuring instruments and spare parts are not so large.
Periodical operating works	Adjustment of a horizontal level of connecting pipes. Adjustment of mooring place of pump stations.	No economic benefits can be created since the operation is carried out by manpower.	Currently, the level of connecting pipe is adjusted by manpower by means of chain block fixed to the frame on the top of water tower. Adjustment of mooring place is carried out with MED possessing tugboats.	In the viewpoints of labor saving and safety of works, the maintenance ship is required, especially in Aswan due to fast water velocity and larger difference of water levels.
Special and technical works	Welding against corrosion on water tower and discharge pipes.	Some economic value can be found, since prevention of leaking can enhance efficiency of water use.	Although it is possible to use maintenance barge procured in phase 3, there still are some constraints on distance.	Urgency is not recognized since the existing generator is used only for 50 hours per year.
Towing and transporting	Towing of floating pump station toward Aswan workshop. Transportation of materials to and from pump stations.	Further use of existing tug boards has much economic advantage than procurement of new ship.	Although rehabilitation of existing tugboats is necessary, it is responsible for MED.	Urgency is not recognized because the existing tugboats are available.

2-2-1-6 Criteria on Operation and Maintenance

(1) Lessons learnt from Phase-1 to Phase-3 Projects

- As for management of floating pump stations, maintenance teams are usually dispatched from regional or branch offices at Al-Khatara, Daraw and Idfu upon the request from the supervisors of pump stations. Each office is mandated to manage floating pump stations by territorial area.
- Roles of supervisors at pump stations are as shown in the box, and they are quite important for maintenance of pumping units. However, actual maintenance varies a little depending upon the technical capacity of individual personnel. There are minor communication problems between the engineers in offices and the supervisors in some pump stations. In most of cases, the maintenance team provides services of greasing and lubricating.
- Currently, replacement of spare parts is not periodically carried out, and made by the MED regional and branch offices after breakdown of the equipment. For example, although it is recommended to replace bearings every five years in condition with 4,000 working hours per year, and impellers every 10 years, it is hardly conducted. It is reported that grand packing is frequently replaced due to the water leakage.
- Measuring instruments, which are procured by phase-3 project, are utilized to check the conditions of pumps and motors quantitatively. Currently, while Daraw branch office manages such instruments, East/ West Idfu regional offices and Al-Khatara branch office do not possess any measuring instruments at the time of inspection of pump equipment.

Roles of Supervisors of Pump Stations

- Management of entire operation of the appointed pump station
- Confirmation of electric supply condition
- Greasing and lubrication to bearings of pump and motor
- Operation of vacuum pump and motor
- General maintenance works
- Recording operational problems
- Inspection of working records
- Monthly reporting to regional office
- Coordination of working shift of operators
- Adjustment of working hours of pumps upon request from irrigation department

(2) Prolongation of Equipment Life Period

Although MED engineers and technicians have adequate technical capacities, actual maintenance services are made after breakdown of equipment. Generally the pump has 20 years of life in normal operating conditions, however, it is required to prolong equipment life period including pump stations procured in phase-1 to -3 in order to enlarge cost-effectiveness. Therefore, it is recommended that the concept of 'Preventive Maintenance' is introduced before fatal breakdown of equipment.

Table 2-4 Preventive Maintenance of Pump Stations

Objective	Service	Person in charge	Frequency	Input
Preventive Maintenance	Periodical maintenance (replacement of major spare parts)	Engineers, mechanics, electricians of maintenance team in regional and branch office and supervisors of pump stations	Once every 5 to 10 years	Inspection of parts by overhaul of pump and motor. Procurement of spare parts such as bearing, sleeve, etc.
	Functional diagnosis	Engineers, mechanics, electricians of maintenance team in regional and branch offices	Once a year or when suspicious trouble is recognized at periodical maintenance	Procurement of clamp meter, isolated resistance meter, rotary meter, frequency meter, noise meter and velocity meter in two places. Training on usage of their instruments.
	Periodical inspection	Supervisors of pump stations	Once a year	Training on replacement of grand packing and mechanical seal. Distribution of maintenance manual in Arabic.
Operative Check	Daily check	Supervisors and operators of pump stations	Before starting operation or any	Greasing and lubrication. Distribution of the maintenance manual in Arabic.

2-2-2 Basic Plan

2-2-2-1 Irrigation Plan

(1) Service Area

Existing service area for each pump station is regarded as a proposed service area as listed in the following table.

Table 2-5 Proposed Service Area

No.	Pump Station	Area Requested (faddan)	Initial Design Area (feddan)	Extended Area (feddan)	Existing Service Area (feddan)
27	Gezeret El-Kobania Kebly	175	175	0	175
29	Sahel El-Akab Bahary	440	440	0	440
30	Gezeret Meneha	200	150	50	200
31	El-Sarag	200	150	50	200
32	Gezeret El-Fawaza El-Keblia	250	200	50	250
33	Middle Fawaza	210	150	60	210
34	Gezeret Abo Arafa	180	150	30	180
35	El-Hegs El-Mostagda	600	600	0	600
Total		2,255	2,015	240	2,255

Note: 1 feddan = 0.42 ha

(2) Proposed Cropping Pattern

The proposed cropping pattern is set up basing on the existing cropping pattern, regional agricultural policy and farmer's intention as well as considering crop water requirements and discharge capacity of existing irrigation systems in each service area. Basic concept of proposed cropping pattern focuses on vertical expansion by augmentation of unit crop yield and cropping intensity, considering the limited arable land where six (6) pump stations are located on islands in the River Nile and a new available land can be hardly developed in the remaining two (2) pump stations under current topographical conditions.

The proposed cropping pattern is accorded with traditional crop rotational farming in Upper Egypt such as combining grains with leguminous crops which act nitrogenous assimilations and sustaining fertility of land by dosing compost made with livestock mess.

Wheat is cultivated in the southern Aswan area of the project and 33% of the wheat production is allocated for the self-consumptive use. The remaining 67% is for the market. According to the agricultural survey, cropping intensity of wheat is estimated at about 20 to 35% of the service area. The said percentage is basically applied to the proposed cropping area of wheat with some adjustment, taking into account the average size of the farmland owned by farmers on each area. As maize and corn in summer season are the secondary crops of the *berseem* in winter, cropping areas for these crops are estimated to balance each other.

The following cropping pattern is proposed for each service area in accordance with the above consideration.

Table 2-6 Proposed Cropping Pattern

	Pump Station		No.27	No.29	No.30	No.31	No.32	No.33	No.34	No.35	Total
	Irrigation Area (fed.)		175	440	200	200	250	210	180	600	2,255
Winter Season	Wheat	%	31.3	13.7						2.4	47.4
		fed.	54.8	60.3						14.4	129.5
	Broad Bean	%									0
		fed.									0.0
	Barley	%									0
		fed.									0.0
	Clover	%	15.6	20.0	16.9	18.9	27.0		10.4	7.9	116.7
		fed.	27.3	88.0	33.8	37.8	67.5		18.7	47.4	320.5
	Berseem	%	18.8	33.7	15.4	23.9	6.5	4.6		6.1	109.0
		fed.	32.9	148.3	30.8	47.8	16.3	9.7		36.6	322.3
	Onion	%	12.5	7.4					5.4		25.3
		fed.	21.9	32.6					9.7		64.2
	Garlic	%		0.6							0.6
		fed.		2.6							2.6
	Vegetables	%	6.3	4.6					0.5		11.4
		fed.	11.0	20.24					0.9		32.2
Summer Season	Maize	%		14.4	7.7	17.4		2.3		3.7	45.5
		fed.		63.4	15.4	34.8		4.8		22.2	140.6
	Sorghum	%		14.9							14.9
		fed.		65.6							65.6
	Soybean	%		7.2					23.3		30.5
		fed.		31.7					41.9		73.6
	Sugarcane	%				4.4				81.1	85.5
		fed.				8.8				486.6	495.4
	Banana	%					31.5	59.1	90.3		180.9
		fed.					78.8	124.1	162.5		365.4
	Sesame	%					26.1				26.1
		fed.					65.3				65.3
	Berseem	%	68.9	21.3		4.4					94.6
		fed.	120.6	93.7		8.8					223.1
	Groundnut	%									0
		fed.									0
	Onion	%									0
		fed.									0
	Other Crops	%									0.0
		fed.									0.0
	Vegetables	%		2.2	7.7	12.6		2.3			24.8
		fed.		9.7	15.4	25.2		4.8			55.1
Nile Season	Vegetables	%		2.2	16.2	12.6					31.0
		fed.		9.7	32.4	25.2					67.3
	Fruits	%	31.1	40.0	84.6	63.0	42.4	31.8	2.7	2.5	298.1
		fed.	54.4	176.0	169.2	126.0	106	66.8	4.9	15.0	718.3
	Berseem	%	68.9								68.9
		fed.	120.6								120.6

(3) Consumptive Use of Crops

Consumptive use of crops estimated by the Irrigation Department in Table 2-7 is basically applied to the Project. The data in 1994 based on the Water Management Research Institute is applied to this project as the most appropriate one through the comparison studies made in phase-3 project including the comparison with the estimated result by the modified Penman method.

11Table 2-7 Consumptive Use of Crops in Upper Egypt

Unit:$m^{3/}$month/feddan

Season / Crop	Winter				Summer					Winter			Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Winter Season													
Wheat	450	458	460	452							249	520	2,589
Broad Bean	362	368	533	100							620	618	2,601
Barley	316	418	320								468	493	2,015
Fenugreak	270	315	350									332	1,267
Lupine	253	311	345									334	1,242
Chickpea	265	305	357									345	1,271
Lentil	420	420	294								168	315	1,617
Clover	809	920	860	820	900	950	930	500	910	800	600	590	9,589
Berseem	275	402									245	275	1,197
Flax	410	425	285								150	280	1,550
Onion	550	551	568	515							373	426	2,983
Garlic	390	388	413	364						655	874	995	4,079
Vegetables	650	726	108							358	390	493	2,725
Other Crops	420	399	273									126	1,218
Beat	272	304	564	735	857	422						131	3,285
Summer Season													
Cotton	436	522	621	837	977	495							3,886
Rice					24	150	2,022	1,676	2,430	425			6,727
Maize						423	805	749	859	459			3,295
Sorghum					245	690	1,000	740	140				2,815
Soybean					662	1,015	1,415	203					3,295
Sugarcane	154	240	254	350	792	892	1,239	1,344	1,144	930	699	371	8,408
Banana	160	245	260	360	800	900	1,240	1,350	1,150	1,000	700	380	8,545
Sesame					350	603	637	602	425				2,616
Berseem					825	1,111	1,393	696					
Groundnut					577	670	1,385	1,618					4,250
Onion													0
Vegetables	550	556	1,090	1,186	1,345	1,122	203						6,052
Sweet Corn					686	904	1,154	565					3,309
Other Crops					214	596	647	638	529				2,625
Nile Season													
Maize					220	575	651	642	535				2,623
Sorghum					245	690	1,000	740	140				2,815
Vegetables								1,429	1,836	1,720			4,985
Fruits	250	220	225	308	376	497	484	469	440	425	308	303	4,305
Berseem								1,409	1,813	1,711			
Total	7,661	8,492	8,179	6,026	10,095	11,333	15,274	15,371	12,351	8,483	5,844	7,327	109,779

Data source: Aswan Directorate of Irrigation Department

Notes: The above table shows consumptive use of crops, which does not include any losses such as conveyance and field application of water.

(4) Irrigation Efficiency

Overall irrigation efficiency is estimated at 0.5 based on the standard irrigation efficiencies reported by FAO and ICID. Interpretations of irrigation efficiencies applied are as follows:

Conveyance efficiency Ec

Conveyance efficiency Ec = 0.90 is applied because of the following conditions.

Each irrigation area has no regulating pond and the canal flowing corresponds with 'continuous supply with no substantial change in flow' that gives the conveyance efficiency at 0.9.

Field canal efficiency Eb

Field canal efficiency Eb = 0.70 is applied because field blocks feeding by the field canal unlined is less than 20 ha in size that gives the field canal efficiency at 0.70.

Field application efficiency Ea

Field application efficiency Ea = 0.80 is applied because irrigation method in the service area is classified as a basin irrigation method which gives the field application efficiency at 0.80.

Overall efficiency E is calculated as follows:

Overall efficiency E = Ec × Eb × Ea = 0.90×0.70×0.80 = 0.50

(5) Irrigation Hour

Irrigation hours per day is set up between 7 and 14 hours based on current working hours spent for irrigation and records of pump operation hours at each pump station.

(6) Village Water

Some part of village water including domestic and livestock water is taken from the irrigation canal.

Domestic water: 100lit/day/person

Livestock water: cattle 30lit/day/head, donkey 22.5lit/day/head, sheep 20lit/day/head, chicken 20lit/day/100heads

According to the agricultural survey, an average number of livestock feeding per farm household is estimated as follows:

cattle: 2 head, donkey: 2 heads, sheep: 10 heads, chicken:28 heads

Total village water can be estimated as follows;

Table 2-8 Village Water

Pump Station	Farm Household (house)	Village Population (person)	Domestic Water (m^3/s)	Livestock Water (m^3/s)	Total (m^3/s)
No.27	80	1,000	−	0.001	0.001
No.29	240	3,600	0.008	0.002	0.010
No.30	120	2,200	−	0.001	0.001
No.31	70	1,100	−	0.001	0.001
No.32	130	1,100	−	0.001	0.001
No.33	60	900	−	0.001	0.001
No.34	60	700	−	0.001	0.001
No.35	260	4,700	0.011	0.002	0.013

(7) Irrigation Water Demand

Proposed daily demand of irrigation water is calculated by the following equation:

Daily irrigation water demand = ∑ (Cropping area × Daily consumptive use of water) / Overall efficiency 0.5

Proposed irrigation water demand (m^3/s) adding village water and converting 24hours consumption to 7 to 14 working hours is calculated as follows:

Proposed irrigation water demand (m^3/s) = Daily irrigation water demand × (1 + village water) × (24 /irrigation hours) / 86,400

Irrigation water demand calculated for each month is shown in Table 2-9.

Table 2-9 Proposed Monthly Irrigation Water Demand

Unit: m^3/sec

Pump Station	Area (fed.)	Winter				Summer					Winter		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No.27 Gezeret El-Kobania Kebly	175	0.16	0.19	0.13	0.14	0.26	0.35	0.39	0.38	0.50	0.45	0.13	0.15
No.29 Sahel El-Akab Bahary	440	0.33	0.41	0.26	0.27	0.42	0.61	0.70	0.47	0.38	0.31	0.29	0.31
No.30 Gezeret Meneha	200	0.20	0.23	0.17	0.21	0.29	0.37	0.33	0.40	0.47	0.42	0.21	0.20
No.31 El-Sarag	200	0.14	0.16	0.14	0.16	0.19	0.25	0.23	0.24	0.27	0.23	0.12	0.12
No.32 Gezeret El-Fawaza	250	0.18	0.22	0.18	0.22	0.34	0.42	0.45	0.41	0.42	0.32	0.25	0.19
No.33 Middle Fawaza	210	0.06	0.09	0.08	0.11	0.20	0.24	0.29	0.30	0.27	0.23	0.17	0.11
No.34 Gezeret Abo Arafa	180	0.08	0.12	0.11	0.14	0.29	0.35	0.46	0.39	0.35	0.29	0.22	0.13
No.35 El-Hegs El-Mostagda	600	0.21	0.32	0.27	0.35	0.66	0.78	1.02	1.06	0.98	0.77	0.61	0.36

(8) Proposed Pump Capacity

Existing seven (7) pump facilities at the No.27 Gezeret El-Kobania Kebly, No.29 Sahel El-Akab Bahary, No.30 Gezeret Meneha, No.31 El-Sarag, No.32 Gezeret El-Fawaza, No.34 Gezeret Abo Arafa and No.35 El-Hegs El-Mostagda will be entirely replaced by new floating pumps. Existing one (1) fixed pump facilities at No.33 Middle Fawaza is renewed by new fixed pumps. The capacity of renewal pumps at each station is designed to meet the maximum monthly irrigation water demand as listed in Table2-10 and to have compatibility with the same capacities and spare parts of existing pumps installed during phase-1 to phase-3 projects under the Japanese Grant Aid. Two (2) sets of pumps are provided at each pump station to cope with fluctuation of irrigation water demand. Accordingly, the proposed pump capacity is set up as follows:

Table 2-10 Required Pump Capacity

Pump Station	No.27	No.29	No.30	No.31	No.32	No.33	No.34	No.35
Annual Water Demand (MCM)	3.54	6.25	2.70	2.94	3.95	2.83	3.53	9.73
Cropping Intensity in Max. (%)	115.6	120.0	125.4	122.8	127.0	97.8	126.7	100.0
in Min. (%)	90.5	81.7	11.5	98.9	100.9	93.2	103.4	91.5
in Ave. (%)	111.9	107.2	115.8	113.5	113.9	94.7	114.1	96.3
Monthly Maximum Water Demand (m^3/s)	0.50	0.70	0.47	0.27	0.45	0.30	0.46	1.06
Maximum Water Demand per One Unit of Pump (m^3/s)	0.25	0.35	0.23	0.14	0.23	0.15	0.23	0.53
Requested Pump Capacity per One Unit of Pump (m^3/s)	0.25	0.35	0.23	0.15	0.23	0.15	0.25	0.35
Selected Pump Capacity per One Unit of Pump (m^3/s)	0.25	0.35	0.25	0.15	0.25	0.15	0.25	0.55

2-2-2-2 Plan of Pump Stations

(1) Main Pump

1) Number of pumps in one pump station and discharge rate

To follow the irrigation water demand differing in winter and summer, two pumps will be equipped in one pump station and the pump operator can control the number of operating pumps according to the irrigation plan in each season. In winter season, basically one pump is operated otherwise two pumps are operated in the case of shortening the operation hours. In summer season, two pumps are operated to provide the large amount of water meeting demands.

The common specifications are applied to these two pumps in the one pump station considering the ease of maintenance. Discharge rate of each pump are shown in Table 2-11.

Table 2-11 Discharge Rate of Each Pump

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Number of Pumps	**2 units**	**2 units**	**2 units**	**2 units**	**2 units**	**2 units**	**2 units**	**2 units**
Discharge Rate per Unit (Request) (m^3/s)	0.25	0.35	0.23	0.15	0.23	0.15	0.25	0.35
Discharge Rate per Unit (Plan) (m^3/s)	**0.25**	**0.35**	**0.25**	**0.15**	**0.25**	**0.15**	**0.25**	**0.55**

2) Total head

Fluctuation range of the Nile River is 2 to 4 meter through the year. In winter season, although the condition of low water level makes require high-lift pump, the demand of irrigation water is comparatively low. While in the summer season, water level becomes high and the required total head of pump is low, but much water is necessary for irrigation.

Total head at the operating point of maximum water demand in summer season is adopted as the designed pump specification, because applying the range of high pump efficiency to the large discharge rate can reduce the total power cost through the year.

This means the excessive head is not adopted to avoid the following condition. If the high-lift pump is chosen applying to the lowest river water level in the winter season, the pump operating condition in the summer season is at the over discharge rate. This brings an over load on the motor and too much vibration causes the rotator to wear and hastens the degradation of the motor.

Calculations of the head loss to determine the pump total head are shown on the Table 2-12.

Table 2-12 Pump Total Head

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Total Head (at the lowest water level) (m)	10.600 (Jan)	11.930 (Jan)	10.914 (Jan)	8.633 (Jan)	10.946 (Jan)	8.574 (Jan)	7.301 (Jan)	11.583 (Jan)
Total Head (at the maximum water demand) (m)	8,573 (Sep)	8.918 (Jul)	8,428 (Sep)	6.219 (Sep)	7.397 (Jul)	6.274 (Aug)	5.062 (Jul)	9.500 (Aug)
Total Head (Requested) (m)	13	13	11	16	12	10.6	13	13
Total Head (Plan) (m)	**9**	**10**	**9**	**7**	**9**	**7**	**6**	**11**

3) Pump type and bore diameter

'Horizontal shaft double suction single stage centrifugal pump' is adopted, considering the installation condition (mounting on barge or installing in pump station on the river bank), pump efficiency, suction performance, ease of maintenance and compatibility with the existing pump provided in the former grant aid project.

Although 'Vertical shaft mixed flow pump' can be used to the planned pump operation range, it is not optimal for the following reasons.

- A vertical pump is generally more expensive than a horizontal pump.
- Each pump station has enough space for a horizontal pump.
- Layout of the horizontal pump can maintain the balance of barge.
- Height of motor installation at each pump station is secure from immersion in a swollen river.

'Double suction type' is suitable for the following reasons.

- A double suction type is better than single suction type in suction performance.
- A body of the double suction type pump has dual partitioning structure and has an easy maintenance.

Pump bore (or suction bore) is determined by pump discharge rate and pipe flow velocity as the following equation. Considering the operational status in the existing pump station provided in the former grant project and other projects, the suction performance is to be ensured to prevent harmful cavitations. In particular, No.23 pump station is a fixed pump station and the lower flow velocity in the suction pipe is specified so as to reduce the head loss through suction pipe.

$$D = 146\sqrt{60 \cdot Q/V}$$

Where,

D: Pump bore (mm) (Suction bore is used for the case of the centrifugal pump.)

Q: Discharge rate (m^3/s)

V: Pipe flow velocity (m/s) (Floating pump station: 2.0m/s, Fixed pump station: 1.8m/s)

Table 2-13 Pump Bore

Pump Station	No.27	No.29	No.30	No.31	No.32	No.33	No.34	No.35
Suction Bore (mm)	400	450	400	350	400	350	400	600

4) Operating speed

Rotating speed of pump is calculated as the following equation:

$$N = \frac{S \cdot (Hv + Hs1)^{3/4}}{\sqrt{Q/2}}$$

Where,

N: Rotating speed (rpm)

S: Suction specific speed
(S=780, in the case that discharge rate is 130% of designed point, for the centrifugal pump.)

Hs1: Suction head (m)
(Actual suction head – Head loss through suction pipe (0.1m))

Hv: Available NPSH (Net Positive Suction Head)
(Head in atmosphere (10.23m at altitude 80m) – saturated water vapour pressure (0.43m at 30℃) – suction head margin (0.5m))

Q: Discharge rate (m^3/min)
(Half rate (Q/2) is used for the case of the double suction pump.)

Actual rotating speed of 50Hz motor considering slip is selected as it is slower than the rotating speed of pump calculated above. Then the specific speed is calculated with this speed as below and checked if it is in the normal range from 120 to 650.

$$Ns = N \cdot \frac{\sqrt{Q/2}}{H^{3/4}}$$

Where,

Ns: Specific speed

N: Rotating speed of pump (rpm)

H: Total head (m)

Q: Discharge rate (m^3/min)
(Half rate (Q/2) is used for the case of the double suction pump.)

Furthermore, the rotating speed is checked if it meets the condition that "available Net Positive Suction Head (NPSHav)" is greater than 'required Net Positive Suction Head (NPSHrq).' Because the water level of intake in each pump station forms a suction system and

it is necessary to prevent the cavitations.

Table 2-14 Pump Rotating Speed and Specific Speed

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Pump Rotating Speed N (rpm)	**730**	**730**	**730**	**970**	**730**	**730**	**730**	**580**
Specific Speed at the above speed Ns	385	421	385	479	385	360	522	391

(2) Motor

1) Motor type

The motors will be installed on the barge except No.33 fixed pump station, small and short type is better. In addition to this, taking into account the cost, ease of maintenance, and general versatility, "3 phase squirrel cage type induction motor" is best suited. Considering that the temperature in the sites is considerably high and the sites have the strong storm with sand occasionally, insulation class is F class and protection and cooling method is "totally enclosed fan cooling type". Specification for transportation is tropical type because of the high and humid conditions during shipping through equatorial belt.

2) Required power

Pump shaft power is calculated with discharge rate, total head and standard pump efficiency. Required motor output is provided adding the margin of 15% power to the pump shaft power. Then an economical standard motor output is determined based on the obtained required motor output.

Table 2-15 Pump Shaft Power and Motor Output

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Discharge Rate (m^3/s)	0.25	0.35	0.25	0.15	0.25	0.15	0.25	0.55
Total Head (m)	9	10	9	7	9	7	6	11
Pump Efficiency (%)	76	78	76	74	76	74	76	83
Pump Shaft Power Lp (kW)	29.0	43.9	29.0	13.9	29.0	13.9	19.3	71.3
Required Motor Output Lm(kW)	33.3	50.5	33.3	16.0	33.3	16.0	22.2	82.0
Motor Output L(kW)	**37**	**55**	**37**	**18.5**	**37**	**18.5**	**30**	**90**
Motor Rotating Speed N(rpm)	750	750	750	1000	750	750	750	600
Number of Pole	8P	8P	8P	6P	8P	8P	8P	10P
Power Source	Three phase, 380V, 50Hz							

Note: No. of poles can be finally proposed by the supplier depending on manufacturer's standard models.

3) Starting method

Considering the motor capacity, starting method is reduced-voltage starting to hold down striking current. Taking into account the required torque at starting and acceleration, “reactor starting” is suited for No.35 pump station and “star-delta starting” is suited for the other seven pump stations.

(3) Vacuum Pump

As the main pump is a suction type horizontal centrifugal pump, it needs priming operation before starting. Vacuum pump will be installed in the pump station for this purpose. Vacuum pump is generally used for the main pump which is larger than 300mm of bore diameter and actually used for the pump station of the former grant aid project.

The followings are the specifications of vacuum pump.

- A vacuum pump is driven by a motor in similar manner with the main pump and fixed on the common steel bed with the motor.
- Standard water seal type vacuum pump is selected. Capacity of vacuum pump is determined, as the priming time should be less than 5 minutes.
- One water service tank is set to fill water to the vacuum pump and a float valve is equipped in the tank for automatic switching.
- The vacuum pump is planned to be used commonly for two main pumps in one pump station. The vacuum pumps in one pump station are installed two sets. One is working and the other is used as a standby pump.

(4) Valves

1) Discharge valve

- Discharge valve will be installed to reduce initial load on the motor by shutoff starting and to maintain air tightness in the pump while priming by vacuum pump.
- As for flow control, the discharge rate will be controlled by the number of operating pumps not by valve opening rate. Therefore the intended use of the discharge valve is holding the status of fully opened or fully closed. For this purpose, manually operated valve is suitable because the hand operation is unfailing. Moreover, manually operated valve has an advantage over the motor operated valve on the cost front.
- Considering versatility, required power for manual operation and operating period from the fully opened status to the fully closed status, butterfly valve is suitable.
- Standard on withstanding pressure of the discharge valve has to satisfy the maximum pressure on the discharge side given by the pump.

2) Check valve

- Check valve will be placed between the pump and the discharge valve to prevent back flow from irrigation canal to the river when the main pump stop suddenly with the status that discharge valve is fully opened, such as in the case of power failure without notice.
- Check valve is of the structure that can avoid intense water pressure because of the delayed shutoff of the valve. Standard on withstanding pressure of the check valve is of durable to water hammer pressure.

(5) Pipes

1) Main pipe

- Material of the main pipe is steel on both suction side and discharge side of the main pumps. The pipe weight is lighter than ductile cast iron pipe and adjustment is easy at the time of the installation on site.
- Taper pipe with loose flange, bend pipe and T-pipe are used for connecting with pump and valves.

2) Connecting pipe (including Ball joints)

- Connecting pipe between the discharge pipe on the moored barge and the fixed tower on the bank has to have sufficient expansibility and flexibility to follow up the water level fluctuation. For this purpose ball joints are used at both ends of the connecting pipe.
- Connecting tower will not be installed in No.34 pump station. Suspended rubber flexible pipe is used for connecting pump station and pipes on the bank instead of the steel pipe with ball joints.
- Fastener on the joint part is strengthened to prevent coming off and the colour paint is attached at the expanding part for visible warning.
- For connecting pipe will be supported at the both sides of the barge and the tower, smaller pipe bore is favourable for its lightness to be supported but excessive flow velocity of the pipe has to be avoided.
- As No. 33 pump station is a fixed pump station, a connection pipe is not used.

(6) Control Panel

- For protection from wave splash on the barge, totally enclosed type with leak prevention is adopted.
- For protection from sand storms, dust proof type panel is adopted.
- For protection from scorching heat on the site in summer and humidity during marine freight, tropical type or damp proof type is adopted.
- For easy inspection and maintenance, front door type is adopted.

(7) Barge and Pump Station Shed

- Provision described in the section of Design Policy is to be referred.
- In accordance with the 'Rules for the Survey and Construction of Steel Ships' issued by Nippon Kaiji Kyokai of Japan, structure of barge is determined as the following table:
- No.33 pump station is a fixed pump station and barge is not provided.

Table 2-16 Calculation Formula for Steel Plate Thickness

Bottom Plate Thickness t1 (mm)	$t1 = 4.7S \times (d+0.04L)^{1/2} + 2.5$	S: Interval of longitudinal ribs (m) S = 2L + 450 (mm) L: Total length (m) d: Draught (m)
Side Plate Thickness t2 (mm)	$t2 = 4.1S \times (d+0.04L)^{1/2} + 2.5$	Minimum thickness = 0.044L + 5.6
Deck Plate Thickness t3 (mm)	$t3 = 1.47S \times h^{1/2} + 2.5$	H: Deck load (KN/m^2)
Other Plate Thickness t_{min} (mm)	$t_{min} = 6$	Minimum dimensions of members are stipulated in chapter 23 of the Rules. Outer plating: Smooth water
Buoyancy d1 (tf/m^2)	D1 = Wo/plane area	Wo：Total hull weight (tf)

In the calculation of buoyancy, freeboard height 0.7m is given. In order to lower the centre of gravity till the waterline so as to secure stable barge balance and to prevent air coming into suction pipe, draught height 0.9m to 1.3m shall be given. Sizes of barges are determined as the following table.

Table2-17 Size of Barges

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Length × Breadth (m)	**14x6.5**	**14x6.5**	**14x6.5**	**13x5.5**	**14x6.5**		**14x6.5**	**16x7.5**
Total Weight: Wo (tf)	85	85	85	60	85	**Fixed**	85	125
Draught (required): d1 (m)	0.94	0.94	0.94	0.84	0.94	**Pump**	0.94	1.05
Draught (plan): d (m)	1.0	1.0	1.0	0.9	1.0	**Station**	1.0	1.1
Depth: H (m)	**1.7**	**1.7**	**1.7**	**1.6**	**1.7**		**1.7**	**1.8**

Dimensions of pump station shed are determined considering size of equipment and height of the monorail hoist. Structure of the shed can support the lifting load of monorail hoist and horizontal load supporting A-shaped frame hanging the connecting pipe horizontally. The shed is steel framed with sufficient stiffness not to cause the distortion of the frame.

Table2-18 Size of Pump Station Shed and Main Frame

Pump Station	**No.27**	**No.29**	**No.30**	**No.31**	**No.32**	**No.33**	**No.34**	**No.35**
Length: L(m)	**10**	**10**	**10**	**9**	**10**	**9**	**10**	**12**
Width: W(m)	**4.6**	**4.6**	**4.6**	**3.61**	**4.6**	**3.61**	**4.6**	**5.56**
Height: H(m)	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**
Main Frame (mm)	JIS H-section steel 175x175			150x150	175x175	150x150	175x175	
Main Beam (mm)	JIS C-channel steel 150x75							

2-2-2-3 Specifications and Quantity of Equipment and Materials

Specifications and quantity of planned equipment are show on the following table:

Table2-19 Specification and Quality of Planned Equipment

No. of Pump Station		No.27	No.28	No.29	No.30	No.31	No.32	No.33	No.34	No.35
Name of Pump Station		Gezeret El-Kobania Kebly	Sahel Al-Khatara	Sahel El-Akab Bahary	Gezeret Meneha	El-Sarag	Gezeret El-Fawaza El-Keblia	Middle Fawaza	Gezeret Abo Arafa	El-Hegs El-Mostagda
Irrigation Area	Plan	175 feddan	2000 feddan	440 feddan	200 feddan	200 feddan	250 feddan	210 feddan	180 feddan	600 feddan
Maximum Water Requirement	Plan	0.5m^3/s	2.65m^3/s	0.7m^3/s	0.47m^3/s	0.27m^3/s	0.45m^3/s	0.3m^3/s	0.46m^3/s	1.06m^3/s
Pump Q(m3/s) x H(m) x unit	Request	0.25m3/s x 13m x 2unit	1.35m3/s x 23m x 2unit	0.35m3/s x 13m x 2unit	0.23m3/s x 11m x 2unit	0.15m3/s x 16m x 2unit	0.23m3/s x 12m x 2unit	0.15m3/s x 10.6m x 2unit	0.25m3/s x 13m x 2unit	0.35m3/s x 13m x 2unit
	Plan	0.25m3/s x 9m x 2unit	(Out of Scope)	0.35m3/s x 10m x 2unit	0.25m3/s x 9m x 2unit	0.15m3/s x 7m x 2unit	0.25m3/s x 9m x 2unit	0.15m3/s x 7m x 2unit	0.25m3/s x 6m x 2unit	0.55m3/s x 11m x 2unit
Motor Output (kw), Rotating Speed (rpm) x unit	Request	40kw, 735/ 975rpm x 2unit	448kw, 490rpm x 2unit	101kw, 985rpm x 2unit	45kw, 975rpm x 2unit	40kw, 1470rpm x 2unit	45kw, 975rpm x 2unit	40kw, 1470rpm x 2unit	40kw, 735rpm x 2unit	101kw, 985rpm x 2unit
	Plan	37kw, 750rpm x 2unit	(Out of Scope)	55kw, 750rpm x 2unit	37kw, 750rpm x 2unit	18.5kw, 1000rpm x 2unit	37kw, 750rpm x 2unit	18.5kw, 750rpm x 2unit	30kw, 750rpm x 2unit	90kw, 600rpm x 2unit
Type of Pump Station	Existing	Floating	Floating	Floating	Fixed Station	Fixed Station	Fixed Station	Fixed Station	Floating	Floating
	Request	Floating	Floating	Floating	Floating	Floating	Floating	Floating	Floating	Floating
	Plan	Floating	(Out of Scope)	Floating	Floating	Floating	Floating	Fixed Station	Floating	Floating
Barge LxWxD (m)	Plan	14m x 6.5m x 1.7m	(Out of Scope)	14m x 6.5m x 1.7m	14m x 6.5m x 1.7m	13m x 5.5m x 1.6m	14m x 6.5m x 1.7m	(Out of Scope)	14m x 6.5m x 1.7m	16m x 7.5m x 1.8m

Maintenance Barge	Request	1 boat	Plan	(Out of Scope)

More detailed specifications of the equipment in each pump station are referred to Table2-20 (1) to (8).

Table2-20 (1) Specifications of Equipment in Pumping Station

No.27 Gezeret El-Kobania Kebly Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.25m^3/s×9m Suction Bore: φ400mm Discharge Bore: φ300mm Totally enclosed-fan cooling Squirrel cage type 37kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 350mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 350mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 300mm～450mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
7	Barge (including Pump House)	Steel hull structure 14m×6.5m×1.7m Steel frame structure, eaves height: 4.0m 10m×4.6m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 450mm with ball joints at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

Table2-20 (2)　Specifications of Equipment in Pumping Station

No.29 Sahel El-Akab Bahry Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.35m^3/s×10m Suction Bore: φ450mm Discharge Bore: φ350mm Totally enclosed-fan cooling Squirrel cage type 55kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 400mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 400mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 350mm～450mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	3 panel
7	Barge (including Pump House)	Steel hull structure 14m×6.5m×1.7m Steel frame structure, eaves height: 4.0m 10m×4.6m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 450mm with ball joint at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

Table2-20 (3) Specifications of Equipment in Pumping Station

No.30 Gezeret Meneha Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.25m^3/s×9m Suction Bore: φ400mm Discharge Bore: φ300mm Totally enclosed-fan cooling Squirrel cage type 37kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 350mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 350mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 300mm～450mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
7	Barge (including Pump House)	Steel hull structure 14m×6.5m×1.7m Steel frame structure, eaves height: 4.0m 10m×4.6m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 450mm with ball joint at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

Table2-20 (4) Specifications of Equipment in Pumping Station

No.31 El-Sarag Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.15m^3/s×7m Suction Bore: φ350mm Discharge Bore: φ250mm Totally enclosed-fan cooling Squirrel cage type 18.5kW, 6P or more, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.3m^3/min, Bore: φ25mm with water service tank Totally enclosed-fan cooling Squirrel cage type 0.75kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 300mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 300mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 250mm～350mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
7	Barge (including Pump House)	Steel hull structure 13m×5.5m×1.6m Steel frame structure, eaves height: 4.0m 9m×3.61m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 350mm with ball joint at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

Table2-20 (5) Specifications of Equipment in Pumping Station

No.32 Gezeret El-Fawaza El-Keblia Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.25m^3/s×9m Suction Bore: φ400mm Discharge Bore: φ300mm Totally enclosed-fan cooling Squirrel cage type 37kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 350mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 350mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 300mm～450mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
7	Barge (including Pump House)	Steel hull structure 14m×6.5m×1.7m Steel frame structure, eave height: 4.0m 10m×4.6m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 450mm with ball joint at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

Table2-20 (6) Specifications of Equipment in Pumping Station

No.33 Middle Fawaza Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.15m^3/s×7m Suction Bore: φ350mm Discharge Bore: φ250mm Totally enclosed-fan cooling Squirrel cage type 18.5kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.3m^3/min, Bore: φ25mm with water service tank Totally enclosed-fan cooling Squirrel cage type 0.75kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 300mm	2 unit
4	Check Valve	Dual plate Check Valve Bore: 300mm	2 unit
5	Foot Valve	Bore: 350mm	2 unit
6	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 250mm～350mm	1 unit
7	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
8	Pump Station Shed	Steel frame, eaves height: 4.0m 9m×3.61m×4m	1 unit
9	Spare Parts		1 lot

Table2-20 (7) Specifications of Equipment in Pumping Station

No.34 Gezeret Abo Arafa Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.25m^3/s×6m Suction Bore: φ400mm Discharge Bore: φ300mm Totally enclosed-fan cooling Squirrel cage type 30kW, 8P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 350mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 350mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 300mm～400mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Star-delta starting)	2 panel
7	Barge (including Pump House)	Steel hull structure 14m×6.5m×1.7m Steel frame structure, eaves height: 4.0m 10m×4.6m×4m	1 unit
8	Connection Pipe (including Ball Joints)	Flexible rubber pipe, Bore: 400mm with metallic attachment on both ends to be connected with flange Flexible guard pipe, Bore: 600mm	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

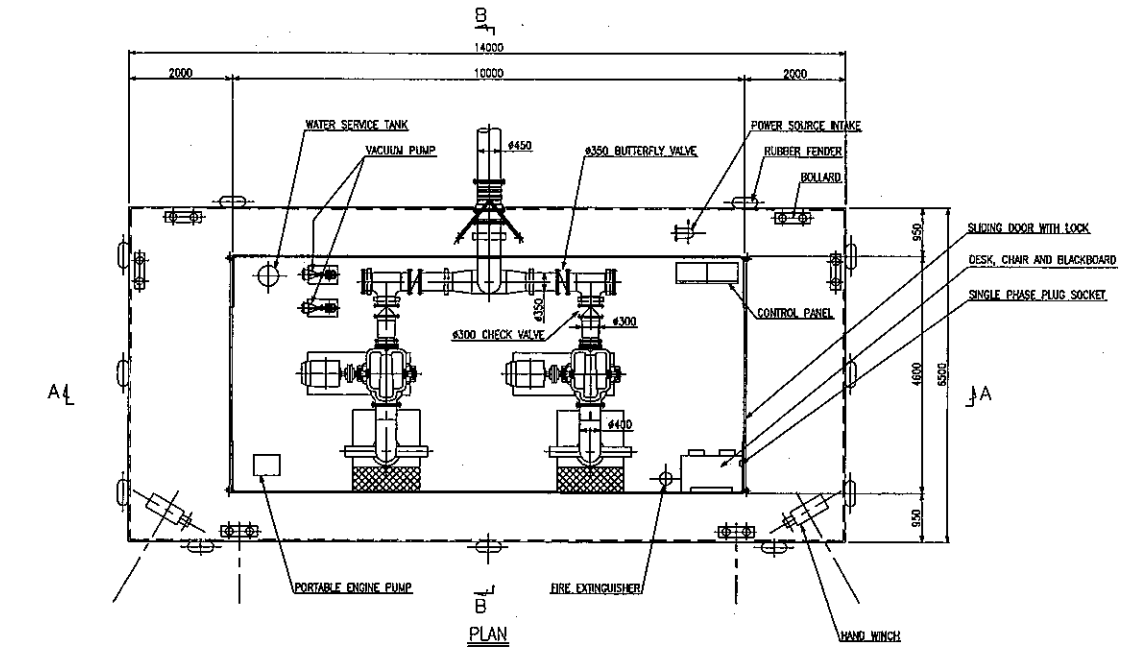
Table2-20 (8) Specifications of Equipment in Pumping Station

No.35 El-Hegs El-Mostagda Pump Station

No.	Item	Specifications	Quantity
1	Main Pump (with Main Motor)	Double suction volute pump 0.55m^3/s×11m Suction Bore: φ600mm Discharge Bore: φ450mm Totally enclosed-fan cooling Squirrel cage type 90kW, 10P, 380V, 50Hz with common bed and coupling	2 set
2	Vacuum Pump (with Motor)	0.7m^3/min, Bore: φ32mm with water service tank Totally enclosed-fan cooling Squirrel cage type 1.5kW, 4P, 380V, 50Hz with common bed and coupling	2 set
3	Discharge Valve	Manually-operated Butterfly Valve Bore: 500mm	2 unit
4	Check Valve	Dual Plate Check Valve Bore: 500mm	2 unit
5	Suction & Discharge Pipes	Steel pipe, with flanges Bore: 450mm～600mm	1 unit
6	Control Panel (Pump Panel)	Self-standing type, Steel panel Pump control circuit (Reactor starting)	3 panel
7	Barge (including Pump House)	Steel hull structure 16m×7.5m×1.8m Steel frame structure, eaves height: 5.0m 12m×5.56m×5m	1 unit
8	Connection Pipe (including Ball Joints)	Steel pipe, Bore: 600mm with ball joint at both ends	1 set
9	Scouring Pump	Submersible pump, 200lit/min, Head: 30m with hose, nozzle and support	1 unit
10	Ballast Pump	Engine pump, 250lit/min, Head: 10m with hose	1 unit
11	Spare Parts		1 lot

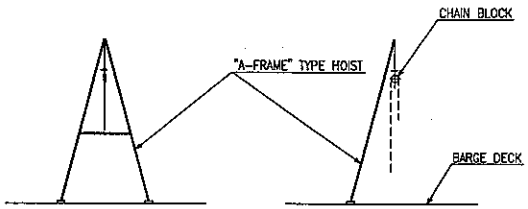
2-2-3 Basic Design Drawing

List of Basic Design Drawing



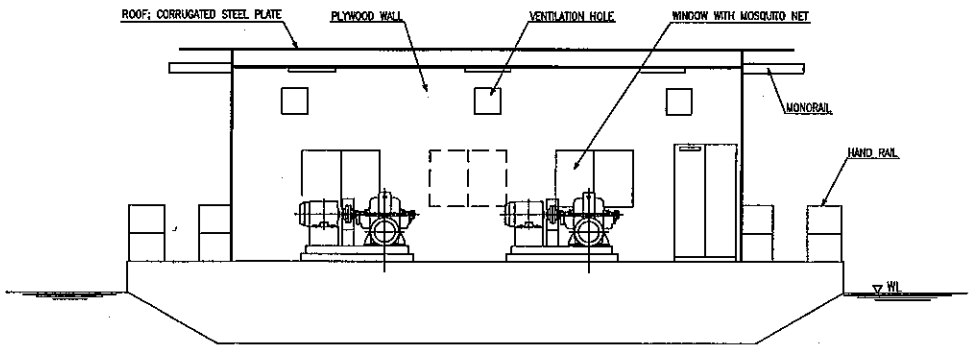
PLAN

S=1/100(S=1/50)



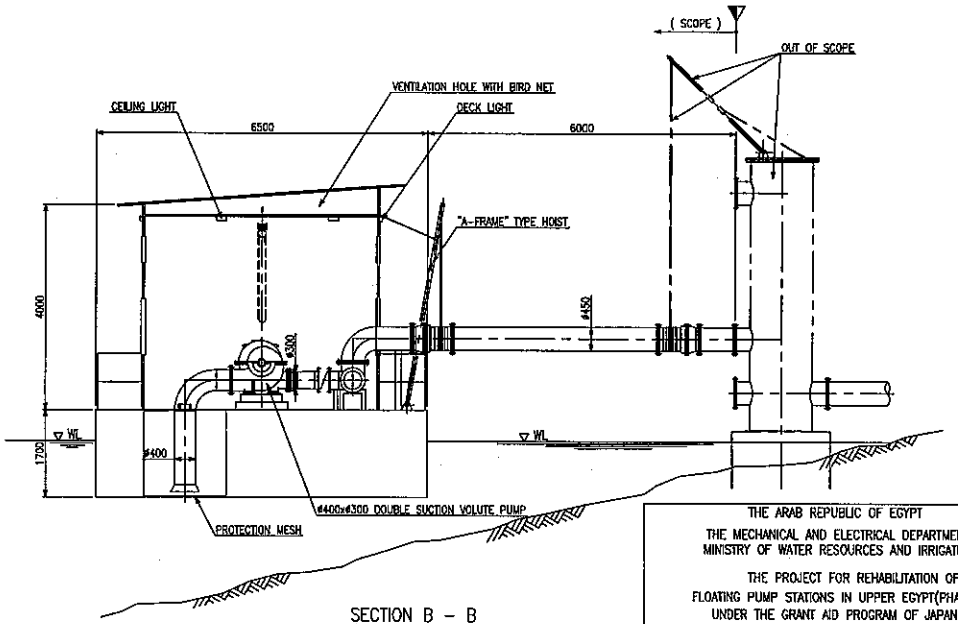
FRONT VIEW

SIDE VIEW



SECTION A – A

S=1/100(S=1/50)



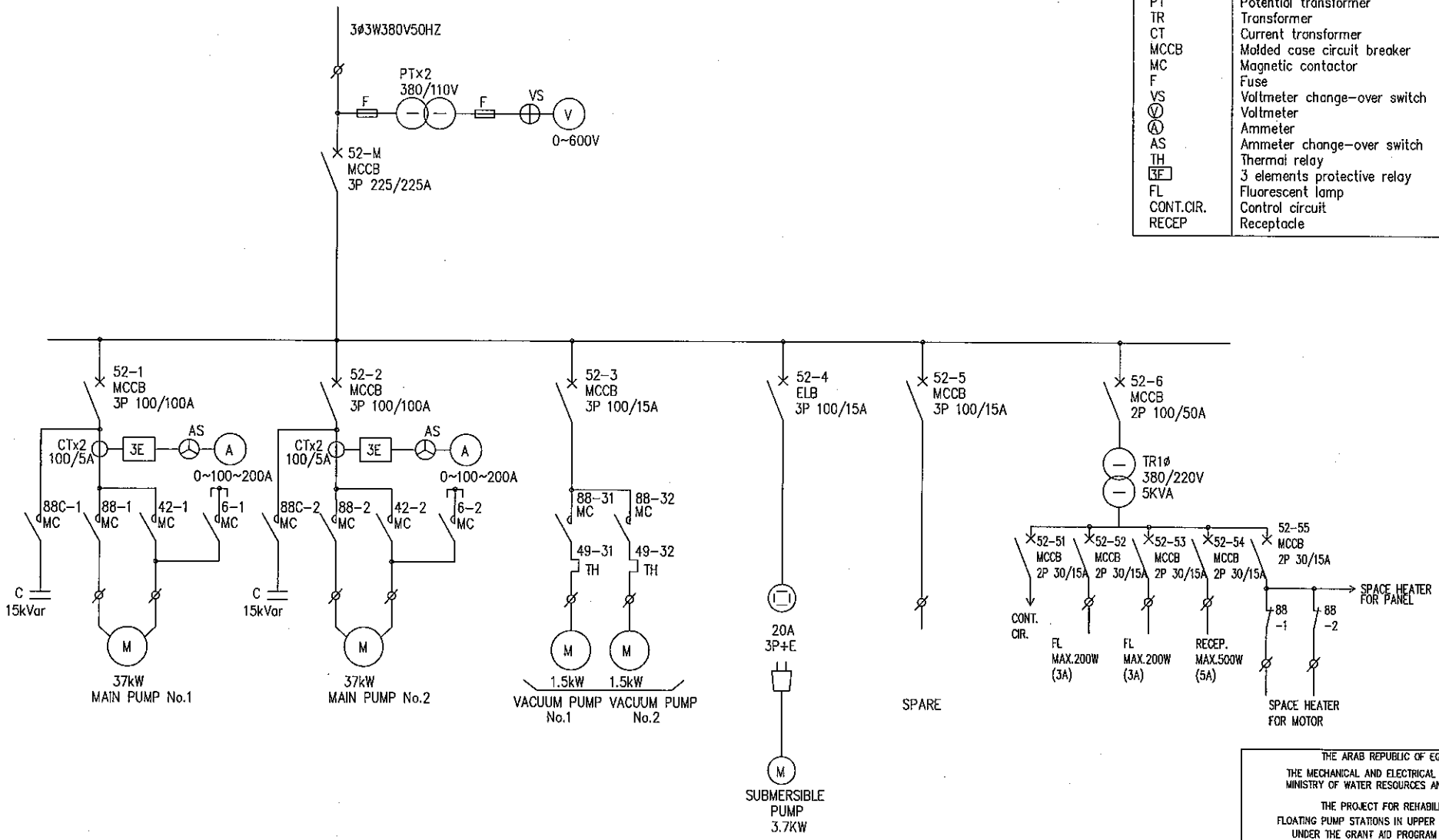
SECTION B – B

S=1/100(S=1/50)

No.1 Plan and Section of Floating Pump Station (No.27、No.30、No.32)

THE ARAB REPUBLIC OF EGYPT THE MECHANICAL AND ELECTRICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV) UNDER THE GRANT AID PROGRAM OF JAPAN
PLAN OF No.27, No30, No32
SANYU CONSULTANTS INC. 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN
DESIGNED CHECKED
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION
DWG. NO. – SHEET – OF –

ABBREVIATIONS	
PT	Potential transformer
TR	Transformer
CT	Current transformer
MCCB	Molded case circuit breaker
MC	Magnetic contactor
F	Fuse
VS	Voltmeter change-over switch
Ⓥ	Voltmeter
Ⓐ	Ammeter
AS	Ammeter change-over switch
TH	Thermal relay
3E	3 elements protective relay
FL	Fluorescent lamp
CONT.CIR.	Control circuit
RECEP	Receptacle



No.2 Single Line Diagram of Floating Pump Station (No.27、No.30、No.32)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

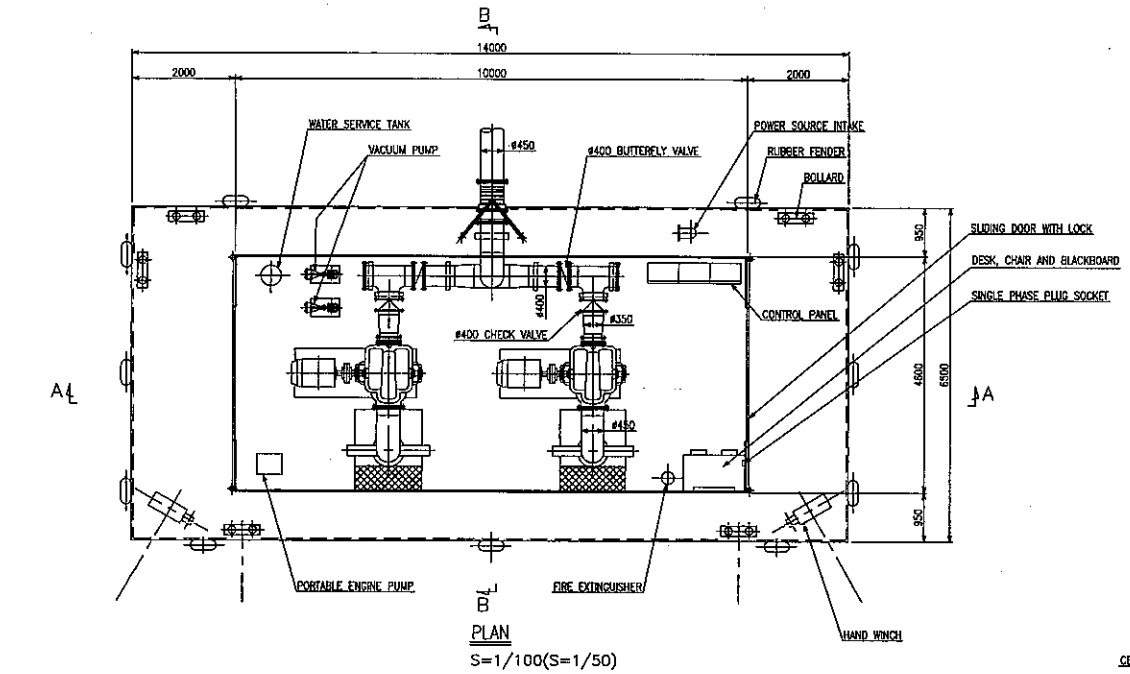
SINGLE LINE DIAGRAM OF
No.27, No.30, No.32

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED CHECKED

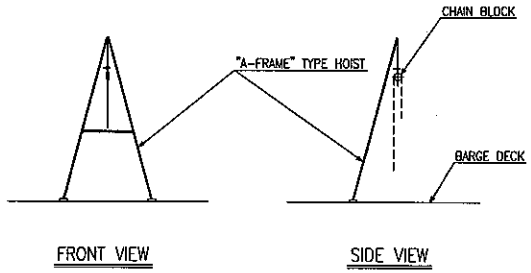
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

DWG. NO. 03 SHEET OF

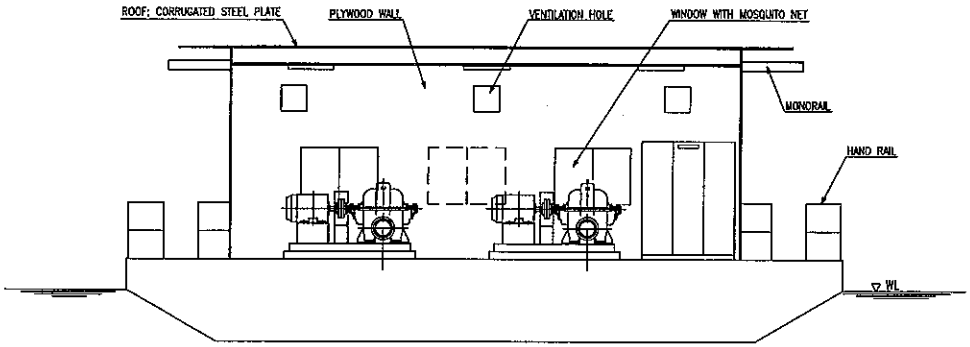


PLAN

S=1/100(S=1/50)

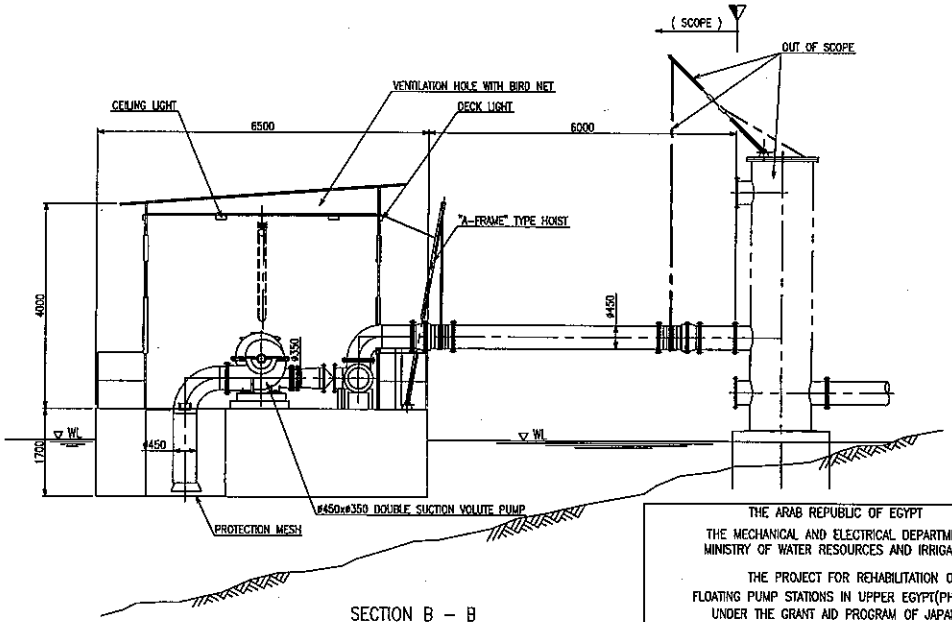


FRONT VIEW SIDE VIEW



SECTION A – A

S=1/100(S=1/50)



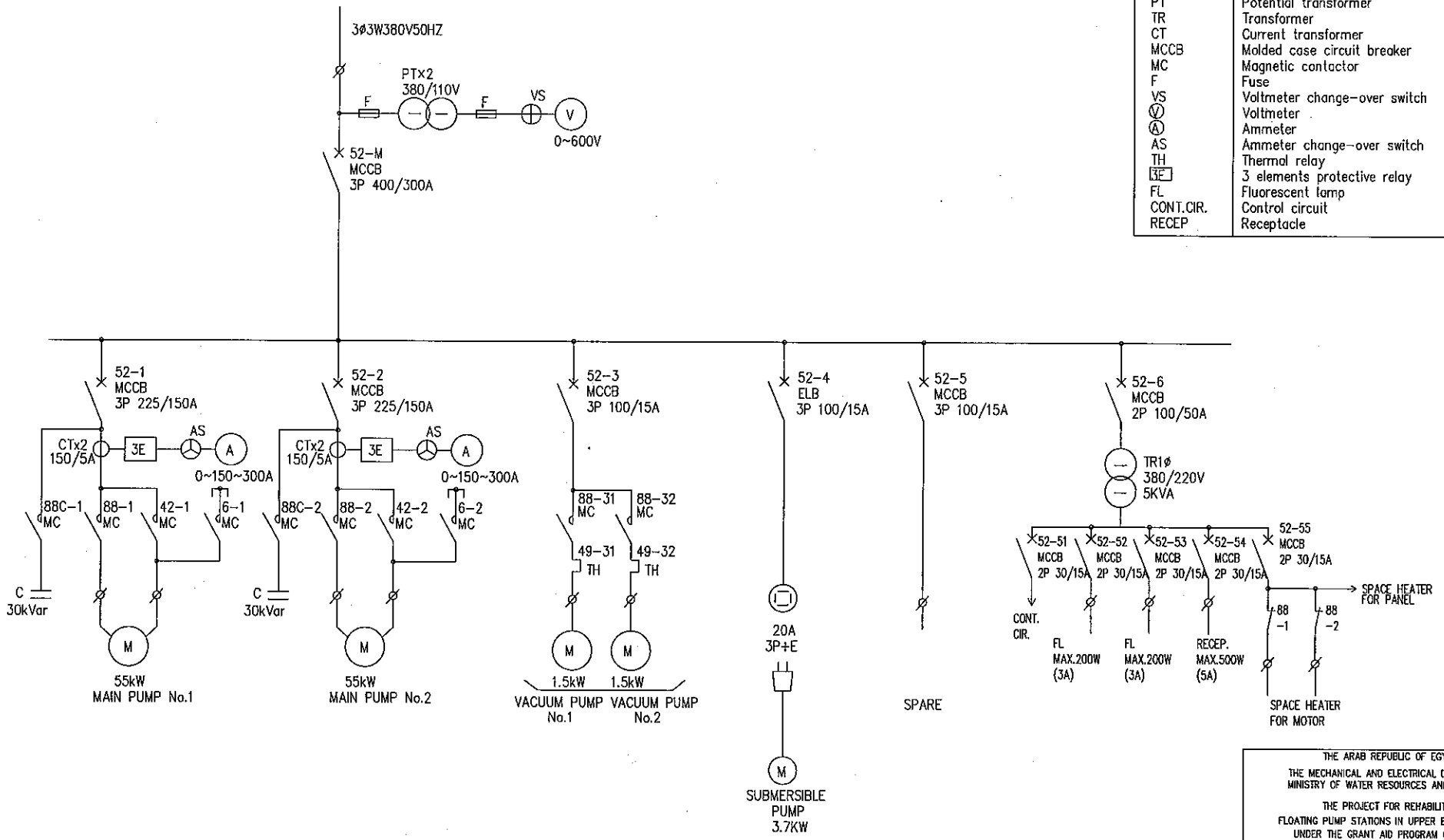
SECTION B – B

S=1/100(S=1/50)

No.3 Plan and Section of Floating Pump Station (No.29)

THE ARAB REPUBLIC OF EGYPT THE MECHANICAL AND ELECTRICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION	
THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV) UNDER THE GRANT AID PROGRAM OF JAPAN	
PLAN OF No.29	
SANYU CONSULTANTS INC. 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN	
DESIGNED	CHECKED
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION	
DWG. NO. –	SHEET – OF –

ABBREVIATIONS	
PT	Potential transformer
TR	Transformer
CT	Current transformer
MCCB	Molded case circuit breaker
MC	Magnetic contactor
F	Fuse
VS	Voltmeter change-over switch
Ⓥ	Voltmeter
Ⓐ	Ammeter
AS	Ammeter change-over switch
TH	Thermal relay
3E	3 elements protective relay
FL	Fluorescent lamp
CONT.CIR.	Control circuit
RECEP	Receptacle



No.4 Single Line Diagram of Floating Pump Station (No.29)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

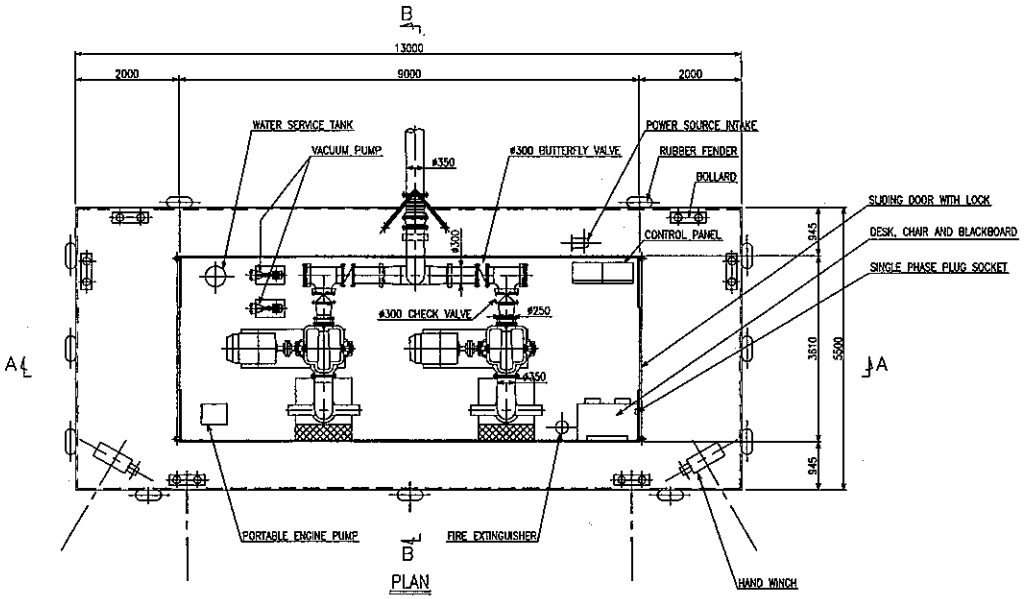
SINGLE LINE DIAGRAM OF
No.29

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED | CHECKED

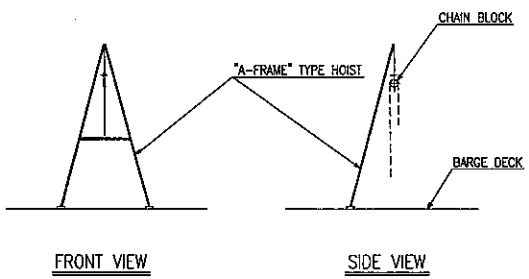
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

DWG. NO. 03 | SHEET OF

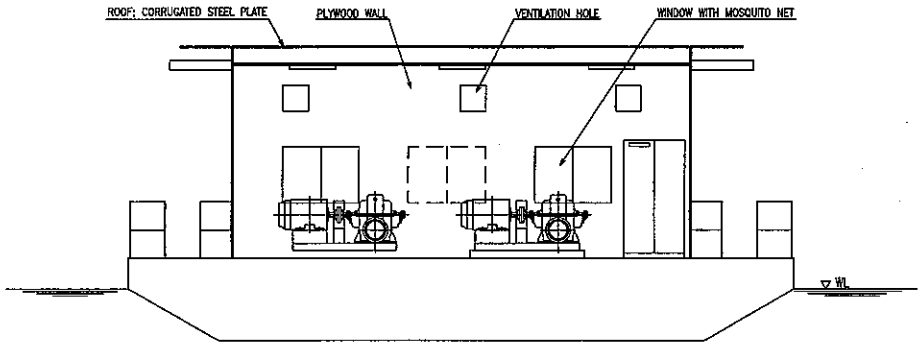


PLAN

S=1/100(S=1/50)

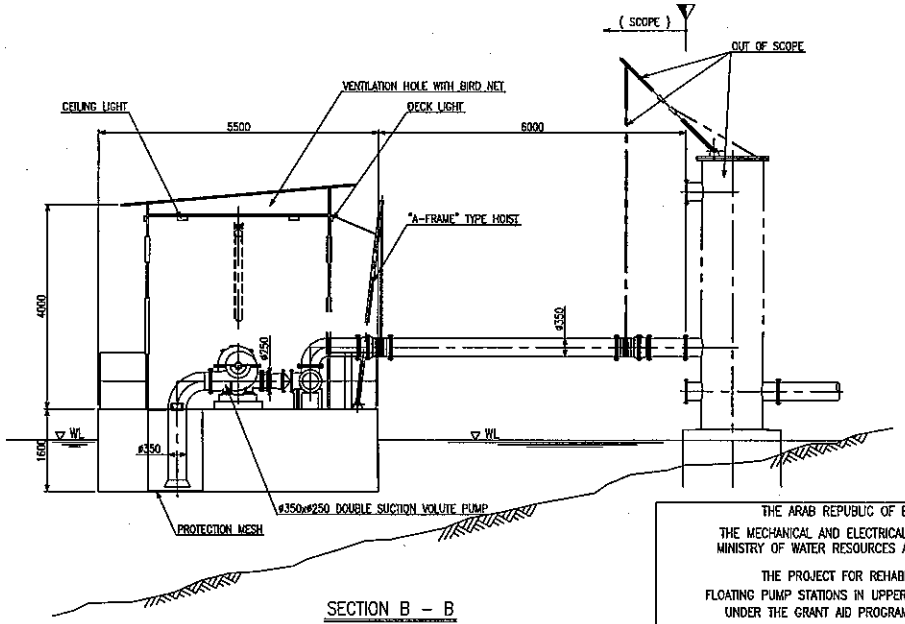


FRONT VIEW SIDE VIEW



SECTION A – A

S=1/100(S=1/50)



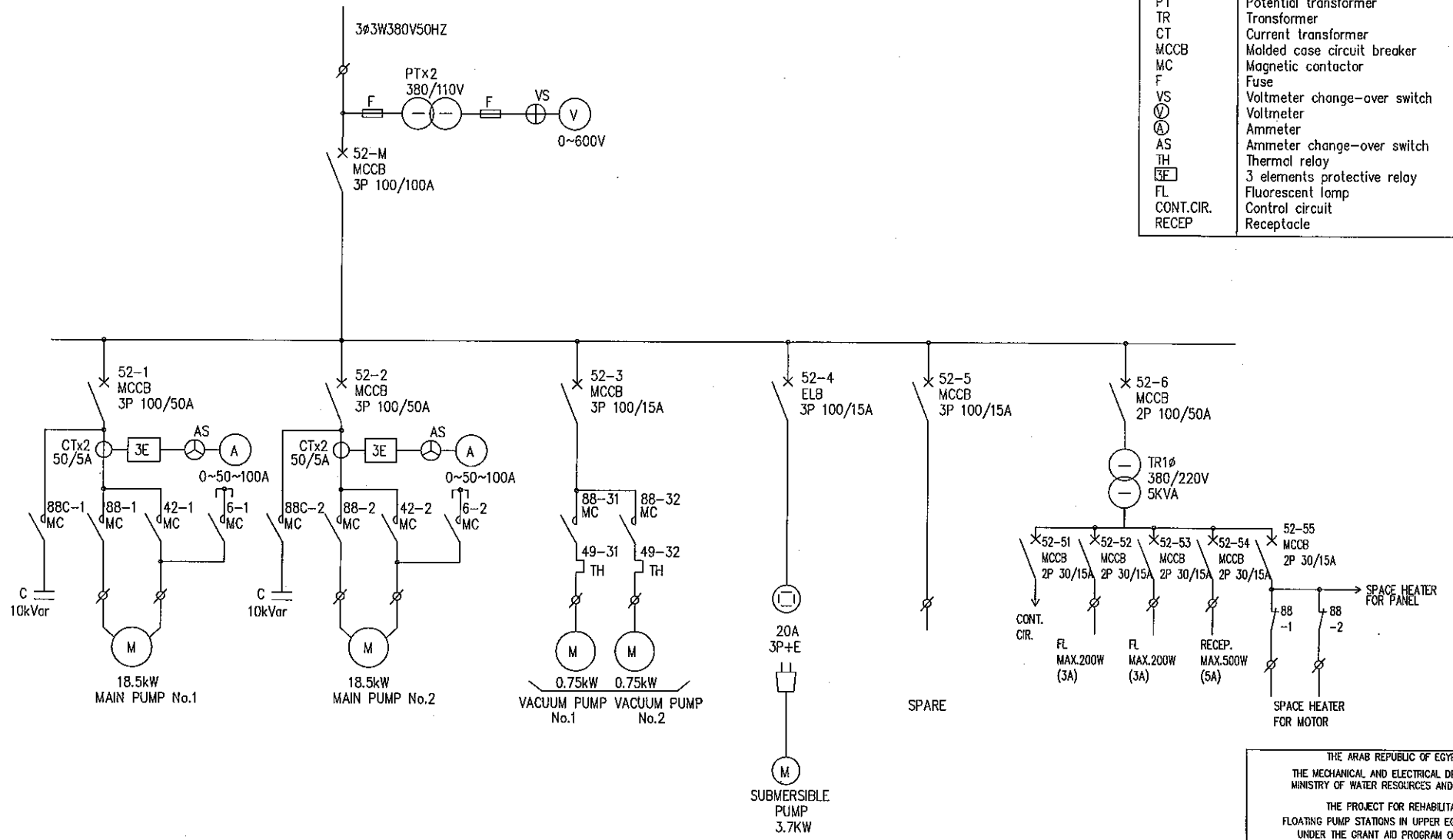
SECTION B – B

S=1/100(S=1/50)

No.5 Plan and Section of Floating Pump Station (No.31)

THE ARAB REPUBLIC OF EGYPT THE MECHANICAL AND ELECTRICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV) UNDER THE GRANT AID PROGRAM OF JAPAN	
PLAN OF No.31	
SANYU CONSULTANTS INC. 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN	
DESIGNED	CHECKED
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION	
DWG. NO. –	SHEET – OF –

ABBREVIATIONS	
PT	Potential transformer
TR	Transformer
CT	Current transformer
MCCB	Molded case circuit breaker
MC	Magnetic contactor
F	Fuse
VS	Voltmeter change-over switch
(V)	Voltmeter
(A)	Ammeter
AS	Ammeter change-over switch
TH	Thermal relay
3E	3 elements protective relay
FL	Fluorescent lamp
CONT.CIR.	Control circuit
RECEP	Receptacle



No.6 Single Line Diagram of Floating Pump Station (No.31)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

SINGLE LINE DIAGRAM OF
No.31

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED CHECKED

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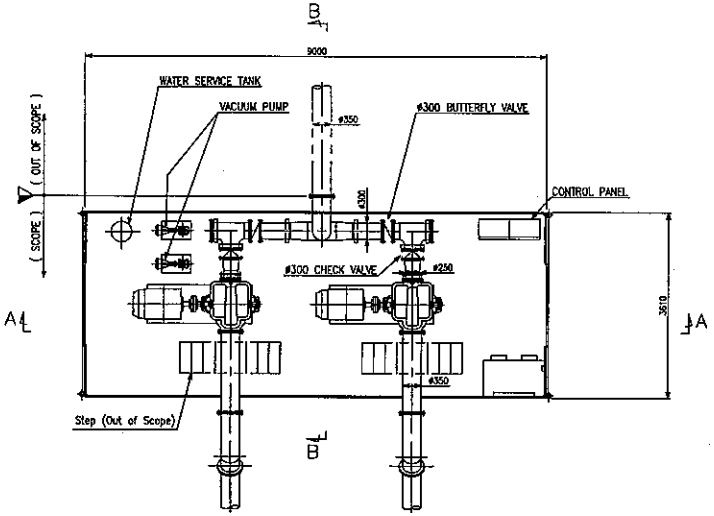
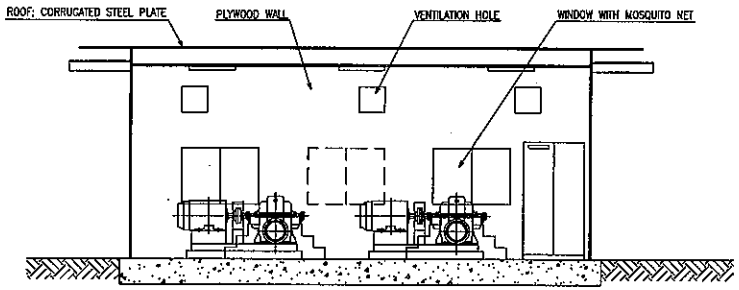
DWG. NO. 03 SHEET OF



PLAN
S=1/100(S=1/50)



SECTION A – A
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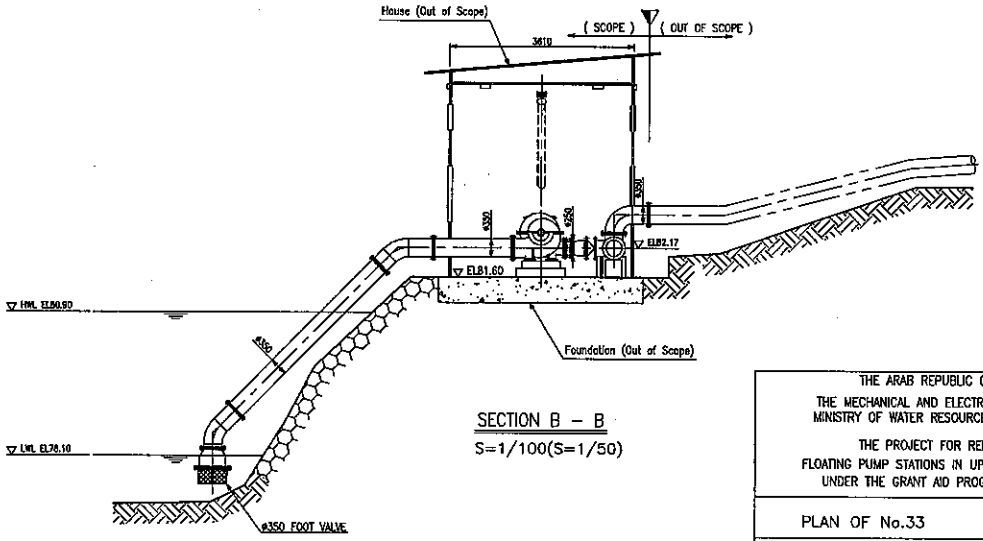
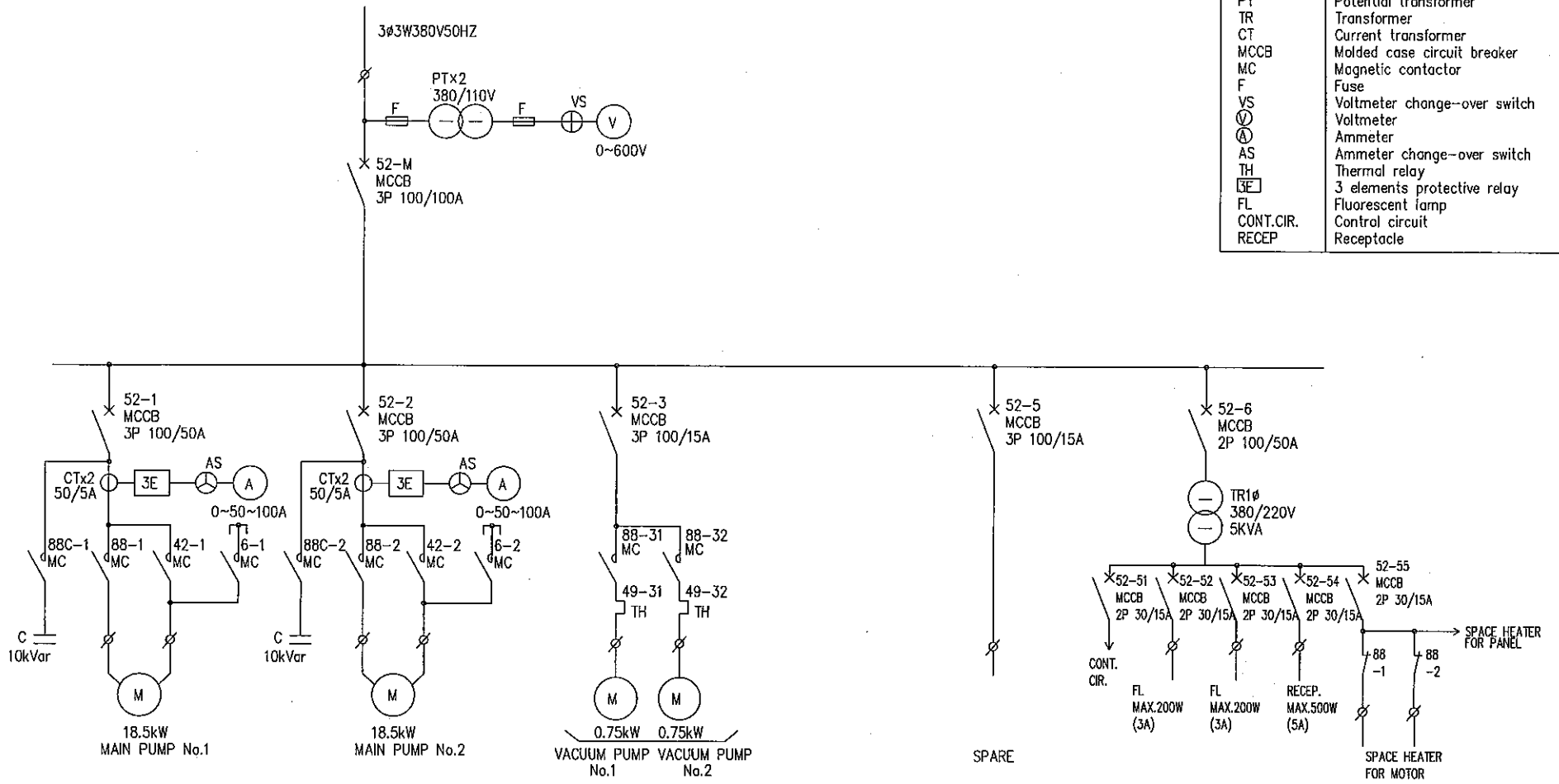


SECTION B – B
S=1/100(S=1/50)

No.7 Plan and Section of Fixed Pump Station (No.33)

THE ARAB REPUBLIC OF EGYPT THE MECHANICAL AND ELECTRICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV) UNDER THE GRANT AID PROGRAM OF JAPAN
PLAN OF No.33
SANYU CONSULTANTS INC. 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN
DESIGNED CHECKED
APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION
DWG. NO. – SHEET – OF –

ABBREVIATIONS	
PT	Potential transformer
TR	Transformer
CT	Current transformer
MCCB	Molded case circuit breaker
MC	Magnetic contactor
F	Fuse
VS	Voltmeter change-over switch
Ⓥ	Voltmeter
Ⓐ	Ammeter
AS	Ammeter change-over switch
TH	Thermal relay
3E	3 elements protective relay
FL	Fluorescent lamp
CONT.CIR.	Control circuit
RECEP	Receptacle



No.8 Single Line Diagram of Fixed Pump Station (No.33)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

SINGLE LINE DIAGRAM OF
No.33

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

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MINISTRY OF WATER RESOURCES AND IRRIGATION

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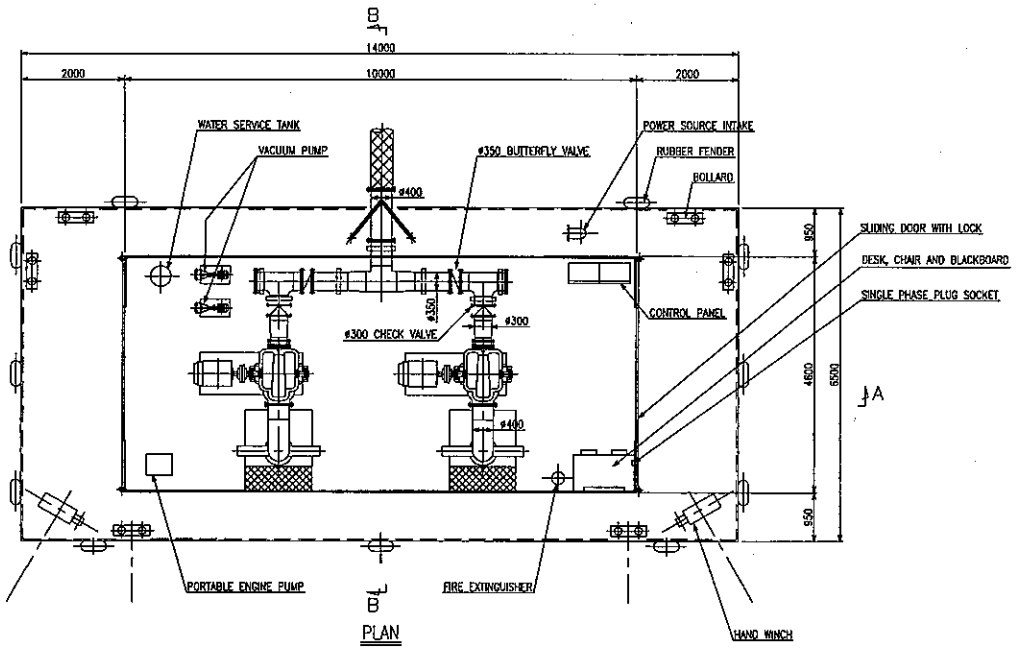
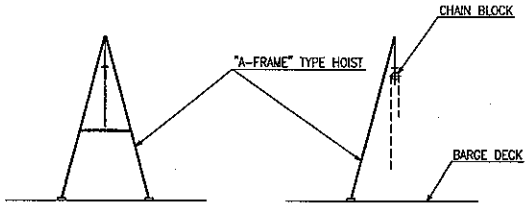
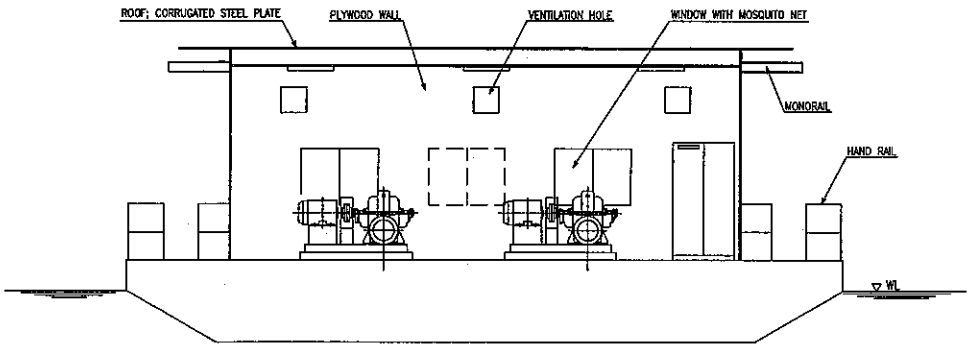


PLAN

S=1/100(S=1/50)



FRONT VIEW SIDE VIEW



SECTION A – A

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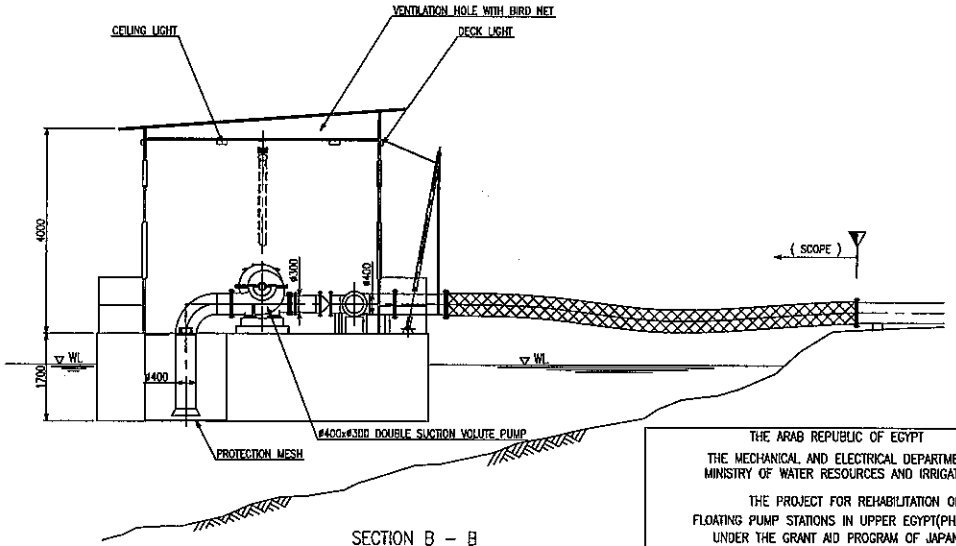

SECTION B – B

S=1/100(S=1/50)

No.9 Plan and Section of Floating Pump Station (No.34)

THE ARAB REPUBLIC OF EGYPT THE MECHANICAL AND ELECTRICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV) UNDER THE GRANT AID PROGRAM OF JAPAN
PLAN OF No.34
SANYU CONSULTANTS INC. 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN
DESIGNED CHECKED
APPROVED BY:THE MECHANICAL AND ELECTORICAL DEPARTMENT MINISTRY OF WATER RESOURCES AND IRRIGATION
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FL	Fluorescent lamp
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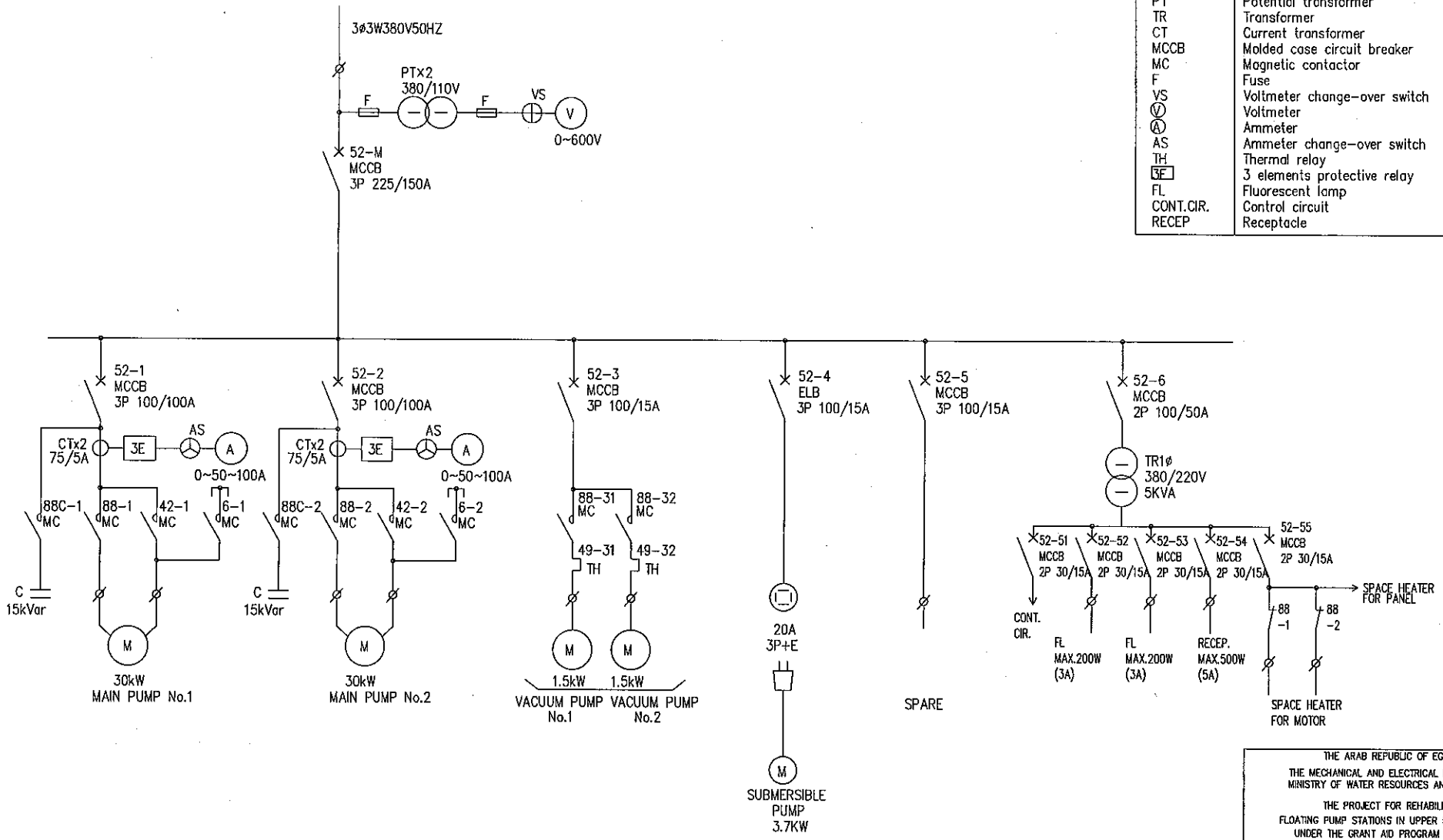


No.10 Single Line Diagram of Floatin Pump Station (No.34)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

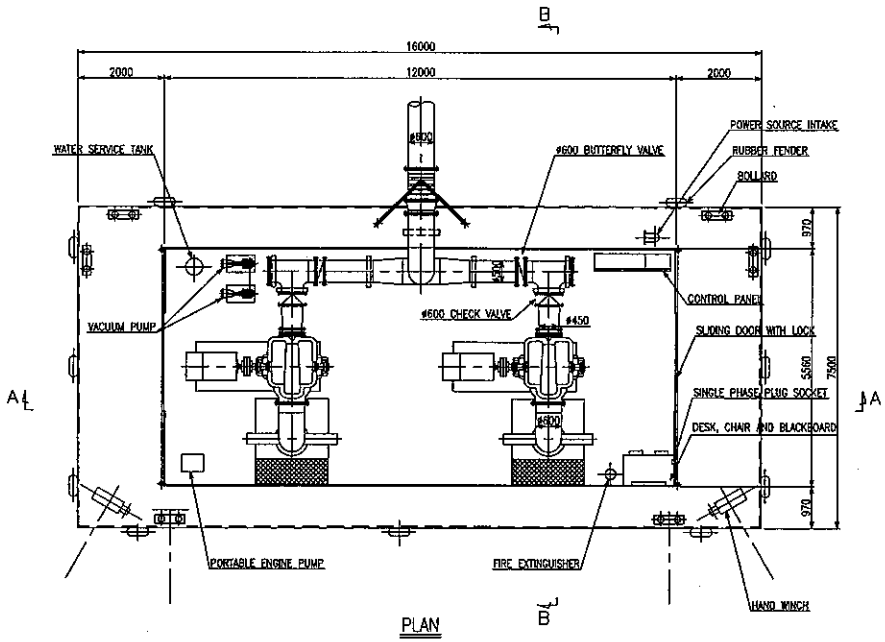
SINGLE LINE DIAGRAM OF
No.34

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED CHECKED

APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

DWG. NO. 03 SHEET OF



PLAN

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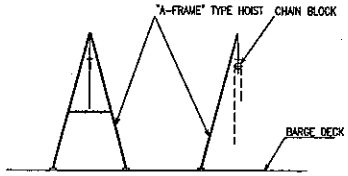
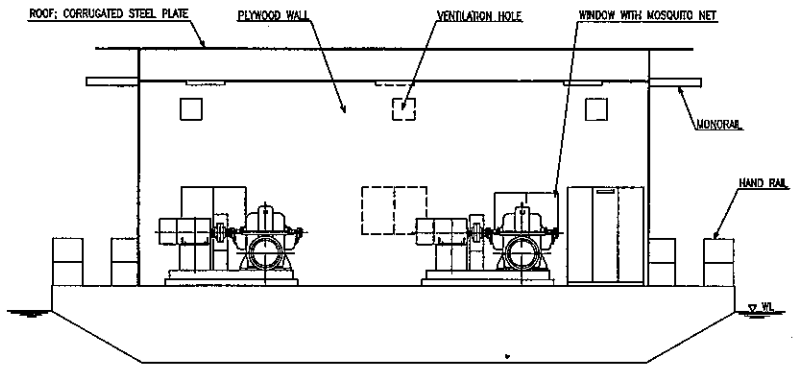


FRONT VIEW SIDE VIEW



SECTION A – A

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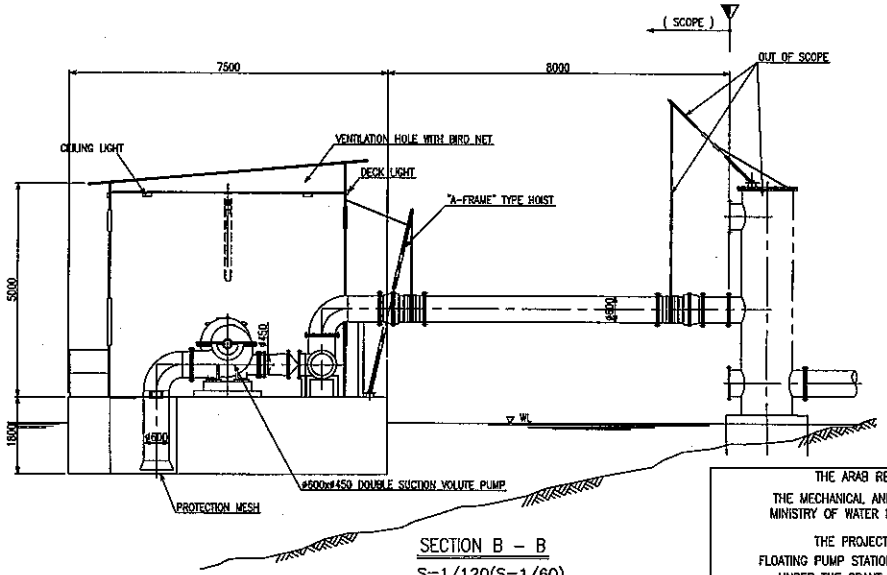

SECTION B – B

S=1/120(S=1/60)

No.11 Plan and Section of Floating Pump Station (No.35)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE IV)
UNDER THE GRANT AID PROGRAM OF JAPAN

PLAN OF No.35

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED CHECKED

APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

DWG. NO. – SHEET – OF –

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TR	Transformer
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TH	Thermal relay
3E	3 elements protective relay
FL	Fluorescent lamp
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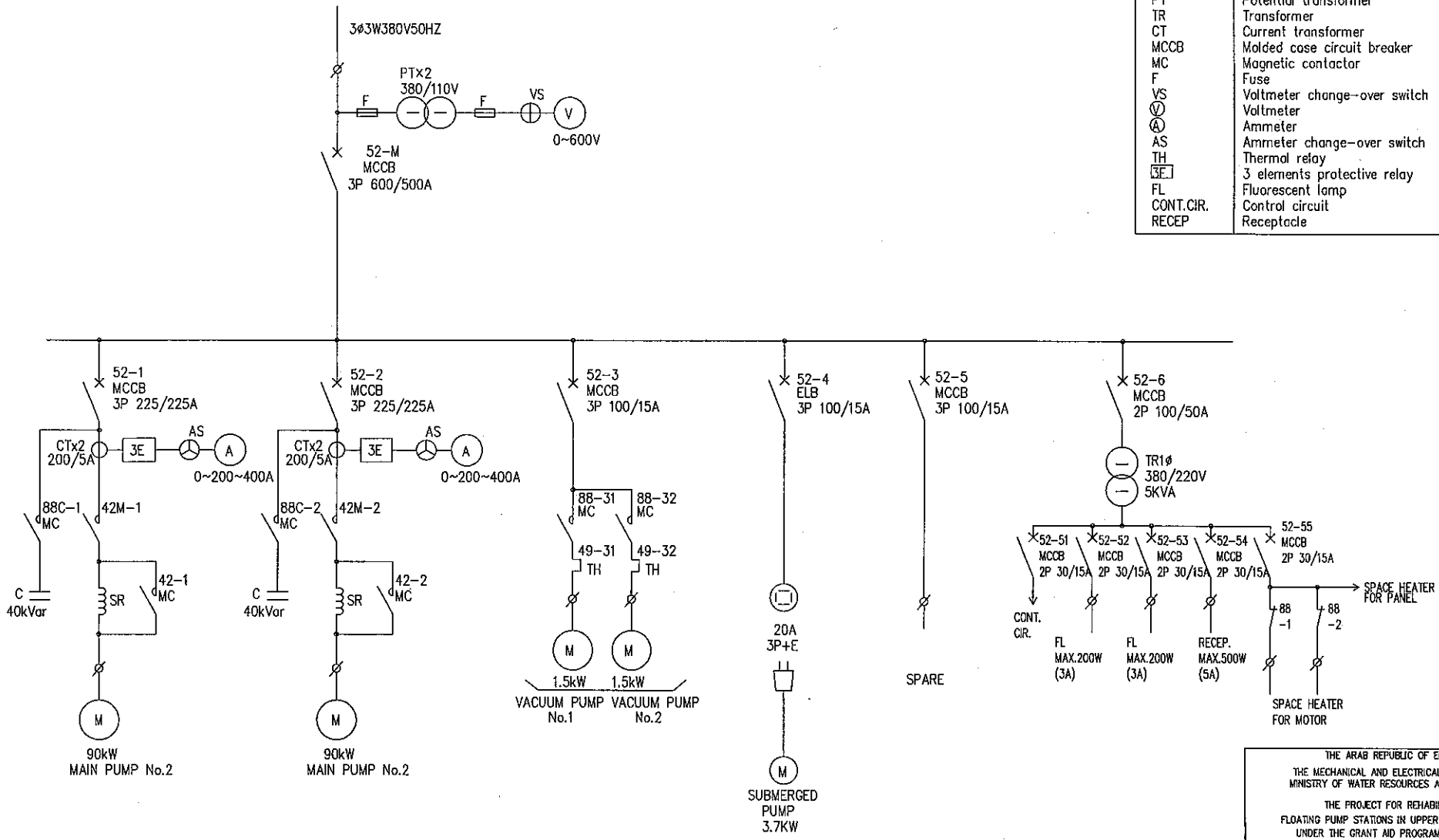


No.12 Single Line Diagram of Floating Pump Station (No.35)

THE ARAB REPUBLIC OF EGYPT
THE MECHANICAL AND ELECTRICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

THE PROJECT FOR REHABILITATION OF
FLOATING PUMP STATIONS IN UPPER EGYPT(PHASE III)
UNDER THE GRANT AID PROGRAM OF JAPAN

SINGLE LINE DIAGRAM OF
NO35

SANYU CONSULTANTS INC.
15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA, JAPAN

DESIGNED | CHECKED

APPROVED BY: THE MECHANICAL AND ELECTORICAL DEPARTMENT
MINISTRY OF WATER RESOURCES AND IRRIGATION

DWG. NO. 07 | SHEET OF

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The project is to procure the floating pump stations consisted of pumps with motors, barges and other necessary equipment which are united in each one pump station. The Mechanical and Electrical Department (MED) of Ministry of Water Resources and Irrigation is the direct executing agency of the Project.

All of the equipment and materials are to be procured in Japan. Inland transportation of the pump stations procured shall be carried out by MED.

Setting the pump station and connecting the discharging pipe with tower and subsequent test run are to be carried out by the workforce of MED. Supervisory mechanical engineer for the installation works of equipment will be provided by the supplier.

2-2-4-2 Implementation Conditions

GOE shall be responsible for necessary works of customs clearance and exemption from taxation, also for removing and reinstalling the roof portion of the deck house in some bridge location where the clearance under the bridge are not enough for the barges to pass through during inland transportation along the river.

2-2-4-3 Scope of Works

For the project implementation, the following works shall be carried out and be borne by GOE.

- Customs clearance at Alexandria port and inland transportation to each site.
- Installation of floating pump station, equipments and materials for each pump station, and demonstration/trial run.
- New construction, and alteration and rehabilitation of discharge tower, water pipes, valves, transformer, power cable and irrigation canal up to farm land.
- Removal of the existing pump station shed, foundation works and installation of discharge pipe at No.33 Middle Fawaza pump station

These are same nature of works as previous projects (phase-1, phase-2 and phase-3).

Responsibilities of the Government of Japan are the procurement of equipment and materials as indicated in Section 2-2-3 “Basic Design Drawing”, and ocean transportation from Japan to Alexandria.

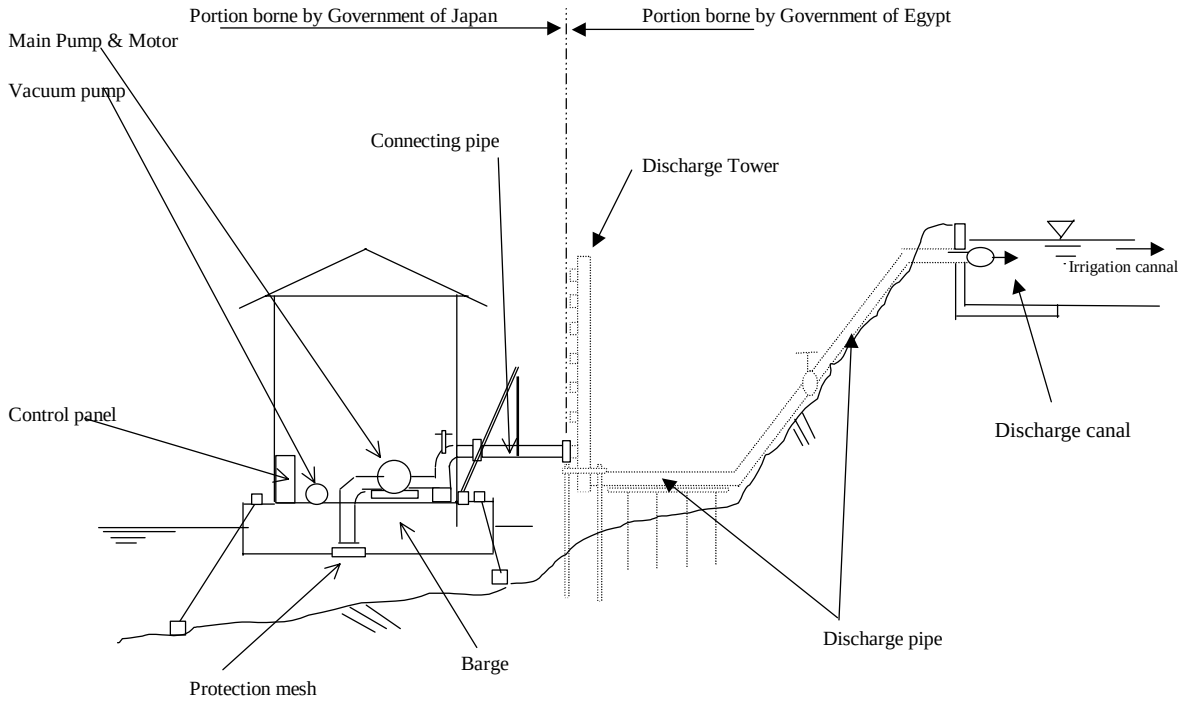


Figure 2-3 Typical Drawing of Pump Station

2-2-4-4 Consultant Supervision

(1) Supervision for Procurement

Interim inspection: Before commencement of manufacturing of equipment and materials, the manufacturing drawing shall be inspected in accordance with design drawing.

Factory inspection: After completion of manufacturing of procured equipment and materials, their specifications shall be confirmed based on the contract documents. Also the performance and data of major equipment shall be inspected at a supplier's factory.

Pre-shipment inspection: Prior to shipment of procured equipment and materials, the consultant will organize the inventory check by the third inspection agency.

Inspection on installation at site:

To inspect and conduct ① proper installation and adjustment of equipment and materials, ② test-run of equipment and training on operation and maintenance, and ③ final inspection and hand over of equipment and materials.

(2) Supervision by MED

As mentioned in 2-2-4-3, customs clearance, inland transportation from Alexandria to the site and installation, test-run of the pump station equipment shall be conducted by GOE.

2-2-4-5 Procurement Plan

Floating pump stations consist of pumping facilities and barge assembled by many equipment, materials and parts, which are procured taking into account the following viewpoints:

- Pump stations shall be systematically manufactured through design and assembling stages in order to fulfill the function of a pump unit.
- Equipment and materials in this project will be procured in Japan taking into account the quality of unit function and after-sales service.
- Procurement of equipment and materials in this project will include the supervision of pump station installation, adjustment of equipment and materials and confirmation of test-run by the supplier under the supervision of the Consultant.

Spare Parts for equipment and materials will be determined on the following basis:

- To prepare minimum required quantity of spare parts, since the site are located far from Cairo.
- To prepare spare parts required for repairing based on actual consumption records of spare parts supplied in phase-1, phase-2 and phase-3 taking into consideration the 20-25 years durable period of pump.
- To prepare spare parts which are hardly available in Egypt such as main shafts, bearings, control breakers of pump and motor.

Equipment and materials will be loaded off at Alexandria Port and, after custom clearance they will be towed to the site along the River Nile by GOE.

2-2-4-6 Implementation Schedule

The project will be implemented after the Exchange of Notes as follows:

(1) Implementation Planning Stage

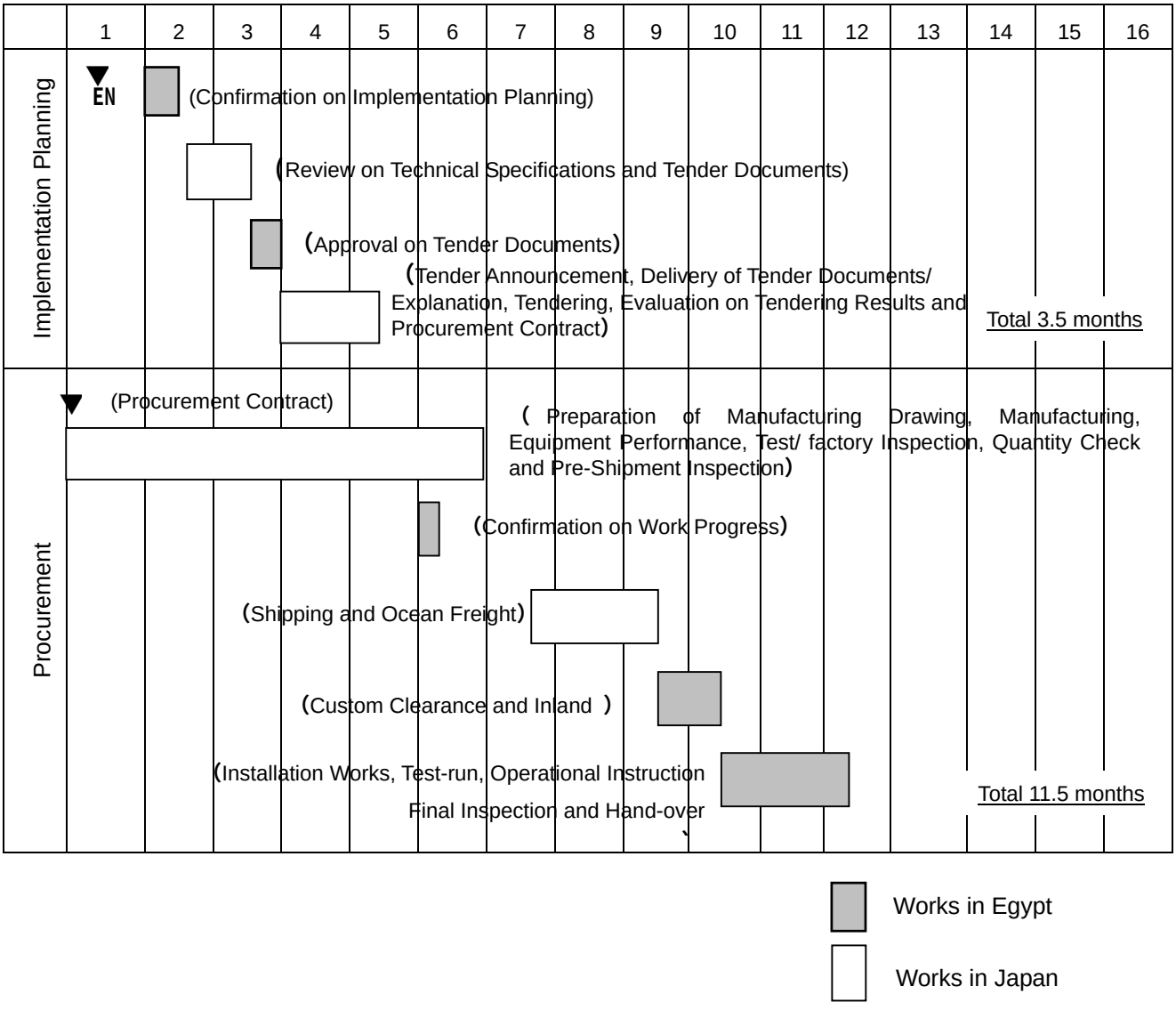
Confirmation on Implementation Planning	0.5 months
Review on Technical Specifications and Tender Documents	1.0 month
Approval on Tender Documents	0.5 months
Tender Announcement, Delivery of Tender Documents/ Explanation, Tendering, Evaluation on Tendering Results and Procurement Contract	1.5 months
Total	3.5 months

(2) Procurement Stage

Preparation of Manufacturing Drawing, Manufacturing, Equipment Performance Test/ factory Inspection, Quantity Check and Pre-Shipment Inspection	6.5 months
Shipping and Ocean Freight	2.0 months
Custom Clearance and Inland Transportation	1.0 month
Installation Works, Test-run, Operational Instruction, Final Inspection and Hand-over	2.0 months
Total	11.5 months

Implementation schedule of the Project is tentatively shown in Table 2-21.

Table 2-21 Implementation Schedule



2-3 Obligations of the Egyptian Government

In the implementation of the Project, GOE is responsible for undertaking such necessary measures as follows:

2-3-1 General

(1) To provide necessary data and information for detailed design conducted by the Japanese consultant after commencement of the Project
(2) To secure land necessary for the sites of the Project prior to commencement of the installation
(3) To provide facilities for the distribution of electricity and other incidental facilities in and around the sites
(4) To bear an advising commission of an authorization to pay and payment commissions to the Bank
(5) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of Alexandria and internal transportation of the pump stations procured under the Grant Aid
(6) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies, which will be imposed in Egypt with respect to the supply of the products and services under the Verified Contracts
(7) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into Egypt and stay therein for the performance of their works
(8) 'Proper Use' of procured equipment and materials should be secured. The recipient country is duty to maintain and use the facilities constructed and equipment procured under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to inform the conditions of equipment procured by the Grant aid to Japanese side as requested, the products purchased under the Grant Aid should not be re-exported from the recipient country
(9) To bear all expenses other than those to be borne by the Grant Aid, necessary for the execution of the Project

2-3-2 Specific Works

The following Table 2-22 shows the undertakings by GOE regarding the specific works:

Table 2-22 Contents of the Undertakings by the Egyptian Side

Pump Station	Water Tower (for Discharge)	Discharge Pipe	Trans-former	Electric Cable	Discharge Canal*	Others
No.27 Gezeret El-Kobania Kebli	Vertical extension of water tower, Painting	Replacement of pipe with inner diameter 600mm×34m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=50m	Repairing of canal lining at L=30m (MED)	–
No.29 Sahel El-Akab Bahary	Painting, removal of second tower	Replacement of pipe with inner diameter 600mm×45m, lifting-up of horizontal level of pipe	Replacement of transformer with 300KVA/ 400V	Replacement of cable with 600V 3c 38mm^2 L=50m	Repairing of canal lining at L=30m (MED)	Improvement of siphon structure of irrigation canal crossing drainage (ID)
No.30 Gezeret Meneha	New installation of vertical type water tower with outer diameter 1000mm, suction intake with inner diameter 450mm×4pcs	New installation of pipe with inner diameter 600mm×33m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.31 El-Sarag	New installation of vertical type water tower with outer diameter 1000mm, suction intake with inner diameter 350mm×4pcs	New installation of pipe with inner diameter 450mm×23m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 5.5mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.32 Gezeret El -Fawaza El-Keblia	New installation of vertical type water tower at outer diameter 1000mm, suction intake at inner diameter 450mm×4pcs	New installation of pipe with inner diameter 600mm×16m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=30m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.33 Middle Fawaza	–	Replacement of pipe with inner diameter 450mm×14m	–	Replacement of cable with 600V 3c 5.5mm^2 L=20m	Repairing of canal lining at L=30m (MED)	Removal of pump shed & equipment, Foundation Works, Adjustment of Suction Pipes, Compensated water supply during rehabilitation works**(MED)
No.34 Gezeret Abo Arafa	–	Painting of existing pipe, Installation of two (2) flexible pipe supports	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 8mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dredging around Pump Station (MED)
No.35 El-Hegs El-Mostagda	Painting	Replacement of pipe with inner diameter 750mm×27m with flap valve	–	Replacement of cable with 600V 3c 100mm^2 L=50m	Removal of water weed (MED)	Checking of canal capacity, enlargement of canal section if necessary, improvement of pipe structure crossing path and drainage (ID)
Implementation Order (see Annex IV)	1	2	1	1	3	No.29:2(stage1) No.30~32:3(stage2) No.33 :1(stage2) No.34 :2(stage1) No.35 :2(stage1)

Note: * MED is responsible for discharge canals for 30m in length from the end of discharge pipe. ID is responsible for the remaining main and secondary canals.

** MED is responsible for installing emergency pump(s) to supply enough amount of irrigation water during the period of rehabilitation works for No.33 pump station.

2- 4 Project Operation Plan

2-4-1 Staff

O&M General Directorate of Upper Egypt (in Idfu) and O&M General Directorate of South Upper Egypt (in Kom Ombo) under MED are responsible for the execution and operation of the pump stations of the Project. Pump stations in Upper Egypt region have been managed and operated well for a long time. The present engineers and technicians have implemented the phase-1, phase-2 and phase-3 projects with sufficient technical capacity. Currently, MED appoints 8 supervisors, 28 mechanics/electricians and 21 operators for target 8 pump stations.

2-4-2 Contents of Maintenance Works

Rehabilitated pump stations will be maintained in accordance with the following manners:

- Specification sheets, operation & maintenance manuals, spare parts list, operation records and so on should always be available for the daily inspection and maintenance. To prolong the equipment life, the operation records shall be described in accordance with the checking items such as suction pressure, discharge pressure, discharge, current, voltage, suction water level, vibration, noise, etc.
- Spare parts, gaskets, grease, tools, etc. should be equipped.
- Inspection shall be made periodically with short intervals at the initiation period of pump operation in order to maintain fitness and stability between pump equipment and barge as well as pipefittings.

1st month	:	Check of temperature at shaft bearings, water leakage, noise, suction/discharge pressure, current, etc.
3rd month	:	Injection of grease at shaft bearings, measurement of vibration/ noise/ current
6th month	:	Change of grease at shaft bearings, replacement of grand packing, if necessary
One year or more	:	Disassembling of pump casing, replace of parts such as sleeves, grand packing, bearings, O-rings, gaskets, if necessary, check of tightness of bolts, check of abnormal parts in temperature/ noise/ vibration/ rush current/ isolation/ etc., check of inside of pipes and valves, cleaning

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The total cost needed for implementation of the Project under the Grant Aid is estimated at 828 million yen. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant. On the basis of the above mention, itemized shares of cost undertaken by Japan and Egypt are estimated as follows;

Estimated total project cost Approx. 828 million yen

(1) Cost Estimation undertaken by the Government of Japan Approx. 742 million yen

Unit: million yen

Item	Stage I	Stage II	Total
Procurement of equipment/materials	413	287	700
Implementation and supervisory services	21	21	42

(2) Cost Estimation undertaken by the Government of Egypt Approx. 86 million yen

Total costs borne by the Government of Egypt for the project implementation is estimated as follows:

Cost Description	Amount （thousand LE）
(1) Custom clearance and inland transport	Approx. 3,088
(2) Installation work	Approx. 70
(3) Improvement of irrigation facilities	Approx. 1,093
Total	Approx. 4,251

Note: Transportation from Alexandria to the project site and installation shall be borne by the Government of Egypt. Further detail estimation shall be made and confirmed by MED.

2-5-2 Operation and Maintenance Cost

The annual operation and maintenance cost of eight (8) pump stations is 365 thousand LE (or equivalent to 161 LE/feddan). After implementation of the Project, annual operation and maintenance cost for eight (8) pump stations composed of replaced floating pumps and one (1) fixed pumps is estimated at approximately 405 thousand LE (or 169 LE/feddan) as shown in Table 2-23.

Table 2-23 Annual Operation and Maintenance Cost of Pump Stations

Unit: LE

	Past Records for Existing 8 Stations			Estimated Cost for 8 Stations after Rehabilitation
	2003	2004	2005	
Maintenance	1,750	1,056	2,276	1,522
Electricity and Fuel	95,851	56,054	78,861	92,227
Wages and Salary	317,624	229,140	311,541	311,541
Total	415,226	286,250	392,678	405,291
Service Area (feddan)	2,263	2,263	2,263	2,393
Water Supply(1000m^3)	28,815	26,304	26,334	35,472
Unit Cost per 1000 m^3	14.4	10.9	14.9	11.4
Unit Cost per feddan	184	127	174	169

Annual operation and maintenance cost after implementation of the Project will increase at 3% of annual operation cost in 2005 due to full operation with 2 sets of pumps at each station. However, O&M cost per unit water supply amount by pumps will be decreased to 11.4LE/1000m^3 from 14.9 LE/1000m^3 in 2005 in terms of effective use of water resources by rehabilitation of eight(8) pump stations.

In the Project, some pump stations are renewed in discharge capacity, while there is no pump station newly constructed. The number of staff will not change. Therefore, MED would be financially-capable for operation and maintenance of rehabilitated pump stations in the current budget level.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effects

The definite effects by the implementation of the Project are expected as follows:

(1) Present Situation and Problems

1) Agricultural production is depending on the pump irrigation from the Nile River with problems such as;
   - Malfunction of pump stations due to deterioration,
   - Frequent mechanical trouble, and
   - Long period of repair works for malfunctioned pumps, which are affecting farming activities in terms of non-availability of irrigation water.
2) Expansion of farmland has been promoted up to the permissible range of topographical conditions by farmers themselves. However, limited irrigation water is the main constraints for the horizontal and vertical expansion to increase agricultural production and yields.

(2) Strategies (Project Components)

1) Procurement of the equipment necessary for the improvement of eight (8) pump stations that require urgent rehabilitation.
2) Current beneficial area of eight (8) pump stations is 2,255 feddan (947 ha).

(3) Project Effects

① Direct effect

1) Current pump efficiency being 30 to 40% will be improved to 80% in maximum water demand period.

   Where, pump efficiency (E) in terms of energy transmission is calculated as the following equation:

   $E(\%) = WP / EP \times 100$

   WP: Water power output (kW)
   EP: Electrical power input (kW)

2) Total discharge delivered by eight (8) pump stations will be increased by 24 % from the current discharge at 28.6 million m^3/year.
3) Crop production will be increased by 27% from the current annual production at 19,500 tones.
4) O&M cost per unit volume of supply water by pump stations will be decreased.

② Indirect effect

1) Live stock number owned by farmers according to stable produce of feed crop

2) Agricultural income of farmers will be increased

3-2 Recommendations

To achieve expected benefits of the project, it is the duty for the Egyptian side to respond to the following issues simultaneously with the improvement of pump stations.

(1) Constraints and Recommendations on Improvement of Irrigation Facilities

The targeted rehabilitation works of irrigation facilities in the entire Project consist of floating pump stations, discharge towers, discharge pipes, discharge canals and irrigation canals at seven (7) sites and a fixed pump station, a discharge tower, discharge pipes and irrigation canals at one (1) site. The scope of the Project is to improve eight (8) pump stations until connection pipes which connect pump stations to discharge towers. The rehabilitation works for other facilities excluding eight (8) pump stations with connection pipes shall be implemented by the Egyptian side. Basically the existing discharge towers and facilities after the towers will be utilized, but the facilities, which are deteriorated and insufficient capacity, shall be urgently implemented by MED and ID of MWRI to meet the increment of supply water for irrigation areas with higher cropping intensity. Such improvement and rehabilitation works will be possibly executed under the present O&M system, and GOE shall recognize necessity of budget allocation for the works.

1) Recommendations to MED

MED is required to execute the following works in accordance with improvement and replacement of the pump stations.

Pump Stations	Components of the Works
No.27 Gezeret El-Kobania Kebly	Repair of discharge tower, renewal of discharge pipe, transformer and power cable, repair of discharge canal
No.29 Sahel Al-Akab Bahary	Repair of discharge tower, dismantlement of old discharge tower, renewal of discharge pipe, transformer and power cable
No.30 Gezeret Meneha	New installment of discharge tower, renewal of discharge pipe, transformer and power cable, repair of connection canal, dismantlement of existing pump unit
No.31 El-Sarag	New installment of discharge tower, renewal of discharge pipe, transformer and power cable, repair of connection canal, dismantlement of existing pump unit
No.32 Gezeret El-Fawaza El-Keblia	New installment of discharge tower, renewal of discharge pipe, transformer and power cable, repair of connection canal, dismantlement of existing pumps unit

No.33 Gezeret Fawaza	Renewal of discharge pipe, power cable, repair of discharge canal, dismantlement of existing pumps unit and pump shed, foundation work, compensation on water supply during works (introduction of temporally-installing pump unit)
No.34 Gezeret Abo Arafa	Renewal of discharge pipe, power cable and transformer, repair of discharge canal, dredging around pump station
No.35 El-Hegs El-Mostagda	Repair of discharge tower, renewal of discharge pipe and power cable

2) Recommendations to ID

ID is required to execute improvement works for existing canals connected with the pump stations in accordance with replacement of the said pump facilities and discharge pipes.

Pump Stations	Components of the Works
No.29 Sahel Al-Akab Bahary	Cleaning and repair of siphon structure
No.35 El-Hegs El-Mostagda	Removal of waterweed, enlargement of canal section and concrete pipes if necessary,

(2) Problems and Recommendations on O&M of the Pump Stations

Since procured pumps are operated through the year, temporary non-operation is expected during irrigation period for inspection and repair in accordance with its deterioration and aging. Therefore, MED is required to maintain existing pump stations replaced by the project in order to cope with such situations.

(3) Technical Assistance or Necessity of Cooperation with Other Donors

In Egypt, the rehabilitation of pump stations have been implemented in the whole country financially-assisted by the World Bank and other donors, and the target pump stations for rehabilitation are located even in Upper Egypt. However, these pump stations cover large-scale beneficial areas with more than 10,000 feddan and possess independent irrigation networks. On the other hand, the Japan's Grant Aid Project had been targeting the small-scale pump stations, and thus, there have been great benefits for especially small-scale farmers in Upper Egypt. Although the rehabilitation of deteriorated pump stations by the donors including Japan, the productivity of agriculture had improved up to now.

However, for the sustainable agriculture and further augmentation of crop production in Upper Egypt, it is suggested that GOE should initiate self-financed rehabilitation of deteriorated pump stations and maintenance of irrigation canals.

(Appendixes)

Appendix-1. Member List of the Study Team

The Basic Design Study Team of the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (Phase IV)

Team Leader：	Wada Yasuhiko	Japan International Cooperation Agency (JICA) Duputy Resident Rpresentative, Egypt Office
Project Management：	OYA Takeyuki	Japan International Cooperation Agency (JICA) Grant Aid Management Department
Chief Consultant / Irrigation Planner：	OBU Fumimichi	Sanyu Consultants Inc.
Equipment Design Planner：	ARAI Shinichi	Sanyu Consultants Inc.
Procurement Planner/ Testimation：	CHIBA Nobuaki	Sanyu Consultants Inc.
Team Coordinater / Farming Planner：	MARUNO Yusuke	Sanyu Consultants Inc.

The Study Team for Explanation of the Draft Basic Design for the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (Phase IV)

Team Leader：	Wada Yasuhiko	Japan International Cooperation Agency (JICA) Duputy Resident Rpresentative, Egypt Office
Chief Consultant / Irrigation Planner：	OBU Fumimichi	Sanyu Consultants Inc.
Equipment Design Planner：	ARAI Shinichi	Sanyu Consultants Inc.

Appendix-2． Study Schedule

1) The Basic Design Study Team

Date			Study Schedule	Stay
2/22	1	Wed	Leave Japan（Narita 18:45 → Bangkok 23:45）	Flying Overnight（OYA, OBU, ARAI, CHIBA, MARUNO）
2/23	2	Thu	Move（Bangkok 1:50 → Cairo 6:50）, Courtesy call（JICA, Embassy of Japan, Ministry of International Cooperation） Discussion with MED（Explanation about Inception Report and Questionnaire）	Cairo (WADA, OYA, OBU, ARAI, CHIBA, MARUNO)
2/24	3	Fri	Move（Cairo 7:00 → Aswan 8:20） Discussion with MED Aswan Office, Field Survey (Phase IV and Phase I to III) Having Estimation and Making Contract Topographic Survey and Boring Survey	Cairo (CHIBA, MARUNO) Aswan（WADA, OYA, OBU, ARAI）
2/25	4	Sat	Field Survey (Phase IV and Phase I to III)	Cairo (CHIBA, MARUNO) Aswan（WADA, OYA, OBU, ARAI）
2/26	5	Sun	Field Survey (Phase IV and Phase I to III)	Cairo (CHIBA, MARUNO) Aswan（WADA, OYA, OBU, ARAI）
2/27	6	Mon	Field Survey (Phase IV and Phase I to III) Move (Aswan → Luxor(by road), Luxor 22:40 → Cairo 23:45)	Cairo（WADA, OYA, OBU, CHIBA, MARUNO） Aswan (ARAI)
2/28	7	Tue	Discussion with MED, Signing of M/M Move（Cairo 5:00 → Aswan 6:25）, Discussion with MED Aswan Office	Cairo（WADA, OYA, OBU） Aswan (ARAI, CHIBA, MARUNO)
3/1	8	Wed	Meeting with MED Farmers Survey（for beneficiaries of Phase I - III）	Cairo（WADA, OYA, OBU） Aswan (ARAI, CHIBA, MARUNO)
3/2	9	Thu	a.m.：Report to JICA and Embassy of Japan Farmers Survey（for beneficiaries of Phase I - III）	Cairo（WADA, OBU） Aswan (ARAI, CHIBA, MARUNO)
3/3	10	Fri	Collection and Arrengement of Data Move（Cairo 17:25 → Aswan 18:50）	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/4	11	Sat	Survey of Pump Stations	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/5	12	Sun	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/6	13	Mon	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV） Move（Aswan → Luxor (by road)、Luxor 19:10 → Cairo 20:15）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/7	14	Tue	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/8	15	Wed	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/9	16	Thu	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/10	17	Fri	Arrengement of Data	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/11	18	Sat	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/12	19	Sun	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/13	20	Mon	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV）	Cairo（CHIBA） Aswan (OBU, ARAI, MARUNO)
3/14	21	Tue	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV） Move（Cairo 5:00 → Aswan 6:25）, Survey of O&M	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/15	22	Wed	Survey of Irrigated Area, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase IV） Boring Survey	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/16	23	Thu	Discussion of MED Aswan Office Survey of Pump Stations, Farmers Survey	Aswan (OBU, ARAI, CHIBA, MARUNO)
3/17	24	Fri	Survey of Related Infrastructure, Survey of Pump Stations Farmers Survey（for beneficiaries of Phase I - III） Move (Aswan → Luxor (by road)) Survey of O&M, Move（Aswan 22:45 → Cairo 0:15）	Cairo（CHIBA） Luxor（OBU, ARAI, MARUNO）
3/18	25	Sat	Arrangement of Data Move (Luxor 17:00 → Cairo 18:05)	Cairo (OBU, ARAI, CHIBA, MARUNO)
3/19	26	Sun	Report to JICA Egypt Office Move（Cairo 5:00 → Aswan 6:25）, Boring Survey	Cairo (OBU, ARAI, MARUNO) Aswan (CHIBA)
3/20	27	Mon	Discussion with MED Survey of O&M, Move（Aswan 22:45 → Cairo 0:15）	Cairo (OBU, ARAI, CHIBA, MARUNO)
3/21	28	Tue	Discussion with MED	Cairo (OBU, ARAI, CHIBA, MARUNO)
3/22	29	Wed	Report to JICA Egypt Office and Embassy of Japan Move (Cairo 19:15 → Dubai 0:35)	Flying Overnight（OBU, ARAI, CHIBA, MARUNO）
3/23	30	Thu	Arrival at Tokyo (Haneda Airport) (Dubayy 2:50 → Kansai 16:40、Kansai 18:30 → Haneda 19:35)	

2) The Study Team for Explanation of the Draft Basic Design

Date			Study Schedule	Stay
7/31	1	Mon	Move（Narita 16:55 → Bangkok 21:25）	Flying Overnight（OBU, ARAI）
8/1	2	Tue	Move（Bangkok 0:45 → Cairo 5:55） Courtesy Call and Discussion with JICA Egypt Office, Ministry of International Cooperation, Ministry of Water Resources and Irrigation, MED, and Embassy of Japan	Cairo (WADA, OBU, ARAI)
8/2	3	Wed	Discussion with MED （Explanation of the Draft Basic Design）	Cairo (WADA, OBU, ARAI)
8/3	4	Thu	Move（Cairo 6:00 → Aswan 7:25） Discussion with MED Aswan Office Field Survey	Aswan (OBU, ARAI)
8/4	5	Fri	Field Survey	Aswan (OBU, ARAI)
8/5	6	Sat	Field Survey Move（Aswan 21:35 → Cairo 23:50）	Cairo (OBU, ARAI)
8/6	7	Sun	Discussion with MED, Signing of Minites	Cairo (WADA, OBU, ARAI)
8/7	8	Mon	Report to Embassy of Japan and JICA Egypt Office Move (Cairo 19:15 → Dubayy 23:50)	Flying Overnight（OBU, ARAI）
8/8	9	Tue	Move (Dubayy 2:50 → Kansai 17:20, Kansai 18:45 → Haneda 19:55)	

Appendix-3. List of Parties Concerned in the Eghptian Governemnt

Ministry of Water Resources and Irrigation (MWRI)

Mechanical and Electrical Department (MED)

1. Headquarters Office

Eng. Sami Moh. Fahmi Ouf	Chairman
Eng. Mohamed Sayid Aboulfotoh	Director of Mechanical Studies & Specifications
Eng. Mohamed Hatem Abdel Tattah	Manager of Mechanical Studies & Specifications
Eng. Mohamed Rarhad Ahamed	Management of Financial Aspects
Eng. Amira Aly Gamal El Dim	Management of Financial Aspects
Eng. Mohammed Ib Al Ghamray	Management of Financial Aspects

2. Aswan MED Office

Eng. Ahmad Mohamed Desouky	Chief Engineer
Eng. Taha Mohamed Taha	Floating Pump Workshop Engineer
Mr. Hamdy Al-said	Translator

3. El Katara Office, under Aswan MED Office

Eng. Mohamed Ali	Maintenance Engineer
Eng. Mousa Hamdahmed	Big Mechanic
Eng. Basher Abdalkafor	Mechanic
Eng. Mohamed Ramdan	Engineer
Eng. Marwa Sleim	Engineer

4. Daraw Office, under Aswan MED Office

Eng. Fussien Easa	Electric Engineer, Maintenance Department

5. Edfu MED Office

Eng. Nassef Abd El Reham	Chief Engineer
Eng. Mohamed Mostafa Mahmoud	Engineer
Eng. Abdel Salam Aamed	Mechanical Engineer, Edfu Pump Stations
Eng. Atef El Mahmoudy	Engineer

6. Luxor MED Office

Eng. Omar ABD Raheem	Top Manager
Eng. Mohamed Said Ahnd	El Biadia Station Director Manager
Eng. Medhat Kamel Gergis	Operation and Maintenance
Eng. Ahmad Mossad Reyad	Maintenance Engineer

Irrigation Department (ID)

1. Aswan ID Office

Eng. Adel Amin	First Undersecretary
Eng. Ireen Fayz Boctor	Civil Engineer

Ministry of Agriculture and Land Reclamation (MALR)

1. Aswan MALR Office

Eng. Mohamed El Monier	General Manager of General Agriculture Directorate

Ministry of International Cooperation（MOIC)

Mr. Nabil Abdel-Hamid Hassan	Undersecretary

Appendix-4. Minutes of Discussion

The Basic Design Study

MINUTES OF DISCUSSIONS
ON
BASIC DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT
(PHASE Ⅳ)
IN
THE ARAB REPUBLIC OF EGYPT

In response to a request from the Government of the Arab Republic of Egypt (hereinafter referred to as "Egypt"), the Government of Japan decided to conduct a Basic Design Study on the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Egypt the Basic Design Study Team (hereinafter referred to as "the Team"), which was headed by Mr. Yasuhiko WADA, Deputy Resident Representative, Egypt Office, JICA and was scheduled to stay in the country from February 22nd to March 22nd, 2006.

The Team held a discussion with the officials concerned of the Government of Egypt and conducted a field survey at the study area. In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets.

Cairo, February 28th, 2006

Mr. Yasuhiko Wada
Leader
Basic Design Study Team
Japan International Cooperation Agency
(JICA)

Eng. Sami Moh. Fahmi Ouf
Chairman
Mechanical and Electrical Department
Ministry of Water Resources and Irrigation
Arab Republic of Egypt

Mr. Nabil Abdel-Hamid Hassan
Undersecretary
Central Department for Asia
Ministry of International Cooperation
Arab Republic of Egypt

ATTACHMENT

1 Objective of the Project

The objective of the Project is to rehabilitate the function and capacity of the nine existing deteriorated pump stations through the provision of necessary equipments and materials.

2 Project site

The Project site will be at nine pump stations in Upper Egypt, and their locations are described in as Annex- I .

3 Responsible and Implementing Agency

3.1 The responsible agency is Ministry of Water Resources and Irrigation (hereinafter referred to as "MWRI").

3.2 The implementing agency is Mechanical and Electrical Department of MWRI.

3.3 The organization chart of MWRI is attached as Annex - II .

4 Items requested by the Government of Egypt

After discussions with the Team, the components described below were finally requested by the Government of Egypt. JICA will assess the appropriateness of the request and will summarize it into the draft basic design report.

4.1 Procurement of equipments, such as main pumps, vacuum pumps, valves, discharge pipes with joint balls, control boards etc., for rehabilitation of the below nine pump stations;

- Gezeret Meneha
- El-Sarag
- Gezeret El-Fawaza El-Keblia
- Middle Fawaza
- Gezeret El-Kobania Kebly
- Sahel Al-Khatara
- Sahel El-Akab Bahary
- Gezeret Abo Arafa
- El-Hegs El-Mostagda

4.2 Procurement of self-mobile maintenance ship

5 Japan's Grant Aid Scheme

The Egyptian side understood Japan's Grant Aid Scheme and would take necessary measures described in Annex – III for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6 Further Schedule of the Study

6.1 The consultant members will proceed to further study in Egypt until 22nd Match, 2006.

6.2 JICA will prepare a draft report in English and dispatch a mission in order to explain its contents around July 2006.

6.3 In case the content of the draft report is accepted in principle by the Government of Egypt, JICA will complete a final report and send it to the Government of Egypt by the end of August, 2006.

7 Other relevant issues

7.1 Priorities of rehabilitation

Since the objective of the Project is rehabilitation of the deteriorated pumps, it is important to analyze the necessity and urgency of rehabilitation of each pump station. So, both sides confirmed that the consultant members will assess the current condition of deterioration and its reason, validity of irrigated area and other related factors through the field survey and discussion with the Egyptian side, in order to prioritize the necessity of rehabilitation of each nine pump stations. Then, the Japanese side will assess the appropriateness of the rehabilitations under the Project, and will reflect the result in the draft final report. Only if some equipments of the pump stations are found to be still usable, they shall be under consideration of further utilization, instead of replacement.

7.2 Type of pump stations

Through the discussion with the Egyptian side and the field survey, the consultant members will confirm the appropriate type of pump station (either floating or fixed) to be provided under the Project, and will reflect the result in the draft final report.

7.3 Capacity of pumps

Both sides confirmed that the capacity of new pumps should be determined based on the capacity of the current pumps, irrigating area, amount of scarce water, cropping pattern, operation hours, and irrigation efficiency etc. In addition, the Team expressed that the most important thing is to know the original calculation to determine the capacities of the nine pump stations. Mechanical Electrical Department of MWRI agreed to coordinate well with Irrigation Department and Ministry of Agriculture and Land Reclamation to provide the data and information about the nine existing pump stations to the Japanese side.

7.4 Maintenance ship

Both sides understood that in order to verify the necessity and validity of new self-mobile maintenance ship, it is significant to investigate the operation frequency of the maintenance barge provided under Phase-Ⅲ, maintenance needs in the Project site, and the current activity & capacity of the workshop in Aswan, in detail. In case the new self mobile maintenance ship found to be less necessary, the exclusion of the new maintenance ship would be considered.

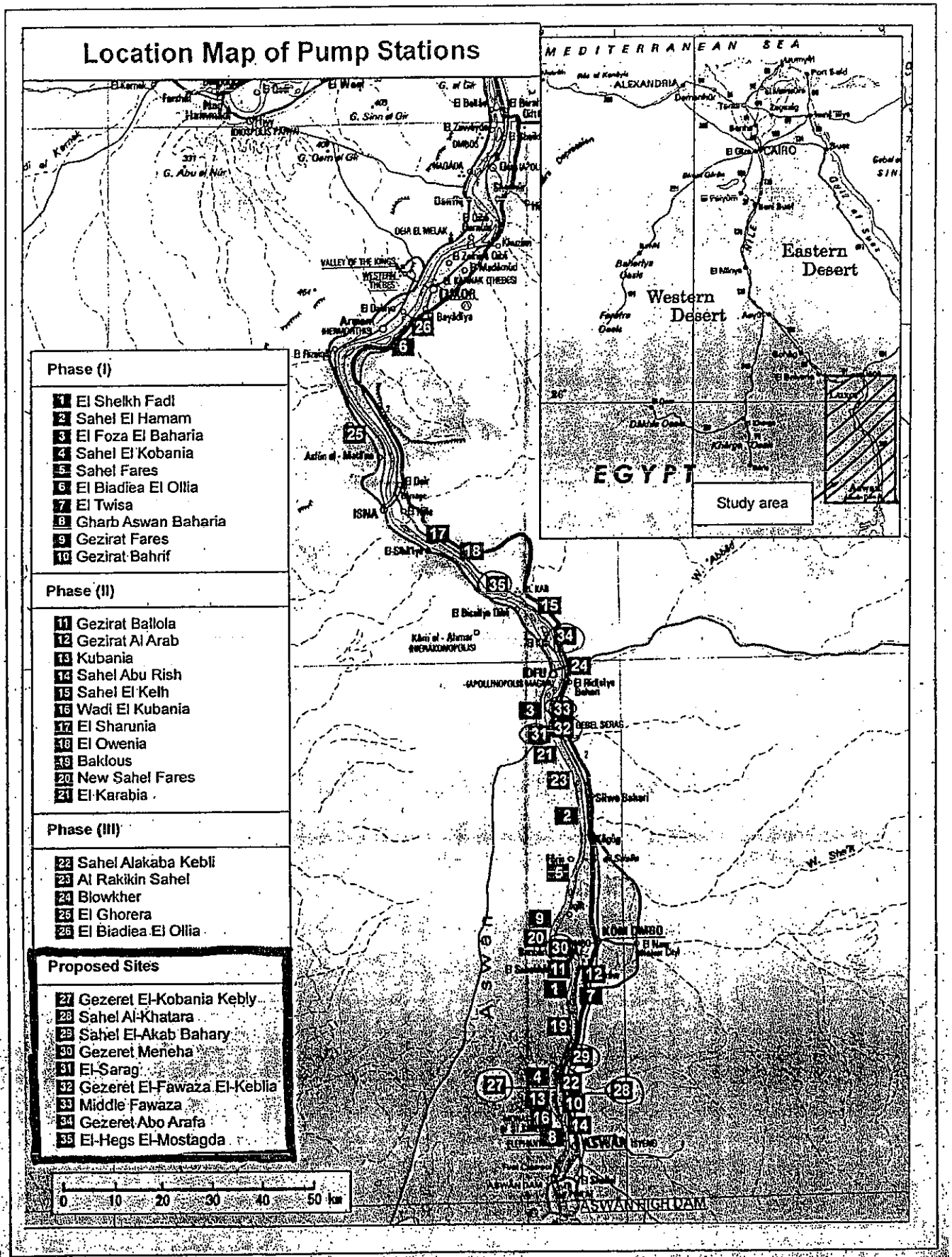
7.5 Items to be taken by the Egyptian side

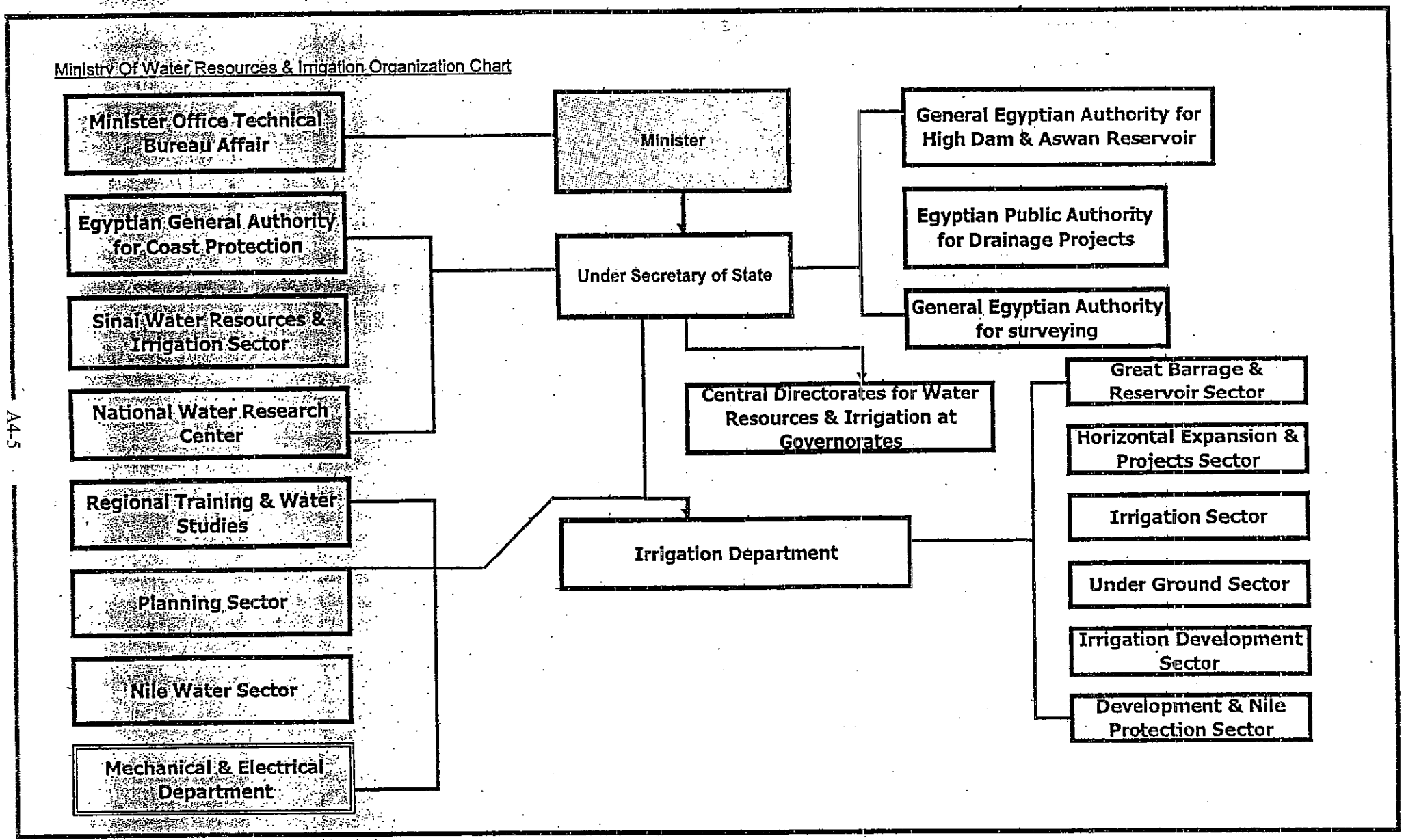
(1) The Egyptian side explained that they will take necessary measures including coordination among the different ministries, security of persons concerned of the study, and facilitation of interview survey to the farmers in order to support the smooth implementation of further study by the consultant members.

(2) Both sides confirmed that the tower, discharge pipe, electric cable, main irrigation canal, and the house (in case of fixed type) had to be improved and/or replaced by the Egyptian side in proper timing to secure the full function of the new pump stations, provided the Government of Japan would finally decide the implementation of the Project. Moreover, in case any compensation to the farmers is needed during the installation or replacing works of pumps, the Egyptian side will take all the necessary measures.

(3) The Team explained that under the Japan's Grant Aid project, it is duty of the recipient side to secure necessary budget, personnel and any other measures to conduct proper operation and continuous maintenance. In this context, the situation on the operation and maintenance of the floating pump stations provided under the previous Japan's Grant Aid will be carefully examined in the further study by the consultant members.

END


Location Map of Pump Stations
MEDITERRANEAN SEA
ALEXANDRIA
CAIRO
Eastern Desert
Western Desert
EGYPT
Study area
Phase (I)
1 El Shelkh Fadl
2 Sahel El Hamam
3 El Foza El Baharia
4 Sahel El Kobania
5 Sahel Fares
6 El Biadiea El Ollia
7 El Twisa
8 Gharb Aswan Baharia
9 Gezirat Fares
10 Gezirat Bahrif
Phase (II)
11 Gezirat Ballola
12 Gezirat Al Arab
13 Kubania
14 Sahel Abu Rish
15 Sahel El Kelh
16 Wadi El Kubania
17 El Sharunia
18 El Owenia
19 Baklous
20 New Sahel Fares
21 El Karabia
Phase (III)
22 Sahel Alakaba Kebli
23 Al Rakikin Sahel
24 Blowkher
25 El Ghorera
26 El Biadiea El Ollia
Proposed Sites
27 Gezeret El-Kobania Kebly
28 Sahel Al-Khatara
29 Sahel El-Akab Bahary
30 Gezeret Meneha
31 El-Sarag
32 Gezeret El-Fawaza El-Keblia
33 Middle Fawaza
34 Gezeret Abo Arafa
35 El-Hegs El-Mostagda
0 10 20 30 40 50 km
ASWAN HIGH DAM
LAKE NASSER


Ministry Of Water Resources & Irrigation Organization Chart
Minister Office Technical Bureau Affair
Egyptian General Authority for Coast Protection
Sinai Water Resources & Irrigation Sector
National Water Research Center
Regional Training & Water Studies
Planning Sector
Nile Water Sector
Mechanical & Electrical Department
Minister
Under Secretary of State
Central Directorates for Water Resources & Irrigation at Governorates
Irrigation Department
General Egyptian Authority for High Dam & Aswan Reservoir
Egyptian Public Authority for Drainage Projects
General Egyptian Authority for surveying
Great Barrage & Reservoir Sector
Horizontal Expansion & Projects Sector
Irrigation Sector
Under Ground Sector
Irrigation Development Sector
Development & Nile Protection Sector

Japan's Grant Aid Scheme

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

A. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Preparatory Study and Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request. If necessary, JICA send a Preparatory Study Team to the recipient country to confirm the contents of the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

B. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a

requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

a) Confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project;
d) Preparation of a basic design of the Project; and
e) Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a Japanese consulting firm selected through its own procedure (competitive proposal). The selected firm participates the Study and prepares a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Project, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to maintain the technical consistency between the Basic Design and Detailed Design as well as to avoid any undue delay caused by the selection of a new consulting firm.

C. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

a) To secure a lot of land necessary for the construction of the Project and to clear the site;

b) To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;

c) To ensure prompt unloading and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid;

d) To exempt Japanese nationals from customs duties, internal taxes and fiscal levies, which may be imposed in the recipient country with respect to the supply of the products and services under the verified

contracts?

e) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;

f) To ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Project; and

g) To bear all the expenses, other than those covered by the Grant Aid, necessary for the Project.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

9) Banking Arrangement (B/A)

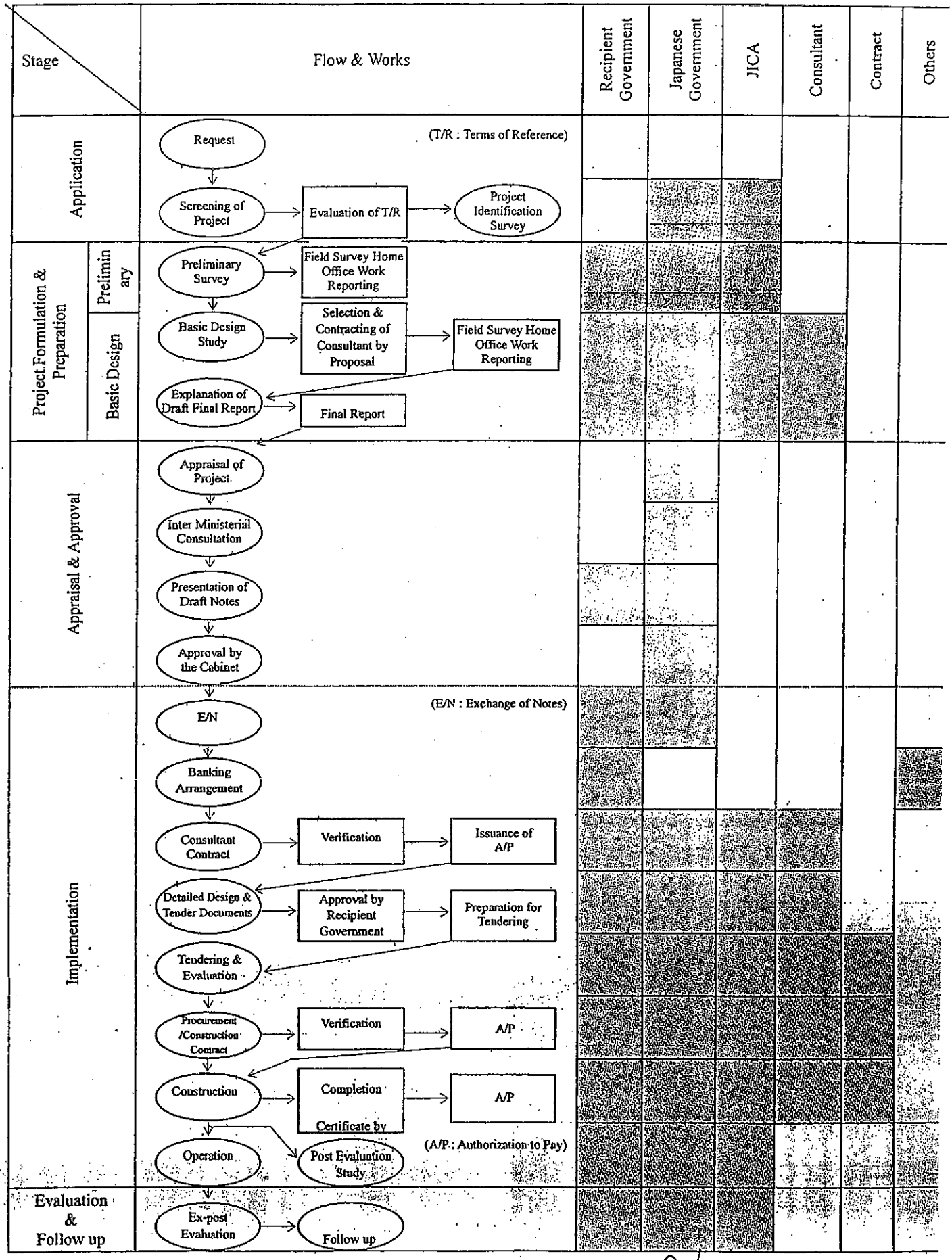
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.

10) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
1) Advising commission of A/P			•
2) Payment commission			•
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
1) Marine(Air) transportation of the products from Japan to the recipient country		•	
2) Tax exemption and custom clearance of the products at the port of disembarkation			•
3) Internal transportation from the port of disembarkation to the project site			•
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

Explanation of the Draft Basic Design

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR REHABILITATION OF FLOATING PUMP STATIONS IN UPPER EGYPT
(PHASE – Ⅳ)
IN THE ARAB REPUBLIC OF EGYPT
(EXPLANATION OF DRAFT FINAL REPORT)

In March 2006, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project for Rehabilitation of Floating Pump Stations in Upper Egypt (hereinafter referred to as "the Project") to the Arab Republic of Egypt (hereinafter referred to as "Egypt"), and through discussion, field survey, and technical examination in Japan, JICA prepared a draft final report of the study.

In order to explain and to consult with officials concerned of the Government of the Arab Republic of Egypt on the components of the draft final report, JICA sent to Egypt the Draft Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Yasuhiko WADA, Deputy Resident Representative, JICA Egypt Office and was scheduled to stay in the country from 1st August to 7th August, 2006.

As a result of discussion, both parties confirmed the main items described on the attached sheets.

Cairo, August 7, 2006

Mr. Yasuhiko WADA
Deputy Resident Representative
Japan International Cooperation Agency
Egypt Office

Eng. Sami Moh. Fahmi Ouf
Chairman
Mechanical and Electrical Department
Ministry of Water Resources and Irrigation
Arab Republic of Egypt

Witness

Mr. Nabil Abdel-Hamid Hassan
Undersecretary
Central Department for Asia
Ministry of International Cooperation
Arab Republic of Egypt

Dr. Mohammed Bahaa Eldin Saad
Senior Undersecretary and Chairman
Irrigation Department
Ministry of Water Resources and Irrigation
Arab Republic of Egypt

ATTACHMENT

1. Explanation of the Draft Final Report

The Government of Egypt agreed and accepted in principle the contents of the draft final report explained by the Team.

2. Japan's Grant Aid Scheme

The Egyptian side understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Egypt as explained by the Team and described in Annex-Ⅲ and Annex-Ⅳ of the Minutes of Discussions signed by both parties on 28th February, 2006.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Ministry of Water Resources and Irrigation representing the Government of Egypt by the end of September, 2006.

4. Other Relevant Issues

4-1. Components of the Project

Both sides confirmed that the Project would be composed of the items listed in Annex- Ⅰ in case the Japanese Government would finally decide to implement the Project.

4-2. Undertakings by the Egyptian side

(1) Both sides confirmed that, for the smooth implementation of the Project, it should be indispensable for the Egyptian side to implement its undertakings described in Annex-Ⅱ and Ⅲ, according to the Tentative Implementation Schedule shown in Annex-Ⅳ in case the Japanese Government would finally decide to implement the Project.

(2) Both sides confirmed that the Mechanical and Electrical Department would bear overall responsibility for the coordination and implementation of all the undertakings by the Egyptian side under the supervision of the Irrigation Department of Ministry of Water Resources and Irrigation in case the Japanese Government would finally decide to implement the Project.

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(3) Both sides confirmed that the Egyptian side would report the progress and completion of its undertakings every three months to the Japanese side (Embassy of Japan in Egypt and JICA Egypt Office) according to the schedule indicated in Annex-Ⅳ in case the Japanese Government would finally decide to implement the Project. The Egyptian side agreed to provide the reason of delay and future action plan if the undertakings would not progress nor been completed according to the schedule.

(4) Both sides confirmed that, in order to ensure the benefit to the end users over a long period by utilizing the facilities to be rehabilitated under the Project, it should be indispensable for the Egyptian side to implement proper operation and continuous maintenance works, and secure adequate budget for these purposes.

END

Annex - Ⅰ Components of the Project

Annex - Ⅱ Contents of the Undertakings by the Egyptian Side

Annex - Ⅲ Map of Each Pump Station Describing Undertakings by the Egyptian Side

Annex - Ⅳ Tentative Implementation Schedule

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Components of the Project

Procurement of Equipment for the following pump stations;

No. 27 Gezeret El-Kobania (floating → floating)
No. 29 Sahel El-Akab Bahary (floating → floating)
No. 30 Gezeret Meneha (fixed → floating)
No. 31 El-Sarag (fixed → floating)
No. 32 Gezeret El-Fawaza (fixed → floating)
No. 33 Middle Fawaza (fixed → fixed)
No. 34 Gezeret Abo Arafa (floating → floating)
No. 35 El-Hegs El-Mostagda (floating → floating)

* The current pump stations would be replaced by the new pump stations and there would not be the current and new pump stations working at the same time.
* Procurement of equipment for No. 28 Sahel Al-Khatara pump station and a self-mobile maintenance ship will not be considered under the Project.

Contents of the Undertakings by the Egyptian Side

Pump Station	Water Tower (for Discharge)	Discharge Pipe	Trans-former	Electric Cable	Discharge Canal	Others
No.27 Gezeret El-Kobania Kebli	Vertical extension of water tower, Painting	Replacement of pipe with inner diameter 600mm×34m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=50m	Repairing of canal lining at L=30m (MED)	–
No.29 Sahel El-Akab Bahary	Painting, removal of second tower	Replacement of pipe with inner diameter 600mm×45m, lifting-up of horizontal level of pipe	Replacement of transformer with 300KVA/ 400V	Replacement of cable with 600V 3c 38mm^2 L=50m	Repairing of canal lining at L=30m (MED)	Improvement of siphon structure of irrigation canal crossing drainage (ID)
No.30 Gezeret Meneha	New installation of vertical type water tower with outer diameter 1000mm, suction intake with inner diameter 450mm×4pcs	New installation of pipe with inner diameter 600mm×33m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.31 El-Sarag	New installation of vertical type water tower with outer diameter 1000mm, suction intake with inner diameter 350mm×4pcs	New installation of pipe with inner diameter 450mm×23m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 5.5mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.32 Gezeret El -Fawaza El-Keblia	New installation of vertical type water tower at outer diameter 1000mm, suction intake at inner diameter 450mm×4pcs	New installation of pipe with inner diameter 600mm×16m	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 14mm^2 L=30m	Repairing of canal lining at L=30m (MED)	Dismantlement of current pump station (MED)
No.33 Middle Fawaza	–	Replacement of pipe with inner diameter 450mm×14m	–	Replacement of cable with 600V 3c 5.5mm^2 L=20m	Repairing of canal lining at L=30m (MED)	Removal of pump shed & equipment, Foundation Works, Adjustment of Suction Pipes, Compensated water supply during rehabilitation works*(MED)
No.34 Gezeret Abo Arafa	–	Painting of existing pipe, Installation of two (2) flexible pipe supports	Replacement of transformer with 200KVA/ 400V	Replacement of cable with 600V 3c 8mm^2 L=40m	Repairing of canal lining at L=30m (MED)	Dredging around Pump Station (MED)
No.35 El-Hegs El-Mostagda	Painting	Replacement of pipe with inner diameter 750mm×27m with flap valve	–	Replacement of cable with 600V 3c 100mm^2 L=50m	Removal of water weed (MED)	Checking of canal capacity, enlargement of canal section if necessary, improvement of pipe structure crossing path and drainage (ID)
Implementation Order (see Annex IV)	1	2	1	1	3	No.29:2(stage1) No.30~32:3(stage2) No.33 :1(stage2) No.34 :2(stage1) No.35 :2(stage1)

Note: MED is responsible for discharge reservoir and connection canal to 30m in length from the end of discharge pipe. ID is responsible for the remaining main and secondary canals.

* MED is responsible for installing emergency pump(s) to supply enough amount of irrigation water during the period of rehabilitation works for No.33 pump station.

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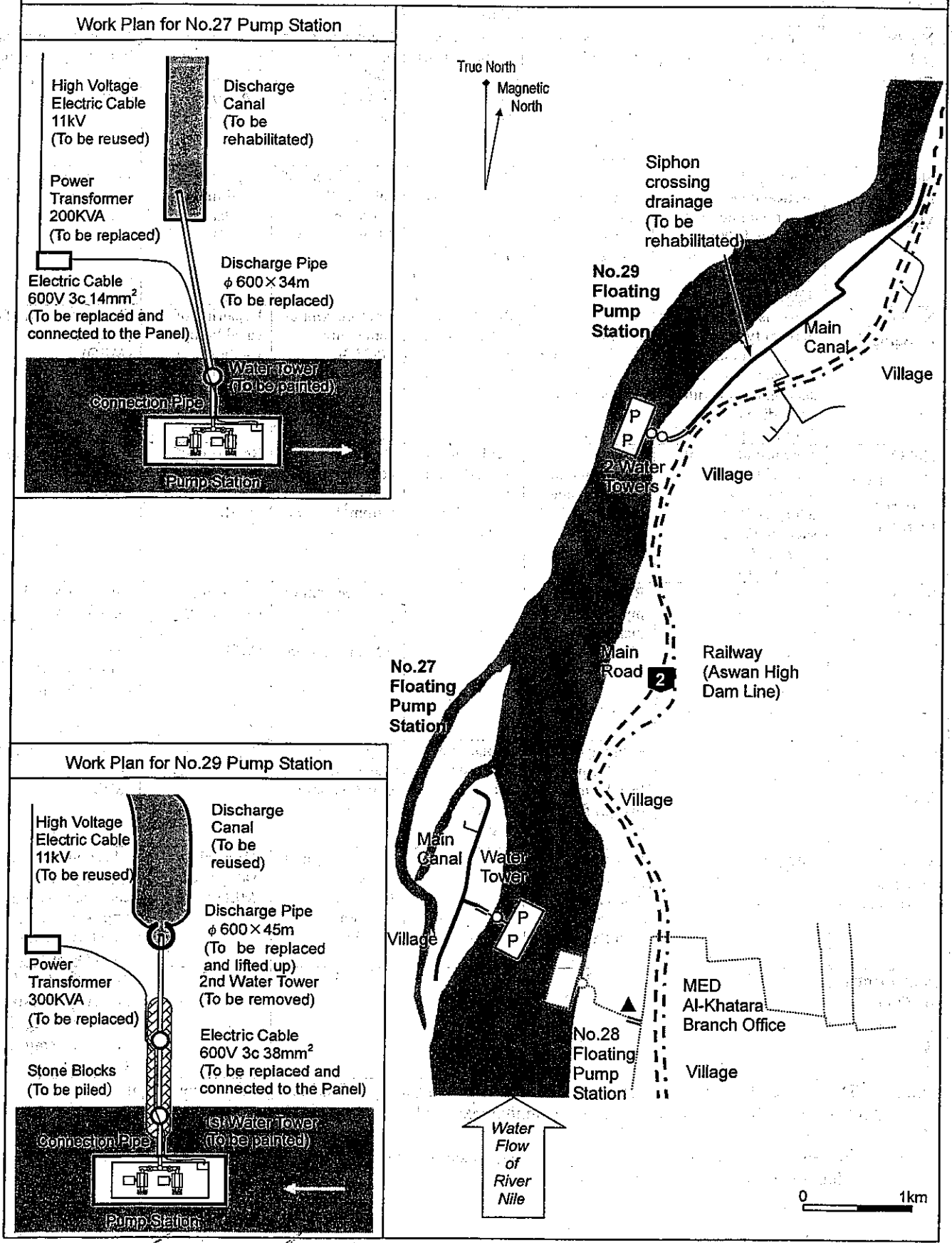
No.27 Gezerat El-Kobania Kebly Pump Station and No.29 Sahel El-Akab Bahary Pump Station

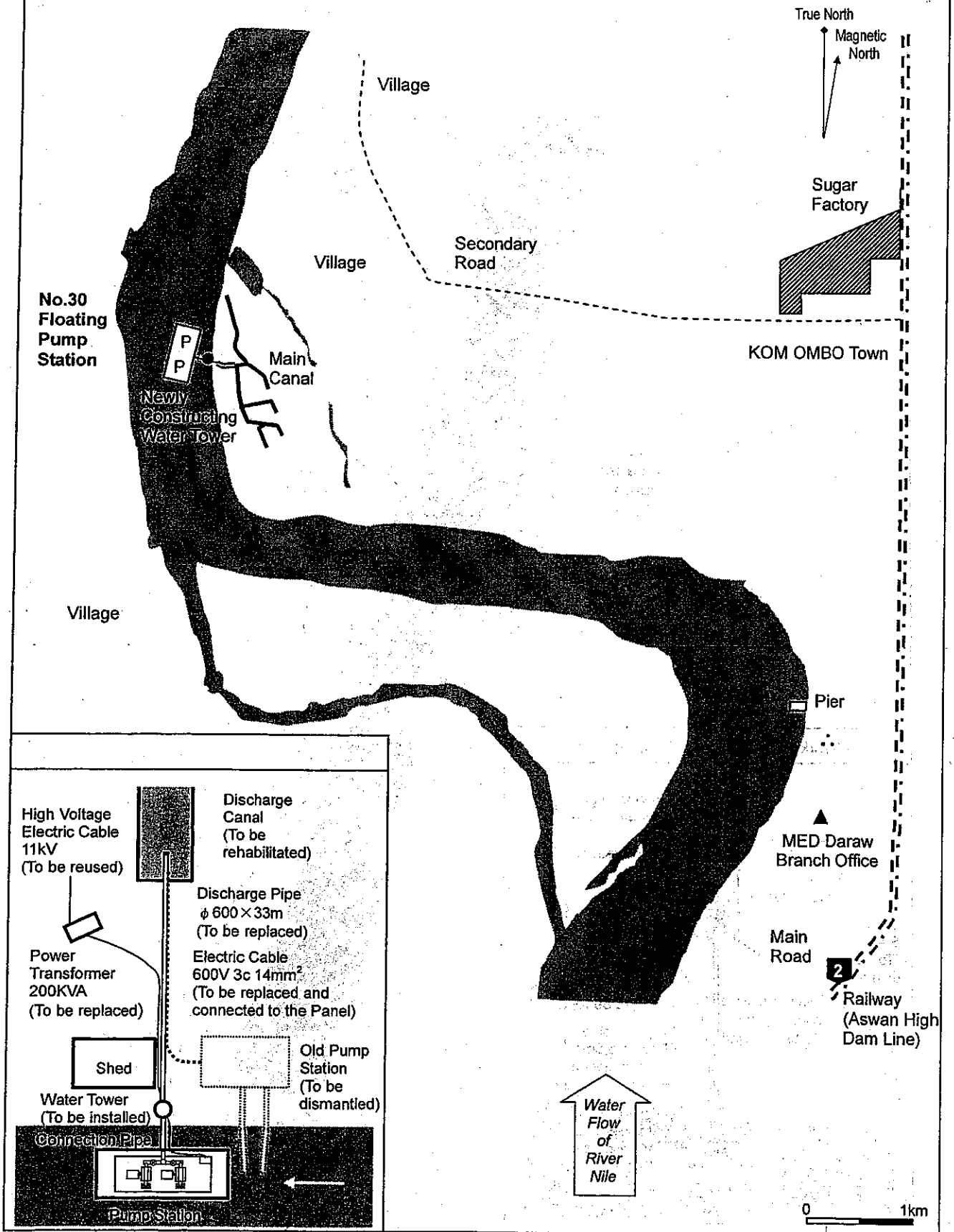
(Floating Pump Type for No.27 and No.29)



A4-17

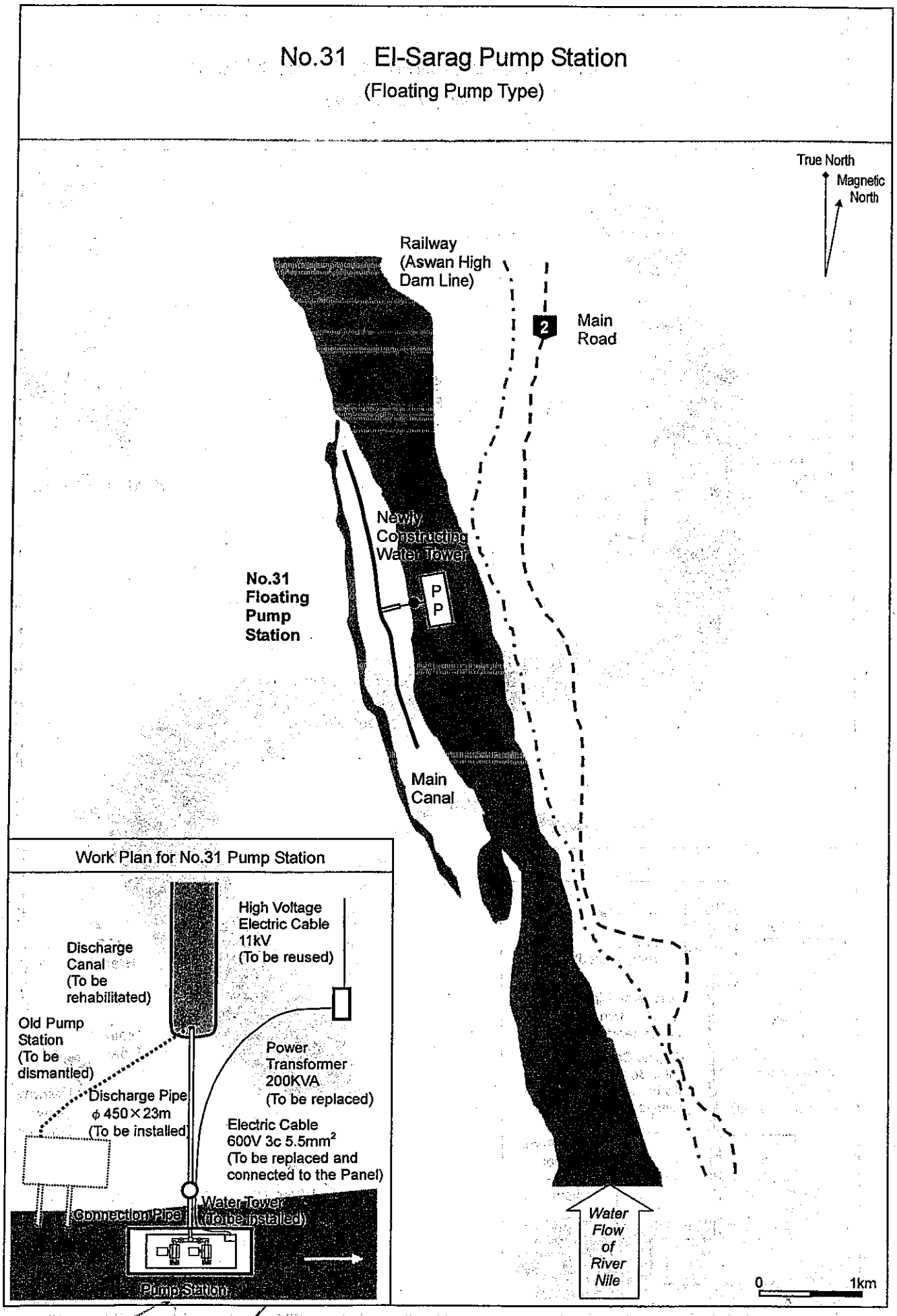
No.30 Gezeret Maneha Pump Station

(Floating Pump Type)



No.31 El-Sarag Pump Station

(Floating Pump Type)



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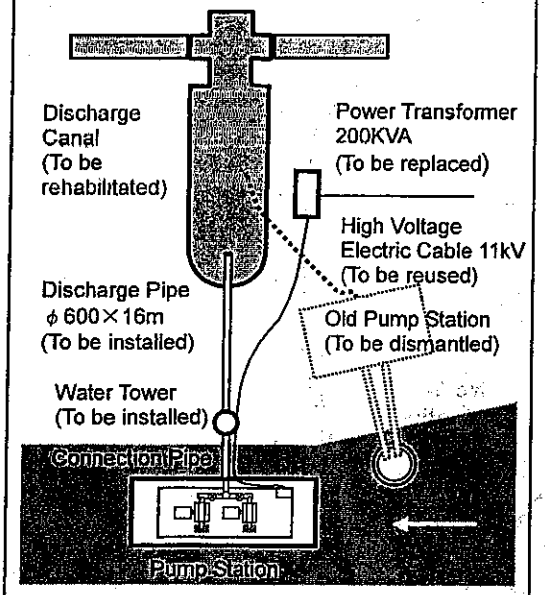
No.32 Gezeret El-Fawaza El-Keblia Pump Station and No.33 Middle Fawaza Pump Station

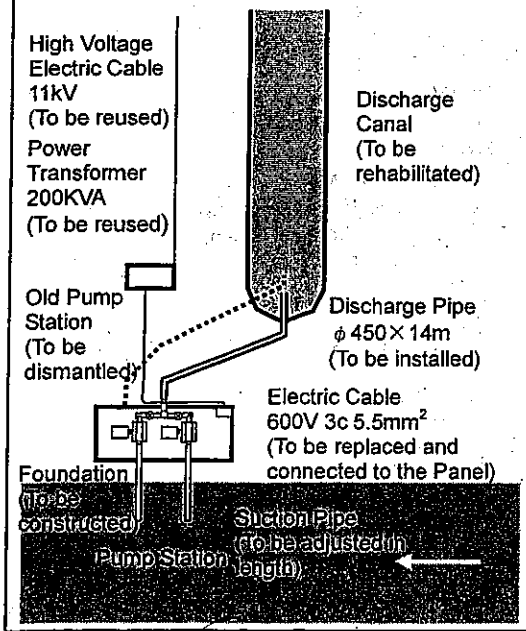
(Floating Pump Type for No.32 and Fixed Pump Type for No.33)

Work Plan for No.32 Pump Station



Electric Cable 600V 3c 14mm^2
(To be replaced and connected to the Panel)

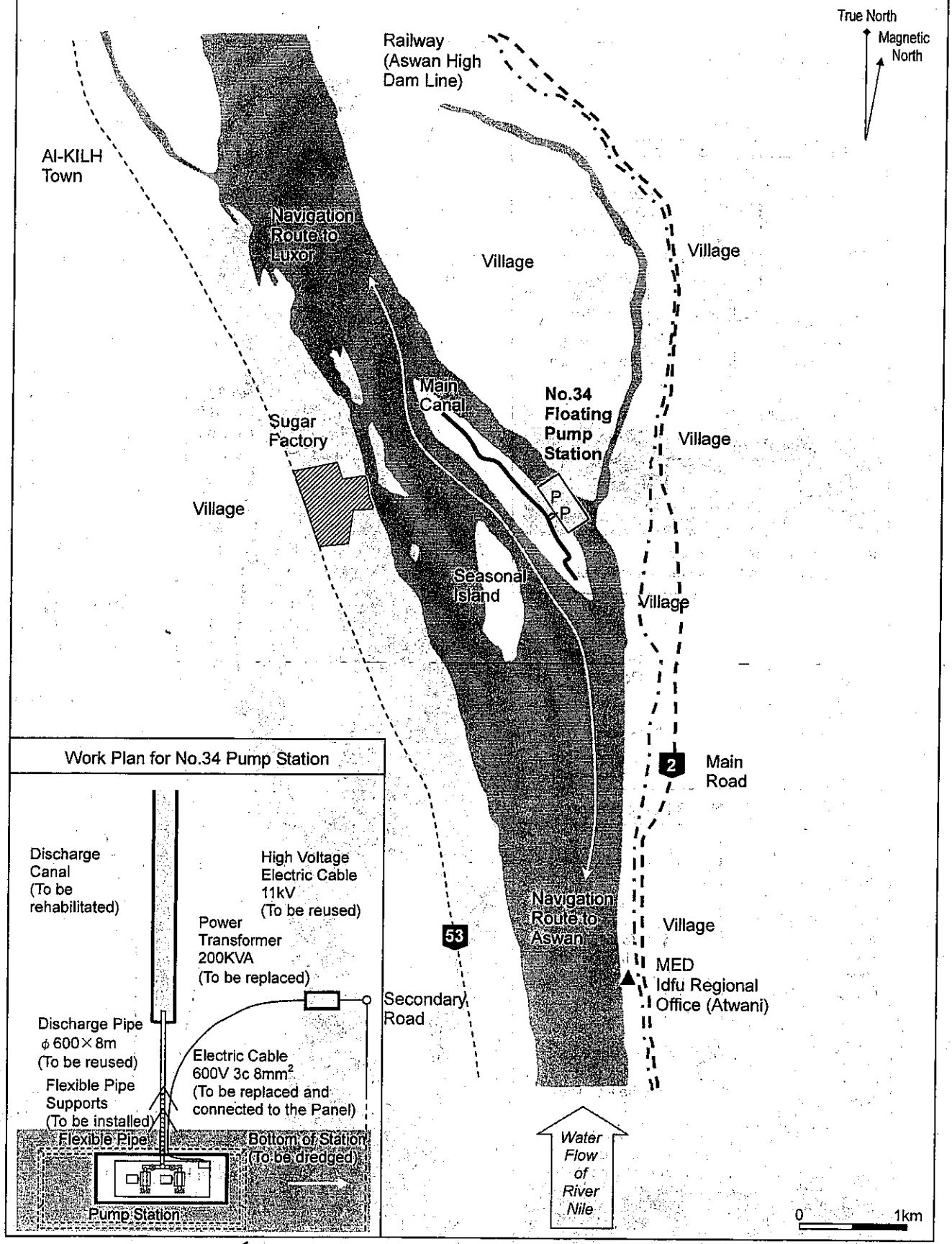
Work Plan for No.33 Pump Station



A4-20

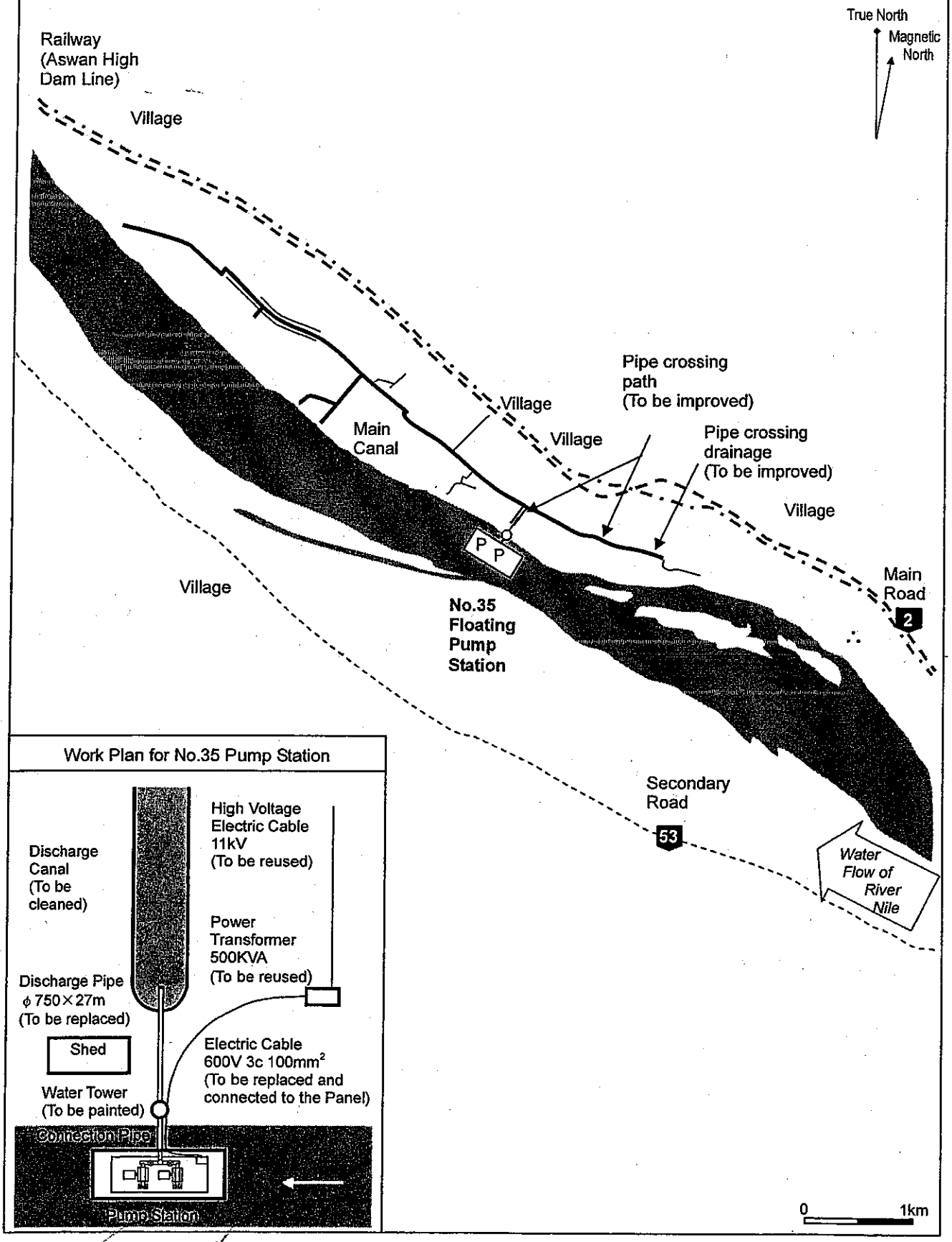
No.34 Gezerat Abo Arafa Pump Station

(Floating Pump Type)



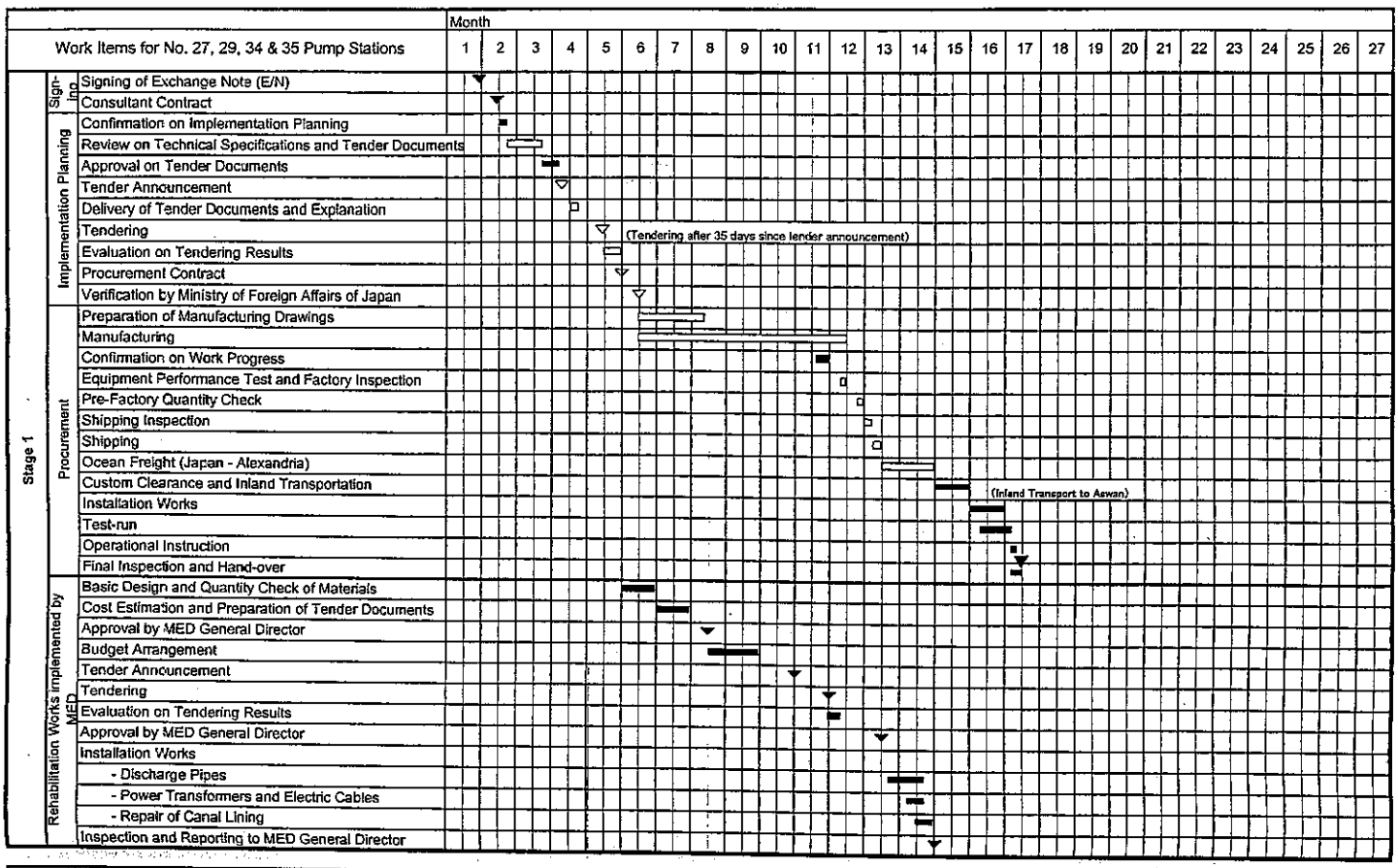
No.35 El-Hegs El-Mostagda Pump Station

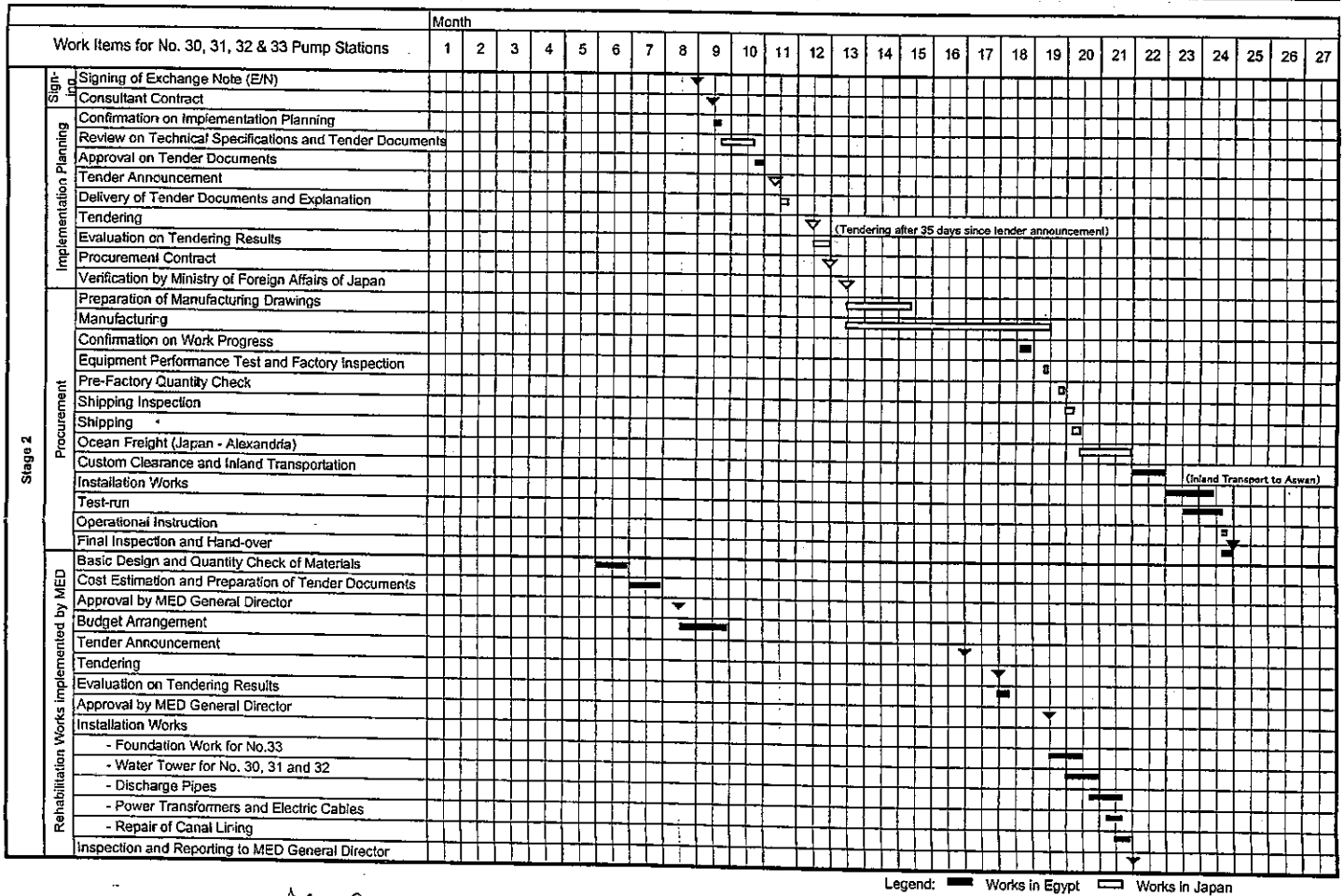
(Floating Pump Type)



Tentative Implementation Schedule

Project Title: The Project for Rehabilitation of Floating Pump Stations in Upper Egypt (Phase-IV)





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5. List of Data Collected

No.	Title	Data Type Book, Videotape Map, & Photo etc.	Original /Copy	Data Source	Date
1	The State's General Budget for the Financial Year 2005/2006		Original	The Middle East Library for Economic Series	
2	National Water Resources Plan for Egypt 2017		Original	Ministry od Water Resources and Irrigation Plannning Sector	
3	The Statistical Year Book 2004		Original	Central Agency for Public Mobilization and Statistics	
4	The Area belongs to Each Pumping Stations in Aswan Governorate		Copy		2003 Dec
5	Project for the Rehabilitation of Floating Pump Stations in Upper Egypt (Phaze no.4)		Copy		2003. 7. 6
6	Actual Discharge of High Dam Resevoir in m3/day for the period from 2001-2005		Copy		
7	Average Level of Water Behind High Dam Level in "M"iod from 2001-2005		Copy		
8	Cultivated Crops per Feddan		Copy	Aswan Agricultural Department	
9	Area per Feddan		Copy	Aswan Agricultural Department	
10	The Area, Inportant Crops and number of Farmers in 1)Aswan, 2)Kom Ombo, 3)Edfu		Copy	Aswan Agricultural Department	
11	Final Report for Maize Crop for 2004-2005 in Aswan Governarate		Copy	Aswan Agricultural Department	
12	Final Report for Sugar Cane Crop for 2004-2005 in Aswan Governarate		Copy	Aswan Agricultural Department	
13	Distance from Aswan High Dam		Copy		
14	Water Level in Pumping Stations (1996-1998, 2001-2005				
15	Water Level in El Ghovera Pump Station				
16	Climatic Condition in Upper Egypt				
17	Chemical Test Analysis for Sample taken in front of Feryal Mesurement (East Bank) during February				

No.	Title	Data Type Book, Videotape Map, & Photo etc.	Original /Copy	Data Source	Date
18	Water Resources and Irrigation Engineering for Aswan Engineering Sketch of Canals				
19	Water Resources and Irrigation Engineering for Idfu Engineering Sketch of Canals				
20	Sample of Tender Doucment for Works borne by the Government of Egypt		Copy		
21	Name of Main Contractors who have awarded Construction and rehabilitation works for Pumping Stations Projects in MED		Memo	MED	
22	List of Pump Suppliers		Memo	MED	
23	MED'S Projects		Memo	MED	
24	Cost of Local Works related to the Project		Memo	MED	
25	Pumping Stations Rehabilitation Project to be Financed from KFW		Memo	MED	
26	Import and Export Law Dec.2005		Original	The Middle East Library for Economic Service (MELES)	
27	Stamp Duty Law Jan. 2004		Original	MELES	
28	The Executive Statues vof the General Sales Tax Law Jan. 2005		Original	MELES	
29	The General Sales Tax Law October, 2003		Original	MELES	
30	Customs Tariff Jan. 2005		Original	MELES	
31	The Executive Decrees of the Labour Law Sep.		Original	MELES	
32	Labour Law Jan. 2006		Original	MELES	
33	The Import and Export and the System of Procedures of Examination and Control of Imported and Exported Commodities		Original	MELES	
34	Organization Chart for MED		Copy	MED	
35	Organization Chart for General Directorate Upper Egypt (IDFU)		Copy	MED IDFU	
36	The Number of O & M Staff				
37	Operation Hours Record for Pump Stations				
38	Annual O & M Cost for Pump Stations				

No.	Title	Data Type Book, Videotape Map, & Photo etc.	Original /Copy	Data Source	Date
39	Price List (Aswan)				
40	Price List (Cairo)				
41	Used Spare Parts List				
42	The Port Said Engineering Works S.A.E. Affiliated to Suezu Canal Authority Rgypt		Original	Port Said Engineering Works	
43	BEHERA COMPANY		Original	BEHERA COMPANY	
44	TERSANA SHIPYARD		Original	The Egyptian General Irrigation Workshops Company	
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