MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
THE ARAB REPUBLIC OF EGYPT

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR REHABILITATION OF FLOATING IRRIGATION PUMP STATIONS IN UPPER EGYPT (PHASE 2) IN THE ARAB REPUBLIC OF EGYPT

MARCH, 1996

JAPAN INTERNATIONAL COOPERATION AGENCY
SANYU CONSULTANTS INC.

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PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a basic design study on the Project for Rehabilitation of Floating Irrigation Pump Stations in Upper Egypt (Phase 2) in the Arab Republic of Egypt, and entrusted the study to the Japan International Cooperation Agency (JICA).

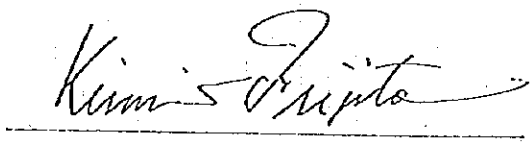
JICA sent to Egypt a study team from December 4, 1995 to January 8, 1996.

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

I hope that this report will contribute to the promotion of the project and 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 the Arab Republic of Egypt, for their close cooperation extended to the teams.

March, 1996



Kimio Fujita
President
Japan International Cooperation Agency

March, 1996

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rehabilitation of Floating Irrigation Pump Stations in Upper Egypt (Phase 2) in the Arab Republic of Egypt.

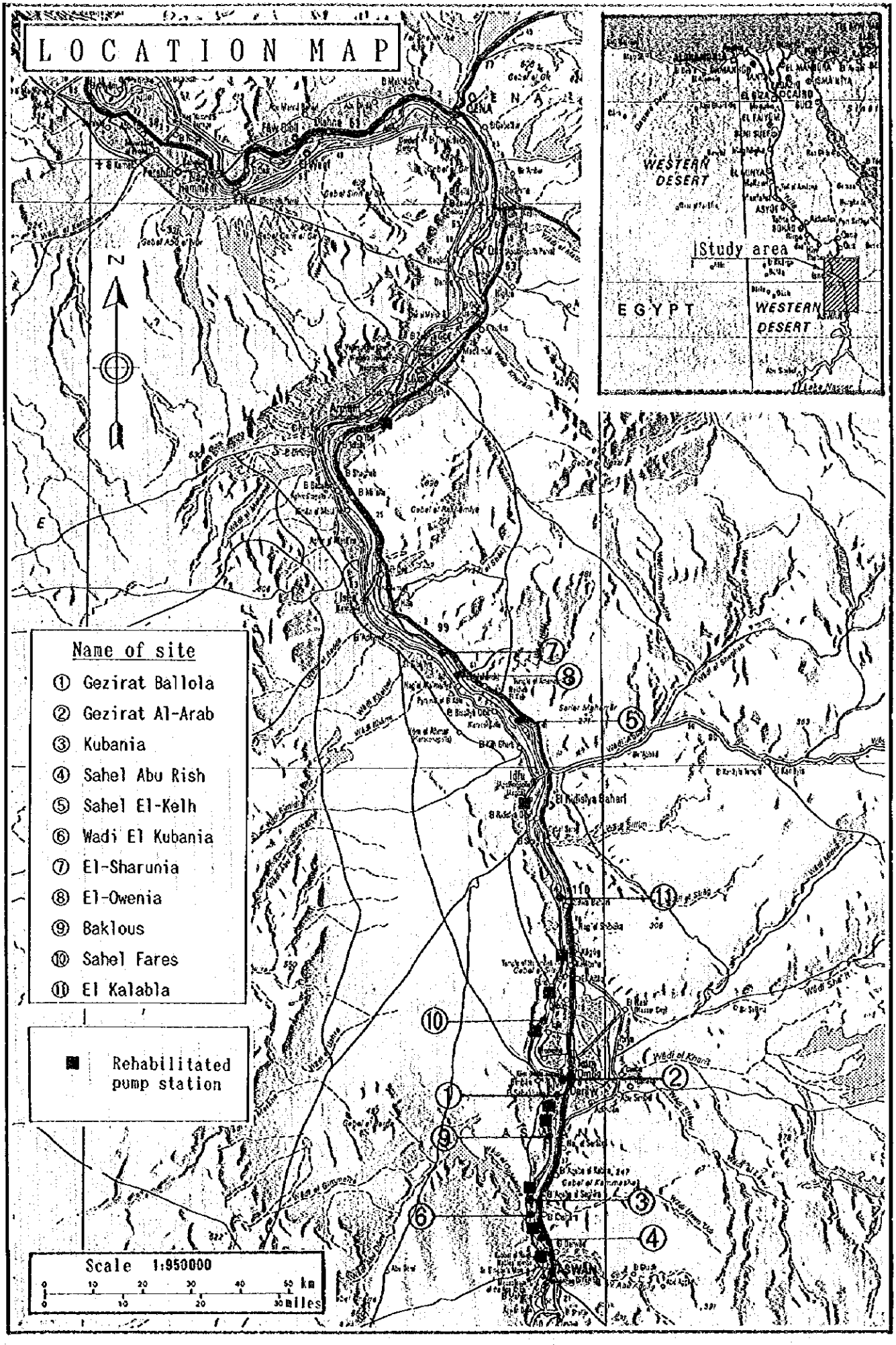
This study was conducted by SANYU CONSULTANTS INC., under a contract to JICA, during the period from November 27, 1995 to March 22, 1996. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Egypt and formulated the 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,

T. Takatsuka

Takanori TAKATSUKA
Project Manager,
Basic Design Study Team on the Project
for Rehabilitation of Floating Irrigation
Pump Station in Upper Egypt
SANYU CONSULTANTS INC.


LOCATION MAP
N
WESTERN DESERT
Study area
EGYPT
WESTERN DESERT
Name of site
① Gezirat Ballola
② Gezirat Al-Arab
③ Kubania
④ Sahel Abu Rish
⑤ Sahel El-Kelh
⑥ Wadi El Kubania
⑦ El-Sharunia
⑧ El-Owenia
⑨ Baklous
⑩ Sahel Fares
⑪ El Kalabla
Rehabilitated pump station
Scale 1:950000
0 10 20 30 40 50 km
0 10 20 30 miles
ASWAN

ABBREVIATIONS

AC	Agricultural Cooperatives
ARE	Arab Republic of Egypt
CAPMAS	Central Agency for Public Mobilization and Statistics
FAO	Food and Agricultural Organization
F/S	Feasibility Study
GNP	Gross National Product
GDP	Gross Domestic Product
HAD	High Aswan Dam
ID	Irrigation Department
IDir	Irrigation Directorate
JICA	Japan International Cooperation Agency
MED	Mechanical and Electrical Department
MALR	Ministry of Agriculture and Land Reclamation
MP	Master Plan
MPWWR	Ministry of Public Works and Water Resources
O/M, O&M	Operation and Maintenance
S/W	Scope of Works
WMRI	Water Management Research Institute
WUA	Water User's Association

Units

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

Currency

LE	Egyptian Pond
Pt	Egyptian Piaster
Yen, ¥	Japanese Yen
US$	US Dollar

Exchange Rate (January 1996)

LE	= 100 Pt
LE	= ¥ 28.2
LE	= US$ 3.39
US$	= ¥ 101.0

Glossary

Sakia	Water wheel to lift water by animal to field ditch from lateral canal
Ardap	Weight unit for agricultural products. (differing by products) 1 ardap = wheat (150 kg), beans (155 kg), maize (140 kg), sesame (120 kg)

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2. Survey schedule
3. List of Personnel related to the Study in Egypt
4. Minutes of Discussion
5. Data on Operation and Maintenance Organization
6. Data on Present Irrigation Condition
7. Data on Present Pumping Facilities

CHAPTER 1 BACKGROUND OF THE PROJECT

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The economy of Egypt has been suffering trade imbalance, unbalanced finance and accumulated debt burden. GDP is $40.9 billion in 1994 and GNP per capita is stagnant at $711, according to the statistic data of Egypt Central Bank.

Under the straitened economic circumstances, agriculture sector of Egypt plays a significant role, supplying large employment opportunity to 33 percent of the labour force (1991/92) and occupying 19.7 percent of GDP. Therefore, under the present Third Five year Plan for Socio-Economic Development (1992/3 - 1996/7), basic principles of agricultural sector puts on modernization of agriculture, increase of agricultural productivity and improvement of trade balance by agricultural products.

In Egypt, Agriculture depends on irrigation due to a lack of precipitation. Water resources available for irrigation is limited, solely the Nile river, so that effective use of water is the most important subject for agriculture sector to increase agricultural productivity. The efficiency, however, is decling since most of the existing irrigation/drainage facilities are presently deteriorated.

These facilities have to be rehabilitated urgently for upgrading agricultural production. Under this concept, Egyptian government has continued to repair and improve the existing pump stations since the pumps are the key facility for irrigation in Egypt.

All irrigation water has been extracted by pumping facilities from the Nile river in upper Egypt. In their pump facilities, floating type with barge has been utilized to adjust to seasonal fluctuation of water level of the Nile river.

There exists 45 stations along the Nile river in upper Egypt. Their facilities, however, can not function fully since most of the pump equipment

were installed more than 40 years ago and some of them are seriously deteriorated. Consequently, irrigation water can not be lifted fully to the agricultural land.

Under this circumstances, the Ministry of Public Works and Water Resources is promoting the rehabilitation/renovation projects for floating pump stations situated along the Nile river. These projects would contribute to solve the deficiency of irrigation water, to increasing the agricultural productivity and to raising the people's standard of living. However, the spare parts of their pumps cannot be obtained because the manufacturers of their existing pumps have changed their pump models. The Ministry has no other way but to replace the existing pump facilities with new ones. However, the projects are not progressing due to lack of foreign currency in the allocated budget and domestic financial difficulties.

Under the above conditions, the Government of Egypt had requested the Government of Japan for grant-aid assistance for rehabilitation of the floating irrigation pump stations in upper Egypt. In response to this request, the Government of Japan had executed the grant-aid for the Rehabilitation Project for Floating Irrigation Pump Stations in Upper Egypt in 1991 and 1993, which supplied pumping equipment and facilities for 10 pump stations.

After this project had been successfully implemented, it was recognized to give great effect on the rural people and economy. Therefore, the Government of Egypt has requested again the Government of Japan for a grand-aid assistance for the Project for Rehabilitation of Floating Irrigation Pump Stations in Upper Egypt, covering 11 pumping stations faced with serious mechanical and irrigation problems.

The contents of the request provided by the Government of Egypt are outlined as follows.

- Procurement of necessary pump equipment and materials for rehabilitation of 11 floating pump stations.
- 2 sets of pump equipment by each floating pump station.

Requested pump stations, the service area and the pumping capacity are as follows.

List of Requested Pumping Stations

Ser. No.	Station Name	Irrigation Area (Feddan)	Pump Capacity (Proposed) (m^3/s)	Existing Pump Capacity (m^3/s)
1	Gezirat Ballola	250	2×0.25=0.50 (B)	2×0.35=0.70
2	Gezirat Al-Arab	110	2×0.15=0.30 (A)	1×0.35=0.35
3	Kubania	200	2×0.15=0.30 (A)	1×0.25=0.25
4	Sahel Abu Rish	575	2×0.50=1.00 (D)	2×0.75=1.50
5	Sahel El-Kelh	400	2×0.35=0.70 (C)	2×0.75=1.50
6	Wadi El-Kubania	600	2×0.50=1.00 (D)	2×0.35=0.70
7	El-Sharunia	800	2×0.60=1.20 (D')	2×0.50=1.00
8	El-Owenia	750	2×0.60=1.20 (D')	2×0.50=1.00
9	Baklous	100	2×0.15=0.30 (A)	Approx. 0.2
10	New Sahel Fares	1,300	2×1.30=2.60 (E)	N.A
11	El-Karabla	400	2×0.35=0.70 (C)	2×0.50=1.00

Remarks: Ser. No. 10 Sahel Fares is proposed as a new pumping station. The canal works to connect with pump are planned to be constructed by Irrigation Department.

CHAPTER 2 CONTENTS OF THE PROJECT

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2-1 Objectives of the Project

The subjects of agricultural sector of Egypt are put on country's food self-sufficiency, increase of agricultural productivity and effective use of agricultural resources. To solve the subjects, the Egyptian Government is promoting the improvement and upgrading projects for irrigation and drainage facilities. In the projects, approximately 1,000 pump stations have been continued to be rehabilitated in the whole country.

Under the above conditions, MPWWR has rehabilitation plan of 45 floating irrigation pump stations in upper Egypt. The Project is formulated in live with this rehabilitation plan. The objective of the Project is to procure pumping equipment and materials required for rehabilitation of 11 floating pump stations.

2-2 Basic Concept of the Project

The target of the Project is to secure reliable and stable water source for irrigation. In order to realize the target, necessary equipment and materials are procured for rehabilitation of the floating pump stations in the Project.

The capacity and dimension of the equipment and materials are planned based on the following viewpoints.

- In upper Egypt, horizontal expansion of cultivated area has been executing by means of land reclamation by farmer themselves. As well as in the service area of the Project, agricultural land has been continued to be reclaimed toward the desert with construction works of irrigation canal. In the Project, therefore, expanded farm land should be included as much as possible, as the targeted area of pump stations, in addition to the existing irrigation areas.

- The capacity of floating pump facility is planned based on the irrigation water requirement of the above targeted irrigation areas. It is estimated on the cropping schedule such as sugarcane, wheat and maize, and irrigation time and efficiency based on the local conditions.

- Irrigation system consists of floating pump stations, tower, discharge pipe and irrigation canal. Out of them, facilities to be rehabilitated in the Project are pumping station and connecting pipe between the pump and tower, which are replaced fully with new ones, since the all existing equipments are deteriorated and the function declined. Tower and discharge pipe will be rehabilitated by MED.

- Design concepts of pumping system and capacity are the same as the previous grand aid project. In the detailed design stage, however, some measures for water weed and wave are taken in the structure of barge to reduce the harmful effect on the operating pump.

- In the existing 10 stations of the requested 11 stations, the Project could be implemented easily since their stations have water right. However, the water right should be renewed by MPWWR in parallel with the project implementation, based on the design capacity of newly installed pump. Related to the No. 10 pumping station newly planned to install, although the water right was applied, but it has not been approved as of December, 1995. It should be obtained by MPWWR before project implementation.

- The Project could be carried out under the present operating organization and staff. Periodic checking and repair of the pumping equipment would be basically done by the workshop in Aswan. But, special parts and materials could not be repaired and made due to no

specific machine tool, so that spareparts of pump should be provided in the Project.

- In the implementation schedule, manufacturing and assembling of pump and barge will require longer term, generally more than 8 months. It will be difficult to procure the whole requested 11 pumping stations simultaneously in one fiscal year. Therefore, it is required to procure them into 2 phases. Phasing is done based on the rehabilitation priority of the pump station, taking account of some factors/criteria prepared frow viewpoints of mechanical and social conditions.

2-3 Basic Design

2-3-1 Basic Design of the Project

(1) Planning Design to Natural Conditions

1) Considerations on Climate

Considerations for High Temperature

The maximum temperature reaches 50 °C in summer in the region. Following considerations are to be given for high temperature;

- material of wall to be of insulation
- adequate breatherbility to be kept
- equipment to be shaded from direct sunshine in summer

All pump stations of Phase-1 are considered on above matters. Therefore, Phase-2 will follow same structure of Phase-1.

Considerations for High Intensity Rainfall

Although rainfall seldom occurs in the region, it is known that high intensity rainfall occurs in the region. In this aspect, it is necessary for

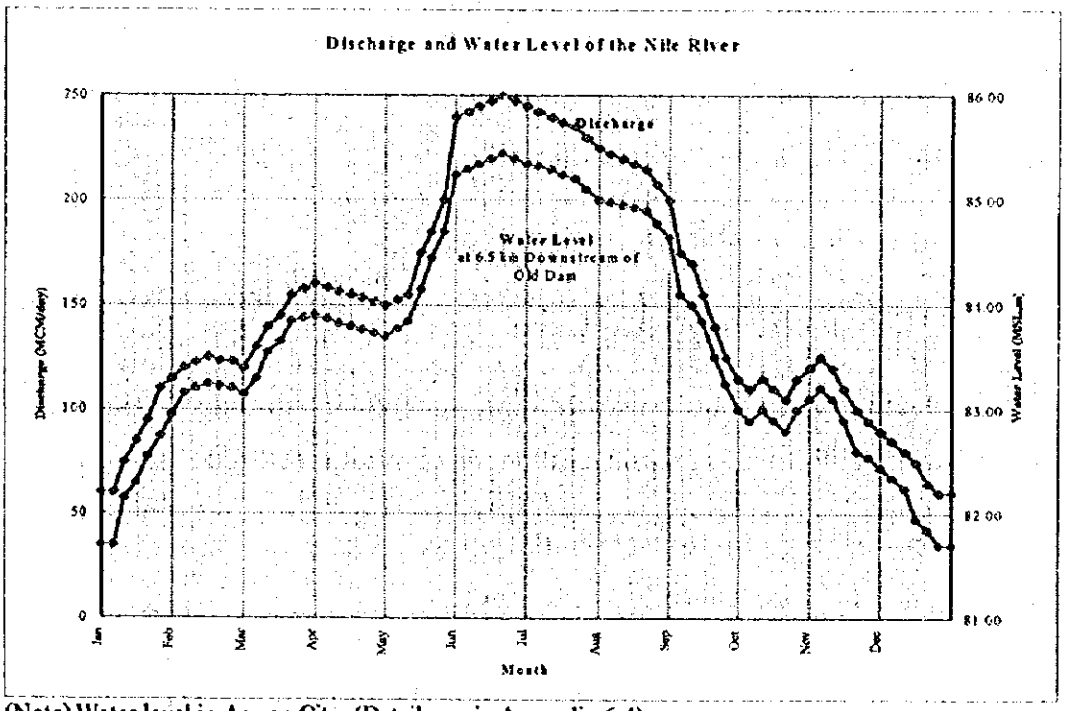
Irrigation Department to give adequate advise to farmers on provision of floodway for expansion of farms in the areas of No.5, No.6 and No.7.

2) Considerations on Flow Regime of the Nile River

Considerations for Fluctuation of Water Level

Discharge of the Nile river is controlled by season, and its water level fluctuates largely by season. As shown in Figure 2.3.1, difference between maximum and minimum water levels reaches 3.75 m. Water head of pump has to be designed on the consideration of fluctuation of water level.

Figure 2.3.1 Water Release Plan of High Aswan Dam and Water Level of the Nile River



(Note) Water level in Aswan City. (Details are in Appendix 6.4)

Considerations for Floating Weeds

Much water weeds are flowing down in the Nile river. Pumps are to be protected from these weeds especially from flowing weeds in the water.

Considerations for Surges

Large-scale passenger boats frequently navigate in the Nile river. These boats cause surges to the floating pump stations. Surges are larger where ship route is close to the pump station such as at No.5, No.7 and No.8 pump stations. Joint pipe between the discharge tower and the discharge pipe is to be more flexible in these stations.

Considerations for Sediments

Flow of the Nile river changes in its velocity and direction by locations. Some of pump stations are located where sediments are heavily deposited. These pump stations are to be maintained by a dredging boat to remove sediment periodically. Pump stations No. 9 and No. 11 are located at such location. No. 11 pump station is maintained and less problems for operation but not for No. 9. It is necessary to maintain also No. 9 after rehabilitation which is not well operated at present due to extreme deterioration.

3) Consideration for Salt Concentration

It will not be necessary to provide a drainage network for preventing water logging, which causes salt concentration, in the area of floating pump station where irrigation system is generally small in scale. Salt concentration is caused in the expansion area of the floating pump station, but it is leached within four to five years by continuing irrigation. Therefore it is not necessary to consider additional leaching water in irrigation. It is recommended to accelerate leaching by excess irrigation in winter when irrigation requirement decreases.

(2) Social condition

In the project sites, floating pump stations should be rehabilitated urgently, since they are the sole irrigation water supply facilities. Each pump station is located along the Nile river, can not be easily accessible from

the nearest trunk road. Procured pump stations are required to be installed and maintained by approaching from river side.

Supply of electric power to the pump station is easy since the electric lines are installed along the Nile river and trunk roads

(3) Policy on improving equipment

1) Type of pumping

The command areas subject to irrigation by each of pumping stations are narrowly distributed along the Nile and trunk roads. Taking into account of their small scale in size and the local requirements, it can reasonably be understood that floating type is employed at 36 stations (60%) out of 62 main stations. Advantages and disadvantages of the floating and fixed types with respect to the local and other requirements are as follows.

Subject	Requirement	Float. Typ.	Fixed Typ.	Remarks
Water level variation	Max. 3.7 m	good	poor	Barge adjustable
Compatibility between stations	Support of failed station	good	poor	Movable by tugboat
Sediment	Dredging in front of station	fair	poor	Dredger boat after move of barge
O&M	Present workshops availability	good	poor	Barge movable to workshop
Construction	Economy	good	poor	Suction sump & some others not required
Overall evaluation		good	poor	

As shown above, the floating type is accordingly recommended.

2) Necessity for renewal of pumping equipment

The results of survey on the status of equipment in each pumping station are presented in the table below.

Table 2.3.1 Equipment and Deterioration [Equipment up to the tower]

Equipment	Function	Category	Appearance	Category
Main pump	Some units low vibration & noise but capacity below 50%	C	Most units paint peeled off. Corrosion advancing	C
Prime mover	Some units low vibration & noise. Most units super annuation advancing.	B	ditto	C
Diesel engine	Much noise & vibration. Serious superannuation.	C	Considerable oil leak. Some units under repair.	C
Vacuum pump	Vacuity fairly lost.	C	Less O&M than main units.	C
Discharge valve	Water leak from gland. Heavy move of wheel.	C	Most units paint peeled off. Corrosion advancing.	C
Ball joint	Most units rubber-made deteriorated. Water leak	B	Corrosion advancing on steel portions	C
Control panel	Insulation satisfactory	A	In and out-sides damaged. Insufficient terminal treatment	C
Power cable	ditto	A	Whole superannuated. Insufficient terminal treatment	C
Barge	Many anchor failed & fixed by wire rope from bank	B	No painted and widely corroded. Serious super-annuation.	C
Pump house	Serious superannuation in & out-sides	C	Much damage on walls & roof	C

Category A : satisfactory

B : fairly deteriorated

C : seriously deteriorated

As shown above, most equipment are seriously superannuated that it is recommended to improve them by a total renewal.

Table 2.3.2 Equipment and Deterioration
[Tower and delivery pipe]

Equipment	Function	Category	Appearance	Category
Tower	Water leak at most flange joints. Some inclined.	C	No painted and widely corroded. Some seriously superannuated.	C
Discharge pipe	ditto	B	ditto	B
Flap valve	Some neither installed nor functionable.	C	ditto	C

Category A : satisfactory
B : fairly deteriorated
C : seriously deteriorated

These equipment are in need of simultaneous improvement with the pumping equipment, so that the improvement is herein implemented under MED projects.

3) Capacity of equipment

Pumping equipment

Judging from the seasonal wide changes in water requirement and suction water level and longitudinal survey results in the Nile, pumping equipment should satisfy the conditions below.

- Functionable against the water level variation 3.75m at maximum in the Nile.
- Delivery adjustable to the minimum requirements.

In order to secure compatibility of pumping equipment between stations from O&M points of view, per-unit pumping capacities are to be unified as much as possible. Number of pump is planned 2 sets for each barge and no stand-by pump is considered.

The capacity of each station is planned as shown in Table 2.3.3.

Table 2.3.3 Pumping Plan of Each Station

Station No. & Name	Seasonal W. Req't (m^3/s)	Actual Head (m)	Loss Head (m)	Total Head (m)	Pumping Plan		
					Capacity (m^3/s)	No.	Total H
1 Gezirat Ballola	0.55 0.31 0.46	7.60 8.90 5.40	1.8 0.6 1.3	9.4 9.5 6.7	0.25	2	12
2 Gezirat Al-Arab	0.21 0.11 0.19	7.80 9.10 5.60	1.6 0.5 1.4	9.4 9.6 7.0	0.15	2	12
3 Kubania	0.21 0.11 0.19	7.86 9.16 5.66	1.6 0.5 1.4	9.46 9.66 7.06	0.15	2	12
4 Sahel Abu Rish	1.02 0.56 0.80	9.54 10.84 7.34	1.7 0.6 1.1	11.24 11.44 8.44	0.50	2	12
5 Sahel El-Kelh	1.26 0.94 0.86	4.57 5.87 2.37	2.7 1.6 1.3	7.27 7.47 3.67	0.60	2	10
6 Wadi El-Kubania	1.18 0.74 0.85	10.67 11.97 8.47	2.5 1.0 1.3	13.17 12.97 9.77	0.60	2	14
7 El-Sharunia	2.25 1.69 1.53	4.94 6.24 2.74	2.3 1.3 1.1	7.24 7.54 3.84	1.00	2	10
8 El-Owenia	1.40 1.05 0.95	4.64 5.94 2.44	3.5 2.0 1.7	8.14 7.94 4.14	0.70	2	10
9 Baklous	0.28 0.17 0.21	9.20 10.50 7.00	1.8 0.7 1.1	11.0 11.2 8.1	0.15	2	12
10 New Sahel Fares	1.67 1.21 1.22	13.70 15.00 11.50	7.5 4.0 4.1	21.2 19.0 15.6	0.80	2	23
11 El-Karabla	0.90 0.64 0.65	6.63 7.93 4.43	2.7 1.4 1.45	9.33 9.33 5.88	0.50	2	10

Note) Values at above : maximum water requirement
at middle : minimum water requirement and maximum head.
at bottom : water requirement at minimum head

Barge

i) Size

In addition to the required spaces for the whole equipment as pumps, motors, valves, panels, etc. for installation, the floor size of the barge is to be determined by taking the following spaces into account.

- Operation space
- Maintenance space

] 1.0m-wide aside or in front of equipment

- Desk work space for operation data recording and other works
- Walk space (0.7m-wide)
- Spare for hoist and bollard

ii) Height of barge

Barge height (H) = Freeboard height (h) + Draft height (d)

a. Freeboard height (height of gunwale above water)

Followings are to be considered.

- Wave height by boats in the Nile (= 1.0m)
- Maximum flow velocity in the Nile (= 0.5m/s)
- Hydraulic inertia by suction and delivery and rotational reaction
- Allowance for other factors (= 0.2m)

b. Draft height (depth of barge bottom below water surface)

Followings are to be considered.

- Draft height by buoyancy calculation
- Draft height to secure buoyancy equivalent to the total weight of equipment and materials on the barge
- The center of gravity be lowered till the water line so as maintain the stability and to be durable against water, flow velocity and winds

c. Structure

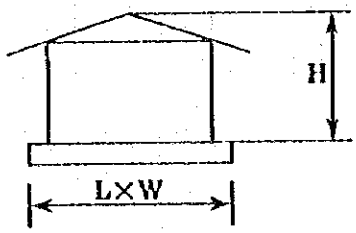
The criteria for STEEL BARGE, Japan Shipbuilding Standard, Nippon Kaiji Kyokai be applied.

Pump house

Pump house on the barge will be designed by taking account of the following reasons of installation and policy.

a. Pump house will be of a roof and walls to protect the equipment from wave splash, sand storm, etc.
b. Prevention of heat rise in the house and equipment by direct sunshine into the house.
c. Natural ventilation
d. A manual hoist will be equipped above the floor for maintenance purpose.
e. The structure of the house equipped with the hoist will be of steel frame to bear the weights of pumps, motors, etc.
f. Walls will be of water-proof plywood
g. Installation of lights for night-time operation inside and outside of the house.
h. Power outlets on the walls for lighting in the house for ordinary works.
i. Installation of hunger board for hung maintenance tools.

Type	Pumping Station	No.	Dimension (m)			Weight (tf)
			L	W	H	
A	No.1, No.2, No.3, No.9	4	13	5.5	6.0	45
B	No.4, No.5, No.6, No.11	4	14	6.5	6.6	55
C	No.7, No.8	2	16	7.5	7.4	65
D	No.10	1	18	7.5	7.7	85



(4) Policy on procurement of the equipment and materials

Taking account of the characteristic of the equipment and materials to be procured, floating pump station is required to be the mechanized and systematic unit functioning as water supply facility. The following cases are considered to procure the pump stations.

① Procure them in other countries except Egypt and Japan
② Procure pumping equipment in Japan and barge in Egypt
③ Procure them in Japan, as same as in the previous grant aid project.

In case ① and ②, the followings are considered in the detailed design and manufacturing stages.

- Implementation might be delayed due to much arrangement works for preparation of specification of how to function as the unit.
- In case necessary equipment and parts are procured individually, much troubles might be happened in the operation and maintenance stage by MED, since each procured equipment and part might not functioned each others as the system.
- Manufacturing and assembling works might be required longer term since many engineers would be sent from the country supplied part and equipment.
- Compared with the procuring sources of equipment, Japanese products have some advantage in views of quality, production management and aftercare in Egypt, though it has the most disadvantage of the price, as shown in Table 2.3.4.

Based on the above considerations, floating pump units in this project will be procured in Japan, considering quality as the system and limited implementation schedule by Japanese grant aid assistance.

Table 2.3.4 Comparison of Procuring Sources of Equipment

Make	Japan Make	Major Third Nation Make		Egypt Make (for Barge only)
		West Europe & USA	Russia & East Europe	
Quality & Function	① Overall quality of design and manufacturing (material, processing and assembling) at the world top level. ② Functions & capabilities especially in mechanical efficiencies competing with Europe and USA in the world market. Grade 1	① (same as in the left) ② (same as in the left) Grade 1	① Behind the top level due to a long absence in the world market by state enterprises. ② Functions & capabilities behind the world top level Grade 3	① Plants old-fashioned & delay in modernization. Unstable quality due to considerable manual processings. ② Dependent on the imported technologies. Original production technologies not established yet. Grade 3
Production Control & Management	① The management system popularly disseminated, & the capability at the world top level. ② Rational and modern production facilities & technological advancement outstanding ③ Labour management system highly efficient through 2-shift or 3-shift production. Grade 1	① The system originated & developed in USA and UK. ② Modernization of Production facilities advanced not as much as Japan, production technology especially in originality of processing tools. ③ Labor management system almost same as in Japan but slightly less work hours. Grade 2	① Modern management as in Japan, West Europe & USA, may not be practice. ② Plants are old fashioned and labor management may not be systematic. Grade 3	① Concept of the management not well understood even in keeping production schedule at production levels. ② Considerable delay in modernizing plants and improving productivity. ③ Day-time short work-hour (6 hr/day) single shift system practiced. Grade 4
Aftercare & Supply of Spareparts	① No direct aftercare by network of agents/sellers of maker, but the importance acknowledged. System of spareparts supply be agents established. Grade 1	① No stock of spareparts by direct agents or sellers of maker. Importance of aftercare may not be understood & the service extensive. Grade 2	① Concept of aftercare may not be well understood and the system is not established. Grade 3	① No established aftercare system, but advantaged by the locality. Grade 2
Price	① Handicapped by current appreciation of Yen offtaking efforts for lowering costs. Grade 4	① Advantaged by Yen Appreciation. Grade 3	① Advantaged by comparative low labor cost and appreciation of Yen. Grade 2	① Advantaged by low labor cost and appreciation of Yen. Grade 1
Selection	Selection			

(5) Policy on procurement of the equipment in Egypt

Floating pump unit is manufactured and assembled in Japan. There are no equipment and materials procured in Egypt.

(6) Policy on operation and maintenance organization

Renovated pump stations will be operated and maintained under the present management offices and same staff. Simple check and repair of the pumping facilities could be done by the workshops. High quality parts, however, could not be made since the present workshops have not enough machines and tools to process and manufacture the materials. Kind and quantity of spareparts in this project will be decided based on the above present conditions.

(7) Policy on coverage of subject equipment and their settings

① Subject equipment

Equipment from pumping station till the connecting pipes are subject to the coverage as below.

- Indoor: main pump, prime mover, vacuum pump, discharge valve, suction & delivery pipe, control panel & power cable.
- Outdoor: barge, pump house & connecting pipes including ball joints.

② Policy on equipment settings

- Pipe joints connecting to the tower be adjusted by change of connecting location to meet the change of water levels. Ball joints or some other flexible joints are to be installed between connecting pipes.

- No stand-by pump is installed. Two sets of pump per barge are therefore to be installed as requested.
- Experiences of rehabilitated stations learned that barges are rolled and pitched by waves of large boats passing along and this gives negative effects to connecting pipes. Number of anchors for each barge is to be increased to four.

(8) Basic policy on implementation schedule

In the procurement of equipment and materials in this project, manufacturing and assembling works will require longer implementation period. Manufacturing term for whole 11 stations will be from 8.0 to 9.0 months. Therefore, it becomes difficult to procure whole stations in one fiscal year. The project will be implemented into two phases.

Priority for rehabilitation

Priority for rehabilitation is given on the each pump station, based on the present operating condition, necessity of irrigation to the farm land. Given priority is summarized in Table 2.3.5. Based on the priority, the Project will be phased as follows.

(No) Pump station	Priority	Pump dimension		Phase
		Capacity×unit (m^3/s)	Total head (m)	
(6) Wadi El-Kubania	1	0.60×2	14	I
(7) El-Sharunia	2	1.00×2	10	
(5) Sahel El-Kelh	3	0.60×2	10	
(8) El-Owenia	3	0.70×2	10	
(9) Baklous	5	0.15×2	12	
(1) Gezirat Ballola	6	0.25×2	12	
(11) El-Karabla	7	0.50×2	10	
(2) Gezirat Al-Arab	8	0.15×2	12	
(3) Kubania	9	0.15×2	12	
(4) Sahel Abu Rish	9	0.50×2	12	II
(10) New Sahel Fares	11	0.80×2	23	

Note) No. 5 and No. 8, No. 3 and No. 4 are the same priority.

Table 2.3.5 Priority of Each Station for Rehabilitation

No	Pump station	Pumping facilities					Irrigation condition				Others	Overall Priority
		Degree of deterioration	Severity of driving	Necessity of spareparts	Provision of spareparts	Deterioration of barge	*1 Expansion of farm land	*2 Existing canal	Change of water demand			
									Crop	Others		
1	Gezirat Ballola	5	4	4	5	4	3	3	3	3	-	6
2	Gezirat Al-Arab	5	3	3	4	3	-	2	3	2	-	8
3	Gezirat Kubania	4	3	3	2	3	-	2	4	3	-	9
4	Sahel Abu Rish	4	3	3	3	3	1	3	2	2	-	9 (Same as No.3)
5	Sahel El-Kelh	5	4	5	5	4	4	4	3	3	-	3
6	Wadi El-Kubania	5	4	5	5	5	5	5	4	4	-	1
7	El-Sharunia	4	5	4	4	4	5	5	4	4	2	2
8	El-Owenia	4	4	4	4	4	4	5	4	4	-	3 (Same as No.5)
9	Baklous	4	5	5	5	4	5	3	2	3	-	5
10	New Sahel Fares	-	-	-	-	-	5	-	-	-	-	11
11	El-Karabla	4	4	3	4	3	4	2	3	2	-	7

Note) (1) Priority is given relatively from grade 5 to 1. In the pumping facilities, highest priority of rehabilitation gives "5", lowest one is "1".

(2) In the irrigation conditions,

*1 : Station with highest water demand of expanded area is the "5"

*2 : Station with highest canal density is the "5"

*3 : Station with highest water demand due to change of cropping pattern is "5"

(3) Others is the necessity of water supply to new farm land, remains of factory.

2-3-2 Basic Design

(1) Irrigation

1) Proposed cropping pattern

Present cropping pattern of the project areas reflects each accessibility to the market. It is, therefore, considered not to change drastically in its present cropping pattern by the project. Present cropping pattern of each project area is shown as in Table 2.3.6.

Table 2.3.6 Present Cropping Pattern

Project Area	Farm Land	Farm Households	Vegetable - Vegetable	Maize - Wheat	G. Maize - Berseem	Sugar-cane	Bananas	Fruits (Mango)	Fruits (Dates)
	(feddan)	(number)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1 Gezirat Ballola	270	193	30%	10%	20%	—	30%	10%	—
2 Gezirat Al-Arab	110	79	20%	10%	20%	—	40%	10%	—
3 Gezirat Kubania	110	79	20%	10%	20%	—	50%	—	—
4 Sahel Abu Rish	590	400	40%	10%	20%	—	—	30%	—
5 Sahel El-Kelh	410	293	10%	10%	20%	60%	—	—	—
6 Wadi El-Kubania	440	314	60%	20%	20%	—	—	—	—
7 El-Sharunia	700	500	10%	10%	20%	60%	—	—	—
8 El-Owenia	610	436	10%	10%	20%	60%	—	—	—
9 Baklous	60	43	10%	—	20%	—	—	—	70%
10 New Sahel Fares	270	193	20%	20%	20%	40%	—	—	—
11 El-Karabla	500	357	10%	10%	20%	50%	10%	—	—
Total	4,040	2,887	22%	12%	20%	34%	6%	5%	1%
		(feddan)	895	469	808	1,390	230	206	42

(Note) 1) Cropping pattern has been observed in each project area by the study team.
2) G. Maize: Green Maize

No. 9 Project area, Baklous, is, however, considered to change its cropping pattern rapidly after project, where it is not sufficiently irrigated at present. Since Baklous is similar to No. 6 Project area, Wadi El-Kubania, in its accessibility to the market. It is considered that vegetables will increase rapidly in its area instead of dates for the market of Aswan City.

Table 2.3.7 Proposed Cropping Pattern

Pump Station	Project Area	Resident Area	Irrigation Area	Vegetable - Vegetable	Maize - Wheat	G. Maize - Berseem	Sugar-cane	Bananas	Fruits (Mango)	Fruits (Dates)
	(Feddan)	(Feddan)	(Feddan)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
1 Gezirat Ballola	270	0	270	30%	10%	20%	—	40%	—	—
2 Gezirat Al-Arab	110	0	110	20%	10%	20%	—	50%	—	—
3 Gezirat Kubania	110	0	110	20%	10%	20%	—	50%	—	—
4 Sahel Abu Rish	590	30	560	40%	10%	20%	—	30%	—	—
5 Sahel El-Kelh	740	70	670	10%	10%	20%	60%	—	—	—
6 Wadi El-Kubania	710	100	610	60%	20%	20%	—	—	—	—
7 El-Sharunia	1,300	100	1,200	10%	10%	20%	60%	—	—	—
8 El-Owenia	770	20	750	10%	10%	20%	60%	—	—	—
9 Baklous	150	0	150	60%	20%	20%	—	—	—	—
10 New Sahel Fares	940	0	940	20%	20%	20%	40%	—	—	—
11 El-Karabla	510	10	500	10%	10%	20%	50%	10%	—	—
Total	6,200	330	5,870	22%	13%	20%	37%	7%	0%	0%
			(Feddan)	1,305	767	1,174	2,198	436	0	0

Sugarcane dominant areas are considered to be located at less advantage from an aspect of transportation comparing to the large-scale sugarcane areas surrounding Komombo and Eduf. Therefore, similar cropping pattern will be maintained also after project including the expansion area in these areas. Fruits will be considered by bananas, which are necessary more water than mangos, from aspect of flexibility on future land-use. Future cropping pattern is proposed as shown in Table 2.3.7 from above considerations.

2) Consumptive use of crops

Consumptive use of crops are estimated for Upper Egypt by Irrigation Department (ID) as shown in Table 2.3.8. Consumptive use of banana has been estimated from reference evapotranspiration due to no estimation by ID.

Table 2.3.8 Consumptive Use of Crops in Upper Egypt

(Unit : m³/month/feddan)

Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Winter Season													
Wheat	0.0	454.2	456.7	428.4							234.0	526.7	2,100.0
Broad Beans	0.0	355.2	534.4	107.2								603.2	1,600.0
Barley	0.0	406.3	340.0								467.5	486.2	1,700.0
Fenugreek	0.0	357.3	109.6							143.2	322.5	357.3	1,289.9
Lupine	0.0	429.8	47.6							173.6	359.8	389.2	1,400.0
Chick-peas	0.0	429.8	47.6							173.6	359.8	389.2	1,400.0
Lentils	0.0	331.9	111.0							140.2	300.0	336.7	1,219.8
Clover										527.0	1,116.0	1,457.0	3,100.0
Berseem	0.0	896.0	879.6	979.2	284.8					72.0	392.0	496.4	4,000.0
Flax	0.0	274.1	283.7	266.3							156.3	329.6	1,310.0
Onion	0.0	540.0	555.9	508.7							508.2	587.3	2,700.1
Garlic	0.0	379.9	391.1	357.9							363.5	413.4	1,905.8
Vegetables	0.0	725.7	107.5							658.6	883.6	984.5	3,359.9
Other Plants	0.0	892.0	880.0	980.0						360.0	392.0	496.0	4,000.0
Summer Season													
Cotton			517.0	479.4	446.5	629.7	963.6	1,109.3	554.6				4,700.1
Rice					1,275.9	2,806.5	2,209.2	2,209.2	2,419.9				10,920.7
Maize					679.8	904.2	1,148.4	567.6					3,300.0
Sorghum					638.6	849.4	1,078.8	533.2					3,100.0
Soia beans					834.3	1,109.7	1,409.4	696.6					4,050.0
Sugarcane	0.0	648.0	624.0	816.0	912.0	960.0	1,248.0	1,488.0	1,608.0	1,320.0	1,224.0	1,152.0	12,000.0
Sugarcane*1	164.0	240.0	254.0	350.0	792.0	892.0	1,239.0	1,344.0	1,144.0	929.0	698.0	371.0	8,407.0
Banana *2	286.0	388.0	458.0	631.0	1,117.0	1,211.0	1,405.0	1,494.0	1,260.0	1,014.0	669.0	449.0	10,382.0
Sesame					705.2	946.0	1,186.8	602.0					3,440.0
Groundnuts					791.3	1,061.5	1,331.7	675.5					3,860.0
Onion					540.0	729.0	945.0	486.0					2,700.0
Vegetables		561.0	1,094.5	1,182.5	1,336.5	1,116.4	209.1						5,500.0
Other Plants					824.0	1,096.0	1,392.0	688.0					4,000.0
Nile Season													
Maize						422.4	801.9	762.4	861.3	462.0			3,300.0
Sorghum						396.8	753.3	706.8	809.1	433.9			3,099.9
Vegetables								1,445.0	1,825.0	1,730.0			5,000.0
Fruits	0.0	214.4	223.7	308.1	373.4	494.2	482.9	478.6	439.2	423.1	305.7	301.3	4,044.6

(Data Source) Irrigation Department Aswan

(Notes) 1) Above table shows consumptive use of crops, which are not including any losses as conveyance and application.

2) *1: based on the research results in 1994 by the Water Management Research Institute. (Appendix

3) *2: estimated referring crop factor of banana shown in Irrigation and Drainage Paper No. 24 FAO.

3) Irrigation hour

Irrigation hour was considered at 16 hours per day in Phase-1 Project. However, it is proposed in Phase-2 to set irrigation hour as follows due to existence of poisonous snakes, farming costume of farmers afraid of snakes, nubian composing of most farmers in the area, and necessity of boat for return to house after farming in islands:

Irrigation Hour

Irrigation Projects at the Bank of Nile River:	14 hours / day
(Pump operation: 16 hours)	
Island Projects in the Nile River:	12 hours / day
(Pump operation: 14 hours)	

Pump Operation Hour

Pumps shall be operated by 2 hours ahead of irrigation to raise water level of the main irrigation canal. Operation hour is, therefore, longer by 2 hours than irrigation hour.

4) Irrigation efficiency

Overall irrigation efficiency has been estimated at 0.36 to 0.40 by previous project, based on standard irrigation efficiencies by FAO and ICID taking present irrigation conditions into consideration. On the other hand, Water Management Research Institute considers overall irrigation efficiency to be 0.55 as standard for unlined open canal system in Upper Egypt, which was researched in the large-scale sugarcane field in Komombo. This overall irrigation efficiency is considered of the large-scale irrigation project equipped with a maintenance road along the main canal. However, in the floating pump irrigation project, maintenance road is seldom provided along the canal and control facilities are generally old. On above considerations, overall irrigation efficiency is considered at 0.50 for this Project. Major differences of both Projects are caused by the difference of field irrigation system. Previous project considered furrow irrigation but basin irrigation for Phase-2 project.

5) Village water

Village water is estimated at 10 % of irrigation water for garden and others.

6) Monthly irrigation water demand

From above conditions, monthly irrigation demand of each project is determined as shown in Table 2.3.9. Maximum irrigation demand will occur in September in all project areas. Pump facilities are to be designed taking water level fluctuation of the Nile river shown in Figure 2.3.1.

Table 2.3.9 Proposed Monthly Irrigation Demand

Project Area	Area (fed.)	Proposed Irrigation Demand (m³/sec)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Gezirat Ballola	270	0.00	0.32	0.36	0.43	0.43	0.46	0.40	0.50	0.55	0.51	0.31	0.31
2 Gezirat Al-Arab	110	0.00	0.12	0.13	0.16	0.16	0.19	0.19	0.20	0.21	0.20	0.13	0.11
3 Gezirat Kubania	110	0.00	0.12	0.13	0.16	0.16	0.19	0.19	0.20	0.21	0.20	0.13	0.11
4 Sahel Abu Rish	590	0.00	0.59	0.67	0.78	0.77	0.80	0.60	0.89	1.02	0.96	0.56	0.56
5 Sahel El-Kelh	740	0.00	0.77	0.72	0.88	0.77	0.86	0.97	1.08	1.26	1.11	0.96	0.94
6 Wadi El-Kubania	710	0.00	0.72	0.85	0.95	0.86	0.85	0.47	0.94	1.18	1.12	0.62	0.74
7 El-Sharunia	1,300	0.00	1.37	1.27	1.58	1.37	1.53	1.72	1.96	2.25	2.00	1.71	1.69
8 El-Owenia	770	0.00	0.85	0.79	0.99	0.86	0.95	1.07	1.21	1.40	1.23	1.07	1.05
9 Baklous	150	0.00	0.17	0.21	0.23	0.21	0.21	0.10	0.23	0.28	0.27	0.15	0.17
10 New Sahel Fares	940	0.00	1.05	1.04	1.21	1.08	1.22	1.21	1.42	1.67	1.49	1.15	1.21
11 El-Karabla	510	0.00	0.55	0.50	0.64	0.58	0.65	0.72	0.82	0.90	0.80	0.67	0.64
Total	6,200	0.00	6.63	6.67	8.01	7.25	7.91	7.64	9.45	10.93	9.89	7.46	7.53

Project Area	Proposed Unit Irrigation Requirement (lit/sec/feddan)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Gezirat Ballola	0.0	1.2	1.3	1.6	1.6	1.7	1.5	1.9	2.0	1.9	1.1	1.1
2 Gezirat Al-Arab	0.0	1.1	1.2	1.5	1.5	1.7	1.7	1.8	1.9	1.8	1.2	1.0
3 Gezirat Kubania	0.0	1.1	1.2	1.5	1.5	1.7	1.7	1.8	1.9	1.8	1.2	1.0
4 Sahel Abu Rish	0.0	1.0	1.1	1.3	1.3	1.4	1.0	1.5	1.7	1.6	0.9	0.9
5 Sahel El-Kelh	0.0	1.0	1.0	1.2	1.0	1.2	1.3	1.5	1.7	1.5	1.3	1.3
6 Wadi El-Kubania	0.0	1.0	1.2	1.3	1.2	1.2	0.7	1.3	1.7	1.6	0.9	1.0
7 El-Sharunia	0.0	1.1	1.0	1.2	1.1	1.2	1.3	1.5	1.7	1.5	1.3	1.3
8 El-Owenia	0.0	1.1	1.0	1.3	1.1	1.2	1.4	1.6	1.8	1.6	1.4	1.4
9 Baklous	0.0	1.1	1.4	1.5	1.4	1.4	0.7	1.5	1.9	1.8	1.0	1.1
10 New Sahel Fares	0.0	1.1	1.1	1.3	1.1	1.3	1.3	1.5	1.8	1.6	1.2	1.3
11 El-Karabla	0.0	1.1	1.0	1.3	1.1	1.3	1.4	1.6	1.8	1.6	1.3	1.3
Maximum	0.0	1.2	1.4	1.6	1.6	1.7	1.7	1.9	2.0	1.9	1.4	1.4

(2) Pump, barge and other equipment plan

① Application standard

The standards for application to the equipment and works be of the current issues of the followings.

Equipment and Works	Standard
Materials and works of pumps, motors, valves, pipes, vacuum pumps, control panels, connecting pipes (including ball joins), and barges	Japan Industrial Standard (JIS)
Electric equipment as motors, control panels, etc.	JBC and JBM
Structure of barge	Nippon Kaiji Kyokai (Japan Ship Building Standard, Steel barge) Standard

Note) Since inlets at discharge tower are in German standard (DIN), flange joints connecting the inlets be of the same standard.

② Specifications of equipment

[Pump]

Following considerations are to be taken for determining the specifications.

(i) Total delivery capacity shall satisfy the requirements.

(ii) From viewpoints of O&M and management, compatibility of equipment and spareparts between stations including those of the rehabilitated ones shall be secured to the full extent.

(iii) Considering the above (ii), various pumps of per-unit discharges and head shall be grouped into a number of typical pumps with the standardized specifications.

(iv) Control method for pumping shall be simple and economic ON-OFF control, since valve opening control method gives poor efficiency and much energy loss while speed control method requires rather complicated system and high cost.

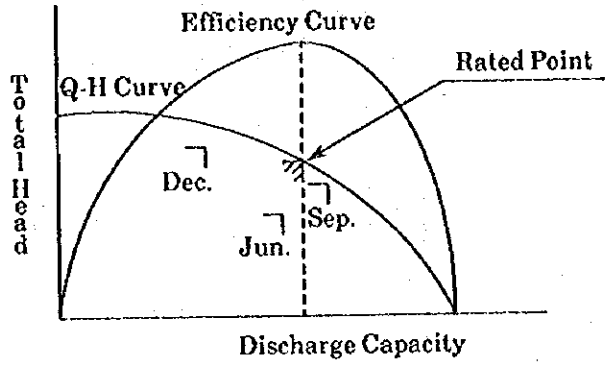
(v) Considering the wide change in seasonal water requirements (approx. one half in winter to in summer), two units of pump shall be installed per barge. One-unit operation in wintertime shall be made alternatedly by avoiding continuous long-term stoppage for equitable operation hours for both units, and thus, pumps are always ready for smooth operation at peak requirement in summer.

(vi) Pump characteristics should simultaneously satisfy the operations of both much requirement at low head in summer and small requirement at high head in winter.

Maximum and minimum of water requirement and head through the year emerge as in the table below.

Month	Head	Req't
6	Min.	—
9	—	Max.
12	Max.	Min.

The rated point on the performance curve for the grouped typical pump, which satisfies the maximum and minimum requirements and heads in the months in the left table, is as shown below.



Upon grouping the pumps, compatibility between stations including the rehabilitated ones shall be taken into account. The pump types are to be finally determined as presented in Table 2.3.10.

[Stand-by Pump]

(i) Concept of stand-by pump is being popularized in the current years from viewpoints of disaster prevention. However except for pumps for flood drainage, stand-by pumps for water supply, sewerage, irrigation, industrial water supply, etc. are generally speaking, rarely installed

(ii) Different from flood drainage pumps whose operation frequency and hours are quite less, main pump operation is favorous to the equipment almost similar to continuous operation and therefore low probability of causing troubles can be expected.

(iii) The survey results indicate that no pump stoppage mechanic troubles can be found other than by power failure.

(iv) Different from the equipment seriously superannuated in 40-50 years since installation without stock of spareparts, the rehabilitated ones are of Japanese made and the system of spareparts supply is prepared.

(v) MED has put much stress on O&M and established a concrete system for O&M.

Considering the above no stand-by pump will be installed, however, stock and supply of spareparts are to be reinforced instead.

[Pumping mover]

Following considerations are to be taken for determining the specifications.

(i) Considering that power supply is available nearby the whole stations and that internal combustion engine requires reserve and supply of fuel and some other facilities for fire protections, electric motor shall be selected as prime mover.

(ii) For convenience in maintenance, inspection and mechanical efficiency, motor shall be of insulation class F and of totally enclosed external fan type.

(iii) Taking high outdoor temperature and occasional sand storms once a month in average into account, motor shall be of insulation class F and of totally enclosed external fan type.

(iv) For structural simplicity and easy O&M compared with wound rotor induction motor, squirrel cage induction motor shall be selected.

(v) Specifications of motor shall be of the tropics for dampproof during marine freight.

[Bleed equipment for priming]

Following considerations are to be taken for determining the specifications.

(i) For quick and reliable priming, vacuum pump shall be employed.
(ii) Similar to prime mover, vacuum pump shall be electric motor-driven.
(iii) Being ready for occasional water supply for vacuum pump, a water service tank shall be installed.

[Stop valve]

Following considerations are to be taken for determining the specifications.

(i) Either sluice valve or butterfly valve shall be installed at delivery side of pump so as to reduce initial load to motor by closed pump operation and to maintain air tightness while priming by vacuum pump.
(ii) In order to avail repair work of check valve, stop valve shall be of perfect watertight specifications.
(iii) Taking account of advantages in continuous operation with less disadvantageous frequent and intermittent operation and in simple on-off operation without complicated discharge control, valve shall be of hand-operated for its economy and reliability.
(v) Valve shall be durable to maximum pressure given by pump.

[Check valve]

Following considerations are to be taken for determining the specifications.

(i) In order to stop reverse flow from delivery side upon emergent stoppage of pump by power failure or other causes, check valve shall be installed at delivery side of pump.
(ii) Check valve shall be of structure not to cause intense water hummer and be of specifications durable to water hummer.

[Main pipe]

Following considerations are to be taken for determining the specifications.

(i) On both suction and delivery sides of pump main pipes shall serve for connecting pump, valves, etc.
(ii) Pipe material shall be steel for the lightness, easy site processing and adjusting such as welding.
(iii) For connecting pump, valves, etc. fittings such as tapers, bends, T's shall be employed as required.

[Connecting pipe]

Following considerations are to be taken for determining the specifications.

(i) In order to secure expansibility and flexibility at joints between barge and tower on pump delivery side, flexible joints shall be employed at both ends of pipe.
(ii) Smaller pipe bore is favourous for its lightness but excessive flow velocity shall be avoided.
(iii) Expansible and flexible joints shall be structured against slip-off.

[Control panel]

Following considerations are to be taken for determining the specifications.

(i) For protection from wave splash on barge, enclosed type with leak prevention shall be employed.

(ii) For easy inspection and maintenance, a door shall be on the front face.

(iii) For protection from sand storms, dust-proof type shall be employed.

(iv) Specifications shall be of the tropics for dampproof during marine freight.

[Barge and pump house]

Following considerations are to be taken for determining the specifications.

(i) Provisions presented in the Design Policy shall be referred.

(ii) In accordance with the Japan Shipbuilding Standard for steel barge by Nippon Kaiji Kyokai, structure of barge shall be as presented in the following table.

Bottom Plate Thickness t_1 (mm)	$t_1 = 4.7S\sqrt{d + 0.035L} + 2.5$	S : Interval of longitudinal ribs (m) $S = 2L + 450$ (mm) L : Total length (m) d : draft (m)
Side Plate Thickness t_2 (mm)	$t_2 = 4.1S\sqrt{d + 0.04L} + 2.5$	Note) minimum thickness $= 0.044L + 5.6$
Deck Plate Thickness t_3 (mm)	$t_3 = 1.47S\sqrt{h} + 2.5$	h : Deck Load (KN / m^2)
Other Plate Thickness t_{min} (mm)	$t_{min} = 6$	Minimum dimensions of members are incorporated in chap. 23 of the Standard. Shell plating : Smooth water
Buoyancy d_1 (tf / m^2)	$d_1 = \frac{Wo}{\text{plane area}}$	Wo : Total hull weight (tf)

Buoyancy Calculation

Type	L (m) × W (m)	Total Weight Wo (tf)	Req'd Draft d_1 (m)	Planned Draft d (m)
A	13 × 5.5	50	0.70	0.9
B	14 × 6.5	62	0.68	1.0
C	16 × 7.5	75	0.63	1.1
D	18 × 7.5	95	0.70	1.1

L : length of barge (m)
W : width of barge (m)
h : required depth (m)
Wo : Total weight(m)

In the above, freeboard height 0.7m is given. In order to lower the center of gravity till waterline so as to secure stable barge balance and to prevent air coming into suction pipe, draught height 0.9 to 1.1m is given. Sizes of barges are consequently as follows.

Type	L (m)	W (m)	H (m)
A	13	5.5	1.6
B	14	6.5	1.7
C	16	7.5	1.8
D	18	7.5	1.8

(iii) Following considerations are to be taken for determining the specifications of pump house.

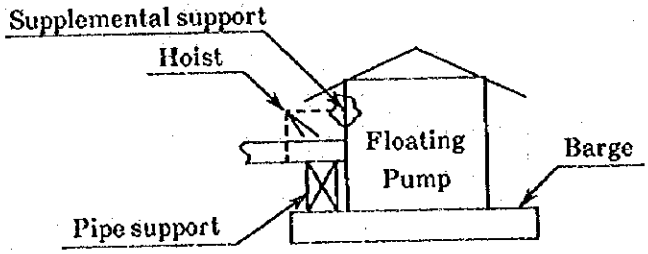
- Being on barge, the house shall be slate-roofed for its light weight.
- House height shall enable hoist operation for maintenance of equipment.
- House shall be of steel frame structure with sufficient stiffness durable to supplemental loads by hoist supporting connecting pipes and not to cause substantial distortion of the frame.

[Others]

Some improvement measures against problems as presented below being emerged in the rehabilitated stations shall be examined and reflected in the design.

(i) Influence of water weed flowing into pump suction :
Countermeasures against water weeds plugging strainer at barge bottom or pump suction, dimensions of suction sump, installation of washer pump, etc. shall be examined.

(ii) Insufficient stiffness of member to support connecting pipes :
In order to avoid damages at main and supplemental supports of connection pipes due to insufficient stiffness of the member, structure of the supports shall be examined for sufficient stiffness.



(iii) Extreme distortion of connecting pipes by water action :
Waves by large boats gives excessive distortion/bend and damages on connecting pipes and other portions, methods of barge anchoring and allowable degree of distortion/bend on the pipes shall be examined.

③ Specifications

In accordance with the aforementioned application standards and specifications for equipment, specifications of pumping equipment and other facilities have been determined as presented in Table 2.3.11 (1) ~ 2.3.11 (11).

Table 2.3.10 Pump Dimension of Each Station

Station No. & Name	Irrigation Area (feddan)	Required Capacity (m^3/s)	Total Pump Capacity (m^3/s)	Rated Capacity (m^3/s)	Actual Head (m)	Loss Head (m)	Calculated Total Head (m)	Rated Total Head (m)	Rated Motor Out-Put (kw)	No. of Unit	Station's Type
1. Gezirat Ballola	270	0.46 0.55 0.31	0.5	0.25	5.40 7.60 8.90	1.3 1.8 0.6	6.7 9.4 9.5	12	45	2	B
2. Gezirat Al-Arab	110	0.19 0.21 0.11	0.3	0.15	5.60 7.80 9.10	1.4 1.6 0.5	7.0 9.4 9.6	12	30	2	A
3. Kubania	110	0.19 0.21 0.11	0.3	0.15	5.66 7.86 9.16	1.4 1.6 0.5	7.06 9.46 9.66	12	30	2	A
4. Sahel Abu Rish	590	0.80 1.02 0.56	1.0	0.5	7.34 9.54 10.84	1.1 1.7 0.6	8.44 11.24 11.44	12	80	2	C
5. Sahel El-Kelh	740	0.86 1.26 0.94	1.2	0.6	2.37 4.57 5.87	1.3 2.7 1.6	3.67 7.27 7.47	10	80	2	C
6. Wadi El Kubania	710	0.85 1.18 0.74	1.2	0.6	8.47 1.67 11.97	1.3 2.5 1.0	9.77 13.17 12.97	14	110	2	D
7. El-Sharunia	1,300	1.53 2.25 1.69	2.0	1.0	2.74 4.94 6.24	1.1 2.3 1.3	3.84 7.24 7.54	10	140	2	E
8. El-Owenia	770	0.95 1.40 1.05	1.4	0.7	2.44 4.64 5.94	1.7 3.5 2.0	4.14 8.14 7.94	10	100	2	F
9. Baklous	150	0.21 0.28 0.17	0.3	0.15	7.00 9.20 10.50	1.1 0.8 0.7	8.1 11.0 11.2	12	30	2	A
10. Sahel Fares	940	1.22 0.67 1.21	1.6	0.8	11.50 13.70 15.00	4.1 7.5 4.0	15.6 21.2 19.0	23	240	2	G
11. El Kalabla	510	0.65 0.90 0.64	1.0	0.5	4.43 6.63 7.93	1.45 2.7 1.4	5.88 9.33 9.33	10	75	2	C

Table 2.3.11 (1) Pumping Plant Plan
No.1 Gezirat Ballola Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.25m³/s×12m (φ350/φ300) 45kw×6P	2 PC
2	Vacuum pump (with motor)	0.3m³/min (φ25mm) with water service tank 0.75kw	2 PC
3	Sluice valve or Butterfly valve	Manual sluice valve φ350mm	2 PC
4	Non return valve	φ350mm	2 PC
5	Suction and discharge pipe	Steel pipe φ300~φ500mm	1 set
6	Control panel (for pump starting)	For 45kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	13m×5.5m×1.6m Eaves height 4.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ500mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (2) Pumping Plant Plan
No.2 Gezirat Al-Arab Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.15m³/s×12m (φ300/φ250) 30kw×4P	2 PC
2	Vacuum pump (with motor)	0.3m³/min (φ25mm) with water service tank 0.75kw	2 PC
3	Sluice valve or Butterfly valve	Manual sluice valve φ300mm	2 PC
4	Non return valve	φ300mm	2 PC
5	Suction and discharge pipe	Steel pipe φ250~φ400mm	1 set
6	Control panel (for pump starting)	For 30kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	13m×5.5m×1.6m Eaves height 4.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ400mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (3) Pumping Plant Plan
No.3 Kubania Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.15m³/s×12m (φ300/φ250) 30kw×4P	2 PC
2	Vacuum pump (with motor)	0.3m³/min (φ25mm) with water service tank 0.75kw	2 PC
3	Sluice valve or Butterfly valve	Manual sluice valve φ300mm	2 PC
4	Non return valve	φ300mm	2 PC
5	Suction and discharge pipe	Steel pipe φ250~φ400mm	1 set
6	Control panel (for pump starting)	For 30kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	13m×5.5m×1.6m Eaves height 4.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ400mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (4) Pumping Plant Plan
No.4 Sahel Abu Rish Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.15m³/s×12m (φ500/φ450) 80kw×8P	2 PC
2	Vacuum pump (with motor)	0.7m³/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ500mm	2 PC
4	Non return valve	φ500mm	2 PC
5	Suction and discharge pipe	Steel pipe φ450~φ600mm	1 set
6	Control panel (for pump starting)	For 80kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	14m×6.5m×1.7m Eaves height 4.5m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ600mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (5) Pumping Plant Plan
No.5 Sahel El-Kelh Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.6m³/s×10m (φ500/φ450) 80kw×8P	2 PC
2	Vacuum pump (with motor)	0.7m³/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ500mm	2 PC
4	Non return valve	φ500mm	2 PC
5	Suction and discharge pipe	Steel pipe φ450~φ700mm	1 set
6	Control panel (for pump starting)	For 80kw×2 (Star-delta starting)	1 set
7	Barge (including House)	14m×6.5m×1.7m Eaves height 4.5m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ700mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (6) Pumping Plant Plan
No.6 Wadi EL Kubania Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.6m³/s×14m (φ500/φ400) 110kw×8P	2 PC
2	Vacuum pump (with motor)	0.7m³/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ500mm	2 PC
4	Non return valve	φ500mm	2 PC
5	Suction and discharge pipe	Steel pipe φ400~φ700mm	1 set
6	Control panel (for pump starting)	For 110kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	14m×6.5m×1.7m Eaves height 4.5m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ700mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (7) Pumping Plant Plan
No.7 El-Sharunia Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	1.0m3/s×10m (φ700/φ600) 140kw×10P	2 PC
2	Vacuum pump (with motor)	0.7m3/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ700mm	2 PC
4	Non return valve	φ700mm	2 PC
5	Suction and discharge pipe	Steel pipe φ600~φ700mm	1 set
6	Control panel (for pump starting)	For 140kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	16m×7.5m×1.8m Eaves height 5.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ700mm	2 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (8) Pumping Plant Plan
No.8 El-Owenia Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.7m³/s×10m (φ600/φ500) 100kw×10P	2 PC
2	Vacuum pump (with motor)	0.7m³/min (φ2mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ600mm	2 PC
4	Non return valve	φ600mm	2 PC
5	Suction and discharge pipe	Steel pipe φ500~φ700mm	1 set
6	Control panel (for pump starting)	For 100kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	16m×7.5m×1.8m Eaves height 5.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ700mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (9) Pumping Plant Plan
No.9 Bakulous Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.15m³/s×12m (φ300/φ250) 30kw×4P	2 PC
2	Vacuum pump (with motor)	0.3m³/min (φ25mm) with water service tank 0.75kw	2 PC
3	Sluice valve or Butterfly valve	Manual sluice valve φ300mm	2 PC
4	Non return valve	φ300mm	2 PC
5	Suction and discharge pipe	Steel pipe φ250~φ400mm	1 set
6	Control panel (for pump starting)	For 30kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	13m×5.5m×1.6m Eaves height 4.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ400mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (10) Pumping Plant Plan
No.10 Sahel Fares Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.8m³/s×23m (φ600/φ450) 240kw×8P	2 PC
2	Vacuum pump (with motor)	0.7m³/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ600mm	2 PC
4	Non return valve	φ600mm	2 PC
5	Suction and discharge pipe	Steel pipe φ450~φ600mm	1 set
6	Control panel (for pump starting)	For 240kw×2 units (Reactor starting)	1 set
7	Barge (including House)	18m×7.5m×1.8m Eaves height 5.0m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ600mm	2 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

Table 2.3.11 (11) Pumping Plant Plan
No.11 El Kalabla Pump Station

No.	Equipment Name	Specification	No. of Quantity
1	Double suction volute pump (with motor)	0.5m³/s×10m (φ500/φ450) 75kw×8P	2 PC
2	Vacuum pump (with motor)	0.3m³/min (φ32mm) with water service tank 1.5kw	2 PC
3	Sluice valve or Butterfly valve	Manual butterfly valve φ600mm	2 PC
4	Non return valve	φ600mm	2 PC
5	Suction and discharge pipe	Steel pipe φ450~φ600mm	1 set
6	Control panel (for pump starting)	For 75kw×2 units (Star-delta starting)	1 set
7	Barge (including House)	14m×6.5m×1.7m Eaves height 4.5m	1 set
8	Connecting pipe (including Ball joint)	Steel pipe φ600mm	1 PC
9	Scouring pump (for suction screen)	φ50mm Submerged motor pump 3.7kw (with hose)	1 PC
10	Spare parts		Lump sum

CHAPTER 3 IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

The project is to procure the floating pump stations consisted of pump with motor, barge and other necessary equipment. The Mechanical and Electrical Department (MED) of MPWWR is the direct executing agency of the Project.

All of the equipment and materials are procured in Japan. Internal transportation of the procured pump stations shall be carried out by the government of Egypt.

Fixing the pump and connecting the pipe with tower are carried out as the installation works by skilled labours from MED.

3-1-2 Implementation Conditions

The government of Egypt shall be responsible for necessary works of customs clearance and exemption from taxation.

3-1-3 Scope of Works

For the project implementation, the following works shall be carried out and borne by the government of Egypt

- Customs clearance at Alexandria and internal transportation to the nearest large port of the Nile river from each site.
- Installation of floating pump, equipment and materials for each pump station, and demonstration/trial run.

These works are the same as the previous grant aid project

Responsibilities of the government of Japan are the procurement of equipment and materials, and ocean transportation.

3-1-4 Consultant Supervision

(1) Supervision for the procurement

Interim inspection : Equipment and materials shall be inspected provisionally, based on the manufacturing drawings.

Inspection before shipment : Before shipment, the equipment and materials shall be inspected based on the tender documents and contract. Procured equipment and materials shall be shipped, after checking the quantity and the ability test.

(2) As mentioned in 3-1-3, customs clearance, internal transportation from Alexandria to Aswan and installation, trial run of the pumps shall be supervised by the government of Egypt.

3-1-5 Procurement Plan

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

- Pump stations should be manufactured systematically from design stage to assembling since procured parts have to functions each other successfully.

- In Egypt, large pump is not manufactured generally. It is imported. Barges could be made by general shipbuilding company. It will be, however, very difficult actually to manufacture them under the limited implementation term in JICA's grant aid system. Imported

pumps should be also assembled on the barge, which will be required more longer implementation schedule. Considering the above conditions, Floating pump unit could not be procured in Egypt.

- In case of procurement from the other countries except Japan and Egypt, following problem might be considered.

  - Implementation works will require longer term, since unexpected additional works for adjustment of interaction with parts and materials will be needed.

  - In the detailed design stage, additional works for preparation of tender documents will be required.

  Considering the above conditions, it will be difficult to procure the floating pump station from the other countries.

- In case that each equipment and materials are procured individually from various countries, many troubles might be happened in the assembling stage. As the result, low quality pump stations might be procured.

Under the above conditions, equipment and materials in this Project will be procured in Japan, taking account of the quality, aftercare in Egypt and limited implementation period.

3-1-6 Implementation Schedule

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

Phase I

(1) Detailed design

◦ Study in Egypt ◦ Detailed design ◦ Preparation of tender documents	3.0 months
◦ Tendering, evaluation ◦ Negotiation and contract	1.5 months
Total	4.5 months

(2) Procurement

◦ Manufacturing	6.5 months

Phase II

(1) Detailed design

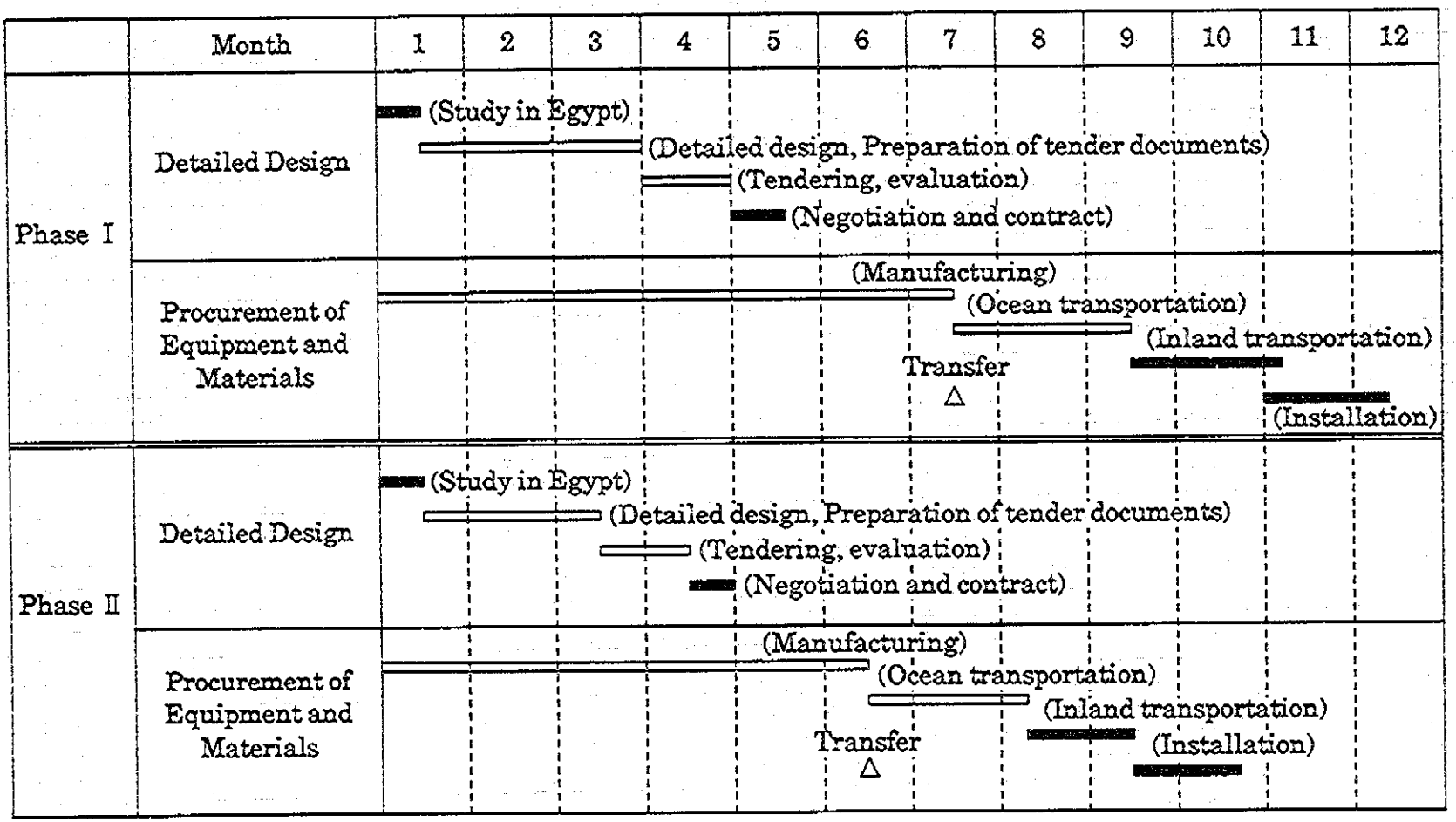
◦ Study in Egypt ◦ Detailed design ◦ Preparation of tender documents	2.5 months
◦ Tendering, evaluation ◦ Negotiation and contract	1.5 months
Total	4.0 months

(2) Procurement

◦ Manufacturing	5.5 months

Implementation schedule of the Project is tentatively shown in Table 3-1-1.

Table 3-1-1 Implementation Schedule



3-1-7 Obligations of the Government of Egypt

In the implementation of the Grant Aid project, the government of Egypt is required to undertake such necessary measures as the following:

(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 ensure all the expenses and prompt execution for unloading, customs clearance at the port of Alexandria and internal transportation of the pump stations purchased under the Grant Aid.

(5) 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.

(6) 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 work.

(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 staff necessary for this operation and maintenance 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 should not be reexported from the recipient country.

(9) Banking Arrangement (B/A)

a) The Government of Egypt or its designated authority should open an account in the name of the Government of Egypt 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 will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of Egypt 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 issued by the Government of Egypt or its designated authority.

(10) To bear all the expenses other than those to be borne by the Grant Aid, necessary for the execution of the Project.

3-2 Project Cost Estimation

3-2-1 Cost Estimation Bone by the Egyptian Government

Cost bone by the Government of Egypt for project implementation is estimated as follows.

Phase I

Item	Cost (LE)
(1) Custom clearances and internal transportation	300,000
(2) Installation and trial run	5,000
Total	305,000

Phase II

Item	Cost (LE)
(1) Custom clearances and internal transportation	80,000
(2) Installation and trial run	2,000
Total	82,000

Note): Transportation from Alexandria to the project site and installation works shall be borne by the Government of Egypt.

The above cost was obtained from MED. Applied conditions were as follows.

- Cost estimation : as of March, 1996
- Foreign exchange rate : US$ 1.0 = 101.0 Yen
  LE 1.0 = 28.2 Yen

3-2-2 Operation and Maintenance

(1) Operation and maintenance organization

After the implementation of the Project, operation and maintenance of the pump stations will be executed under the present organization and staff. Workshop in Aswan will be responsible for regular check and repair of renovated pump.

(2) Operation and maintenance plan

Renovated pump stations will be maintained and operated in accordance with the following manner.

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

parts, lubricating oil and daily operation.

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

- Provision of spare parts, packing, lubrication oil, and tools.

- Maintenance of pump

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

  one month : check the alignment of the direct coupled pump and prime mover and lubricating oil

  three month : change the lubricating oil of bearings, supplement grease, and measure vibration and noise

  six month : change the grease in bearings and packing

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

(3) Operation and maintenance cost

After the renovation of pumps, annual operation and maintenance cost of 11 pumping stations is estimated at LE 830,000, which is the cost for electric power, maintenance including lubricating, oil and checking, repairing, wages and salary.

Operation and Maintenance Cost

Item	Cost of existing 11 pump stations				Cost for renovated pumps
	Actual one			Estimated one	
	1992/1993	1993/1994	1994/1995	1995/1996	
1. Maintenance	102,500	127,100	133,800	154,633	98,900
2. Electric power	200,900	169,900	183,800	184,900	479,500
3. Wages and salary	223,500	246,300	250,500	267,100	267,100
Total	526,900	543,300	568,100	606,633	845,500
Unit cost per feddan	126	130	136	145	136

In case of renovated pumps, No. 10 pump station is involved in the cost estimation. Unit operation and maintenance cost per feddan is almost same as the present.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4-1 Project Effect

The economy in upper Egypt depends on agriculture, and irrigation water is solely the Nile river by using pump stations. It is the most important subject for the local farmer to distribute irrigation water timely and efficiently. On the other hand, horizontal expansion of farm land toward the desert has been carrying out by farmer themselves.

To secure stable supply of irrigation water for the both present and expanded farm land, immediate implementation of the Project is required.

Under the above conditions, the Egyptian government is promoting the rehabilitation project of pump stations in whole country as the major development subjects. The Project is linked with this rehabilitation project. The effects of the Project on the farm land and local economy are summarized as follows.

(1) Learned from the previous same type grant aid project, rehabilitation of the floating pump stations contributes to the stabilization and improvement of the farmer's life, increase of agricultural productivity and food self-sufficiency,

(2) By the project implementation, irrigation water from the Nile river could be supplied timely and efficiently into the farm land. The Project will generate satisfactory benefit, covering 6,200 feddan of service area, 4,400 farm household and 23,000 benefited farm population (refer to Table 4.1.1).

(3) Out of the whole service area, 1,830 feddan of farm land is the newly expanded area.

(4) Through this expanded area, incremental direct benefit of about 86,000 ton/year is expected from the cash crop of sugarcane, average

production of 47 ton/feddan. Its equivalent in farm cash income is LE 774 millions in 1994, based on LE 90 per ton.

(5) In the seven pump stations suffering serious deficit of irrigation water, water supply will become stable throughout the year.

(6) As indirect and unquantitative effect, labour requirement in processing and marketing fields for agricultural products such as sugarcane and vegetable, will be increased through stable agricultural production.

(7) In respect of indirect benefits, the Project will contribute to the uplift of the standard of living of the rural people, vitalization of regional industries and agricultural production as well as improvement of balance of food supply and demand through increase in country's agricultural productivity, as one of the national development target.

Table 4.1.1 Benefits by the Project

Pump Station		Proposed Irri. Area (Fed.)	Beneficial Agri. Households	Beneficial Agri. Population	Increase of Production (Expansion of Farm)			Benefits on Improvement of Irrigation
No	Name of Station				Present Farm (Fed.)	Planed Farm (Fed.)	Expansion (Fed.)	
1	Gezirat Ballola	270	193	934	270	270	0	
2	Gezirat Al-Arab	110	79	403	110	110	0	
3	Gezirat Kubania	110	79	403	110	110	0	
4	Sahel Abu Rish	590	421	2,147	560	560	0	Elimination of summer water shortage.
5	Sahel El-Kelh	740	529	2,698	410	670	260	
6	Wadi El-Kubania	710	507	2,586	440	610	170	Stable irrigation through the year.
7	El-Sharunia	1,300	929	4,738	700	1,200	500	Stable irrigation through the year.
8	El-Owenia	770	550	2,805	610	750	140	Elimination of summer water shortage.
9	Baklous	150	107	546	60	150	90	Elimination of water shortage through the year.
10	New Sahel Fares	940	671	3,422	270	940	670	Unification of individual private small pumps and economizing the operation and maintenance cost.
11	El-Karabla	510	364	1,856	500	500	0	Elimination of summer water shortage.
		6,200	4,429	22,588	4,040	5,870	1,830	

(Notes) 1) Number of beneficial agricultural households are based on the average land ownership of 1.4 feddan/household.

2) Number of beneficial agricultural population are based on average family size of 5.1 members/household.

Based on the above direct or indirect benefits, the Project is considered viable for Japanese grant-aid assistance.

4-2 Recommendation

Based on the above consideration, the Project will contributes to the promotion of regional agriculture and economy. It is given high priority by the government of Egypt. MED, executing agency could be responsible for operation and maintenance of renovated pumps, from viewpoints of their long term operating experiences. Related to the 11 floating pump stations requested, the followings are recommended in the execution of the Project.

(1) Rehabilitation of the present facilities

Irrigation facilities consist of floating pump, connecting pipe, tower, discharge pipe, irrigation canal. Out of them, floating pump and connecting pipe are covered by the Project.

The remaining present facilities may be used basically with the renovated pump station. However, if those present capacities do not accord with the renovated pump capacities or the present tower, discharge pipe and canal facilities have been deteriorated, those facilities should be rehabilitated by MED and ID, as follows.

① Rehabilitation by MED

The following facilities are recommended to be rehabilitated by MED.

	Pump station	Facility to be rehabilitated
No.5	Sahel El Kelh	Tower and Discharge pipe
No.6	Wadi El Kubania	Tower and Discharge pipe
No.7	El Sharunia	Tower and Discharge pipe
No.8	El Owenia	Tower and Discharge pipe
No.9	Baklous	Discharge pipe
No.11	El Karabla	Tower and Discharge pipe

Note) Including air valve of tower and coverage of electric line

② Rehabilitation by ID

ID shall rehabilitate the irrigation canal, based on the renovation of pump, discharge pipe and increase of irrigation water requirement.

	Pump station	Rehabilitation works
No.5	Sahel El Kelh	Reinforcement of outlet of discharge pipe (ℓ = 10m)
No.6	Wadi El Kubania	
No.7	El Sharunia	
No.11	El Karabla	

In the No.9 Baklous station, irrigation facilities after discharge pipe have not provided yet. Therefore, the following facilities shall be constructed before the installation of pump station.

Construction works	Quantity
Canal at outlet of discharge pipe	1 set
Irrigation canal	1,000 m
Appurtenant facilities of canal	1 set

(2) Water right of No.10 New Sahel Fares pump station

Water right of No.10 pump station was applied, but not approved yet as of December, 1994. For project implementation of No.10 station, the water right should be obtained urgently by MPWWR.

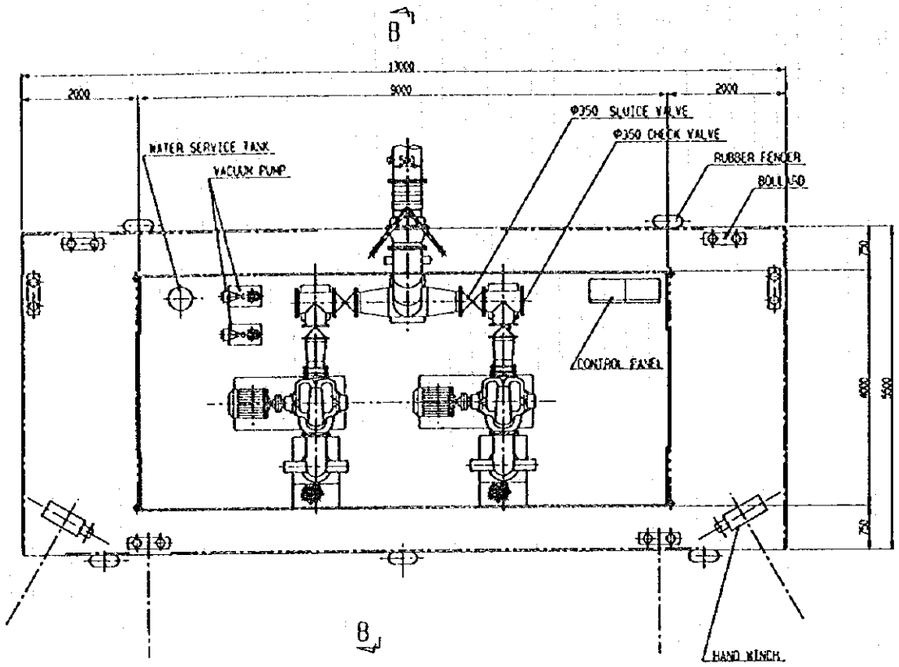
With the approval of water right, tower, discharge pipe and irrigation canal should be also provided by MED and ID.

The above water right and construction of facilities are the precondition for project implementation of No.10 pump station by Japanese grant aid.

(3) Operation and maintenance for pump stations

Renovated pumps may need occasionally emergent check and repair in future since each of them is scheduled to be driven fully throughout the year. MED should check and repair the present pump station at the workshop after replacement with new station, to utilize it in future as stand-by pump station. Taking account of the above conditions, the present operation and maintenance organization should be strengthened quantitatively and qualitatively, as one of long-term rehabilitation program.

DRAWINGS



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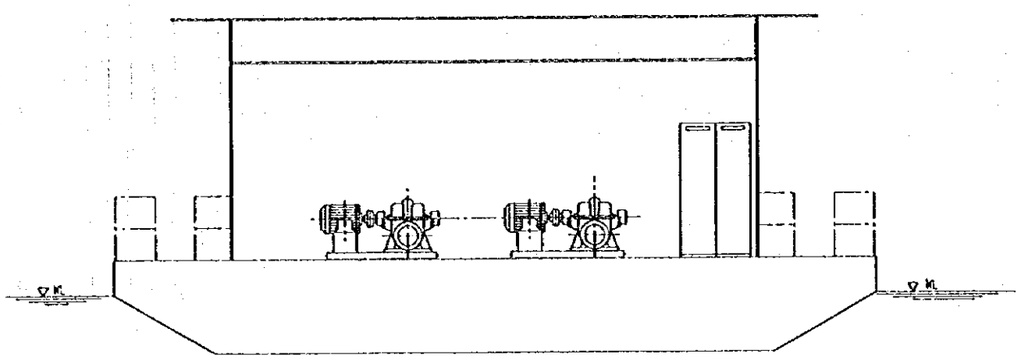

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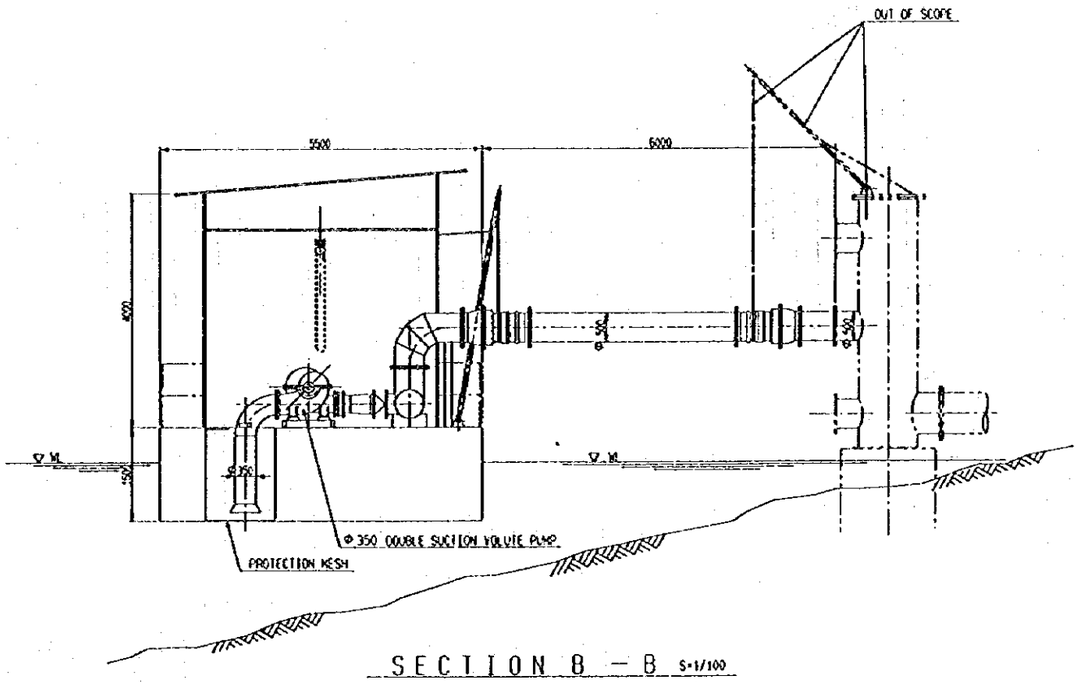
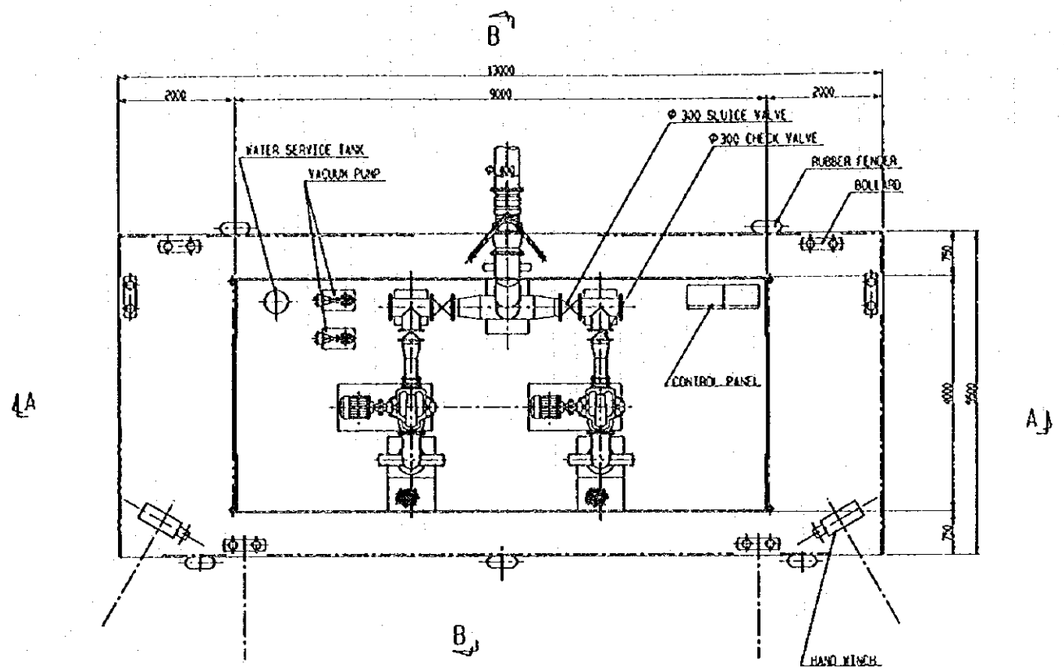


SECTION B — B S=1/100

No. 1 : GEZIRAT BALLOLA PUMP STATION



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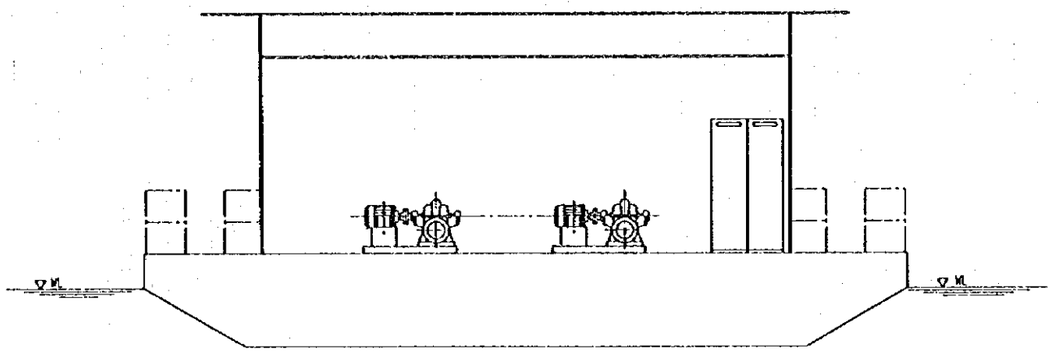

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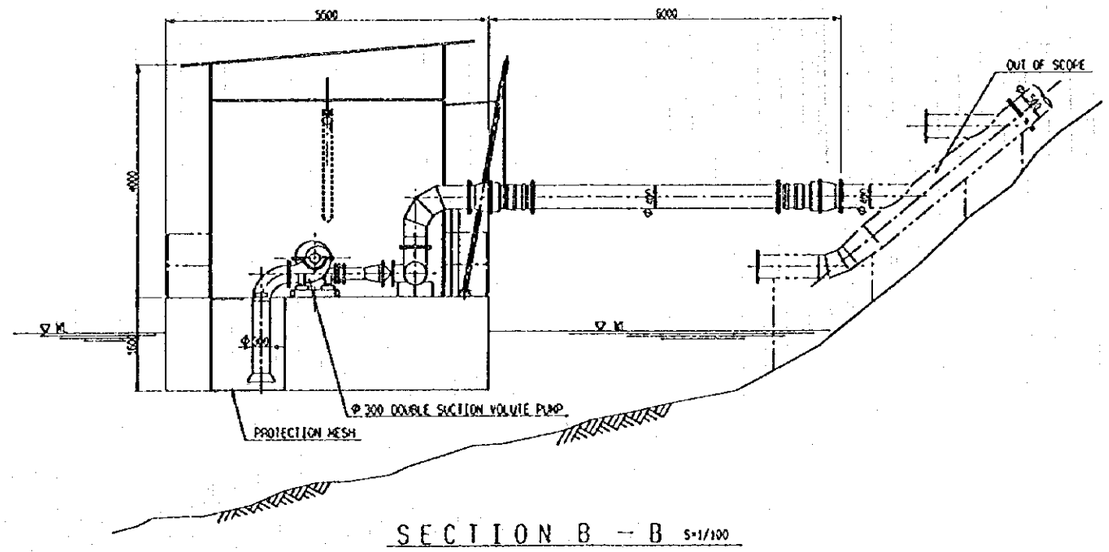

SECTION B — B S=1/100

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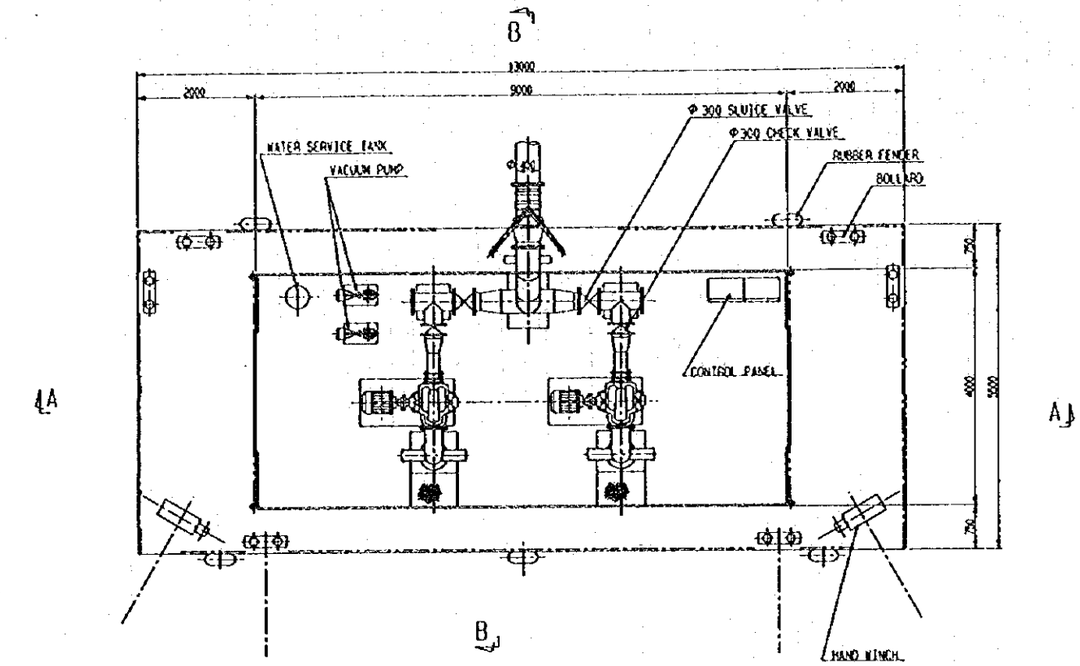

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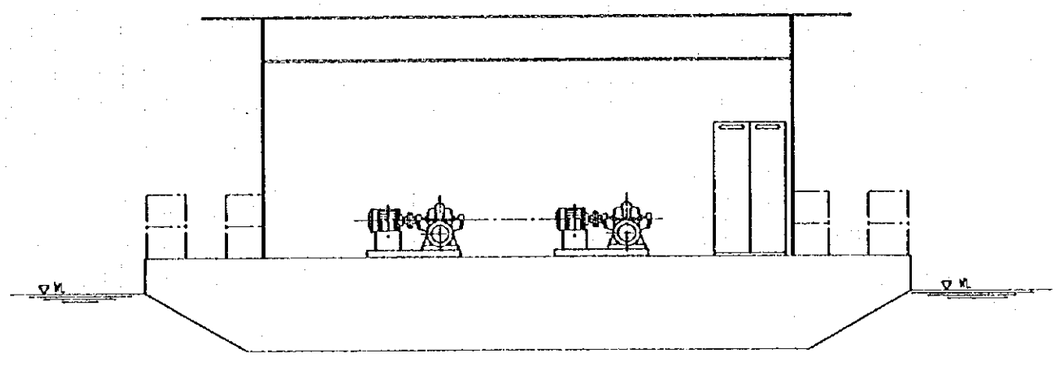

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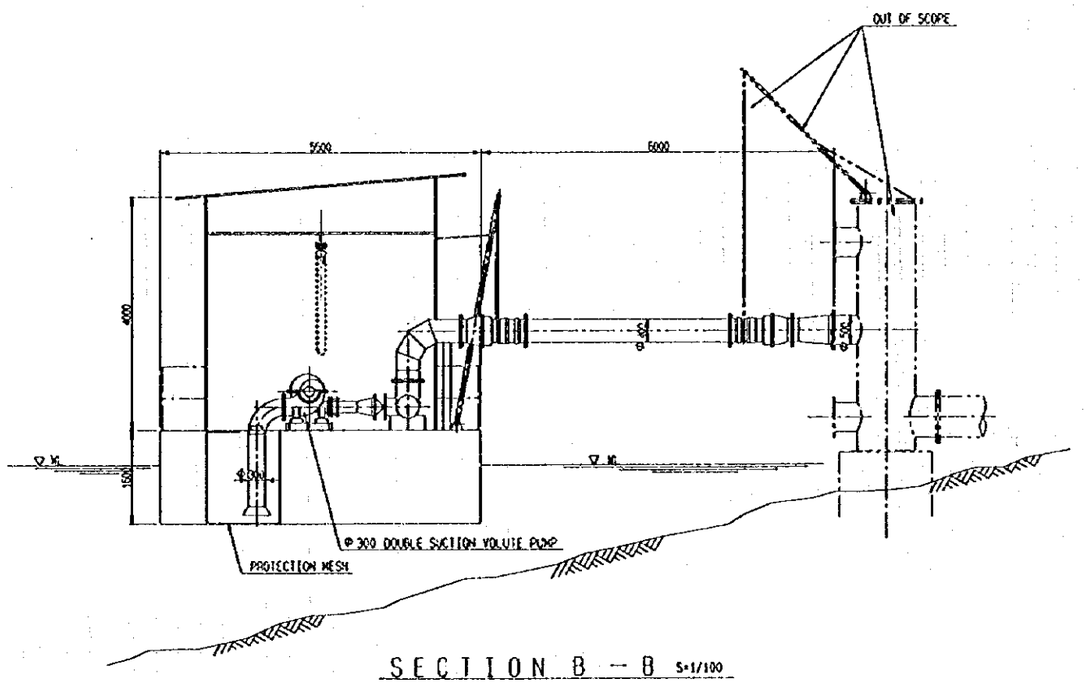

SECTION B — B S=1/100

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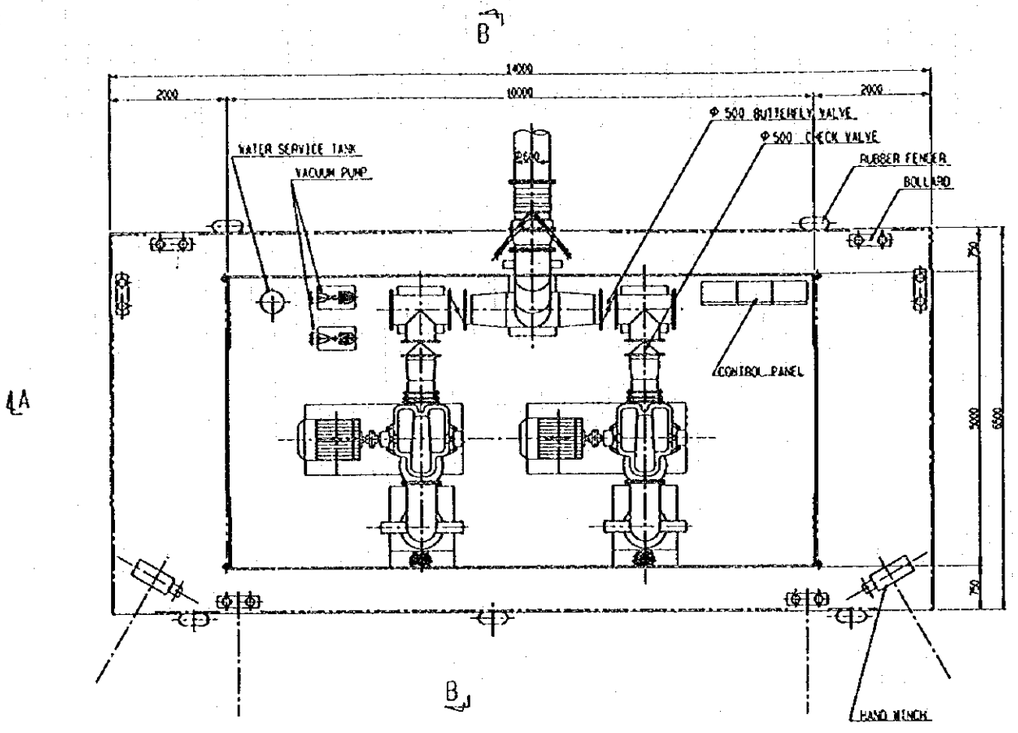

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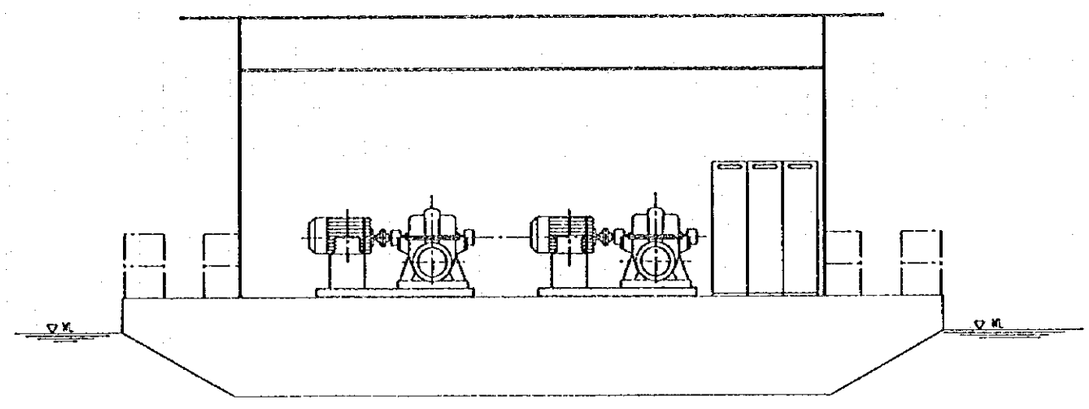

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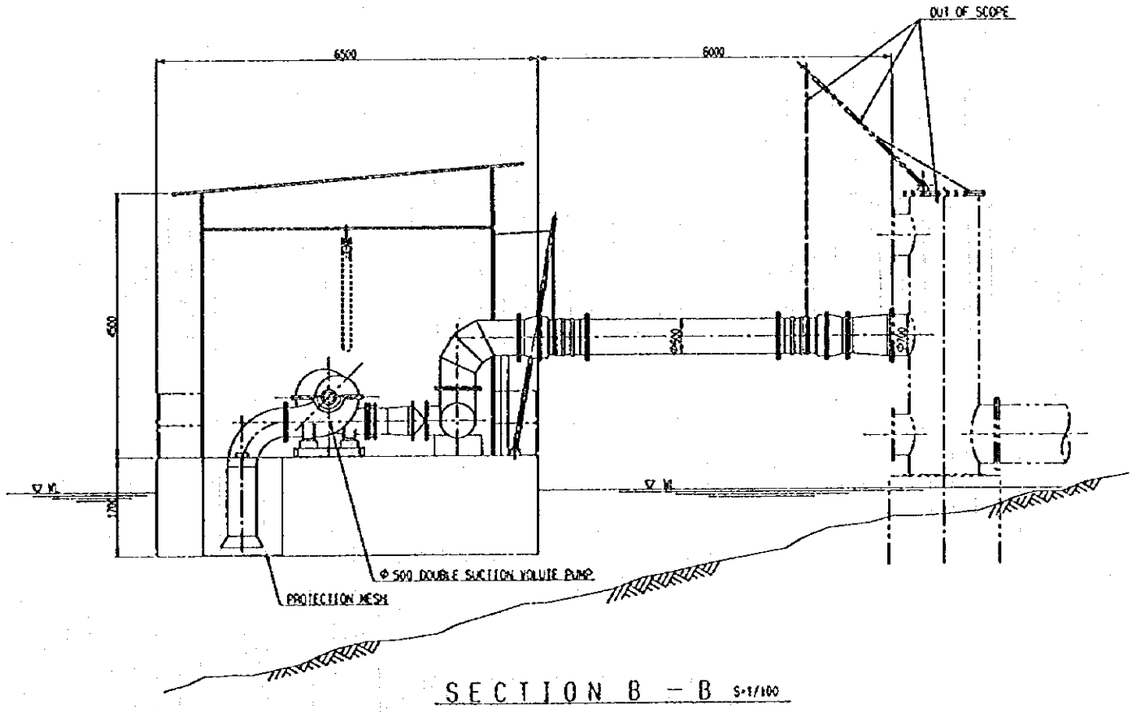

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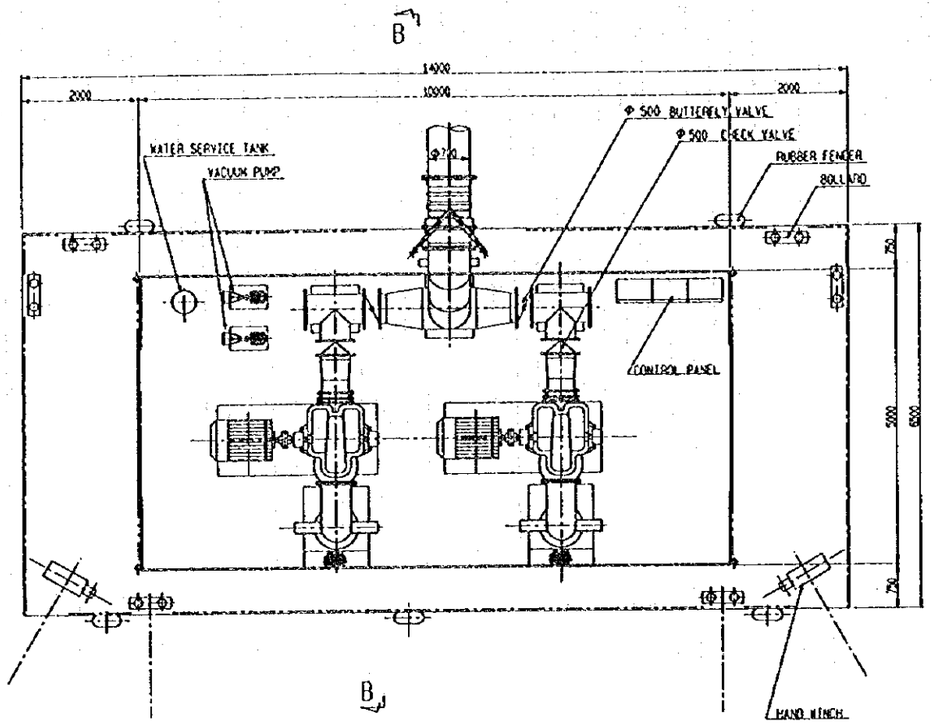

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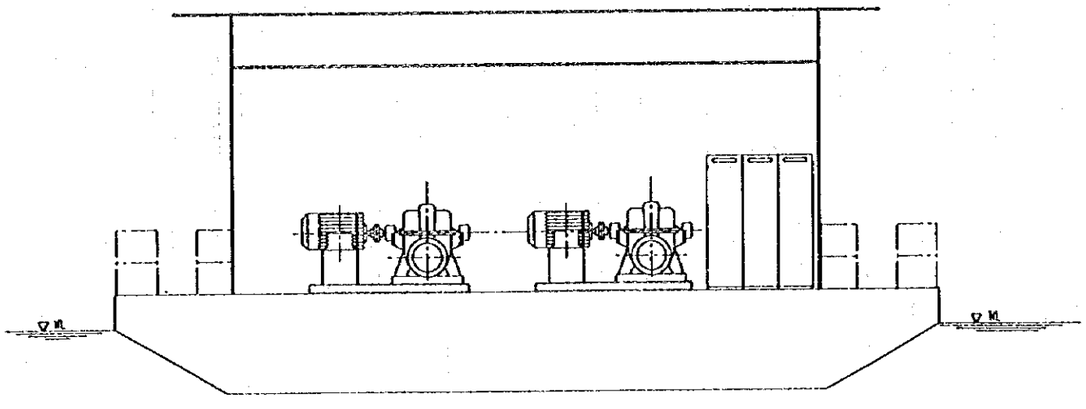

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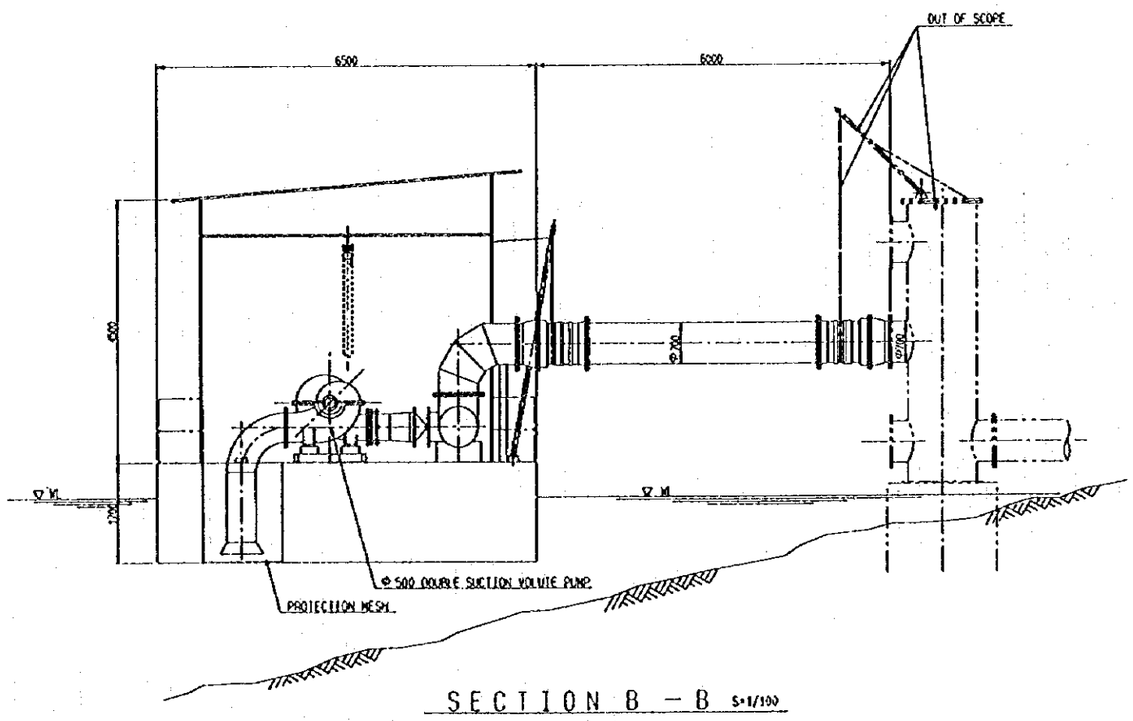

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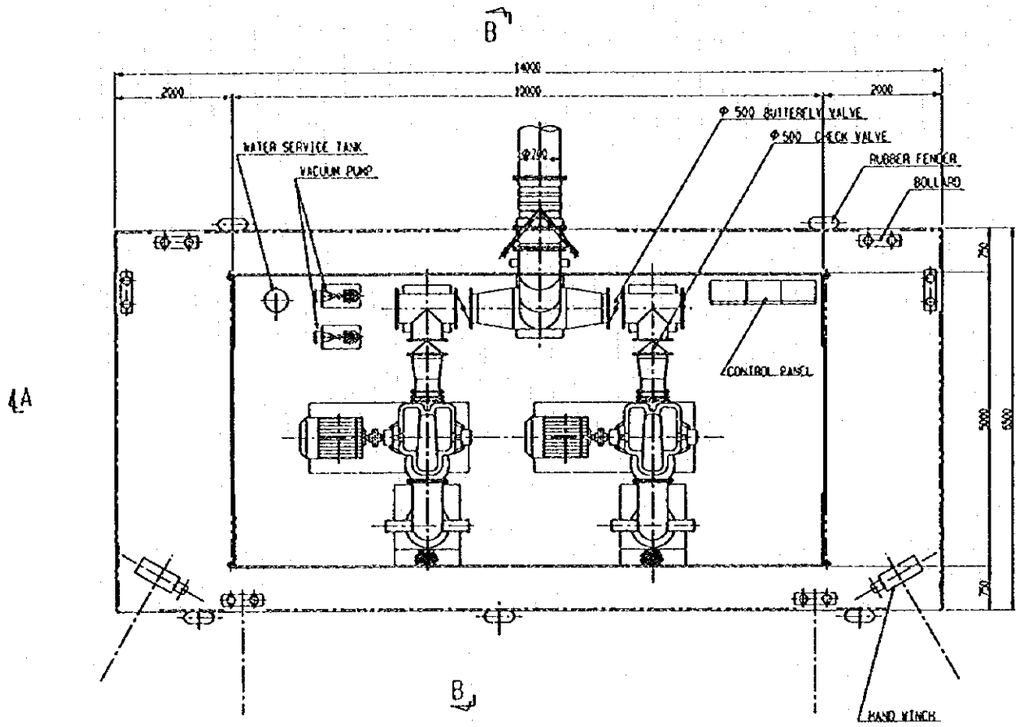

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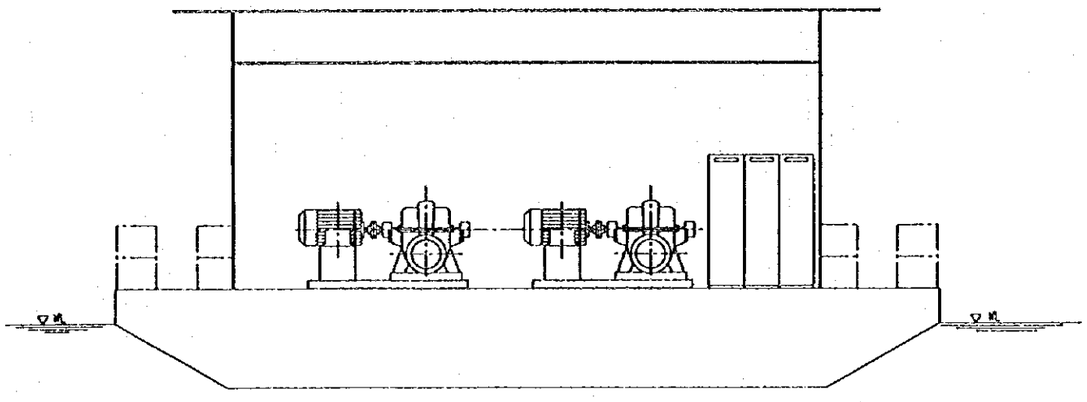

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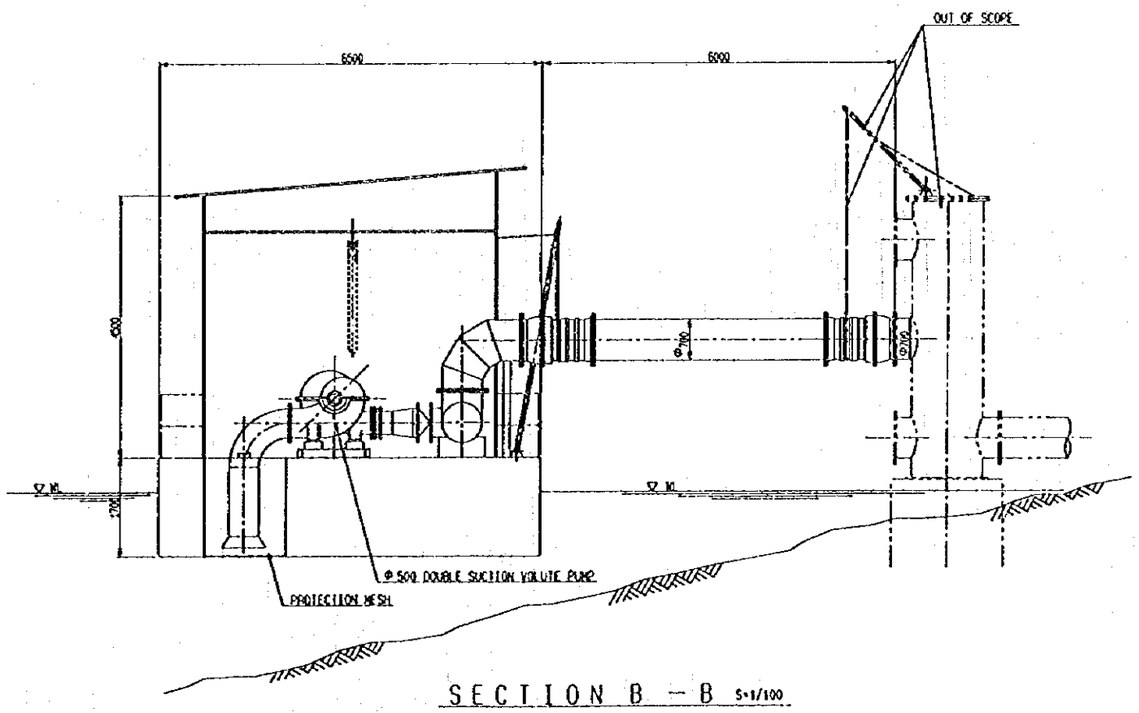

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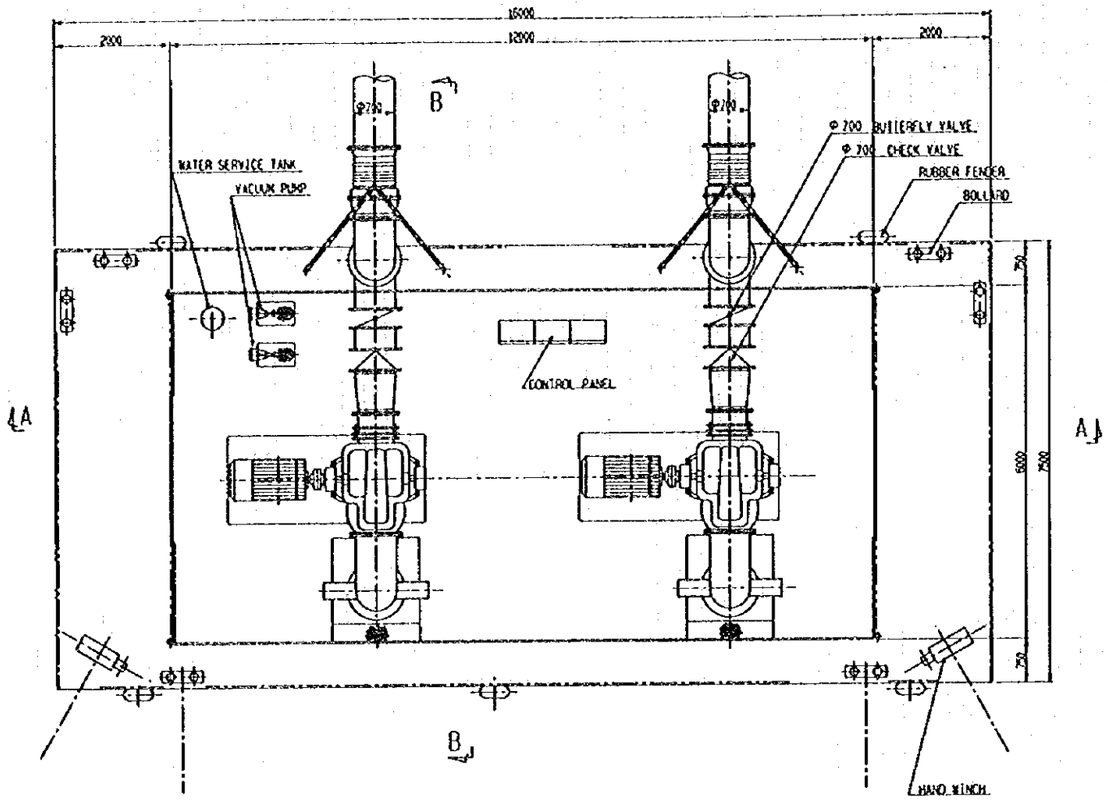

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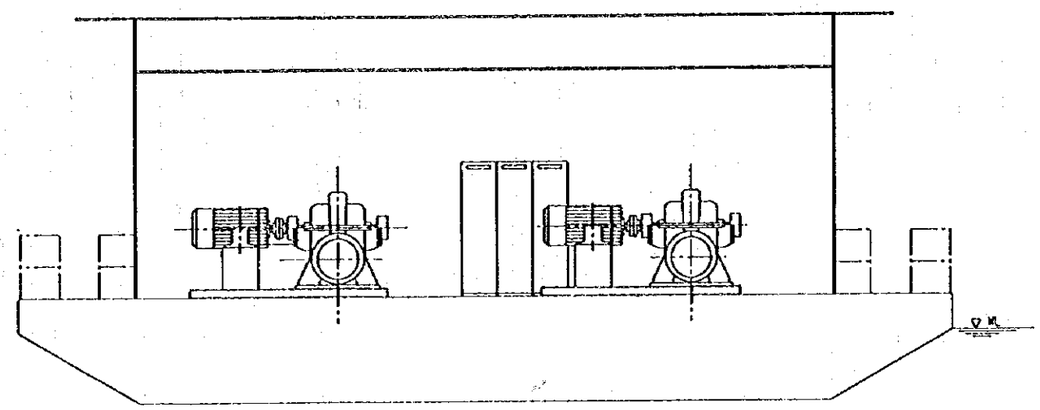

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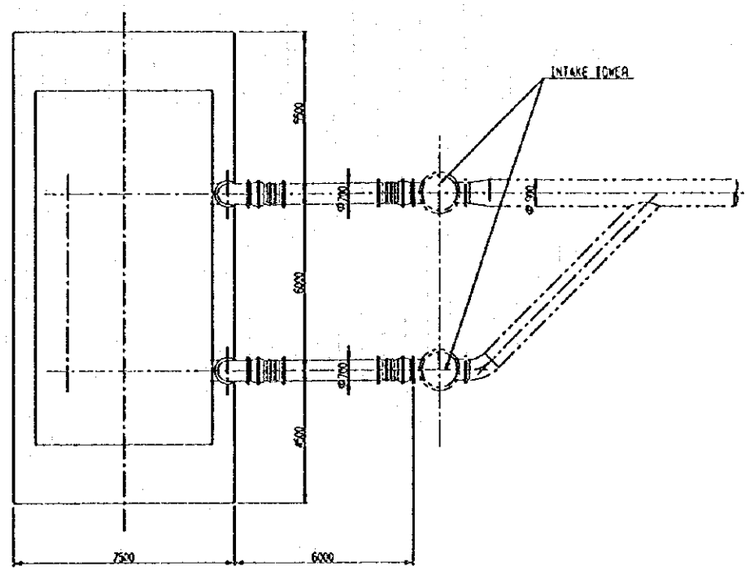

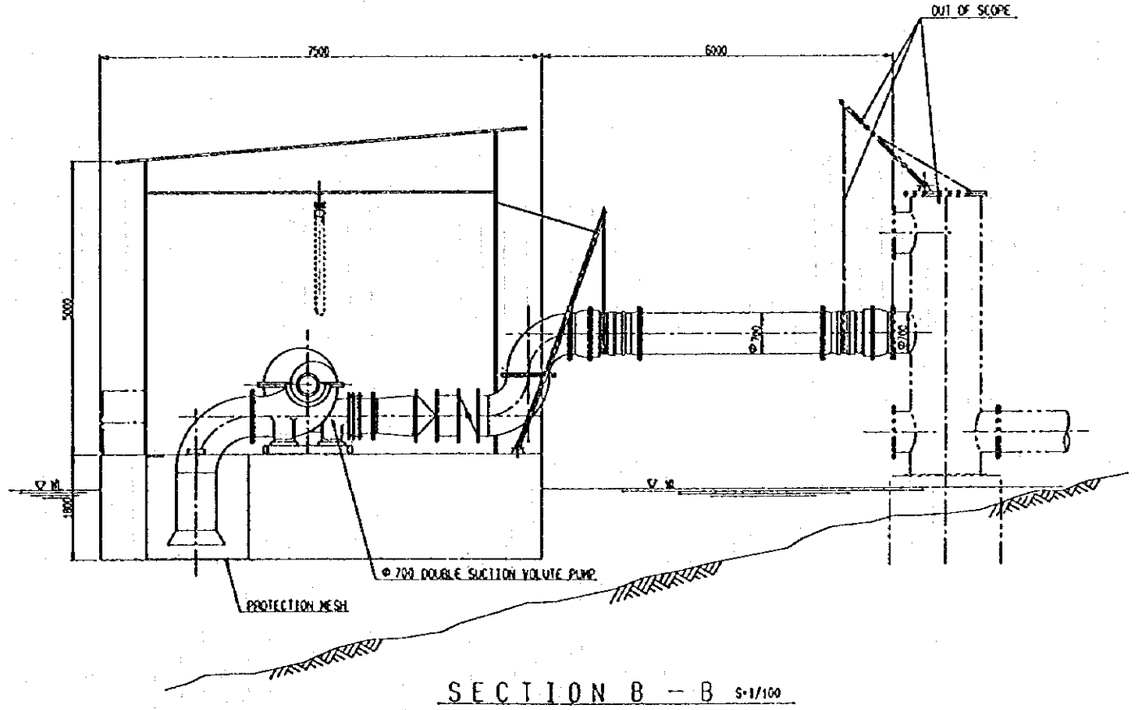

SECTION B – B S=1/100

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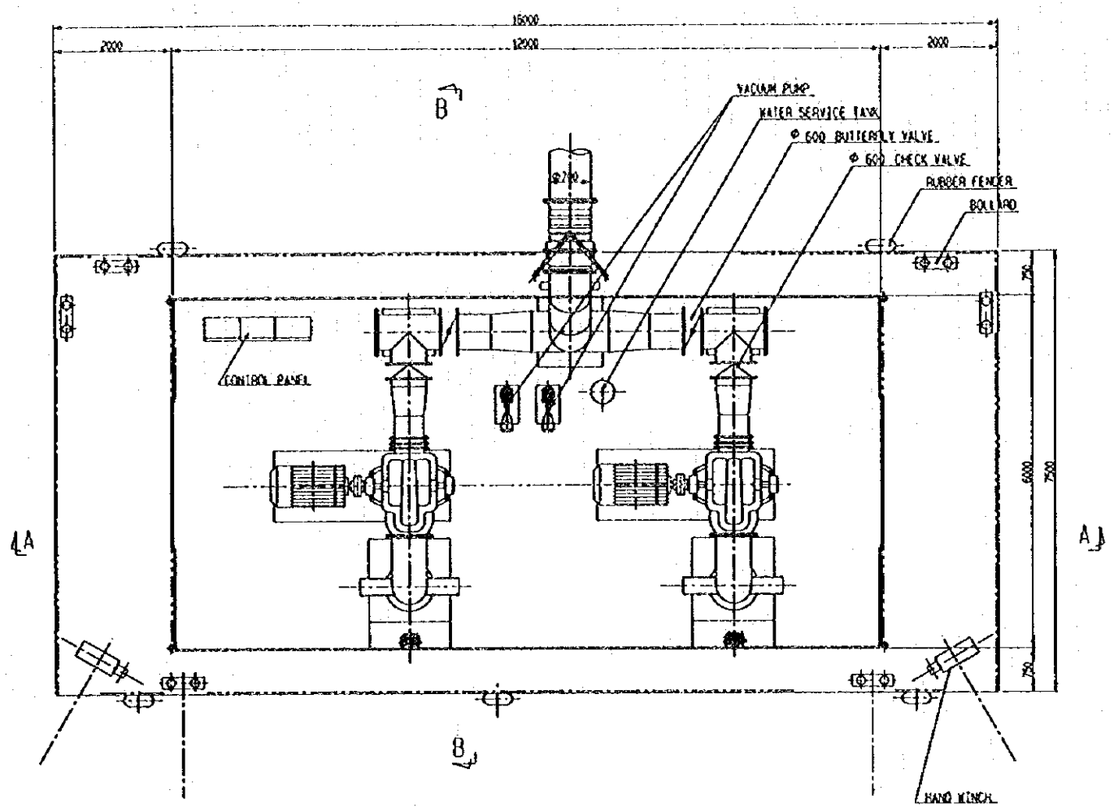

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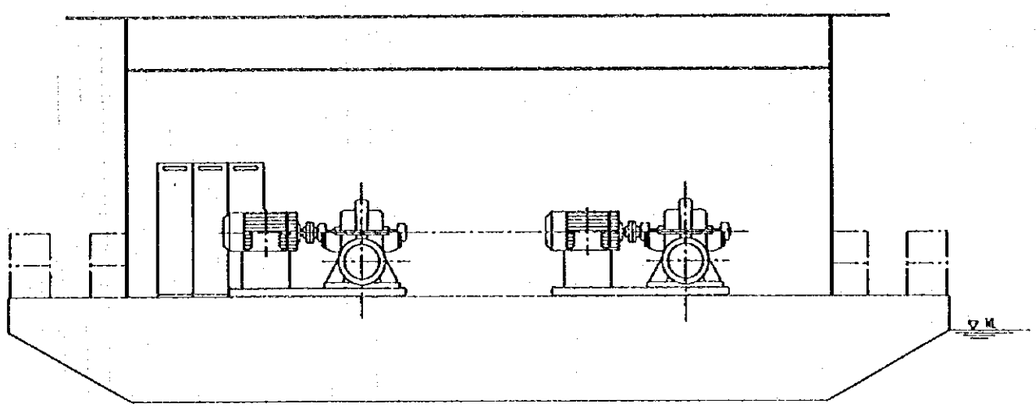

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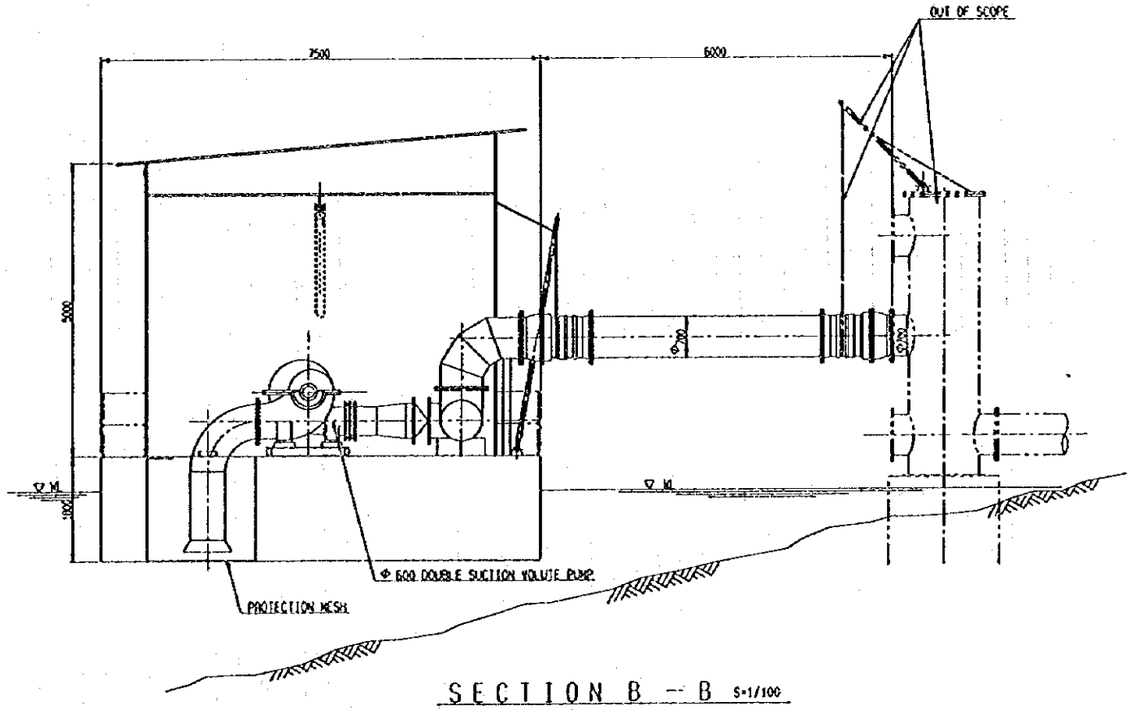

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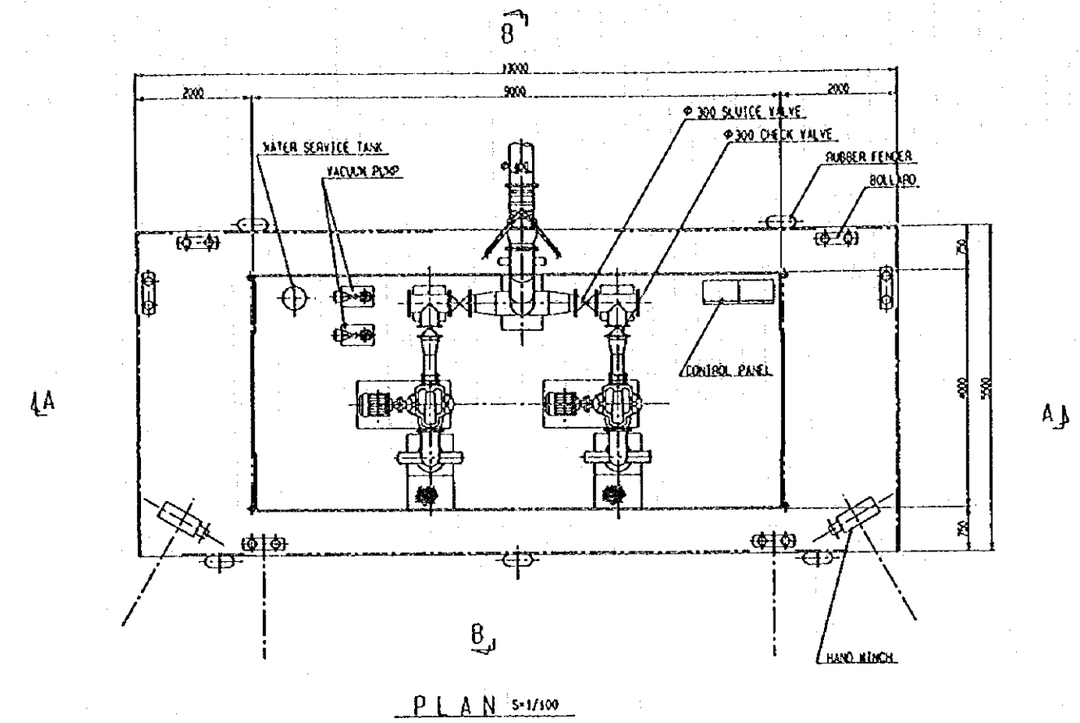

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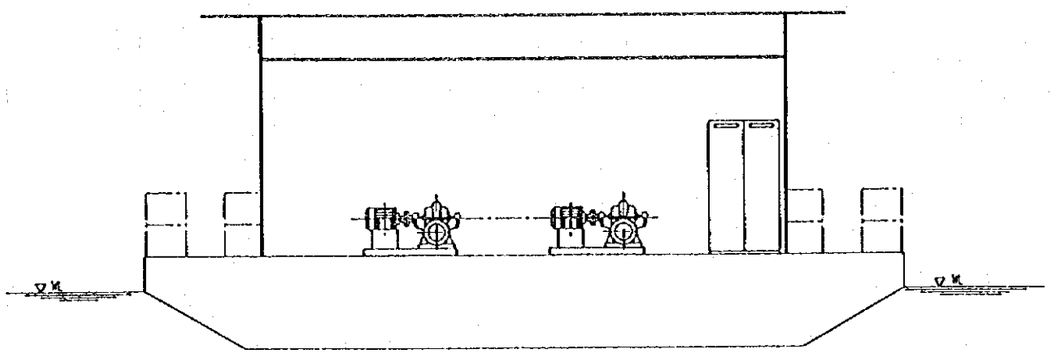

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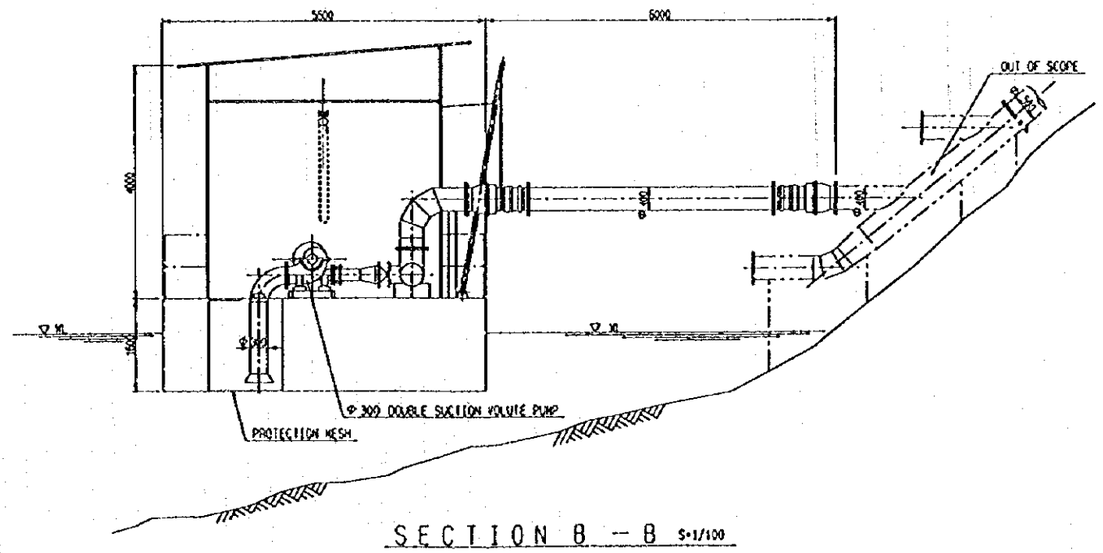
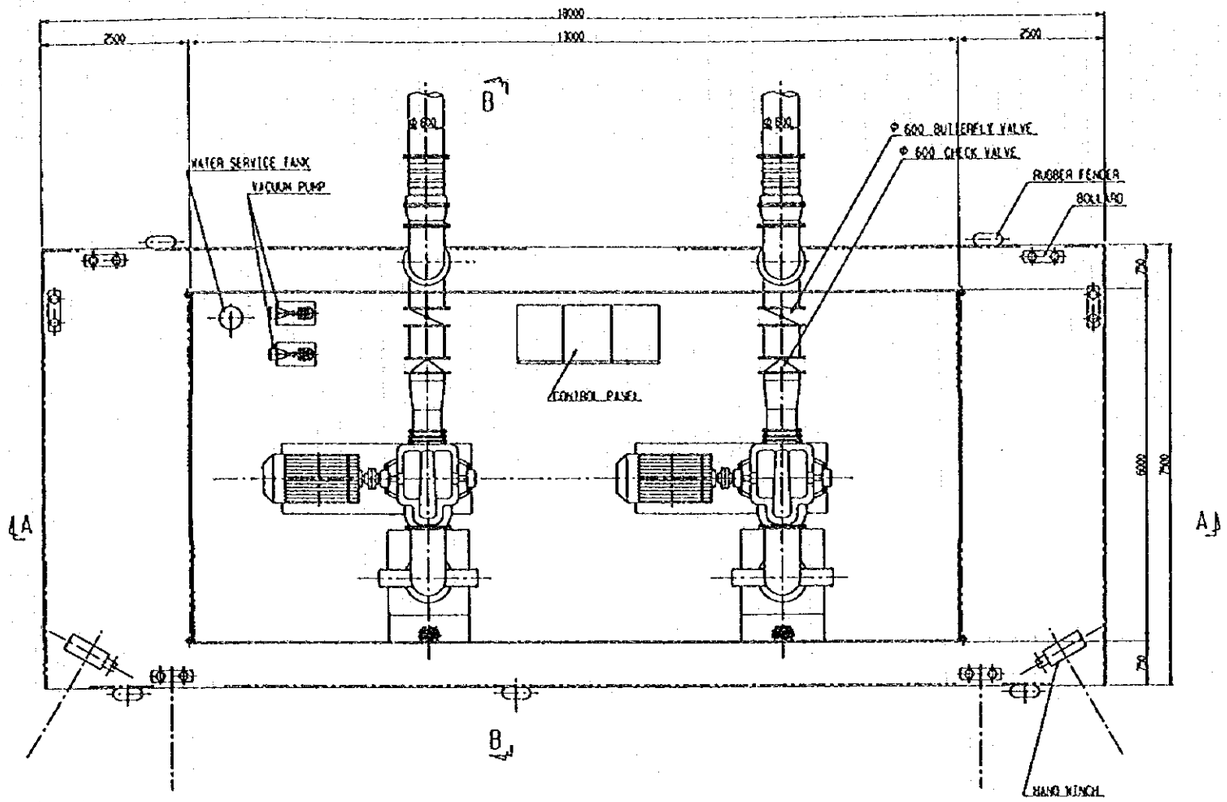


SECTION B – B S=1/100

No. 9 : BAKLOUS PUMP STATION



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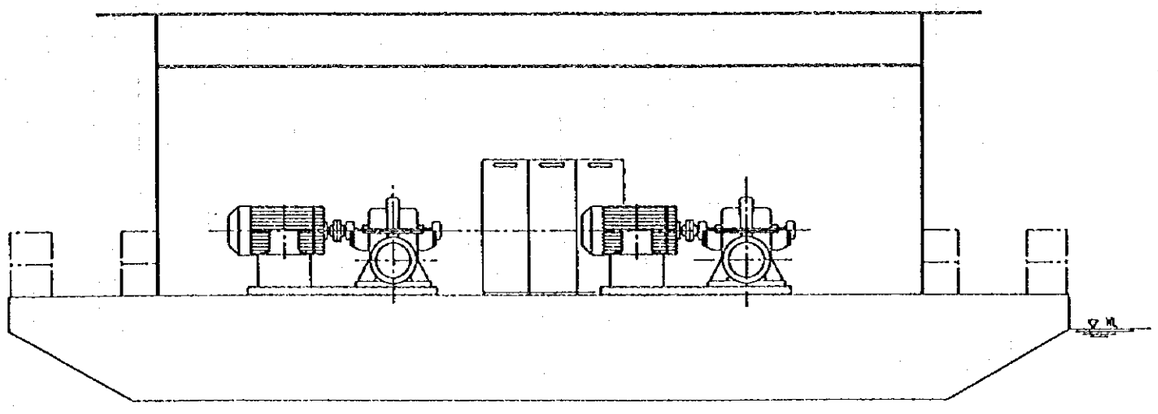

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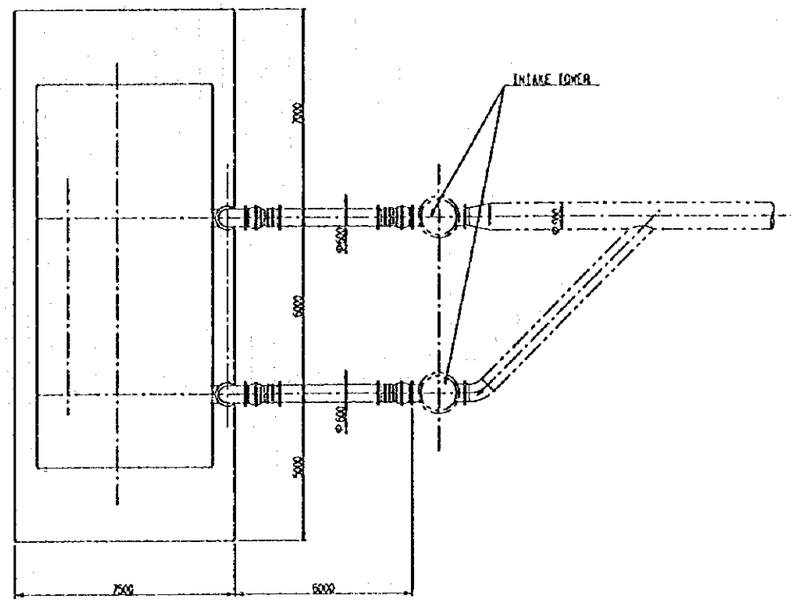
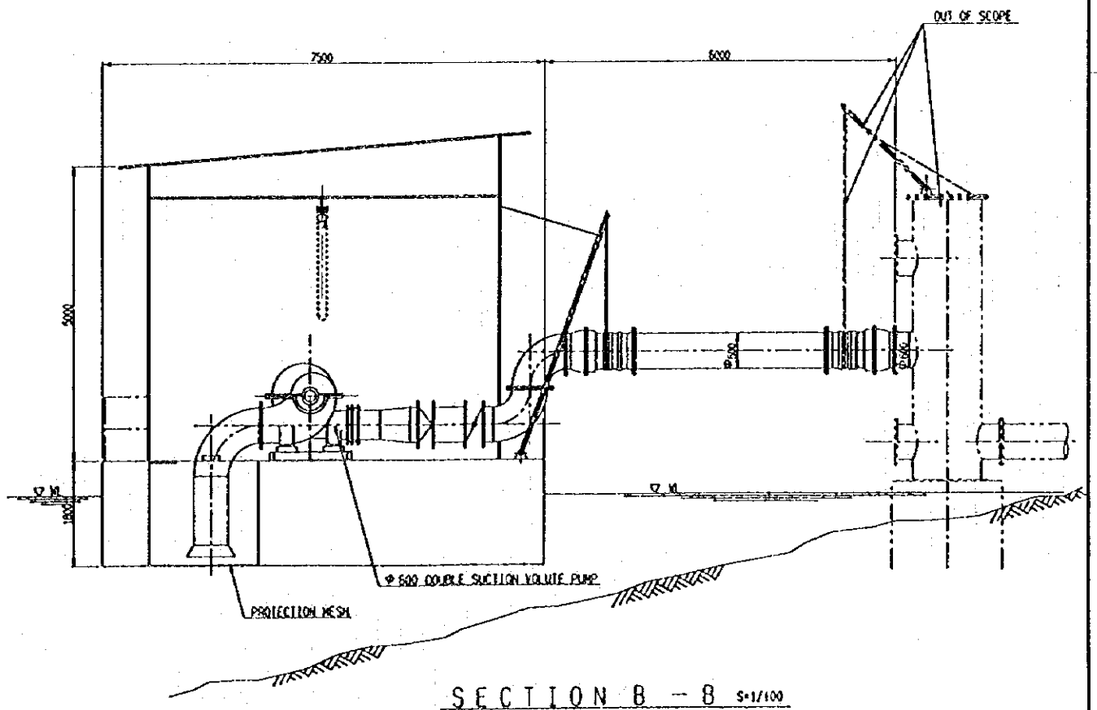
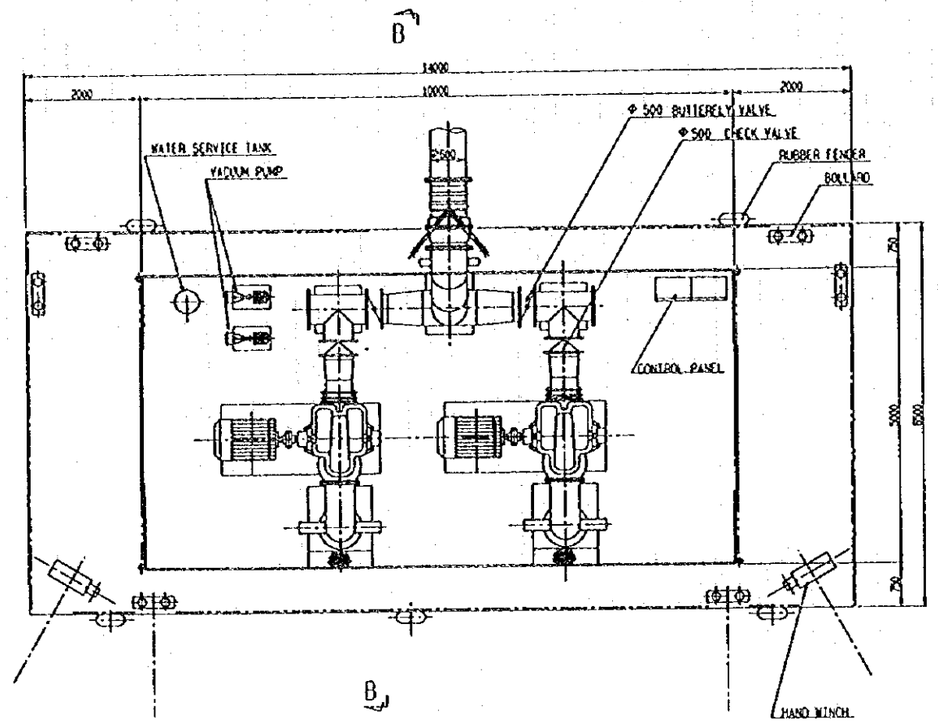




SECTION B – B S=1/100

No. 10 ; NEW SAHEL PUMP STATION



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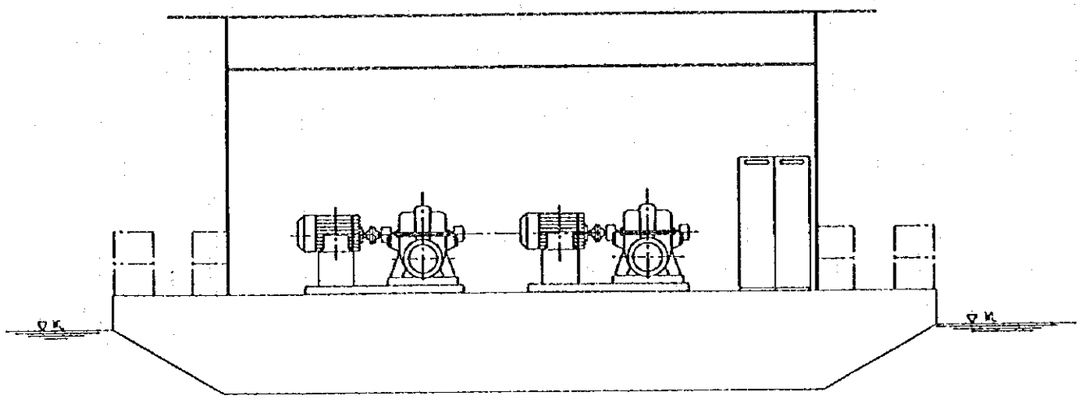

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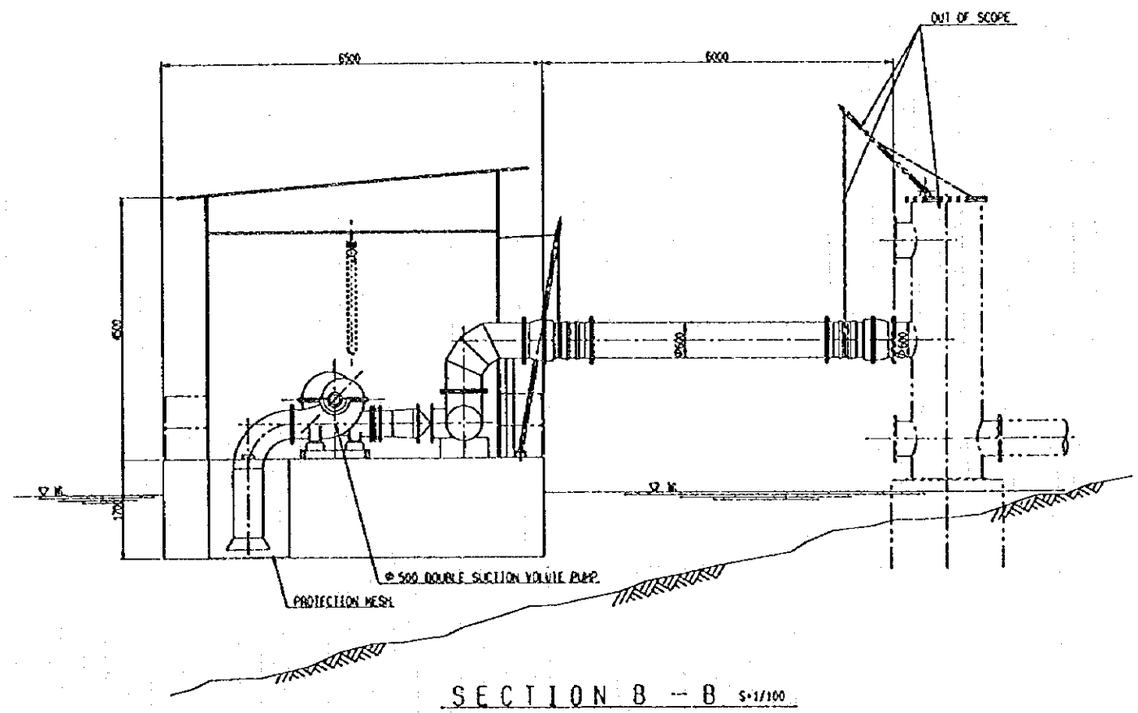

SECTION B – B S=1/100

No. 11 ; EL-KARABIA PUMP STATION

APPENDICES

Appendix-1 Member List of Study Team

Name	Designation and Present Position
Mr. Kenji IWAGUCHI	Leader Managing Director of Grant Aid Study and Design Department, JICA
Mr. Shigenori NAGASHIMA	Technical Advisor Electrical Substation Chief, Design Division, Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries (MAFF)
Mr. Hiroaki OKUBO	Project Coordinator Deputy Director, Administration Division, Tsukuba International Center, JICA
Mr. Takanori TAKATSUKA	Chief Consultant / Maintenance & Operation Planner Sanyu Consultants Inc.
Mr. Yasuo MATSUBARA	Irrigation Planner Sanyu Consultants Inc.
Mr. Tsuneo FUJIWARA	Equipment Planner Sanyu Consultants Inc.
Mr. Jiro YABE	Cost Estimator / Supply Planner Sanyu Consultants Inc.

Appendix-2 Study Schedule

Date	Work Schedule	Stay
<Iwaguchi, Nagashima, Okubo>		
Dec, 9 (Sat)	Leave Tokyo for London (JL 403)	London
10 (Sun)	Leave London for Cairo (BA 155)	Cairo
11 (Mon)	Courtesy call MOIC, MPWWR, EOJ, JICA	〃
12 (Tue)	Explanation of Inception Report Leave Cairo for Aswan	Aswan
13 (Wed)	Site Survey	〃
14 (Thu)	Site Survey, Remove to Luxor	Luxor
15 (Fri)	Site Survey, Remove to Cairo	Cairo
16 (Sat)	Discussion meeting with MED	〃
17 (Sun)	Signing of M/D at MOIC	〃
18 (Mon)	Leave Cairo for Vienna (OS 384)	Vienna
19 (Tue)	Leave Vienna for Tokyo (OS 125, JL 408)	
20 (Wed)	Arrive at Tokyo	
<Takatsuka, Matsubara, Fujiwara, Yabe>		
Dec, 2 (Sat)	Leave Tokyo for London (BA 008)	London
3 (Sun)	Leave London for Cairo (BA 155)	Cairo
4 (Mon)	Courtesy call MOIC, EOJ, JICA	〃
5 (Tue)	Discussion with MED Leave Cairo for Aswan	Aswan
6 (Wed)	Discussion with MED at Aswan	〃
7 (Thu)	Site Survey	〃
8 (Fri)	Site Survey	〃
9 (Sat)	Site Survey	〃
10 (Sun)	Takatsuka remove to Cairo Matsubara, Fujiwara continue survey	〃

Date	Work Schedule	Stay
11 (Mon)	Site survey and Discussion	Cairo, Aswan
21 (Thu)	Takatsuka remove to Aswan	Aswan
22 (Fri)	Site Survey, Yabe leave Tokyo (BA 006)	〃
23 (Sat)	〃	〃
24 (Sun)	〃 Yabe arrive at Aswan	〃
.	Site survey and data collection	〃
31 (Sun)	〃	〃
Jan, 1 (Mon)	Remove to Cairo, Data collection	Cairo
2 (Tue)	Data collection and discussion at MED	〃
3 (Wed)	〃	〃
4 (Thu)	Supplement data collection	〃
5 (Fri)	Review of collected data	〃
6 (Sat)	Discussion meeting with MED	〃
7 (Sun)	Report to EOJ, JICA	〃
8 (Mon)	Leave Cairo for London (BA 154)	London
9 (Tue)	Leave London for Tokyo	
10 (Wed)	Arrive at Tokyo	