Appendix-4 Minutes of Discussions

MINUTES OF DISCUSSIONS ON BASIC DESIGN STUDY ON THE PROJECT FOR WATER SUPPLY DEVELOPMENT IN NORTHWEST PART OF SHARQIYA GOVERNORATE IN THE ARAB REPUBLIC OF EGYPT

In response to a request from the Government of the Arab Republic of Egypt (hereinafter referred to as "Egypt"), the Government of Japan decided to conduct a Basic Design Study on the Project for Water Supply Development in Northwest Part of Sharqiya Governorate (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Egypt the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Norio Shimomura, Resident Representative, JICA Egypt Office, and is scheduled to stay in the country from May 17 to June 29, 2003.

The Team held discussions with the officials concerned of the Government of Egypt (hereinafter referred to as "the Egyptian side") and conducted field survey in the study area.

In the course of the discussions and field survey, both sides have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study report.

Cairo, May 22, 2003

Mr. Norio Shimomura Leader Basic Design Study Team JICA	Mr. Elshafei Eldakrouri Chairman National Organization for Potable Water and Sanitary Drainage (NOPWASD) The Arab Republic of Egypt	Mr. Mohamed Hamad Chairman Sharqiya Economical General Authority for Water and Sanitary Drainage (SHEGAWASD) The Arab Republic of Egypt

(Witness)

Mrs. Sanaa' Hegazy
Under Secretary of the Central Administration for Cooperation with Asia and Australia
International Cooperation Sector
Ministry of Foreign Affairs
The Arab Republic of Egypt

ATTACHMENT

1. Objective

The objective of the Project is to improve quality and quantity of water supplied to Hihya markaz, Sharqiya Governorate through water supply development such as construction of a new water treatment plant and water transmission mains, and construction/rehabilitation of water distribution facilities.

2. Project Site

The Project Site shall be Hihya markaz, the location of which is shown in the attached Annex-1.

3. Responsible and Executing Organization

(1) Responsible and coordinating organization of the Project is the Ministry of Housing, Public Utilities and New Urban Communities.

(2) Executing organizations and each role are as follows:

1) NOPWASD

(a) Coordination of the Project between the Japanese side and the Egyptian side

(b) Providing technical information for the Project to the Japanese side related to design of facilities

(c) Design and construction for water supply facilities to be provided by the Egyptian side such as water transmission mains, water reservoirs and distribution mains of more than 300mm in diameter related to the Project

2) SHEGAWASD

(a) Providing technical information for the Project to the Japanese side related to operation and maintenance of the facilities and the management of Water Supply Services

(b) Operation and maintenance for the facilities constructed under the Project

(c) Design and construction/rehabilitation of secondary distribution branch lines with the diameters of 300mm or less and house connections

(3) Organization Chart of Executing Organizations

The organization chart of NOPWASD is described in Annex-II (1/2).

The organization chart of SHEGAWASD is described in Annex-II (2/2)

4. Items requested by the Government of Egypt

After discussions with the Basic Design Study Team, the following items were finally requested by the Egyptian side.

(1) Construction of water treatment plant

- Water treatment plant including water intake facility, raw water pump facility, water treatment facility, sludge treatment facility, water transmission pump facility and other appurtenant facilities with the capacity in consideration of the design population and design average supply per capita in the target year of 2010 for Hihya markaz and the quantity of available treated water based on the water quality from the existing water supply facilities in Hihya markaz

(2) Construction of water transmission mains

- Water transmission mains within the boundary of water treatment plant

However, final items to be constructed and procured under Japan's Grant Aid will be decided after further studies in Japan, taking account of:

- Existing conditions of the water supply system
- Justification of the Project in the future plan for the water supply system
- Water supply demand forecast
- Operation and maintenance capability of SHEGAWASD
- Economic and administrative viability of the Project

5. Japan's Grant Aid System

(1) The Egyptian side has understood the system of Japan's Grant Aid in Annex-III as explained by the Team.

(2) The Egyptian side will take the necessary measures described in Annex-IV for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) The consultants in the Team will proceed to further studies in Egypt until June 29, 2003.

(2) Based on the Minutes of Discussions and technical examination of the study results, JICA will prepare the draft report and dispatch a mission in order to explain its contents in August, 2003.

(3) In case that the contents of the draft report are acceptable in principle by the Egyptian side, JICA will complete the final report and send it to the Government of Egypt around October, 2003.

7. Other Relevant Issues

The following were discussed and confirmed by both sides.

(1) Water Transmission Mains and Water Distribution Facilities

The Egyptian side stated that design and construction for water transmission mains, water reservoirs and distribution mains of more than 300mm in diameter within the Project Site shall be done by NOPWASD, and design and construction/rehabilitation for secondary distribution branch lines with diameters of 300mm or less within the Project Site shall be done by SHEGAWASD by the completion of the water treatment plant to be constructed by the Japanese side. The Egyptian side also stated that the budget for the above work by SHEGAWASD will be allocated by NOPWASD.

NOPWASD and SHEGAWASD shall prepare the design drawings for distribution mains and secondary distribution branch lines and show the drawings to the mission for the explanation of the draft report.

(2) Target Year

The Egyptian side stated that they have a plan for the water treatment facilities and water transmission mains for three marakez of Hihya, Ibrahimiya and Diarb Nigm for the target years of 2020 and 2040.

Both sides agreed that the target year is 2010 for the water treatment plant to be constructed by the Japanese side.

(3) Capacity of Water Treatment Plant to be constructed by the Japanese Side

The capacity of the water treatment plant to be constructed by the Japanese side shall be determined by the design population and design daily average supply per capita in 2010 for Hihya markaz, and in consideration of possibility to utilize the existing water supply facilities. The design population and design daily average supply per capita in 2010 for Hihya markaz shall be clarified during the Basic Design Study.

(4) Future Expansion

The Egyptian side stated that the acquisition of the land having the area of approx. 200m x 200m (4 hectares) for the water treatment facilities for the Project has been completed.

The layout and arrangement of the water treatment facilities in the land for the three marakez will be planned by both sides taking into account the target year of 2020. The Team explained that the Egyptian side may be required to acquire the additional land in case that the given land is not enough for the future expansion facilities.

Water intake facility to be constructed by the Japanese side will be designed taking into account the future expansion, as required.

(5) Raw Water Allocation from the Muweis Canal

The Egyptian side stated that they have already obtained the approval of the raw water allocation for the Project from the Ministry of Water Resources and Irrigation with the maximum intake volume of 200,000m^3 per day.

(6) Budget Allocation for the Project

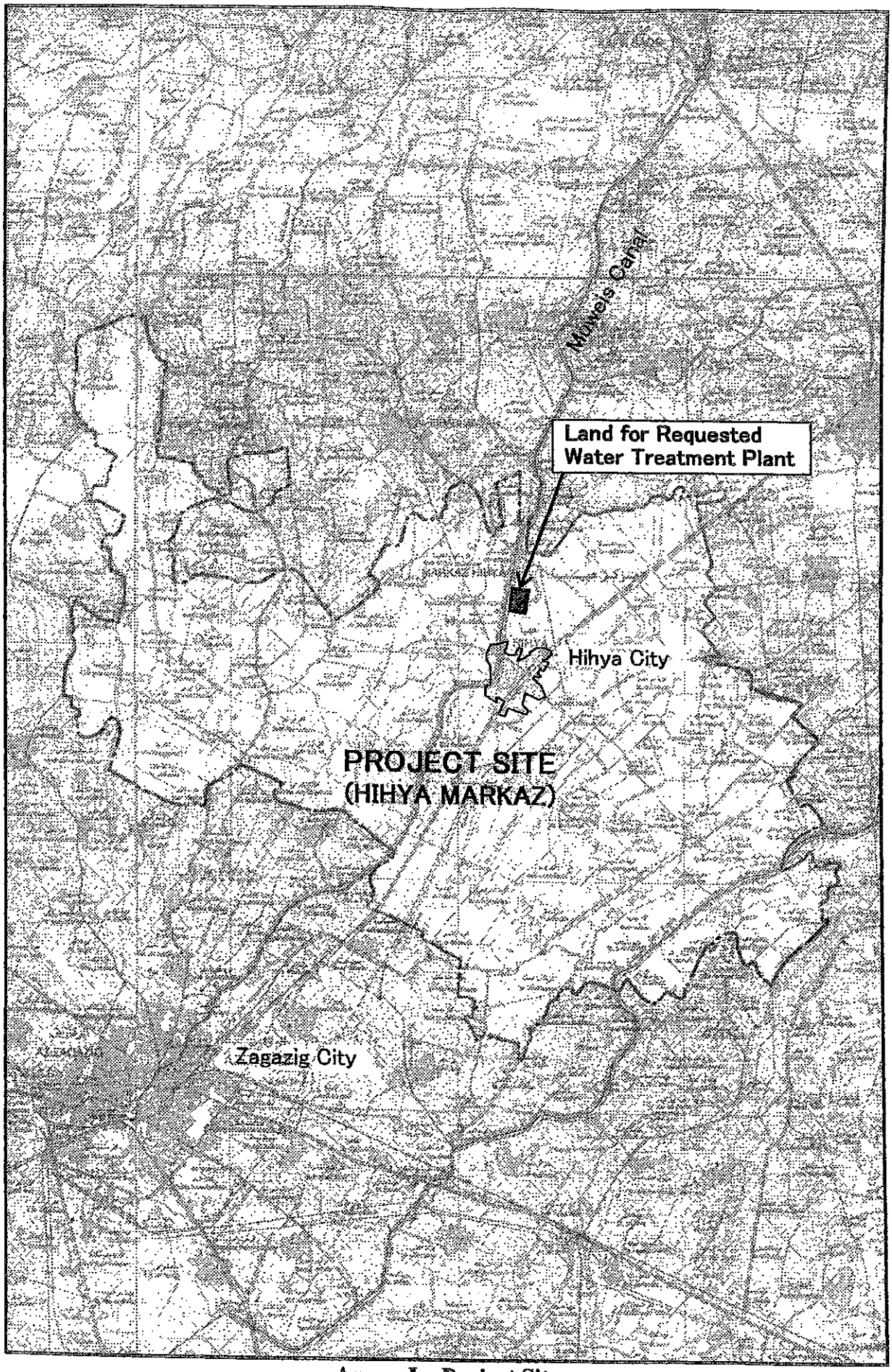
The Egyptian side explained to the Team that they have already acquired two code numbers in the five-year plan of 2002/07, No.32312 for the expansion of water treatment plants and water transmission mains for three marakez of Hihya, Ibrahimiya and Diarb Nigm, and No.32316 for expansion and upgrading of distribution network for Sharqiya Governorate.

(7) Operation, Maintenance and Management of the Water Supply Services

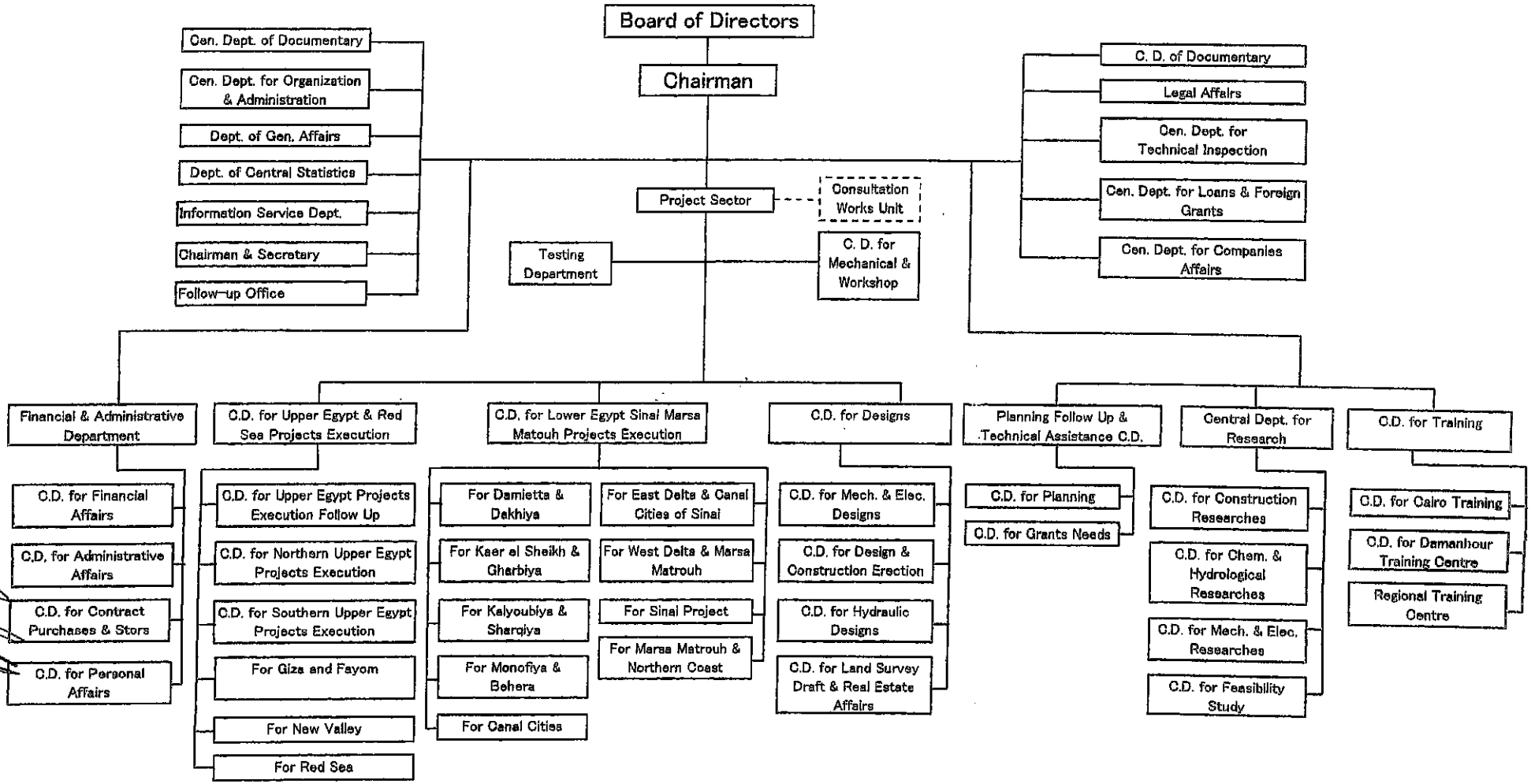
The Team emphasized on the importance of the improvement on the management of the water supply services, namely the countermeasures for water leakage, tariff system, organization, etc. as well as the proper operation and maintenance for the facilities to be constructed by the Japanese side. The Egyptian side agreed on the Team's view and requested the Team to execute the study and to provide necessary technical training such as OJT (on the job training) and Soft Component (technical and/or managerial assistance).

(8) Reclamation of the Proposed Land

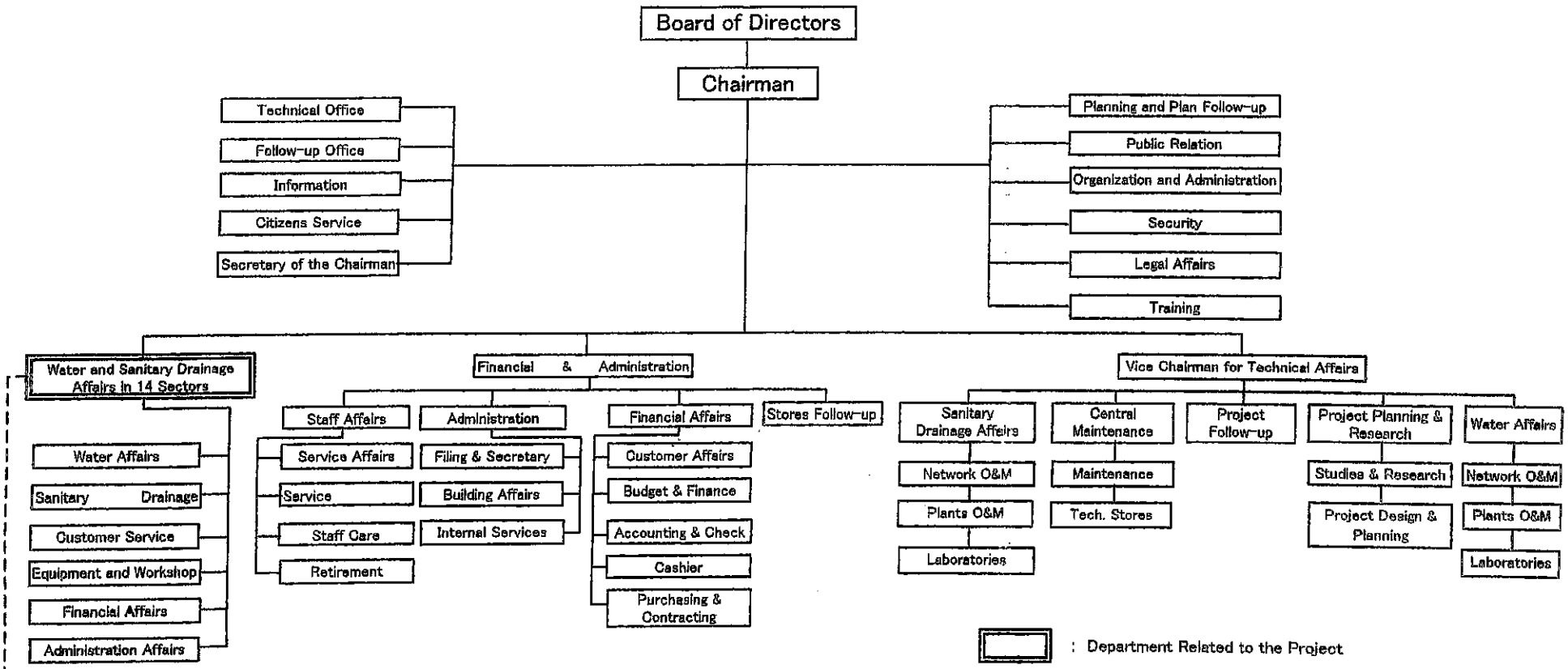
The Egyptian side (NOPWASD) agreed to do reclamation of the proposed land for the water treatment plant to be constructed by the Japanese side before the commencement of the construction, taking into account the high water level of the Muweis Canal, if required.



Annex-I Project Site



Annex-II (1/2) Organization of NOPWASD



14 Sectors

1.	Zaqazig City	8.	Mashtul El Soak Markaz
2.	Zaqazig Markaz	9.	Ibrahimiya Markaz
3.	Minyet El Qanh Markaz	10.	Awlad Saqr Markaz
4.	Abu Hammad Markaz	11.	Kafr Saqr Markaz
5.	Bilbeis Markaz	12.	Abu Kabir Markaz
6.	Faquas Markaz	13.	El Husiniya Markaz
7.	Diarb Nigm Markaz	14.	Hihya Markaz

Annex-II (2/2) Organization of SHEGAWASD

Japan's Grant Aid Programme

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

1. Grant Aid Procedures

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

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

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

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

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

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

2. Basic Design Study

(1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

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

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

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

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.
The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

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

(2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

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

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

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

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

(4) Necessity of "Verification"

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

(5) Undertakings required of the Government of the Recipient Country

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

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.
4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country 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 the recipient country and stay therein for the performance of their work.

(6) "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.

(7) "Re-export"

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

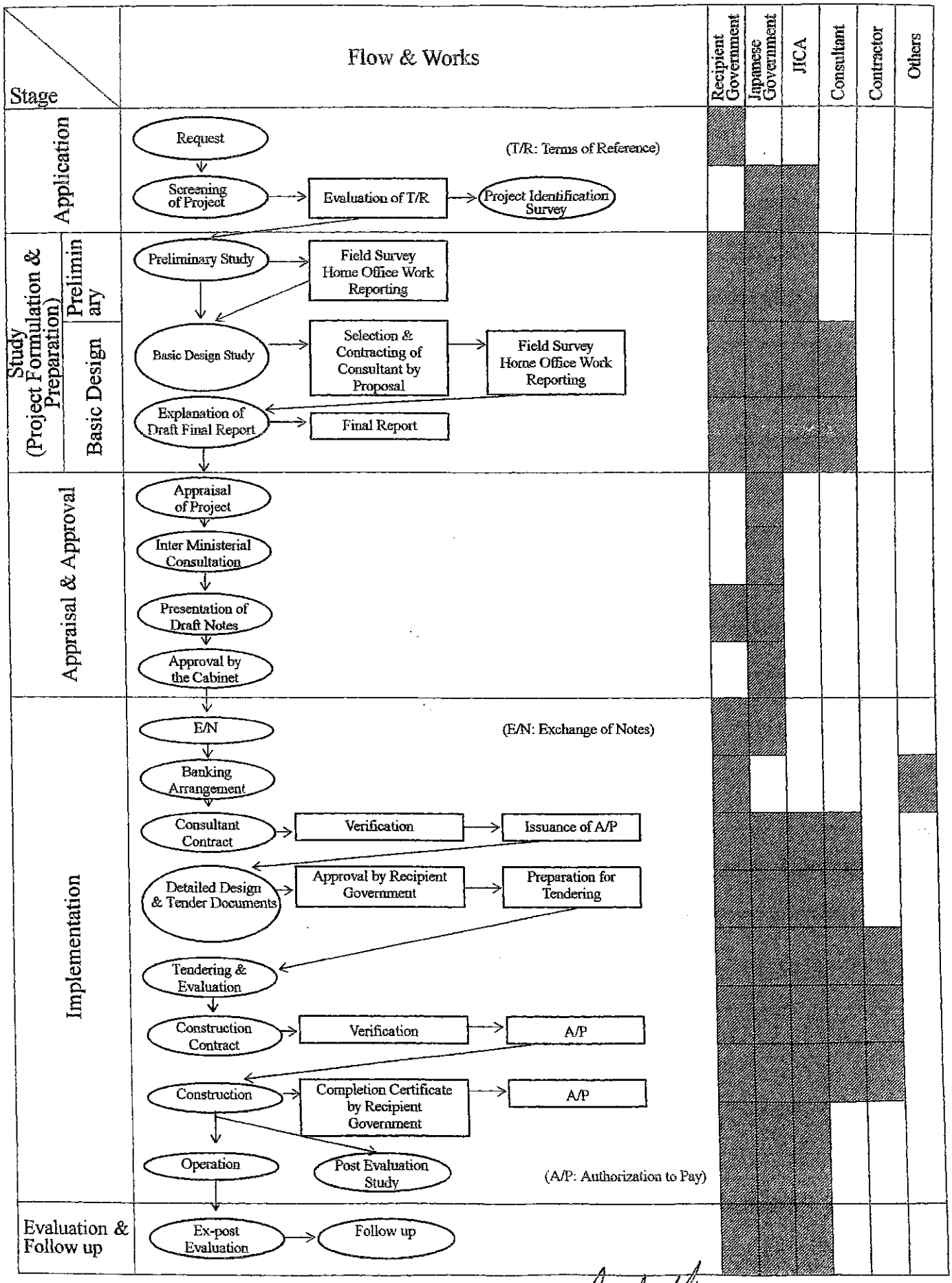
(8) Banking Arrangements (B/A)

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

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (P/A)
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

Flow Chart of Japan's Grant Aid Procedures



Necessary measures to be taken by the Government of the Arab Republic of Egypt on condition that Japan's Grant Aid is extended

1. To secure the land for the construction site of water treatment plant for the Project.

2. To clear, level and reclaim the site taking into account the high water level determined by the Ministry of Water Resources and Irrigation and the level of the adjacent access road to the new water treatment plant before commencement of the construction by the Japanese side.

3. To construct an access road to the site prior to the commencement of the construction by the Japanese side.

4. To provide facilities for the distribution of electricity, telephone, drainage and other incidental facilities to the site.

5. To undertake incidental outdoor works such as gardening, fence, gates and exterior lighting in and around the site.

6. To execute the construction work for water transmission mains from the new water treatment plant to be constructed by the Japanese side to each town/village and for water distribution facilities such as water reservoirs and network within the Project Site by the completion of the construction by the Japanese side.

7. To bear the following commissions to a bank in Japan for the banking services based upon the B/A.
   - Advising commission of A/P
   - Payment commission

8. To ensure prompt unloading and customs clearance of the goods for the Project at the port of disembarkation in Egypt.

9. To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contract(s) such facilities as may be necessary for their entry into Egypt and stay therein for the performance of their works.

10. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Egypt with respect to the supply for the products and services under the verified contract(s). And to take necessary measures for such tax exemption.

11. To use and maintain properly and effectively all the facilities constructed, and equipment and materials provided under the Japan's Grand Aid.

12. To bear all the expenses, other than to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

2. Explanation on Draft Report

MINUTES OF DISCUSSIONS ON BASIC DESIGN STUDY ON THE PROJECT FOR WATER SUPPLY DEVELOPMENT IN NORTHWEST PART OF SHARQIYA GOVERNORATE IN THE ARAB REPUBLIC OF EGYPT (EXPLANATION ON DRAFT REPORT)

In May and June 2003, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Water Supply Development in the Northwest Part of Sharqiya Governorate (hereinafter referred to as "the Project") to the Arab Republic of Egypt (hereinafter referred to as "Egypt"), and through discussions, field survey, and technical examination of the results in Japan, JICA has prepared a Draft Report of the Basic Design Study on the Project.

In order to explain and to consult Egyptian side on components of the draft report, JICA sent to Egypt the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Noboru Saeki, Chief Consultant, Yachiyo Engineering Co., Ltd. from September 3 to September 12, 2003.

As a result of discussions, both sides confirmed the main items described on the attached sheets.

Cairo, September 10, 2003

Mr. Noboru Saeki Leader Basic Design Study Team JICA	Mr. Elshafei Eldakrouri Chairman National Organization for Potable Water and Sanitary Drainage (NOPWASD) The Arab Republic of Egypt	Mr. Mohamed Hamad Chairman Sharqiya Economical General Authority for Water and Sanitary Drainage (SHEGAWASD) The Arab Republic of Egypt

(Witness)

Mrs. Sanaa' Hegazy
Under Secretary of the Central Administration for Cooperation with Asia and Australia
International Cooperation Sector
Ministry of Foreign Affairs
The Arab Republic of Egypt

Attachment

1. Components of the Basic Design

The Egyptian side has agreed and accepted in principle the components of the draft report proposed by the Team.

2. Japan's Grant Aid Scheme

The Egyptian side has understood the system of Japan's Grant Aid Scheme as explained by the Team and confirmed to take the necessary measures described in ANNEX –III・IV of the Minutes of Discussions signed on May 22, 2003 by the both sides.

3. Further Schedule of the Study

JICA will complete the final report and send it to the Government of Egypt around October, 2003.

4. Other Relevant Issues

The followings were discussed and confirmed by the both sides.

(1) Design Drawings by NOPWASD/ SHEGAWASD

As agreed in the Minutes of Discussions signed on May 22, NOPWASD and SHEGAWASD have prepared the design drawings for transmission mains and secondary distribution branch lines and submitted them to the Team during the discussion. The Team pointed out that there should be an integrated water supply system combining new water treatment plant of the Japanese side and the new compact unit and some existing groundwater pumping stations to be utilized in the Project by the Egyptian side.

Upon the submission of the design drawings, the Egyptian side requested the Team that the protection of transmission pumps of the Project from the water hammer should be examined according to the proposed water supply network by NOPWASD. The Team explained that the proposed basic design considered providing only slow closing valves and agreed to examine the design and give suitable advice if necessary.

(2) Schedule of undertakings by the Egyptian side

Both sides confirmed that the undertakings by the Egyptian side will be implemented according to the Tentative Implementation Schedule and Tentative

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Schedule of Budget Allocation shown in Annex 1 and Annex 2, if it is determined that Japan's Grant Aid is extended in October 2003.

The Egyptian side informed that the contractor for the works to be taken by NOPWASD has been nominated by ministerial appointment and the works will be commenced in November, 2003 and the detail schedule for implementation of these undertakings should be submitted to the Japanese side by November, 2003.

(3) Technical Transfer (Soft Component)

The Japanese side proposed in the report to conduct technical transfer (hereinafter referred as to "soft component") through lecturing and training in order to improve operation and maintenance ability of SHEGAWASD for the new water treatment plant as a part of the Project. The soft component covers the following areas.

i. Operation and maintenance of the new water treatment plant
ii. Information management

The Egyptian side agreed to appoint operators and trainees in due course of the soft component program in accordance with the list and the schedule shown in the report. The Egyptian side promised that they attend the soft component program full time. The selected operators/trainees should have completed the existing relevant training course of each trainee, which is run by NOPWASD and/or General Organization for Greater Cairo Water Supply before the soft component begins.

At the same time the Egyptian side explained that SHEGAWASD applied the Japanese governmental technical cooperation for the improvement of water service management through Government of Sharqiya Governorate related to this Project and since "ii Information Management" is duplicated, it may be excluded from the soft components activities of the Project.

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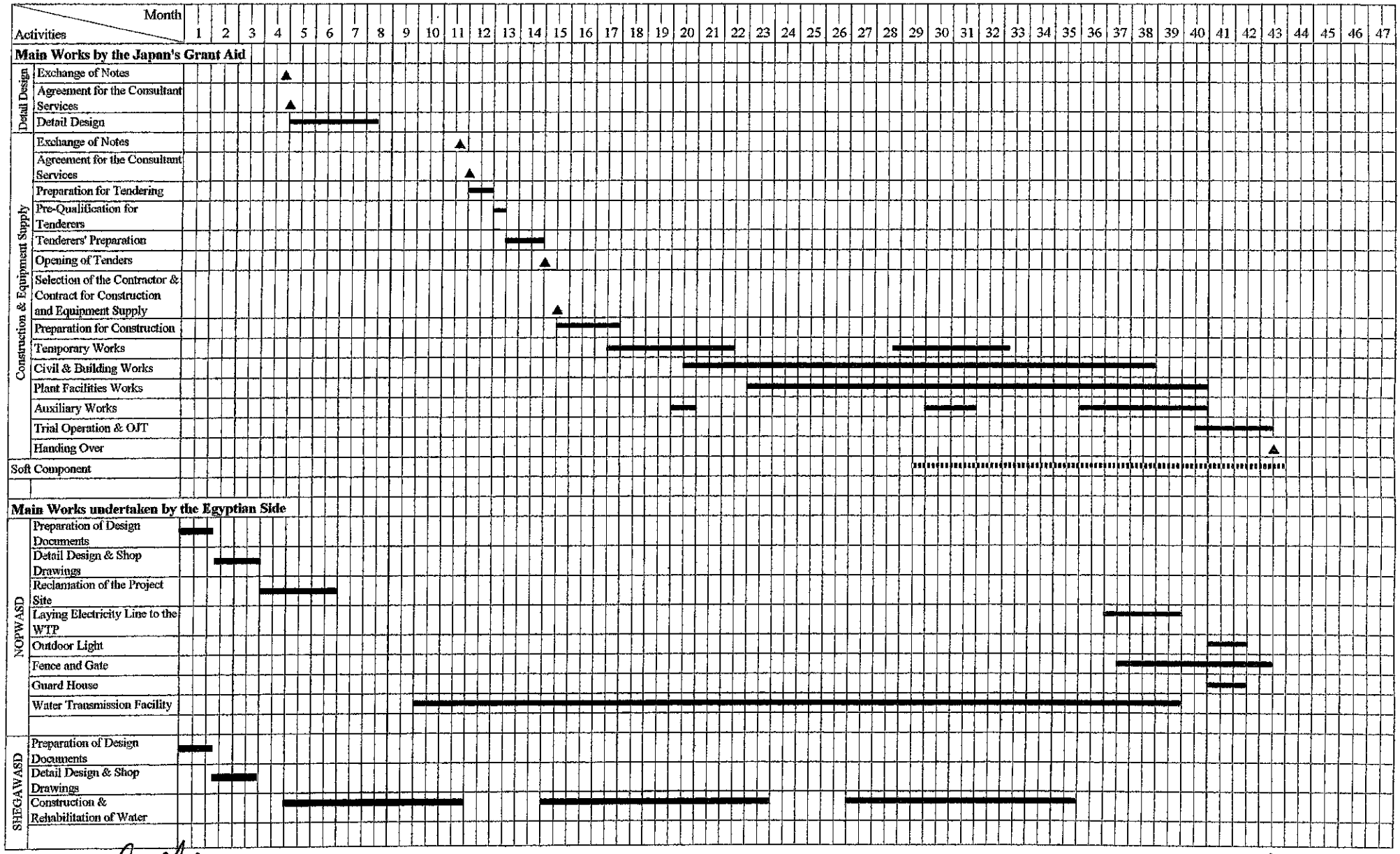
ANNEX-1. Tentative Implementation Schedule
The Project for the Water Supply Development in Northwest Part of Sharqiya Governorate, the Arab Republic of Egypt



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ANNEX-2. Tentative Schedule of Budget Allocation for Main Undertaken Works by the Egyptian Side
The Project for the Water Supply Development in Northwest Part of Sharqiya Governorate, the Arab Republic of Egypt

Currency Unit: Thousand LE

	Year, Month / Activities	2003	2004	2005	2006	2007	Total Cost
		8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6	
	Main Works undertaken by the Egyptian Side						
MOPWASD	Reclamation of the Project Site	262.5					262.5
MOPWASD	Laying Electricity Line to the WTP				600.0		600.0
MOPWASD	Outdoor Light					300.0	300.0
MOPWASD	Fence and Gate				200.0		200.0
MOPWASD	Guard House					90.0	90.0
MOPWASD	Water Transmission Facility		7% 2,241.75	40% 12,810.0	40% 12,810.0	13% 4,163.25	32,025.0
MOPWASD	Sub-Total	2,504.25	12,810.0	12,810.0	5,353.25		33,477.5
SHEGAWASD	Construction & Rehabilitation of Water Distribution Network	13% 2,281.5	40% 7,020.0	47% 8,248.5			17,550.0
SHEGAWASD	Laying Telephone Line to the WTP					10.0	10.0
SHEGAWASD	Sub-Total	2,281.5	7,020.0	8,248.5	10.0		17,560.0
	Grand Total	4,785.8	19,830.0	21,058.5	5,363.3		51,037.5

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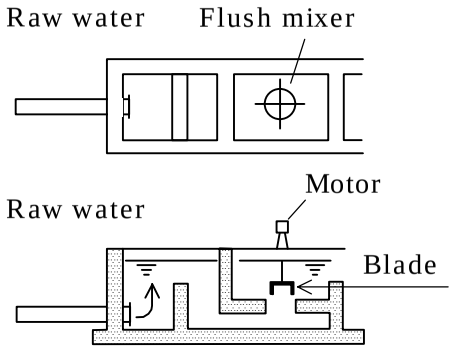
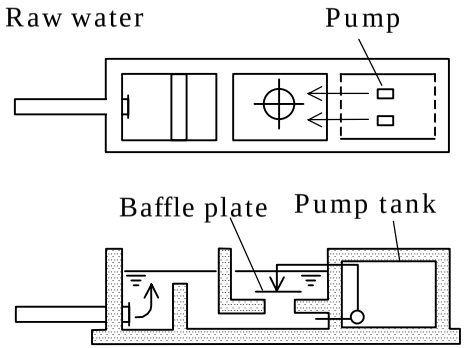
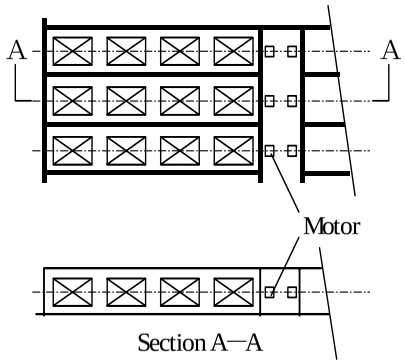
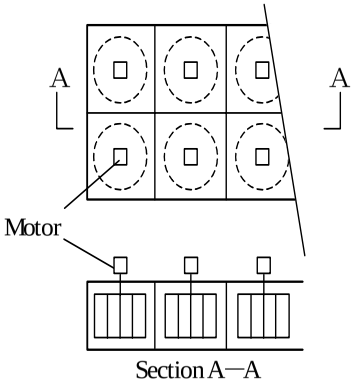
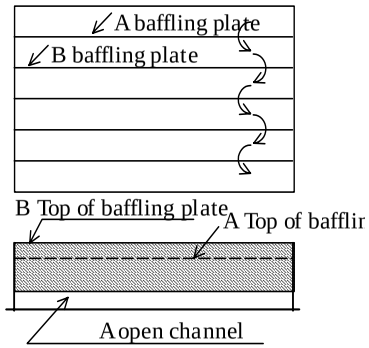
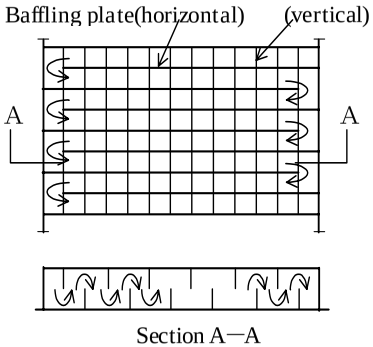
Appendix-5 Comparison Table for Main Water Treatment Facilities

Table 1 Mixing method

Item \ Type	①Flush mixer type	②Pressured water mixing type
1) Structure outline	 Mixing blades attached around the vertical shaft rotate to mix the chemical in the mixing well. Edge speed of blades is approx. 1.5m/s.	 Pressured water generated by the exclusive pump installed in the neighbor tank are poured and attacked to mix the chemical in the mixing well.
2) Reliability for mixing	There are many installation results and good performance is confirmed in them. Therefore, high reliability for mixing is secured.	Not so good Because pressured water current in the mixing well is not constant and drift spatially and timely.
3) Adaptability to the quantity change of raw water	・It is easy to adjust the rotation speed that influences the mixing power directly. ・Thus, this type has enough flexibility for water quantity change.	・Theoretically adjusting the valve operation could change the amount of pressured water, but it is difficult to control the water current and mixing efficiency by this type.
4) maintenance	・The system is simple, so the maintenance is easy. ・Overhaul for driving gear is required periodically. ・By selecting the corrosion resistant material (FRP,SUS,etc), continuous use would be applied.	・It is easy to access the machines because all systems are installed out of the water pit. ・Yet, the system are consisted of many mechanical items (pump,valve,etc) and it is difficult to maintain. ・The system required strong electric power compared with other type. ・All the mechanical gear should be maintained periodically. ・Some scales originated from baffle plate would be

Item \ Type	①Flush mixer type	②Pressured water mixing type
		adhered near pump outlet hole. Periodical maintenance is required.
5) Problem of design or construction phase	It is easy to design/install the civil structure because the system is simple.	The system is complicated and prediction of current flow is required. So, it is difficult to design/ install the civil structure compared with other type.
6) Water head loss for mixing	Approx. 20cm(same as other type)	Approx. 20cm(same as other type)
7) Required space	Small (approx.16m^2)	large (approx.30m^2)
8) maintenance cost	Maintenance cost is small compared with the other type.	Maintenance cost is expensive compared with the other type.
Conclusion	○ 1) High reliability. 2) System is simple and initial cost is low. 3) Maintenance cost is low. 4) Required space is small.	× 1) Reliability is not good. 2) System is not simple, initial cost is expensive. 3) Maintenance cost is expensive. 4) Required space is large.

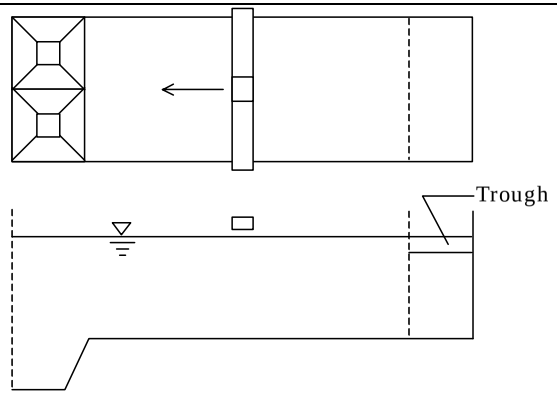
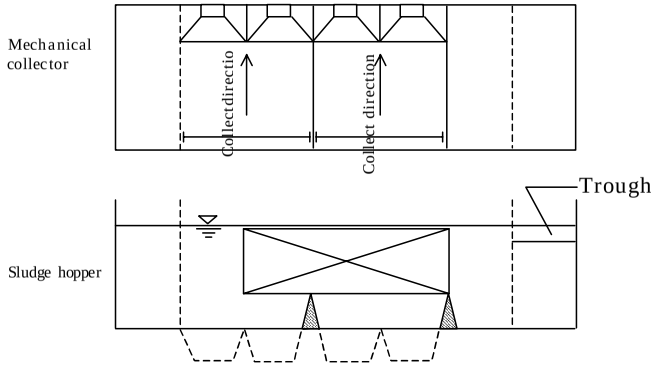
Table 2 Coagulation method

Item \ Type	① Flocculator type (Horizontal shaft)	② Flocculator type (Vertical shaft)	③Baffling plate type (Vertical waterway)	④Baffling plate type (Vertical and horizontal waterway)
1) Structure outline	 ・ Agitation blades attached around the horizontal shaft rotate to make the turbulent and cherish the flock formation. Edge speed of the blade is approx. 15～80cm/s.	 ・ Agitation blades attached around the vertical shaft rotate to make the turbulent and cherish the flock formation. Edge speed of the blade is approx. 15～80cm/s.	 ・ Vertical baffling plate is installed to make a long and obstacle waterway. Vertical waterway generates the turbulent and cherishes the flock formation. ・ Baffling plate is designed so that the excess turbulent would not destroy flock and tapered flocculation is considered.	 ・ Vertical and horizontal baffling plate is installed to make a long and obstacle waterway. Vertical and horizontal waterway generates the turbulent and cherishes the flock formation. ・ Baffling plate is designed so that the excess turbulent would not destroy flock and tapered flocculation is considered.
2) efficiency for	・ According to the quantity and quality change of raw water, it is easy to adjust the rotation speed. So, suitable mixing intensity could be secured. Especially low turbidity condition is suitable for this system because sensitive	・ According to the quantity and quality change of raw water, it is easy to adjust the rotation speed. So, suitable mixing intensity could be secured. Especially low turbidity condition is suitable for this system because sensitive	・ The flock formation is carried out efficiently under the stable condition. ・ But unstable current (short pass, etc.) in the basin is sometimes generated and flock formation is interfered by them.	・ The flock formation is carried out efficiently under the stable condition. ・ It is easy to manufacture because baffling plate do not be made holes for the waterway. ・ It is difficult to modify the shape

Item \ Type	① Flocculator type (Horizontal shaft)	② Flocculator type (Vertical shaft)	③Baffling plate type (Vertical waterway)	④Baffling plate type (Vertical and horizontal waterway)
	adjustment of first and second flocculator can take independently.	adjustment of first and second flocculator can take independently.	・The length of open channel is too long and sometimes it is difficult to manufacture. ・It is difficult to modify the shape of open channel after installation.	of open channel after installation.
3）maintenance	・Motor is set neibour to the water tank, and horizontal shaft penetrate the tank wall. So, there is a serious risk that water of tank would be leaked from shaft hole. ・Shaft support in the basin would be damaged by friction, so periodical replacement whose interval is approx. 1 time per 5 to 10 years of these parts would be required. ・Operator can adjust the edge speed easily according to the quantity and quality change of raw water. ・After long-term operation, sludge would be accumulated on the basin bottom. So, periodical removal of sludge is required.	・Motor is set over the water surface and vertical shaft don't penetrate the civil structured. So, there is no risk that basin water would be leaked from shaft hole. ・Shaft support in the basin would be damaged by friction, so periodical replacement whose interval approx. 1 time per 5 to 10 years of these parts would be required. ・Operator can adjust the edge speed easily according to the quantity and quality change of raw water. ・After long-term operation, sludge would be accumulated on the basin bottom. So, periodical removal of sludge is required.	・There are no mechanical items, it is easy to do the daily maintenance. ・But, there is the risk to generate the scum because of the unstable current. ・Operator can't adjust any more to the quantity and quality change. ・After long-term operation, sludge would be accumulated on the basin bottom. So, periodical removal of sludge is required.	・There are no mechanical items; it is easy to do the daily maintenance. ・Operator adjusts the baffling plate to the quantity and quality change. ・The risk to generate the scum is small compared with the other type. ・After long-term operation, sludge would be accumulated on the basin bottom. So, periodical removal of sludge is required.
4）Adaptability to the quantity change of raw water	・It is easy to adjust the edge speed by operating the gearbox.	・It is easy to adjust the edge speed by operating the gearbox.	・It is difficult to adjust.	・Operators adjust the baffling plate.

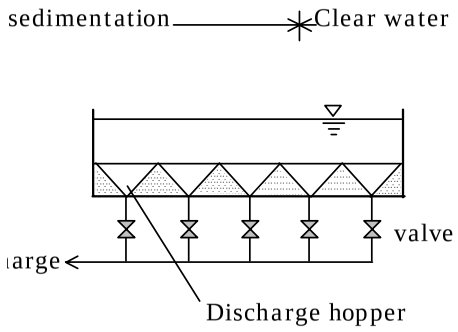
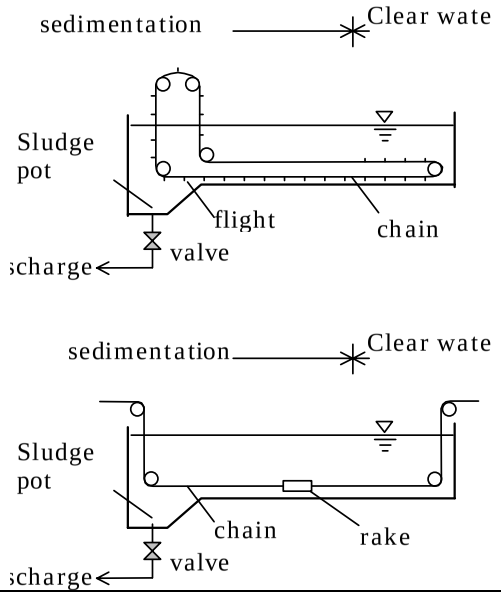
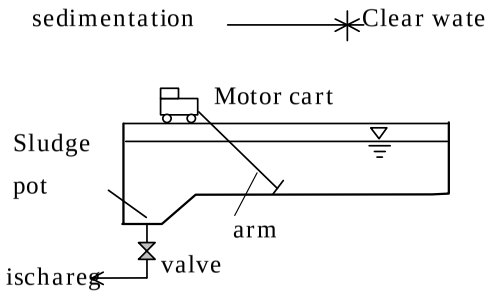
Item \ Type	① Flocculator type (Horizontal shaft)	② Flocculator type (Vertical shaft)	③Baffling plate type (Vertical waterway)	④Baffling plate type (Vertical and horizontal waterway)
5) Water head loss	None But, large horizontal space is required for this type.	None Driving gear is installed over the water surface, no more horizontal space is required for this type.	Approx.50～60mm	Approx.500～1000mm
6) Maintenance cost	Normal Small electrical power is required.	Normal Small electrical power is required.	Small There is no electrical gear.	Small There is no electrical gear.
7) Conclusion	○ ・ Good flock would be made. ・ Installation space is wide. ・ There is the risk to leak the basin water from the shaft hole.	◎ ・ Good flock would be made. ・ Installation space is same as baffling space type. ・ There is no risk to leak the basin water.	× ・ Flock production is not so good. ・ Installation space is same as flocculator vertical type. ・ There is no risk to leak the basin water. ・ There is no mechanical gear, so daily maintenance is easy.	△ ・ Flock production is normal. ・ Installation space is same as flocculator vertical type. ・ There is no risk to leak the basin water. ・ There is no mechanical gear. So, daily maintenance is easy. ・ Head loss is big, thus, civil structure should be tall and consequently expensive.

Table 3 Sedimentation method

Item \ Type	①Horizontal flow type	②Horizontal flow with inclined plate
1) structure outline		
2) Detention time	Long(2～5 hours)	Short (approx.1 hour including approx.20 minutes in inclined plate)
3) Efficiency of sedimentation under the quantity, quality, temperature change of raw water	・ Same as the other type	・ Same as the other type ・ To modify the location of inclined plate, suitable sedimentation is secured.
4) Maintenance	・ There is no mechanical gear. so, maintenance is easy. ・ Dry condition maintenance is required ones a year.	・ Basically say, maintenance item is same compared with the other type. ・ Dry condition maintenance is required ones a year. ・ To carry out the dry maintenance, winter season is recommended because inclined plates receive the bad influence from the high temperature and ultraviolet ray originated from strong sunshine. ・ The location of inclined plate should be modified by mechanical gear for cleaning of sedimentation basin at the dry condition maintenance. ・ To clean up the incline plate, high-pressure water pump and pipes is required to install. ・ At the preparation of the dry condition maintenance, water drainage from the sedimentation basin should be controlled slowly approx. 50cm/h not to load the water to the incline plate.

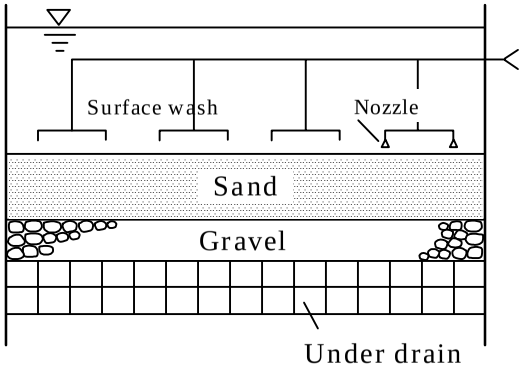
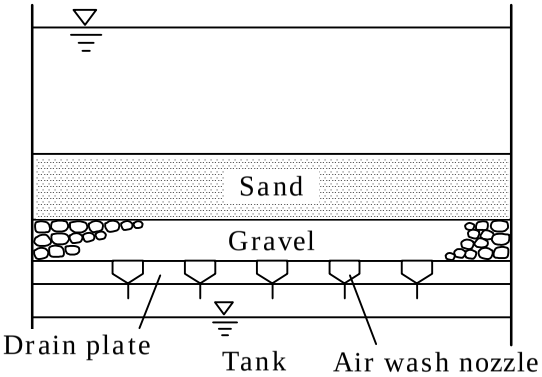
Item \ Type	①Horizontal flow type	②Horizontal flow with inclined plate
5) Required space	Wide (2 to 3 times compared with another type)	Small ・ Detention time for inclined plate is approx. 20 minutes. So, civil structure is small. ・ Heavy flock settle in itself at the upper-stream side of the basin and light flock settle by inclined plate at the downstream side of the basin.
6) Initial cost	Small ・ The cost of civil structure is expensive because large basin is required for sedimentation. But there is no expensive inclined plate for this type. So, totally, initial cost is small compared with the other type.	Expensive ・ The cost of civil structure is small because of the small basin. But expensive inclined plate is required for this type. Initial cost is expensive in comparison with the other type.
7) Maintenance cost	Nearly equal to ①	Nearly equal to ②
8) Conclusion	◎ ・ Wide space is required. ・ Initial Cost is small	△ ・ Compact space. ・ Initial cost is expensive. ・ Stable sedimentation

Table 4　Sludge discharge method

Item \ Type	①Discharge hopper type	②Mechanical collector in the water	③Mechanical collector in air
1）Structure outline			
2）Conception	・Settled sludge is caught into the discharge hopper and discharged by open/close the hand-operation valve by the operator which is furnished more than 60 pcs in this system. ・To slip and fall down the sludge, hopper angle should be kept 60 degree. So, civil structure should be tall approx. 3m to keep the hopper angle.	・Settled sludge on the basin bottom is collected by the flight or rake into the sludge pot and discharged trough 4 motor-operated valves.	・Settled sludge is collected by the arm connected to the motor cart into the sludge pot and discharged trough 4 motor-operated valve.
3）Discharge capacity	・Discharge capacity is decided by valve operate interval.	・Discharge capacity is decided by the height of flight or rake, collection speed of collector.	・Discharge capacity is decided by height of shoe plate of arm, collection speed of motor cart.

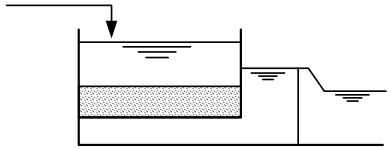
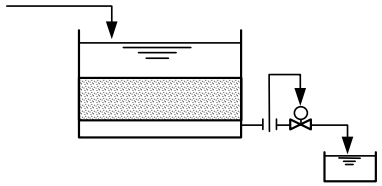
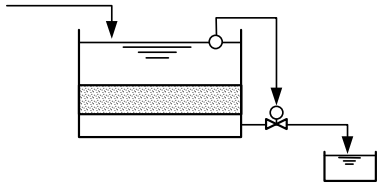
Item \ Type	①Discharge hopper type	②Mechanical collector in the water	③Mechanical collector in air
4) Function	・Sludge is slipped into the sludge hopper whose angle is 60 degree and gathered into the header pipes.	・Flight shoe or rake shoe are traveled on the basin bottom by the driving chain. ・Chain extension occurred by the strain is adjusted by the horizontal take-up.	・Shoe hanged by long arm is rift up/down by the motor drive cantilever and dragged by cart.
5) Maintenance	・It is necessary to operate more than 60pcs hand-operated valve for daily operation. ・Dry condition maintenance is required ones a year. ・Sludge is easily slipped into the hopper because of the slope (60 degree) without any help. ・Discharge capacity is large, but the amount of discharged water is too much compared with the other type.	・To check the submerged main body, dry condition maintenance is required. ・Dry condition is required for repair works because main body is submerged in the basin. ・Daily or weekly maintenance is required because there is mechanical rotation part on the water surface. But these jobs are not so serious. ・Discharge capacity is large.	・It is easy to maintain because main body is on the water surface. ・But mechanical cantilever is weak and would cause trouble. ・Cart is a heavy structure because of the large span of basin. Thus, driving unit is massive and sufficient maintenance is required.
6) Initial cost	Less expensive than ③	Less expensive than ③	Most Expensive
7) Maintenance cost	Less expensive than ②	Less expensive than ③	Most Expensive
8) Conclusion	△ ・Initial cost is small but depth of basin will be deeper than other methods by approx.3m. ・60 pcs hand-operated valves should be open/close by the operator daily. ・Discharge capacity is large, but the amount of discharged water is large.	◎ ・Initial cost is a little expensive ・Main body is submerged in the basin and dry condition maintenance is required ones a year. ・Discharge capacity is large and the amount of discharge water is small.	△ ・Initial cost is expensive ・Main body is installed in the air. So, it is easy to access the machine. But the machine is large and heavy and mechanical cantilever is weak and would be troubled. Sufficient maintenance is required. ・Discharge capacity is large and the amount of discharge water is small.

Table 5　Sand washing method

Item \ Type	①Surface wash +back wash type	②Air wash +back wash type
1）structure outline		
2）Concept	On the surface of sand layer, many sludge is adhered. So, pressured water is sprayed strongly on it and breaks the mud layer. This surface wash combined with backwash clean up sand efficiently.	The pressured air supplied from air wash nozzle installed under the gravel expands the sand layer and at the same time surface sludge is removed by the air babble. These air wash before doing the backwash efficiently.
3）Flux ( ) indicates the operation time	Surface wash water flux 0.15－0.2 m^3/min・m^2 （4-6 min） Back wash water flux 0.6－0.9m^3/min・m^2 （4-6 min）	Air wash air flux：0.8－1.5m^3/min・m^2 （approx.5 min） Back wash water flux：0.6－0.9m^3/min・m^2 （approx.10 min）
4）Features	・Many sludge on the sand is destroyed by pressured water. So, mud ball is prevented from growing and clogging would be avoided. ・Surface wash is not just a support system but a main system for cleaning. ・Influence of surface wash reach approx. 10 to 20cm below the sand surface. The bottom of sand layer is	・Supplied air spread unequally and partially concentrated into the sand layer. ・Consequently, efficiency for washing is not enough. ・And sludge would accumulate at these unclean areas and mud ball would grown-up. ・Much air remains into the sand and prevent the efficient backwash because sand friction at back wash operation

Item \ Type	①Surface wash +back wash type	②Air wash +back wash type
	fluidized adequately by backwash and sand/ water current would clean sand by friction. ・ Rigid perforated Brock is employed for drain system which would not be destroyed by sand/gravel load.	loses by these air. ・ Sand and gravel is easily removed or supplied because there is no surface wash piping.
5） Efficiency of cleaning	Excellent	Good
6） Maintenance	・ This system is easy to maintain because surface wash pipe which periodical check or repair is required are installed on the sand.	・ This system is difficult to maintain because air wash system (pipe, nozzle, etc) which periodical check or repair is required are installed under sand. ・ Blower should be also repaired periodically.
7） Initial cost	Cheaper than ②	More expensive than ①
8） maintenance cost	Cheaper than ②	More expensive than ①
9） Conclusion	○ ・ Excellent washing efficiency ・ Easy maintenance ・ Initial cost is cheaper. ・ Maintenance cost is cheaper.	× ・ Washing efficiency is poor compared with the other type. ・ Maintenance is difficult. ・ Initial cost is more expensive. ・ Maintenance cost is more expensive.

Table 6 Filtering System

Type / Item	1. Balanceable system between water level and head loss of sand filter	2. Flow rate or water level control system
1) Structure outline	 At the downstream side, The weir leveled over the sand surface is installed. At the upstream side, Immediately after the back wash, The water level on the sand filter is balanced with head loss of sand and the former would gradually ascend in the basin the latter originated from accumulating the suspended substance in water would be increased after times pass away.	Flow rate control system  At the downstream side, flow meter and control valve are installed. Immediately after the back wash, valve is relatively closed to increase the artificial head loss. After times pass away, the head loss originated from accumulating the suspended substance in water would be increased and the valve would be gradually opened to keep the flux constant. Water level control system  At the downstream side, level sensor and control valve are installed. Immediately after the back wash, valve is relatively closed to increase the artificial head loss. After times pass away, the head loss originated from accumulating the suspended substance in water would be increased and the valve would be gradually opened to keep the water level constant.
2) Facilities to be required	Facilities to be requires is just a water level sensor and it is very simple.	Facilities to be required are magnetic flow meter or water level sensor and motor-drive or pressured air-drive valve and electrical feedback control system.

Type / Item	1. Balanceable system between water level and head loss of sand filter	2. Flow rate or water level control system
3) Filtration performance	Filtration performance is mainly regulated by flux, the diameter of sand, thickness of sand layer. Therefore, Filtration performance is same compared with the other type.	Filtration performance is mainly regulated by flux, the diameter of sand, thickness of sand layer. Therefore, Filtration performance is same compared with the other type.
4) Maintenance	The system is very simple and maintenance is easy.	Many facilities are required and maintenance work would be frequently and difficult.
5) Required space	Required space is mainly regulated by the amount of design water and flux. Therefore, required space is same compared with the other type.	Required space is mainly regulated by the amount of design water and flux. Therefore, required space is same compared with the other type.
6) Initial cost	Small	More expensive than 2
7) Maintenance cost	Small	More expensive than 2
8) Conclusion	○ 1) The System is simple and has high reliability. 2) Initial and maintenance cost are small. 3) Easy maintenance.	× 1) The system is complicated and reliability is inferior to the other type. 2) Initial and maintenance cost are little expensive. 3) Maintenance work is not so easy compared with the other type.

Appendix-6 Cost Estimation Borne by the Recipient Country

Cost Estimation Borne by the Recipient Country

The cost for undertakings to be borne by the Government of the Arab Republic of Egypt has been estimated as follows.

1. To be borne by NOPWASD

(1) Reclamation of the Project Site

- Area to be reclaimed : 21,270m^2
- Volume to be reclaimed : 10,500m^3
- Unit price for reclamation : 25LE/m^3

	Volume (m^3)	Unit Price (LE/m^3)	Amount (LE)
Reclamation Work	10,500	25	262,500

(2) Connecting electric line to the Project Site

- Connection work of electric line

	Length (m)	Unit Price (LE/m)	Amount (LE)
Connection Work	2,300 x 2 feeders = 4,600	100	460,000

- Installation of control board

	Quantity (pc)	Unit Price (LE/pc)	Amount (LE)
Installation of Control Board	2	70,000	140,000

(3) Connecting telephone line to the Project Site

	Quantity (line)	Unit Price (LE/line)	Amount (LE)
Connection of Telephone Line	2	5,000	10,000

(4) Outdoor lighting

	Quantity (Lot)	Unit Price	Amount (LE)
Installation of Outdoor Lighting	1	---	300,000

(5) Fence and gate

	Quantity	Unit Price	Amount (LE)
Construction of Fence	800 m	200 LE/m	160,000
Installation of Gate	1 Lot	40,000 LE	40,000

(6) Guard house

	Quantity	Unit Price	Amount (LE)
Construction of Guard House	1 Lot	---	90,000

(7) Water transmission facilities

1) Water transmission mains

Diameter (mm)	Material	Quantity (m)	Unit Price (LE/m)	Amount (LE)
1200	DCI	4,200	1,600	6,720,000
1000	DCI	8,600	1,200	10.320,000
600	DCI	3,550	800	2,840,000
500	DCI	2,000	650	1,300,000
400	PVC	7,000	500	3,500,000
300	PVC	14,200	350	4,970,000
200	PVC	7,500	150	1,125,000
150	PVC	5,000	90	450,000
Total				31,225,000

2) Water reservoir

Capacity (m^3)	Quantity (pc)	Unit Price	Amount (LE)
1,000	1	---	800,000

Therefore, the total cost to be borne by NOPWASD is summarized as follows.

	Item	Amount (LE)
(1)	Reclamation of the Project Site	262,500
(2)	Connecting electric line to the Project Site	600,000
(3)	Connecting telephone line to the Project Site	10,000
(4)	Outdoor lighting	300,000
(5)	Fence and gate	200,000
(6)	Guard house	90,000
(7)	Water transmission facilities	32,025,000
	Total	33,487,500

2. To be borne by SHEGAWASD

Main undertaking by SHEGAWASD is the construction and rehabilitation of water distribution network in Hihya City and 28 village groups. The cost for this work is estimated as follows.

Diameter (mm)	Material	Quantity (m)	Unit Price (LE/m)	Amount (LE)
300	PVC	25,000	350	8,750,000
200	PVC	20,000	150	3,000,000
150	PVC	10,000	90	900,000
100	PVC	7,000	70	4,900,000
Total				17,550,000