

## Summary

In the past, agricultural sector of Egypt has contributed not to employment and amount of production but also acquisition of foreign currency by playing a main role in the economy. The sector accounts for 17.4% out of 89,147.74 million US\$ of the total GDP in 1999, which is placed in the third following to service (51.0%) and mining (31.5%). Egyptian imports of agricultural products such as wheat, vegetable oil, corn and sugar occupy 24% of the total imports (about 4 billion US\$, 1997/98), hence improvement of food self-sufficiency has become the confronting problem of Egypt. From the viewpoint of higher annual increase of population (2.2%, 1980 to 1999) in the recent years, increase of agricultural production has also become an important matter in order to meet domestic demand and to reduce economic disparity between urban and rural areas. Hence, improvement of the irrigation facility is urgently required in Egypt because of deterioration of the existing irrigation facilities and decrease of irrigation efficiency.

In the Upper Egypt, where the project area is, small-scale and self-sufficient agriculture planting mainly sugarcane is managed depending only on irrigation water pumped up from the Nile River. There are 86 pump stations along the Nile River in the Upper Egypt. Of the 86 stations, 45 stations are the floating pump stations. These floating pump stations do not fulfill their function properly due to aged deterioration for more than forty years of operation after installation. To recover their function, 21 floating pump stations had been rehabilitated during the year 1991 to 1993 and 1995 to 1998 entitled the Project for Rehabilitation of Floating Irrigation Pump Stations in Upper Egypt (Phase I and Phase II) under the Japan's Grant Aid. But remaining pump stations still leave unimproved. The five (5) pump stations, those are the subject to this project, have especially declined its function due to deterioration, and cause irrigation water shortage, and hence require urgent replacement and improvement.

The government of Egypt recognized the remarkable benefit of the former Grant Aid Project implemented in two times (Phase I and II), and requested again the government of Japan to carry out the rehabilitation project for the five (5) floating pump stations selected taking into consideration urgency for improvement and higher benefit.

In response to the request from the government of Egypt, Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team from April to May 2002 and discussed with officials concerned to confirm the contents of the request, and visited the site to survey current irrigation conditions and operation and maintenance system of the five (5) pump stations. As a result, the study team confirmed that agricultural sector depending on irrigation water pumped up from the Nile River is the major sector in the Upper Egypt, and also recognized that stable supply of water for farmlands is indispensable for the regional economy and rural life. As for the project area, serious deterioration and declination of the function of the existing pump stations, and necessity for urgent improvement, were also confirmed through the field survey. After the basic design on the request in the home office work in Japan, the Draft Report Explanation Team was dispatched to Egypt to explain and to confirm the contents of the basic design with Egyptian officials concerned.

The object of the project is to supply necessary equipment, pump units for the improvement of five (5) floating pump stations and to supply one barge for O & M of the pump stations in order to improve unstable irrigation

water supply caused by deterioration of the pump stations. Scale and specifications of the Equipment to be supplied were decided based on estimated water requirement in the each beneficial area.

In the Upper Egypt, expansion of farmland is conducted by farmers themselves. Even in the project area, farmlands are newly expanded. However, limited irrigation water is the constraining factor to the farmland expansion. Therefore, these expansion areas were planned to include into the beneficial area of the proposed pump stations in addition to the existing irrigated farmlands provided that Egyptian government would construct necessary irrigation facilities for the expansion area within the completion of this project. Water requirement was estimated based on irrigation hours and irrigation efficiency taking into account characteristics of the beneficial area and farmer's intention, which is mainly composed of sugarcane on current cropping pattern.

The major components of pump stations are composed of floating pump stations, connection pipe, discharge towers, discharge pipes, discharge sump and irrigation canals, and scope of this project is planned to improve floating pump stations, and connection pipes which are used for connecting pump stations and discharge towers. Because of serious deterioration of the five (5) pump stations, all of the existing facilities will be planned to replace to new ones. While, fixed type pump stations, which are constructed beside the three (3) pump stations out of the five (5) pump stations, are not eligible because they are maintained appropriately and functioning. Scale of the proposed floating pump stations was decided based on water volume, which can be calculated by subtracting water supply by fixed type pump station from estimated total irrigation water requirement.

Egyptian side shall implement rehabilitation of the remaining facilities. Implementing agency of the project is MED of MWRI. But construction, rehabilitation and O & M of irrigation canals at the downstream of the discharge sump, will be demarcated to the Irrigation Department of MWRI.

Scale of the facilities and equipments decided based on the basic design are as follows;

#### **Plans for the Rehabilitation of Floating Pump Stations**

| (No) | Pump Stations       | Irrigation Area<br>( feddan ) | Specification of Pumps               |                  |
|------|---------------------|-------------------------------|--------------------------------------|------------------|
|      |                     |                               | Capacity (m <sup>3</sup> /s) x units | Pump Head<br>(m) |
| (22) | Sahel Alakaba Kebli | 300                           | 0.20 x 2                             | 10               |
| (23) | Al Rakikin Sahel    | 150                           | 0.10 x 2                             | 8                |
| (24) | Blowkher            | 2,400                         | 1.00 x 2                             | 11               |
| (25) | El Ghorera          | 2,450                         | 1.45 x 2                             | 12               |
| (26) | El Biadiea El Ollia | 5,100                         | 1.30 x 2                             | 28               |

|                   |            |                                    |
|-------------------|------------|------------------------------------|
| Maintenance Barge | Barge body | 14m(L) x 6.5m(W) x 1.7m(D) x 1ship |
|-------------------|------------|------------------------------------|

The major equipments for each pump stations are as follows;

Inside pump stations   ••• Double suction volute pump, Driving electric motor, Vacuum pump, Sluice valve, Check valve, Control panel, Intake screen flushing pump, Spare articles

Outside pump stations   ••• Barge ( with roof & wall )、 Connection pipe ( including ball joints )

Construction period for the project is estimated as shown below;

| Unit : month                                 |        |
|--|--------|
| Procedures                                   | Period |
| Detail design、 bidding、 procurement contract | 3.5    |
| Manufacturing • procurement                  | 12     |

The total project cost was estimated at 1.635 billion Japanese Yen (share to Japan:0.867 billion Yen, Egypt:0.768 billion Yen)

The project implementation will enable the area including expansion area to be irrigated by stable supply of irrigation water, and contributes to stable agricultural production in the irrigated areas. As a direct benefit, current irrigation area of 7,620 feddans (3,200 ha, 29,860 beneficial persons) will be increased to 10,400 feddans (4,368 ha) by the project, and farm household income will be increased by about 18% (4.44 million LE per year) more than current income in accordance with an increase of irrigation area and increase of agricultural production mainly composed of sugarcane. Likewise, annual O & M cost of the existing five (5) floating pump stations will be decreased from current 1,938 thousand LE (260 LE/feddan) to 1,734 LE (170 LE/feddan), namely, 10% decrease in annual OM cost and 35% decrease in OM cost per feddan based on the calculated O & M cost in the recent three years provided the installation of the proposed scale of pump stations.

As to indirect benefit, increase of employment opportunity to agricultural marketing and processing mainly for sugarcane, would be expected. These benefits will contribute not only to increment of agricultural production and improvement of people living standard in the area but also to national economy in improvement of balance between demand and supply of food. Hence, this project is judged feasible and viable as a Grant Aid Project of Japan.

The existing discharge towers and facilities after towers will be planned to use continuously for the project but improvement and rehabilitation of the facilities necessary to meet with the increment of supply water for further expansion of irrigation area, will be required and be urgently implemented by Egyptian side.

## Table of Contents

|                          |   |
|--------------------------|---|
| Preface                  |   |
| Letter of Transmittal    |   |
| Location Map/Perspective |   |
| Summary                  |   |
| Table of Contents        |   |
| List of Figures & Tables |   |
| Abbreviations            |   |
|                          | Page  |
| <b>Chapter 1</b>         | <b>Background of the Project.....1-1</b>                        |
| <b>Chapter 2</b>         | <b>Contents of the Project .....2-1</b>                         |
| 2-1                      | Basic Concept of the Project .....2-1                           |
| 2-1-1                    | Objectives of the Project .....2-1                              |
| 2-1-2                    | Outline of the Project .....2-1                                 |
| 2-2                      | Basic Design of the Requested Japanese Assistance.....2-2       |
| 2-2-1                    | Design Policy .....2-2  |
| 2-2-1-1                  | Planning Design to Natural Conditions.....2-2                   |
| 2-2-1-2                  | Consideration on Flow Regime of the Nile River.....2-2          |
| 2-2-1-3                  | Social Conditions .....2-3                                      |
| 2-2-1-4                  | Floating Pump and its Specifications.....2-3                    |
| 2-2-1-5                  | Policy for Maintenance Barge.....2-8                            |
| 2-2-1-6                  | Policy on Operation and Maintenance .....2-9                    |
| 2-2-1-7                  | Policy of Subject Equipment and Settings .....2-10              |
| 2-2-2                    | Basic Plan.....2-11   |
| 2-2-2-1                  | Plan of Irrigation .....2-11                                    |
| 2-2-2-2                  | Plan of Pump Stations .....2-17                                 |
| 2-2-2-3                  | Plan of Maintenance Barge .....2-22                             |
| 2-2-2-4                  | Specifications and Quantity of Equipment and Materials.....2-24 |
| 2-2-3                    | Basic Design Drawing.....2-33                                   |
| 2-2-4                    | Implementation Plan.....2-45                                    |
| 2-2-4-1                  | Implementation Policy .....2-45                                 |
| 2-2-4-2                  | Implementation Conditions.....2-45                              |
| 2-2-4-3                  | Scope of Works .....2-45  |
| 2-2-4-4                  | Consultant Supervision .....2-46                                |
| 2-2-4-5                  | Procurement Plan .....2-47                                      |
| 2-2-4-6                  | Implementation Schedule .....2-47                               |

|  |   |            |
|--|---|------------|
| 2-3  | Obligations of Egyptian Government .....    | 2-49       |
| 2-3-1  | General .....                               | 2-49       |
| 2-3-2  | Cost Borne by the Government of Egypt ..... | 2-49       |
| 2-4  | Project Operation Plan .....                | 2-56       |
| 2-4-1  | Staff .....                                 | 2-56       |
| 2-4-2  | Contents of Maintenance Works .....         | 2-56       |
| 2-4-3  | Operation and Maintenance Cost .....        | 2-57       |
| <b>Chapter 3 Project Evaluation and Recommendations.....</b> |   | <b>3-1</b> |
| 3-1  | Project Effects .....                       | 3-1        |
| 3-2  | Recommendations.....                        | 3-2        |

[Appendixes]

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Egyptian Government
4. Minutes of Discussions
5. The List of Data Collected
6. Other Relevant Data and Information

## **List of Figures & Tables**

### **List of Figures**

|  | <u>Page</u> |
|--|-------------|
| Figure 2-2-1(1) Pump Performance and Rated Point .....                               | 2-6         |
| Figure 2-2-4(1) Typical Drawing of Pump Station .....                                | 2-46        |
| Figure 2-3(1) No. 22 Sahel Alakaba Kebli Pump Station Planned Illustration Map ..... | 3-50        |
| Figure 2-3(2) No. 23 Al Rakikin Sahel Pump Station Planned Illustration Map .....    | 3-51        |
| Figure 2-3(3) No. 24 Blowkher Pump Station Planned Illustration Map .....            | 3-52        |
| Figure 2-3(4) No. 25 El Ghorera Pump Station Planned Illustration Map .....          | 3-53        |
| Figure 2-3(5) No. 26 El Biadiea El Ollia Pump Station Planned Illustration Map ..... | 3-54        |

### **List of Tables**

|   |      |
|---|------|
| Table 1 Contents of the Request .....                                     | 1-1  |
| Table 2-2-2(1) Proposed Service Area .....                                | 2-11 |
| Table 2-2-2(2) Proposed Cropping Pattern .....                            | 2-13 |
| Table 2-2-2(3) Consumptive Use of Crops in Upper Egypt .....              | 2-14 |
| Table 2-2-2(4) Proposed Monthly Irrigation Demand .....                   | 2-15 |
| Table 2-2-2(5) Monthly Pump Capacity Required (with Extension Area) ..... | 2-16 |
| Table 2-2-2(6) Standards for Application .....                            | 2-17 |
| Table 2-2-2(7) Specification of Pumps .....                               | 2-18 |
| Table 2-2-2(8) Specification of Motors .....                              | 2-19 |
| Table 2-2-2(9) Calculation Formula for Steel Plate Thickness .....        | 2-21 |
| Table 2-2-2(10) Buoyancy Calculation .....                                | 2-21 |
| Table 2-2-2(11) Size of Barges .....                                      | 2-21 |
| Table 2-2-2(12) Size of Pump House and main Frame .....                   | 2-21 |
| Table 2-2-2(13) Specifications for Planned Pump and Motor .....           | 2-22 |
| Table 2-2-2(14) Standards for Application .....                           | 2-22 |
| Table 2-2-2(15) Calculation Formula for Steel Plate Thickness .....       | 2-23 |
| Table 2-2-2(16) Buoyancy Calculation .....                                | 2-23 |
| Table 2-2-2(17) Size of Barge .....                                       | 2-23 |
| Table 2-2-2(18) Size of House and Main Frame .....                        | 2-23 |
| Table 2-2-2(19) Specification and Quantity of Pump Stations .....         | 2-24 |

|                   |   |      |
|-------------------|---|------|
| Table 2-2-2(21-1) | Specification of Proposed Pump Stations<br>(No.22 Sahel Alakaba Kebli)..... | 2-25 |
| Table 2-2-2(21-2) | Specification of Proposed Pump Stations<br>(No.23 Al Rakikin Sahel) .....   | 2-26 |
| Table 2-2-2(21-3) | Specification of Proposed Pump Stations<br>(No.24 Blowkher) .....           | 2-27 |
| Table 2-2-2(21-4) | Specification of Proposed Pump Stations<br>(No.25 El Ghorera) .....         | 2-28 |
| Table 2-2-2(21-5) | Specification of Proposed Pump Stations<br>(No.26 El Biadica El Ollia)..... | 2-29 |
| Table 2-2-2(22)   | Specification of Proposed Maintenance Barge .....                           | 2-30 |
| Table 2-2-2(23-1) | Equipment and Tools for Maintenance Barge (1/3).....                        | 2-31 |
| Table 2-2-2(23-2) | Equipment and Tools for Maintenance Barge (2/3).....                        | 2-32 |
| Table 2-2-2(23-3) | Equipment and Tools for Maintenance Barge (3/3).....                        | 2-33 |
| Table 2-2-4(1)    | Implementation Schedule.....  | 2-48 |
| Table 2-3         | List of Necessary Measures at the Site Borne by Egyptian Country .....      | 2-55 |
| Table 2-4(1)      | Annual Operation and Maintenance Cost of Pump Stations.....                 | 2-57 |
| Table 2-4(2)      | Annual Operation and Maintenance Cost of Maintenance Barge.....             | 2-57 |

## Abbreviations

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

### Units

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

### Currency

|          |                                  |
|----------|----------------------------------|
| LE       | Egyptian Pond                    |
| Pt       | Egyptian Piaster (1 LE = 100 Pt) |
| Yen or ¥ | Japanese Yen                     |
| US\$     | US Dollar                        |

### Exchange Rate ( August 2002 )

|      |            |
|------|------------|
| LE   | = ¥28.20   |
| LE   | = US\$4.68 |
| US\$ | = ¥122.00  |

### Glossary

|       |  |
|-------|--|
| Sakia | Water wheel to lift water by animal to field ditch from lateral canal  |
| Aldap | Weight unit for agricultural products (differing by products)<br>1 ardap = wheat(150kg), beans(155kg), maize(140kg), sesame(120kg) |
| Meska | Small irrigation field canal constructed by the farmers themselves   |