



NATIONAL WATER RESEARCH CENTER (NWRC)  
WATER MANAGEMENT RESEARCH INSTITUTE (WMRI)  
EGYPT

# DESIGNING LOCAL FRAMEWORK FOR INTEGRATED WATER RESOURCES MANAGEMENT

## PROJECT TECHNICAL REPORT (1)

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**Designing Local Framework for Integrated Water  
Resources Management Project  
1<sup>st</sup> Technical Report**

**EGYPT CHAPTER  
TEAM WORK**

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## EXECUTIVE SUMMARY

In general, imbalanced water distribution, may cause water shortage, may occasionally cause arguments or conflicts among water users and/or WUAs, and between water users and governmental organization that implemented the improvement project. Irrigation Improvement Projects started in Egypt from 1977. Over the past 35 years, many efforts done with contribution of national and international aid agencies that have participated in the projects. Reviewing those efforts is essential in order to make clear future of the limited water resources of the country. Details survey for Dakalt canal is one of the keys for deep understanding the real field conditions including farmers' behaviours, cooperation and actions for better water management. Field data is including water distribution at branch canal, meska and pump operation hours. Data collection started from January 2012 including designing and testing socio-economic questionnaire. Summer season of Egypt is the most critical season, which start from May to October. Therefore, we expect intensive fieldwork will start soon in order to analyse the actual situation of the problems.

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# 1. INTRODUCTION

## 1.1. Background

Egyptian agriculture accounts for approximately 85% of the total limited water resources (MWRI, 2005). Therefore, optimum utilization by improving the irrigation system is urgent to meet food security of the country. The Ministry of Water Resources and Irrigation (MWRI) in Egypt initiated a number of development projects to mitigate wastage of its limited water. For example, Egypt Water Use Research Project (1977-1984) aimed to improve agriculture and water management programs (EWUP, 1984). World Bank (WB) launched the Irrigation Improvement Project (IIP) in a total area of 105,000 ha in Mahmoudia, Wasat, and Manaifa areas in 1993. The main objectives of the IIP are to improve irrigation infrastructure, water-distribution systems, and on-farm irrigation management. Hereafter, the WB and MWRI initiated the Integrated Irrigation Improvement and Management Project (IIIMP) in 2004 in order to increase irrigation efficiency and agricultural productivity as well as improve drainage and groundwater management. The entire project area has divided into different command areas. The total target area under the IIIMP is 210,000 ha, and this area is located in lower, middle, and upper Egypt (MWRI, 2005).

Performance assessment is an essential component of effective irrigation management. The IIP attempted to correct inequitable water distribution and water supply shortage at tertiary canals. Technical tests indicated that the construction of lined canals and buried pipes considerably increases conveyance efficiency. In addition, the replacement of individual pumping units with a centrally operated pumping system, which managed by the users themselves through water user associations, improves irrigation efficiency. The shift from individual to collective pumping has reduced operational costs by one-third (Elshorbagy,

2000; FAO, 2005; ElKassar, 2007; WMRI, 2008). Egypt has adopted a water policy that involves cost sharing by establishing water boards and promoting management at the tertiary canal level. Water users themselves perform operational and maintenance works, and this trend toward user-driven management is a major step forward in institutional reform. About 85– 90% of the construction cost was spent at the farm (tertiary canal) level for the improvement of infrastructure, including equipment (pump sets and gates), whereas 10–15% was spent on the main canals (MERI and WMRI, 2005). The entire construction cost expected to recover from the beneficiaries.

Since the IIP has reduced operational costs, farmers' profits expected to increase. Nevertheless, recovering the construction cost remains quite a challenge because the potential gains from the IIP vary among farmers, depending on the location of their farms along the irrigation canal (head, middle, or tail). For example, field data have shown that in summer, water for rice irrigation is provided on a rotation basis (4/6 rotation; 4 'on' days and 6 'off' days); however, even during the 'off' periods, irrigation is carried out at some locations, usually upstream of branch canal, whenever water is available (McDonald, 1988; Oad and Qzim, 2002). The main concern of this study is that most farmers irrigate more frequently than scheduled, but water supply is insufficient and unequally distributed. Some farmers irrigate their fields twice as often as others do and some fields receive more than 4 times of applied depth to other fields for the same rice variety (Depeweg and Bekheit, 1997). This inequitable distribution of water prior to the beginning of the IIP may have led to concerns among individual farmers regarding their share of potential benefits (Wichelns, 1999). Therefore, the main objective of this study is to find out the essential conditions or requisites for framework of local water management.

This will be through answering the research questions, which are:

- ✓ What is the *desirable/effective management* of water?
- ✓ How can we *evaluate appropriateness* of irrigation?
- ✓ What is *convivial cooperation* for effective water management?
- ✓ How can we establish, share and take over the *wisdom/information of land and water management*?

## **1.2. Scope of the study of Egyptian Chapter**

The scope of the activities under the current contract summarized as follows:

- ✓ Cooperation in Water Management in Egypt is the core of the study.
- ✓ Long history of development of cooperation of farmers; from the ancient Pharaohic Era to the present through the modernization period; cooperation/competition among farmers, between king/nation and farmers.
- ✓ **Two major topics:**
  - History of role of the super/upper structure (Pharaoh/King and National Government) and farmers, and actual field condition of soil, water and crop; From the Ancient to the present age until the construction of the High Dam.
  - Actual impacts of participation or cooperation of farmers on effective water management of district level after the construction of the High Dam with stable water supply.

## **METHODOLOGY**

This chapter presents the methodology and research questions/topics in the Dakalt District for the Sub-subject B of the Egyptian Chapter of the RIHN Project C-09. In addition, it describes selected sites, how the data collected, how it analyzed, and the steps to calculate each indicator.

### **2.1. Present actual observed problems**

In Dakalt district, the IIP was implemented, where water saving must be one of main objectives. Then, we can ask whether the water saving in the whole district realized or not, and to which extent? In addition, we can ask equity of water distribution is improved or not, and to which extent?

We should ask the reason for the actual changes in the situation. We need to review the function of mesqa-level WUAs and District-level WUA, and role and function of governmental organizations. One of key questions is to be why the canal could not shifted from rotational flow system to continuous flow system.

### **2.2. Research Activities in the JFY 2012-2013**

Taking into account the objectives of the case study in the project and limitation of time and budget in this Japanese Fiscal Year 2012-2013, which closes at the end of March 2013, research schedule is planned as follows, while the following schedule includes some activities for the whole Sub-subject B.

Research Schedule of the Japanese Fiscal Year 2012-2013 (specific to for the Dakalt District)

- 1) Collection of references.
- 2) Initial analysis of the development of irrigation improvement.
- 3) Selection of case study areas, including the Dakalt Canal District and another supplementary district.
- 4) Overview of the case areas.
- 5) Making plan of detailed field survey
- 6) Field survey about land and water management system in the Dakalt District.
- 7) Field survey about actual management performances in the Dakalt District.
- 8) Making research plan and schedule of the Japanese Fiscal Year 2013-2014

For the item 7), field observations about water distribution in the district are carried out. The observations include intake to and discharge of the Dakalt Canal, diversion/pump lifting

volume to upstream and downstream sample mesqas, and water allocation inside sample mesqas with soil and water condition if sample farmlands.

Some major indices of water quality, including EC, TDS, PH, etc., and shallow groundwater level measured at some suitable points. For the item 6), field studies including interviews with relevant people including farmers, WUS and GO are planned in details, in which the Japanese members will join. All details are to be discussed and finalized according to progress of preparatory study in each stage.



Fig. (1): Setup survey and first workshop of the project in Egypt

### 2.3. General information about Dakalt Canal

Establishment date of the BCWUA	25 September, 2010
Main Canal (water source)	Meet Yazied Canal (MY)
Total served area	2310 hectar
Length of the irrigation canal	11.3 km
Location of the intake	41 km RMY
Irrigation system	Rotation-Surface Irrigation
Drainage system	Open and subsurface systems
No. of Mesqas (sub-branch canal)	22
Main villages	Dakalt, El wezaria, Abo raya
Total No of Users	4050
Population	21300
Schools No.	12
Mosques No.	30
Agriculture associations names	Eslah Dakalt, Eslah Edryga, Elwezaria, Abo raya and El sabet
Health units	3
Government Divisions	(2) Kafr El Sheikh and El Ryiad
Main boundaries	South: Meet Yazied Canal North: El Hamoul –El Ryiad Road East: Drain NO 7 + international road West: Dail El Kased canal + Drain NO 4
No of members of representative committees	48 member (40 from agriculture societies+ 8 from housing units)

**Table (2. 1): Main Information's for Dakalt**

### 2.5. Fieldwork Plan for the Sub-subject B of the RIHN Project C-09

The fieldwork will run at different levels (Branch canal, Meska and on-farm). In order to complete the full picture of the management problems, RIHN-JSPS project will focus deeply as well as coordinate with the current activities of WMRI as follows:

#### a) Work Plan at the Branch Canal Level:

Currently, Water Management Research Institute (WMRI) collecting water level data for Dakalt Canal (every one hour). Therefore, WMRI installed the following 5 Water Level sensors at Dakalt Canal:

- 1- Two water level sensors at the upstream and downstream of the Daklat Canal intake,
- 2- One water level sensor at 0.150 km from the intake,
- 3- One water level sensor at Helal regulator (5.600 km) and
- 4- One water level sensor at the tail end of Dakalt Canal.

RIHN-JSPS project added other 1 water level-EC sensors to continue monitor water level and salinity data every 1 hour at the tail end of Dakalt Canal. Other activities is needed next year to have a full picture of water distribution at the branch canal level.

**b) Work Plan at the Meska Level:**

In order to evaluate the equity of water distribution along the branch canal, three mesqas, allocated at head, middle and tail end selected for the current study (**Table 2.2**) as follows:

1- As an example of the head location, **Southern Edrega meska (S. Edrega)** is recommended. S. Edrega is allocated on the right hand of the canal at 1.490 km from the intake and consist of 2 pump stations (A and B) at 0.650 and 1.233 km from the meska intake, respectively. The total served area for S. Edrega A and B are 27.1 and 45.57 ha, respectively. S. Edrega also have different pumping discharge unites (60 and 90 liter per second) as well as different options of power supply (diesel and electricity).

2- As an example of the middle location, **Eltayara meska (Tayara)** is recommended. Tayara is allocated on the right hand of the canal at 4.860 km from the intake and consist of 2 pump stations (A and B) at 0.260 and 0.500 km from the meska intake, respectively. The total served area for Tayara A and B are 29.4 and 41.2 ha, respectively. Tayara also have different options of power supply (diesel and electricity).

3- As an example of the tail end location, **Shams El Deen and Abu Zahra meska (Shams)** is recommended. Shams is allocated on the left hand of the canal at 8.260 km from the intake and consist of 1 pump station at 0.100 km from the meska intake. The total served area is 35.3 ha. Shams also have different pumping discharge unites (60 and 90 liter per second) as well as different options of power supply (diesel and electricity).

4- In general, Dakalt canal have 13 direct pump stations distributed along the canal. Therefore, we would like to study the difference between the direct pumping from the branch canal and Meska system. If we would like to study, we plan to monitor the following stations:

4-1) Direct Station No.3 (DS. 3) allocated on the right hand of the canal at 6.275 km from the intake. The total served area is 15.6 ha. DS.3 also have different options of power supply (diesel and electricity).

4-2) Direct Station No.13 (DS. 13) allocated on the left hand of the canal at 11.175 km from the intake. The total served area is 11.3 ha. During our visit in July 2012, we found the farmers are using agriculture drainage (subsurface drainage manhole) water for irrigation.

**Table (2. 2): Description of the selected meskas**

No	Meska Name	Location (km)	Bank side	Served area		Meska length (km)	Improve ment Type	Marwa Length (m)	No. of out lets on the Meska	No. of pumping units		note
				Fed	K					60	90	
1	Edrega S A	1.490	Right	64	12	0.650	Pipe	731	7	1	1	electricity
2	Edrega S B	1.490	Right	108	12	1.233	J-section	1554	11	2	1	electricity
3	Direct 3	3.730	Left	46	13	0.00	Pipe	545	5	2	0	electricity
4	Tayara A	4.860	Right	70	0	0.260	J-section	1272	8	3	0	
5	Tayara B	4.860	Right	98	0	0.500	Pipe	862	11	3	0	electricity
6	Shams El Deen	8.260	Left	84	2	0.100	Left	710	11	3	1	electricity
7	Direct 13	11.175	Left	26	20	0.00	Left	282	3	2	0	

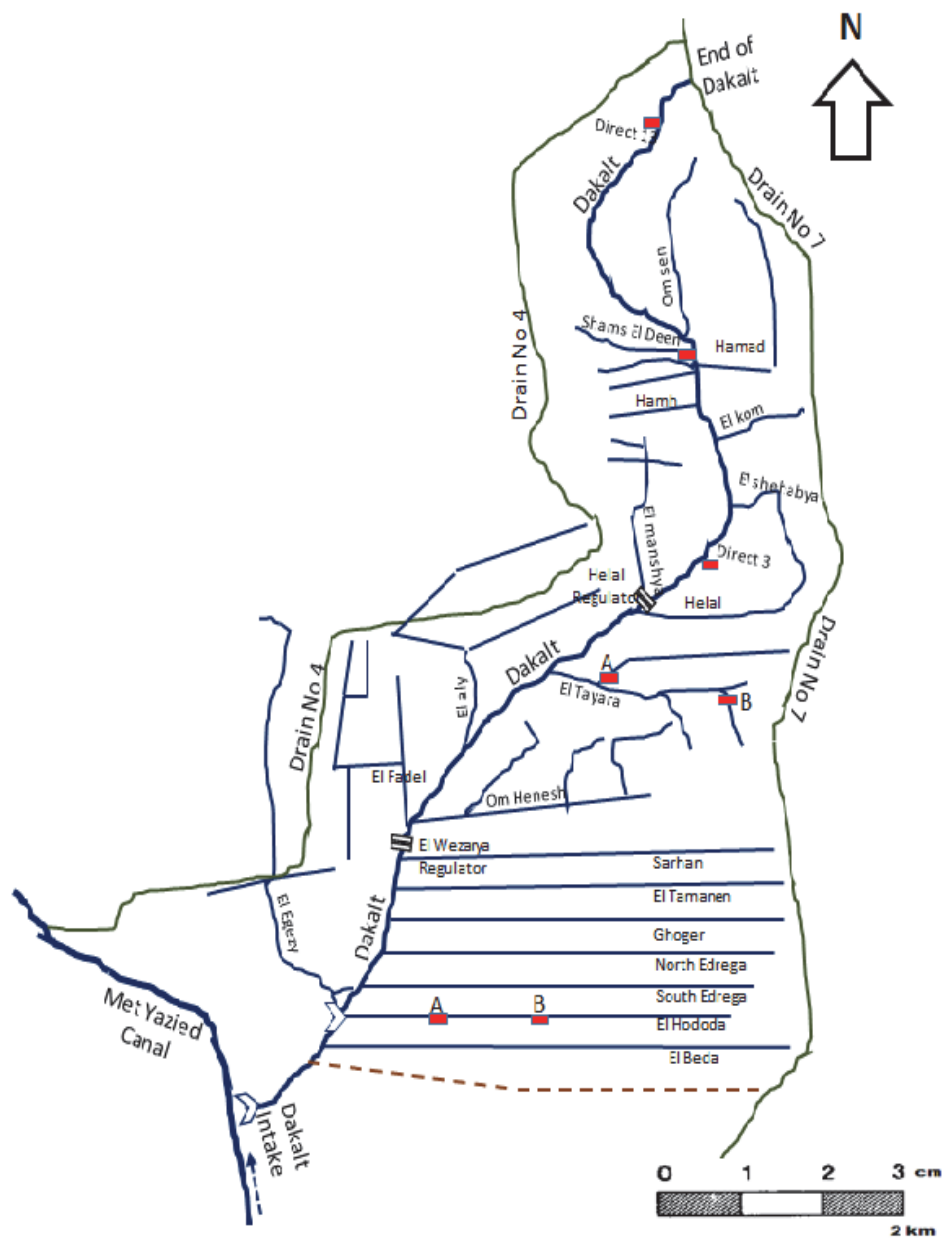


Fig. (2): Dakalt map and selcted meskas

**Required Meska level data:**

Pump operation hours using thermo-managers. Through this figure, we can estimate irrigation time (day or night irrigation time) and rotation system among the Meska farmers. Pump flow rate is needed to estimate next year. Through this figure, we can estimate the flow rate of each pump unit after 15 years of the construction (starting date of IIP project in the area). In addition, we can calculate the amount of water applied from each pump.

**C) Work Plan at the on-farm Level:**

- 1- Groundwater fluctuation using observation wells (once per week).
- 2- Groundwater salinity and pH using portable EC and pH meters (once per week).
- 3- Ground water level and EC will distributed in the farm levels based on the structure of each field.

**D) Work Plan for socio-economic studies:**

In order to understand the full picture of the water management, 2 kind of socio-economic survey is needed (focus group and questioners). The details of this study provided from Egyptian side.

### 3. STUDY OUTPUTS

This chapter presented the results regarding all indicators and presented as follows:

#### 3.1. Review of Irrigation Improvement Projects in Egypt (1977-2012)

Review 35 years of irrigation improvement strategies in Egypt is an effective tool to point out the main constrains facing achievements of its goals. Egypt start its strategy from 1977 through research project, EWUP, and during construction at the large scale monitoring and evaluation done. Therefore, the main question of the importance of improvement from decision makers as well as farmers appearing from time to time. To understand the each project, same conclusion form designed for all projects as follows:

**Table (3. 1): General outlines for EWUP Project**

Project Name:	Egypt Water Use & Management Project (EWUP)
Duration:	(6 Years) 1977-1984
Donors & Organizations:	Joint Funded Project (Egypt - USAID)
Study areas:	El-Minya, Giza and Kafr El Sheikh Governorates, Egypt
Objectives:	<ul style="list-style-type: none"> <li>- Identify the major constraints to improve on-farm water management and optimal water delivery system operations.</li> <li>- Determine and establish the use of optimal irrigation practices at the farm level in the representative pilot areas.</li> <li>- Establish improved water control practices for the farm water delivery systems and farm drainage systems in project areas.</li> <li>- Develop plans for organization and implementation of expanded future programs based on results obtained from project areas.</li> <li>- Develop and/or train qualified professionals and technicians for the conduct of project activities.</li> </ul>
Problems:	<ul style="list-style-type: none"> <li>-The ancient system of basin irrigation and cultivation of one crop per year, which prevailed since the dawn of civilization, has superseded by perennial irrigation. Due to the construction of many control structures, including the High Aswan Dam, water at that time was available for year round crop cultivation.</li> <li>-Management of the delivery and drainage systems has become more difficult under conditions of year-round irrigation and changes in crop patterns. The challenge is to minimize or solve these problems while fully exploiting the opportunities for the benefit of the nation.</li> </ul>
Methodology:	<ul style="list-style-type: none"> <li>- EWUP' efforts had concentrated at the farm level and the lower portions of the delivery system, starting with the distributaries canals.</li> <li>- The project has restricted its efforts to the "Old Lands" of the Nile Valley and Delta, where irrigation systems had established for 100 years or more.</li> </ul>
Institutional Framework and Famers Behaviors:	Determining ways in which improved water management can contribute to improving the economic well-being of the small farmers of Egypt. The project work had sought means for :

	<p>a-Increasing water use efficiency,  b-Increasing the farmers returns per unit of water applied, and  c-Saving water for the horizontal expansion of the irrigated area into “New Lands” being reclaimed from the desert.</p>
Achievements:	<p>According to the projects' results, the Ministry of Water Resources &amp; Irrigation (MWRI) has started a national program for improving irrigation management in the old areas located within the Valley and the Delta. This national program constitutes a well-identified framework including the major project requirements and specific components for implementing improvement of the system management covering an area of 1.47 M ha by year 2017.</p>
Remarks:	<p>EWUP has provided experience and a knowledge base, which been used to formulate plans for expanded irrigation improvement programs in Egypt.</p>

**Table (3. 2): General outlines for RIIP Project**

Project Name:	Regional Irrigation Improvement Program (RIIP)
Duration:	(1985- 1989 Egypt, feasibility study) (1991-1994, implementation of the modernization)
Donors & Organizations:	Notional Program and USAID
Study areas:	Gharbia, Menya, Kafr El Sheikh, Behira, Sharkia, Bani Sweif, Qena Governorates (Beni Ebeid area is located in the western part of Menya Governorate in Middle Egypt (44520 ha).
Objectives:	<ul style="list-style-type: none"> <li>- Improve agricultural productivity in old lands,</li> <li>- Reduce water use in old lands,</li> <li>- Involvement of users in irrigation management.</li> </ul>
Problems:	<p>In order to face the water limitation of Egypt and based on the activities of the EWUP included problem identification, evaluation of alternative solutions for technical and socio-economic feasibility, and demonstration solutions to improve the social and economic livelihood of Egyptian farmers through improved irrigation water use and management and related agro-economic practices. In 1985, the government of Egypt began a national program to improve the existing irrigation system in the old lands. A project called Regional Irrigation Improvement Program (RIIP) established within the MWRI according to the ministerial decree issued in 1984 based on EWUP recommendations.</p>
Methodology:	<p>The system modernization process of the RIIP had two main components:</p> <ul style="list-style-type: none"> <li>a) Physical changes and,</li> <li>b) organizational reform.</li> </ul>
Institutional Framework and Famers Behaviors:	<p><b>The physical changes included:</b></p> <ul style="list-style-type: none"> <li>a) Changing the operation of secondary system from rotational to continuous flow,</li> <li>b) Rebuilding of existing tertiary canals (Mesqas), and</li> <li>c) Replacing individual pumps by collective pumping.</li> </ul> <p><b>The Organizational changes included:</b></p> <ul style="list-style-type: none"> <li>a) establishment of Water User Associations (WUAs) and</li> </ul>

	b) Creation of an Irrigation Advisory Service.
Achievements:	<p>1- The modernized process, through implementing the full package of the IIP, can be considered as revolutionary changes in the irrigation system in Egypt. This process can achieve many benefits to the nation as well as individuals. The process could transfer of the water management aspects to water users and thus privatization of water services.</p> <p>2- One gap could be mentioned here that related to the timing of the improvement of the main delivery system.</p> <p>3- It is quite a long period (7 years), the modernized process in Beni Ebied is working. Consequently, lots of information is available concerning different activities. This could help carry out an evaluation and deduce some lessons to use in setting a vision for overcoming problems of this process.</p>
Remarks:	<p><b>Lessons can be learned:</b></p> <p>a) Rate of implementation should be faster than that conducted in the process. This could be achieved through establishing WUAs and conducting training prior to implementation.</p> <p>b) Cost of improvements is still high and needs to be reduced. This could be achieved through developing private sector expertise to conduct design and construction.</p> <p>c) Continuous training is needed to maintain a certain level of educated staff, particularly for IAS, to support the process operation.</p> <p>d) Establishing canal federations to participate in the branch canal operation.</p> <p>e) Establish specific monitoring programs for water quantities, quality, and crop production before the implementation of the process. This baseline data could be very useful in assessing project impacts after implementation.</p> <p>f) Improvement of the main system should start prior to improvement of the tertiary level to ensure implementing the continuous flow.</p>

**Table (3. 3): General outlines for IIP-1 Project**

Project Name:	Irrigation Improvement Project-1 (IIP-1)
Duration:	(Years) 1994-2006
Donors & Organizations:	WB/KfW/IDA (International Development Association)
Study areas:	El-Behira and Kafr El Sheikh Governorates
Objectives:	<p>The main objectives of the irrigation improvement project listed in the following points:</p> <ul style="list-style-type: none"> <li>• Increase the agricultural production and the farm income by improving the irrigation infrastructure, a more equitable distribution of water, and improving on-farm water management.</li> <li>• Improve the long-term sustainability of irrigation through the assumption of responsibility for operation and maintenance at the tertiary level by farmers, cost sharing arrangement for tertiary level investment costs.</li> <li>• Strengthen the institutional planning and implementation capacity of MWRI within the irrigation Sector.</li> </ul>
Problems:	<p>1- The most pressing problems confronting the irrigation system are the limited control provided by canal structures, many of which are only partially functional, inadequate systems operations, and inequitable distribution of water at the tertiary level with 70 percent of farmers at the tail ends receiving very little water. With assistance from USAID, MWRI has undertaken to address these problems through the rehabilitation or replacement of deteriorated structures throughout the canal system.</p> <p>2- Crop yields and environmental conditions in the three sub-project areas are generally low relative to national levels. In farms located at the upstream parts of main canals and tertiaries (Meskas), yields levels are not at their highest potential.</p> <p>3- There were considerable losses through tail escapes and some over irrigation occurs. The main canals operated under continuous flow and upstream control. The secondary and tertiary canals operated on a seasonally adjusted rotation schedule.</p>
Methodology:	<ul style="list-style-type: none"> <li>• Rehabilitation of water control structures,</li> <li>• Single point pumping at Mesqa level, and</li> <li>• Subsurface Mesqa pipelines.</li> </ul>
Institutional Framework and Farmers Behaviors:	<p>1- Increased agricultural production and farmers' income. Measured by the value of their farming net revenues, 2-Farmers Organizations WUAs taking full responsibility for O&amp;M of tertiary systems (Meskas) under sustainable basis on project-improved area, 3-Strengthen MWRI's capacity in the Irrigation subsector. Measured by the Cost Recovery of O&amp;M costs at Tertiary level.</p>
Achievements:	<p>1- Improvement of main and secondary canal delivery system, 2-concrete lining and slope stabilization, using stone masonry and pitching in the unstable portions covering, 3- Improvement of Tertiary System, 4- Establishment of irrigation advisory service (IAS) &amp; Institutional Support, 5- Environmental Assessment and Management, and 6- On-farm Irrigation Management Demonstration Program.</p>

Remarks:	
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**Table (3. 4): General outlines for W10 Project**

Project Name:	Irrigation Improvement Project (W10 Test Area)
Duration:	2004-2006
Donors & Organizations:	WB, KFW
Study areas:	At the tail end reach of Meet Yazid canal (W10-area), Kafr El Sheikh (Safan, Sefsafa, Masharka, Eliwa right and left sides, Direct Meet Yazied, Sidi salem canals).
Objectives:	A command area selected as pilot to test the effect of several recommended technical and managerial changes.
Problems:	As the cost of improvement works increased and reached L.E 6,000 (about 1000 US\$, 2012) per feddan (4200 m <sup>2</sup> ), a new design criteria was taken into consideration.
Methodology:	Test the effect of several recommended technical and managerial changes on: The application of the continuous flow, irrigation cost & time, agricultural productivity, and farmer's income with a main objective of decreasing the cost of irrigation improvement per feddan. These changes include using automated sluice gates regulators instead of DS control regulators, smaller pipe diameters & pump capacity, more pump operation time per day, marwas improvement and using electric pumps instead of diesel pumps.
Institutional Framework and Famers Behaviors:	-Participation of the WUAs in the planning preliminary design process, and - Training given in the different fields (design, implementation, irrigation advisory services...etc...).
Achievements:	1- using automated sluice gates regulators, 2- more pump operation time per day due to use more smaller pump discharge, 3- using electric pumps, and 4- marwas improvement
Remarks:	It intended to adopt those mentioned changes related to delivery, mesqa and marwa, design, control and operation in IIP2 and the IIIMP project.

**Table (3. 5): General outlines for IIP-2 Project**

Project Name:	Irrigation Improvement Project (IIP-2)
Duration:	(6Years) 2006-2012
Donors & Organizations:	WB/KfW
Study areas:	El-Behira Governorate
Objectives:	-To complete and extend irrigation improvements across a further 17640 hectar. - To identify the possible application of electricity at the Mesqa pump stations level.
Problems:	- Same as IIP1
Methodology:	<ul style="list-style-type: none"> <li>• Rehabilitation of water control structures,</li> <li>• Single point pumping at Mesqa level, and</li> <li>• Subsurface Mesqa pipelines.</li> <li>• Electrification of Mesqa pump stations</li> </ul> <div style="display: inline-block; vertical-align: middle; margin-left: 20px;"> <span style="font-size: 2em;">}</span> IIP         <span style="font-size: 2em; margin-left: 10px;">}</span> IIP       </div>
Institutional Framework and Famers Behaviors:	BCWUA & WUA (Meska)
Achievements:	-Extension of improvement package to whole system (including tertiary and on-farm improvements). -provide new and cheaper equipments.
Remarks:	<p><b>Lessons learned from past operations in the country/sector:</b></p> <p>(a) Given the relatively slow implementation of small civil contracts in irrigation and drainage situated on farms with small-irrigated areas and the extensive, need for detailed coordination between implementing agencies. Contractor and beneficiary farmers and current experience on the IIP and the NDPs the implementation period has considered these circumstances and allowed for an implementation period of six years from effectiveness. (b) Previous projects in the irrigation and drainage sector have encountered considerable delays between Board approval and Effectiveness. The concerted efforts of the MWRI, Irrigation Improvement Sector, Ministry of Foreign Affairs, and the Bank must be mobilized early in the post Board clearance cycle to ensure an accelerated process is in place between Board approval and Loan effectiveness. (c) While the first Bank group funded Irrigation Improvement Project has contributed considerably to the institutional support for the Irrigation Improvement (IIP) Sector, further assistance will continue to be required under the proposed project, the nature of which will defined during project preparation. (d) The participatory water management approach followed in the IIP at the tertiary canal level will expanded to cover the project area to increase beneficiary involvement in O&amp;M management and costs and enhance system sustainability. It expanded to the secondary canal level and closely coordinated with Drainage Collector Users Associations where they exist through Water Boards in selected areas. (e) Water quality is an integral part of water management in Egypt.</p>

	This issue will be addressed by the grant under the project.
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**Table (3. 6): General outlines for IIIMP Project**

Project Name:	Integrated Irrigation Improvement and Management Project (IIIMP)
Duration:	(7 Years) 2007-2014
Donors & Organizations:	World Bank, KFW
Study areas:	Mahmoudia and the Mit Yazeed Main Canals. The project areas are Governorates of Alexandria, Beheira, Kafr El Sheikh and Gharbia.
Objectives:	<p><b>With an objective of completing what had been begun in IIP:</b></p> <p>(a) Develop a framework for integrated water management plan and program in selected areas, combining water quantity and quality management through inter-agency and stakeholder consensus;</p> <p>(b) Improve institutional, financial, and environmental sustainability of water services through intensive user and private sector participation in the investment, and operation and maintenance at the district/branch canal levels and below and improved water quality management practices; and (c) Increase farm incomes through improved agricultural production based on efficient and sustainable use and management of water and land resources.</p>
Problems:	<ul style="list-style-type: none"> <li>- Egypt has a per capita availability of renewable fresh water resources of 950 cum per capita and water availability per capita will further decline to 650 cum by year 2017. Thus, Egypt has to focus on sound water resources management principles and practice, and faces critical challenges in the water sector.</li> <li>- New sources of water are limited, and thus the country faces the compelling challenge of improving the productivity and sustainability of water use rather than increasing supply.</li> <li>- There is growing competition for water from urban and industrial users, as well as environmental needs, exerting serious pressures on the use of water in irrigated agriculture.</li> </ul>
Methodology:	<ul style="list-style-type: none"> <li>• Rehabilitation of water control structures,</li> <li>• Single point pumping at Mesqa level, and Subsurface Mesqa pipelines. } IIP</li> <li>• Electrification of Mesqa pump stations,</li> <li>• Subsurface Marwa pipelines,</li> <li>• Subsurface drainage,</li> <li>• Branch Canal Water User’s Associations (BCWUAs),</li> <li>• District Water Board (DWBs),</li> <li>• Integrated Water Management District (IWMD),</li> <li>• Volumetric water supply to branch canals,</li> <li>• User participation in branch canal water distribution } IIP</li> </ul> <p style="text-align: right;">} IIIM</p> <p><b>The following are the details components of the project:</b></p> <p>(a) Preparation and implementation of integrated water management plans in selected command areas. This component would include support for irrigation, drainage, pumping stations and groundwater sub-sectors of the MWRI, for piloting integrated plans and coordinated implementation arrangements for the project areas</p>

	<p>including technical assistance and training and supply of equipments.</p> <p>(b) Support for the establishment, expansion, and up scaling of WUAs and the proposed Water Boards in line with Government policy of integrated water management; (c) Rehabilitation and Improvement of irrigation and drainage infrastructure. This component include the implementation of a second slice of the Irrigation Improvement Project (IIP) in addition to improvement and rehabilitation of any bottlenecks in the major canals, branch canals, tertiary systems, drains, pumping stations, implementation of new and rehabilitation of existing sub-surface field drainage systems, their subsurface collectors and open drains, covering a total area of about 500,000 feddans; (d) Environmental Management Plan, It sought to address environmental assessment and mitigation measures focusing on water quality for integrated irrigation and drainage in the three regional project areas that have distinctive ecological systems, and would build on site-specific pilots under the ongoing IIP, NDPII, and Pump III projects. This component would fully developed during project preparation; (e) On-Farm Demonstration Program. The project would support the establishment of about 50 on-farm demonstrations spread over the five project areas during the five years of project implementation to demonstrate proven technologies for improved water use.</p>
<p>Institutional Framework and Famers Behaviors:</p>	<p><b>The IIIMP comprises the following five components:</b></p> <p>1- Improved and Integrated Water Management is the component that includes all the improvement works on the water infrastructures.</p> <p>2- Improvement of On-Farm Water Management. This includes activities and measures to increase on-farm water productivity.</p> <p>3-Institutional Development and Capacity Building This covers the establishment and strengthening of water user organizations and Integrated Water Management Districts and Directorates.</p> <p>4-Project Management, Coordination and Integration. The PMU, RCUs and monitoring systems are set up under this component.</p> <p>5- Environmental Mainstreaming focuses on the improvement of environmental conditions within the project areas.</p>
<p>Achievements:</p>	<p>Egypt water requirements about 87.7 BCM by 2017. Additional water needed is to be met partly by: water released through improvements in efficiency in irrigation (4 BCM from 3.5 M. feddans under irrigation improvement); increase in the reuse of drainage water and treated wastewater (over 10 BCM); optimal groundwater use; improved water harvesting; and changes in cropping pattern (resulting in savings of 3 BCM). The 2017 Policy also acknowledges the need for user participation in sharing the burden of capital and O&amp;M costs, as well as action with regard to water quality improvements.</p>
<p>Remarks:</p>	

Project website: <http://iiimp-eg.org/index.html>

**Table (3. 7): General outlines of Water Management Improvement in the Nile Delta (Project-I)**

Project Name:	The Water Management Improvement in the Nile Delta (Project-I)
Duration:	(7 Years) 2000-2005 + 2005-2007 (extension 2 years)
Donors & Organizations:	JICA
Study areas:	Bahr El Nour, Bahr Terra, Biyla, Kafr El Sheikh
Objectives:	Improved methods for the efficient and effective implementation of the IIP disseminated in the Nile Delta, accompanied by an increase of agricultural productivity and the farmers' net income.
Problems:	Ministry of Water Resources and Irrigation (MWRI) has conducted the Irrigation Improvement Project (IIP) for the purpose of efficient water resources and increasing of agricultural productivity. JICA has cooperated to formulate a master plan and a feasibility study called “the Development Study for the Improvement of Irrigation Water Management and Environment; Conservation in the North-East Region of the Central Nile Delta. Upon examining the results of the mentioned study, the government made a request to the Japanese government for a technical cooperation project. The purpose is the improvement of the IIP methods through the implementation of the pilot project with farmers' participation and enhancement of the engineers' capability required for the implementation of the IIP in the above mentioned feasibility study area.
Methodology:	1. Improvement of irrigation facilities. 2. Farmers' Water Management Organization (WUA & WUF).
Institutional Framework and Farmers Behaviors:	According to the questionnaire survey to farmers conducted in 2006, 92% of respondents consider that their WUAs are functioning well in terms of water management at mesqa levels. The main reasons include the WUAs' roles for problem solving, arrangement of irrigation water and fair water distribution. From these results, it seems that WUAs are carrying out appropriate water management at mesqa levels. In regard to WUF, 60% of respondents answered “the WUF is functioning well in terms of water management”, 4% for “No” and 36% for “Not sure”.
Achievements:	<ul style="list-style-type: none"> <li>✓ Less irrigation cost, and increase of yield in some part of the project area, especially midstream and downstream of the canal.</li> <li>✓ Reduction of conflicts among farmers and their complaints because of the fair irrigation water distribution and coordination by WUAs and WUF.</li> <li>✓ Efficient land use, where old mesqa canal was located, filled up and used as field path, making transportation easier.</li> <li>✓ Fairer water distribution at mesqa levels (between beginning point and end of mesqa canal) and among upstream, midstream and</li> </ul>

	<p>downstream of the delivery canal.</p> <p>✓ Good on-farm water management.</p> <p>✓ Functions of WUAs and WUF not only for good water management but also for problem solving.</p>
Remarks:	

**Table (3. 8): General outlines of Water Management Improvement in the Nile Delta (Project-II)**

Project Name:	Water Management Improvement (Project-II)
Duration:	(4 Years) 2008-2012
Donors & Organizations:	JICA
Study areas:	Nile Valley and Delta
Objectives:	WUOs at the district, branch and mesqa levels are technically, organizationally and financially self-operational nationwide to meet the national agenda of efficient water resource management.
Problems:	<p>-The government of Egypt has implemented those irrigation improvement projects with donor agencies from 1980s, which include participatory irrigation management alongside facility rehabilitation.</p> <p>-According to these facts and the effect of the Japanese Technical Cooperation, Water Management Improvement Project implemented from 2000 to 2007, the government of Egypt decided to submit to JICA the Proposal of the Project for enhancing the capacity of the staff of Central Department of Irrigation Advisory Service (CD-IAS) which supervise and manage Water Users Organizations (WUOs).</p>
Methodology:	The capacity of CDIAS staff enhanced to be able to establish and strengthen WUOs nationwide.
Institutional Framework and Famers Behaviors:	<ul style="list-style-type: none"> <li>- Agricultural/Rural Development-Rural Development</li> <li>- Water Resources / Disaster Management-Comprehensive Water Resources Management</li> <li>- Gender and Development-Gender and Development</li> </ul>
Achievements:	<ol style="list-style-type: none"> <li>1. Ideal forms and functions of WUOs at the different levels identified for the realization of proper district-based integrated water resource management.</li> <li>2. Methods of strengthening WUOs developed for the realization of proper district-based integrated water resource management.</li> <li>3. Institutions built nationwide among the government agencies for strengthening WUOs in the country.</li> </ol>
Remarks:	

Website:

<http://gwweb.jica.go.jp/km/ProjectView.nsf/VWAEPrint/235691B7E4A5E4A3492575D10035CB1B>

**Table (3. 9): General outlines for WAT Project**

Project Name:	Sustainable Systems for Food and Bio-energy Production with Water-saving Irrigation in the Egyptian Nile Basin (WAT)
Duration:	(5 Years) 2009-2014
Donors & Organizations:	JST-JICA
Study areas:	Sakha, Zankalon, El Birigat and Ismailia
Objectives:	Improve the methods to secure efficient and sustainable water management for increased agricultural production to meet the rapid population growth.
Problems:	Egypt is facing severe shortage of water resources and farmland, the Government of Egypt is accountable not only for achieving the goals but also for finding solutions to tackle the water issues. One of the conditions regarding water resources that Egypt bound to is the limited quota of the Nile water and undependable rainfall. Therefore, the Government of Egypt has been developing improved water management methods in order to meet the increasing water demand for food production and other uses. In addition, more than 30% of the population in Egypt are farmers, most of whom are small-scale poor farmers.
Methodology:	To achieve the proposed goals, the project have 5 main research groups: Group 1: Water and Salt Balance Group 2: Water Management Group 3: Soil Fertility Group 4: Food Production Group 5: Bio-energy
Institutional Framework and Famers Behaviors:	The project is analyzing the following points: 1. State of water distribution among farmers/farmers' groups and its impact on land use and farming are clarified. 2. Factors influencing on water distribution such as hydraulic facilities, organization and farmers' behavior analyzed.
Achievements:	Going on
Remarks:	

Website: <http://www.agbi.tsukuba.ac.jp/~wat/>

**Table (3. 10): General outlines for Life 1& 2 Project**

Project Name:	<b>LIFE-Integrated Water Resources Management Project (1&amp;2)</b>
Duration:	(4 years) 2004-2008 + (3 years) 2008-2011
Donors & Organizations:	USAID
Study areas:	Sharkiya, Monifiya, Qena and Aswan
Objectives:	To provide technical assistance, training, commodities, and small grants to support decentralization of water management. The aim is to increase water use efficiency and productivity.
Problems:	The GOE is implementing an aggressive irrigated agricultural area expansion program. This is in turn reducing the supply of water per feddan. In addition, the high cost of operating and maintaining the water delivery infrastructure is a serious strain on the national budget because farmers pay a very low portion of the actual costs. This further compounded by decreasing water quality as the water conveyance system increasingly used for waste disposal.
Methodology:	Seven tasks are to be implemented under the LIFE/IWRM Program: <ol style="list-style-type: none"> <li>1. Formation of Integrated Water Management Districts</li> <li>2. Formation of Branch Canal Water Users' Associations</li> <li>3. Equitable Allocation of Water Resources</li> <li>4. Improved Maintenance and Upgrading of Water Management Equipment</li> <li>5. Environmental Services for Improving Water Quality Management</li> <li>6. Improved Wastewater Reuse Practices</li> <li>7. Graduate Degree Training for MWRI Staff</li> </ol>
Institutional Framework and Famers Behaviors:	The objectives expected to achieve through the formation and development of functional and sustainable Branch Canal Water User Associations (BCWUAs) and Integrated Water Management Districts (IWMDs) and developing the capacity of stakeholders to manage solid and liquid wastes in the targeted directorates.
Achievements:	Formation of IWMDs with the capability and authority to coordinate all irrigation and water management activities will result in improved efficiency. Formation of BCWUAs linked with these IWMDs and other local partners will lead to greater civic responsibility for maintaining water ways; improving the quality of water resources through better local management of liquid and solid waste. By participating in water management decision-making and governance, rural inhabitants will realize economic benefits.

Remarks: It anticipated that approximately 9 million farmers and other water users would benefit from the project. The plan is to establish 27 IWMDs linked with approximately 1,000 BCWUAs covering 1.2 million feddans of agricultural land.

Website: <http://www.iwrneg.org/>

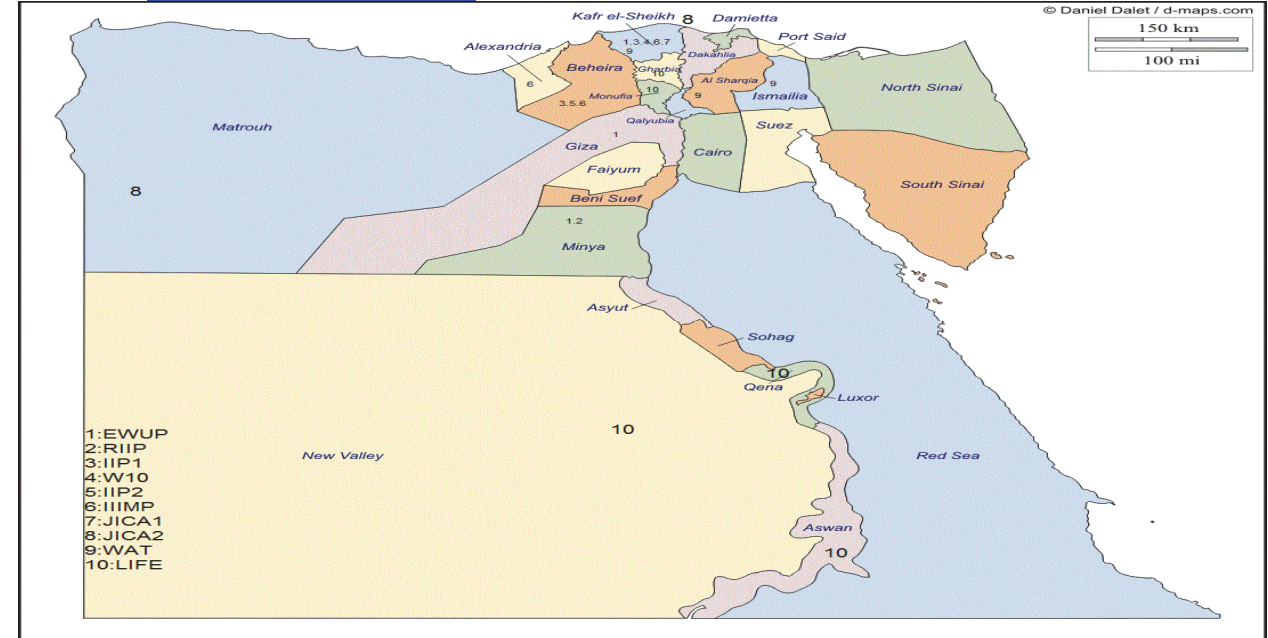


Fig. (3): Egypt map showing the locations of IIPs Projects

Subsurface drainage improvements										
Open drain rehabilitation										
Electrical network										
Marwa Improvement										
Mesqa Improvement										
Branch canal improvement										
Main canal improvement										
Environmental mainstreaming										
Coordination and integration										
Project management										
Capacity building										
Institutional development										
Improved on-farm water management										
Improved integrated water management										
Cost effective techniques										
Indices	EWUP (1977-84)	RIIP (1977-84)	IIP1 (94-2006)	W10	IIP2 (2006-07)	IIMP (2007-14)	JICA-1 (2000-07)	JICA-2 (2008-12)	LIFE (2004-08)	WAT (2009-14)



Fig. (4): Target of each Irrigation Improvement Projects in Egypt (1977-2012)

Figure 2 present the proposed indices for evaluation irrigation improvement projects. This **figure** will be evaluated by senior expertise of the country irrigation projects. This mainly to map the deflection of projects activities from experience point of view and according to the current situation and updated improvement point of view.

### **3.2. Socio-economic Questionnaire**

The main objective of the questionnaire is to analyse satisfactions of the farmers by the irrigation improvements and its effect on water savings and their net income. In addition, the questionnaire reflects farmers' needs as well as their future water requirements. Preliminary report of pre-test, which has been done by the Arabic copy of the questionnaire in February 11, 2013. Samples collected at improved mesqas, as samples, in Dakalt canal area in Kafr El Sheikh Governorate in two cities (Kafr El Sheikh and El Reyad) districts. WMRI project staff applied the pre-test on five cases in location mentioned above at head, middle and tail of Dakalt canal. The results of pre-test questionnaire showed the needs for improving the questionnaire then re-test it again. It is proposed that within May, June and July 2013 the final draft of questionnaire would be ready for more details and final fieldwork. Tested questionnaire is presented in Annex 1. Details of the result can be concluded as follows:

The Arabic copy of the questionnaire for the project "Designing Local Framework for Integrated Water Resources Management" was done in February 11, 2013. Samples were collected at improved mesqas (as samples) in Dakalt canal area in Kafr El Sheikh governorate in two cities (Kafr El Sheikh and El Reyad) districts. WMRI project staff applied the pre-test on 5 cases in location mentioned above from 11 am to 5 pm at head, middle and tail of Dakalt canal. Interview and writing the answers (responses) for each case takes 1 hour approximately (questionnaire contains 12 pages). The results of pre-test questionnaire are:

1- All questions (How is it clear and understandable?).

They are accepted and have minimum confusion in some of it.

2- There is a repetition in some questions, so it is recommended to cancel the question number (4-1) and (4-2) because question number (1-3) has the same information.

3- It is proposed to add a question about the area of pump station (Improved mesqa).

4- It is proposed to add a question about the education (status of the farmer (Educated - Read and Write- cannot read nor write)).

5- It is proposed to add a question about the pump station operators (Name- Age- Land holding- Education).

6- The question number (2-2) about water flow regime in canal (Rotation or continues) farmers response uncertain and different.

7- It is proposed to modificate the question number (1-1) to become as following:

Subject	Name	Location
Main canal	.....	(Head- Middle- Tail)

and remain of question (1-1).

8- Relating to question number (5-8), for the response, it is proposed to add:

{(yes).....(No).....(Do not know)}.

While, for the same question (5-8), items (1 to 9), it is proposed to add two items:

- Does WUA have deal with Bank or post office?
- Does WUA have a cumulative money in Bank or post office and how much?

9- A preliminary results have got from the pre-test of (5) cases as following:

- i. Location of 2 cases at the head, 1 case at middle and 2 cases at the tail.
- ii. Land holding pattern from 5 cases are:

%60 own (average area 1.25 Feddan) (1Feddan=4200 m2)

%40 share rent (by 1/3) (average area 1.75 Feddan).

iii. Type of mesqa improvement for 5 cases is pipeline and start year (2002). The pervious data mentioned about 95 % of improvements is pipeline. The rest (5%) is lined raised canal (marwa).

iv. The crop pattern of 5 cases farms as following:

Season	Main Crops	%
Winter 2011/12	Sugar beet	50
	Clover (Berseem)	30
	Wheat	20
Summer 2012	Rice	70
	Cotton	14
	Watermelon for seeds	16

- v. Land value (price, sale or purchasing) ranging from 150,000 LE per Feddan to 500,000 LE per Feddan by average 280,000 LE per Feddan.
- vi. Land rent per Feddan per year ranging from 4000 LE/Fed/year to 7200 LE/Fed/year by average 5400 LE/Fed/year.
- vii. Annual taxes per Feddan ranging from 35-70 LE/Fed/year by average 45 LE/Fed/year.
- viii. Input costs of crop production (without irrigation costs):
  - Winter crops ranging from 400 LE/Fed/season to 2500 LE/Fed/season by average 1430 LE/Fed/season.
  - Summer crops ranging from 1000-3000 LE/Fed/season by average 1520 LE/Fed/season.
- ix. Revenue of crop production:
  - Winter crops ranging from 2880-7810 LE/Fed/season by average 5450 LE/Fed/season.
  - Summer crops ranging from 4500-6000 LE/Fed/season by average 5400 LE/Fed/season.
- x. Irrigation costs (under improved system) per year for 1 Feddan ranging from 160-200 LE/Fed/year by average 182 LE/Fed/year.
- xi. Annual payment for irrigation improvement project as construction per Feddan ranging from 90 - 100 LE/Fed/year along 17 years.
- xii. Annual payment for diesel pumps per Feddan ranging from 250 - 300 LE/Fed/year along 3 years.
- xiii. The area served by improved mesqa (pump station) ranging from 50-70 Feddan/station by average 65 Feddan/station.
- xiv. Number of the Water Users Associations (WUA) members ranging from 25 to 80 members (In agrarian lands) by average 60 members. And the average of holding area about 1.1 Feddan for each member.
- xv. Age for WUA members ranging from 48 to 61 years by average 52 year (for 5 cases).
- xvi. Number of diesel pumps for improved station (under the questionnaire) is 2 pumps for the station.
  - 60 Liter/Second is one pump per station (3 stations),
  - 90 Liter/Second is one pump per station (3 stations) and 2 pumps per station in 2 stations, total 7 pumps.

- xvii. Diesel pumps 90 Liter/Second replaced by 2 pumps in one station. The total replaced pumps are 4 electric pumps.
- xviii. The average cost to change diesel pump to electric pump is about 15000 LE/pump. The payment done by farmers WUA one time before purchasing except the WUA which have accumulative money in post office or bank.
- xix. Dates of change the electric pumps was from 2008 to 2010.
- xx. The cost of electricity consumption for pump stations ranging from 200 to 500 LE/Station/month by average of 300 LE/Station/month.
- xxi. All five cases in the pre-test are members in WUA. One of them is treasurer, one was former treasurer and now is the chairman of the headquarter of water board on Dakalt canal, 2 are operators of pump stations.
- xxii. Determining the farmer turn in irrigation, the pre-test showed that according to the schedule submitted by WUA in summer and the farmer request from the operator of the pump station in winter season.
- xxiii. The WUA was formed by irrigation improvement project staff, Irrigation Advisory Section (IAS), in the beginning of WUA formation.
- xxiv. The head quarter of WUA was formed by direct election among farmers.
- xxv. The head quarter of the water board on the canal was formed by participate of IAS staff with farmers in Dakalt canal in two stages:
  - A. Dividing Dakalt canal to 3 reaches (Head, Middle and Tail) and determine 48 names, regardless the membership of WUA head quarters,
  - B. Direct election of chairman of water board by 48 members , then elect 3-4 members for each reach (H-M-Tail). Therefore, the total number of headquarter of water board will be 11 members including the chairman.
- xxvi. The style of activities and routine work in WUA, the pre-test showed that:
  - All of them has no building in village except the houses of head quarter persons.
  - The keeping records is just a block notes to write the money in and out. The bank or post office booklet by the name of treasure mostly.
  - Periodical meeting not held except in facing problems.
  - Communications among the WUA members is happened due to neighborhood in farers and houses in villages.

- Meeting with water board sometimes due to the circumstances or facing problems.
  - Communications with water board sometimes due to the circumstances or facing problems.
  - Direct communications with irrigation staff sometimes due to circumstances or facing problems.
  - Irrigation improvement staff passing or meeting with farmers of WUA after submitted the irrigation improvement network and pump station was happened.
- xxvii. The main person responding in solving irrigation problems, pre-test showed that {60% the head quarter of WUA and 40% the irrigation staff}.
- xxviii. How irrigation problems be presented, the pre-test showed that {80% direct communication, 20% inside (phone communication) and 20% have no certain way}.
- xxix. How irrigation problems are solved, the pre-test showed that {60% direct response from irrigation staff which including 20% inside it go to the irrigation district, 20% any one f the four options due to circumstances and 20 % on one of the 4 options but only waiting the time.
- xxx. The main person in WUA head quarter and pump station unit from the farmer point of view showed that:
- ✓ 40% the treasurer (%20 inside the treasurer and pump operator together),
  - ✓ 40% pump operator (%20 inside the pump operator with treasurer and 20 % pump operator with chairman of WUA, and 80 % for pump operator),
  - ✓ 20% chairman of WUA (pump operator with him).
- xxxi. Did the irrigation improvement project solve the irrigation problems, pre-test showed that 100 % answered (yes) in limitation of its capacity in solving problems.
- xxxii. Did the irrigation problems are greater and wider than the capabilities of irrigation improvement project, pre-test showed that 100 % answered (yes) because of the main point is existing water in canals and its availability in quantity and timing.
- xxxiii. About the benefits of irrigation improvement project:
- ✓ %80 answered that it achieved the 8 mentioned benefits.
  - ✓ %20 answered that it achieved 5 from 8 benefits.
- xxxiv. The agricultural problems facing farmers:
- ✓ %80 answered the chemical fertilizers not always available as well as increasing the price of it.

- ✓ %20 answered plus the above mentioned the crop rotation special in agrarian reform lands.

xxxv. The irrigation problems facing farmers:

- ✓ %80 answered no adequate water during summer season the high water requirements.
- ✓ %20 answered the energy problems and its price (Diesel and Electricity) plus the above mentioned.
- ✓ Feeling satisfy (satisfaction) concerning Irrigation Improvement Project by farmers: %100 answered by completely satisfied.

xxxvi. Farmers Recommendations to improve the work of Irrigation Improvement Project:

- ✓ Usage of electricity instead of Diesel.
- ✓ Pipelines better than raised lined canals.
- ✓ Separate electrical transformer to feed electric pumps (out if the village electric network).
- ✓ Achieving the continuous flow of water in canals.
- ✓ The participation in Irrigation Improvement by the farmers it is better to be selective.

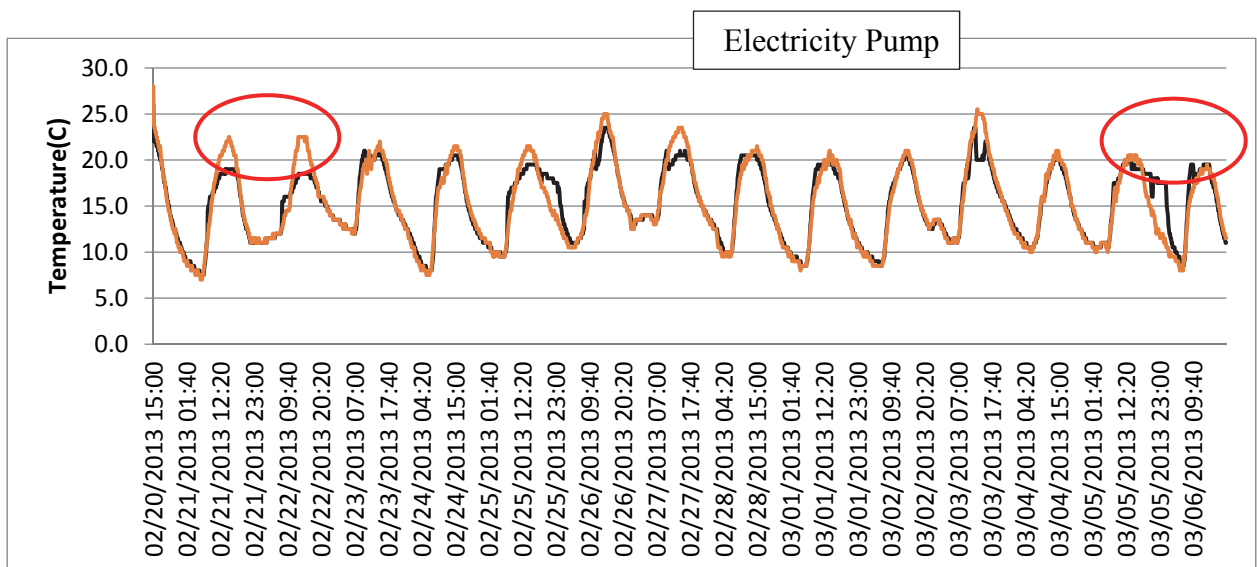
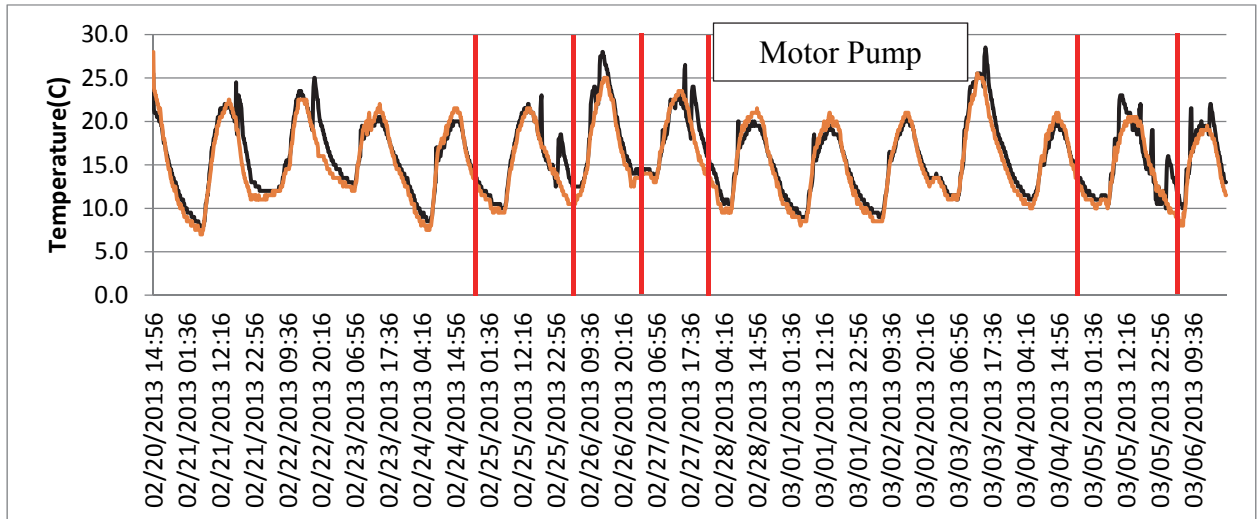
xxxvii. Farmers Recommendations to improve the Water Users Associations (WUA) or Water Board:

- ✓ Serious way to present the irrigation problems to irrigation staff to solve it.
- ✓ WUA take all responsibilities to solve the problems inside the station unit.
- ✓ Direct election of water board members is better.
- ✓ Available budget for water boards.

Analogously, general information of the selected study area, Dakalt canal, collected and confirmed by project staff on December 2012 and January, February 2013. The information include meska name, location along the canal and meska, bank side, improvement type, marwa length, served area, number of outlets along the marwa, number of pumping units, delivery date for users, date of transferring system to the farmers, date of transferring system to the irrigation advisory section as well as any important notes. The details of each water user association (WUA) collected also as a needed database. We found that out of 74 meska, 64 WUA performed and details are presented in Annex 2.

### 3.3. Pump operation hours

Recording pump operation hours is an essential method for calculating amount of water applied to the field. Calculation could be effective after calibration of each pump discharge per unit time. Crop pattern and area needed also. Thermo-managers technology used for the estimation of pump operation hours. The difference between air and pump temperature shows operation time for each pump.



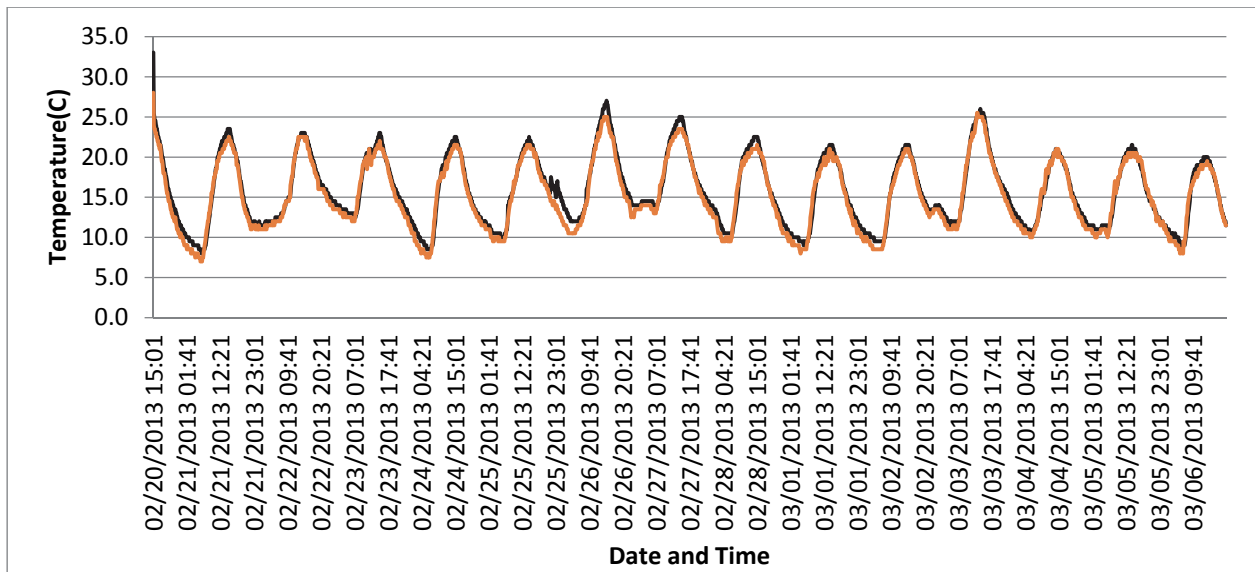


Fig. (5): Edrega A pump operation time from Feb 20 to March 6, 2013

Dakalt, IIP area, farmers changed most of pump stations from diesel to electricity and diesel pumps. From the security point of view, farmers thought this way needed to avoid shortage of power sources at any time. Electricity pumps introduced to W10 and IIIMP improved areas due to cheaper consumption and availability of electricity. Figure 3 represent the pump and air temperature in Edrega A station, as an example, from February 20 to March 6 2013. Decreasing pump temperature shows the operation time of the pump. It is clear from the figure that diesel pump does not operate within the selected period. At the same time, electricity pump operated on February 21 around 12:20 Diesel Pump collected for all selected pump stations (6 stations) with 12 pump units. All are improved stations. At the end of the canal, we select station 13 as an example for unimproved station. Data for this station will be collected from summer 2013 in order to understand the difference between improved (Diesel and Electricity) and un-improved pumps.



**Edrega Pump Station**

### **3.4. Water Level**

It reported that there are water distribution problems in the district. One is imbalanced water supply in the district, where upstream mesqas take averagely much water than downstream. The other one is imbalanced water allocation in a mesqa, where relatively much water applied to upstream fields than downstream fields.

Water level (cm) in the selected meskas along Dakalat canal is currently under observation. The total length of Dakalt is 11.3 km. Three water level sensors installed at Edrega meska (head, 1.49km), Tayara meska (middle, 4.86km) and Shams El Deen meska (tail, 8.26km). The main reason is to check the equity of water distribution along the canal that serve 2310 ha in total. In addition, we can analyse the rotation system in each season. Figure 4 shows that water level for tail end meska (Shams El Deen) is higher than the middle one (Tayara) and head meska (Edrega) which is up normal case. To understand the real situation it recommended measuring the elevation of the intake of each meska. In addition, water discharge to the intake and different checkpoints along the canal would measuring. To make the link between the current obtained data and pump operation hours, crop pattern for each area needed.

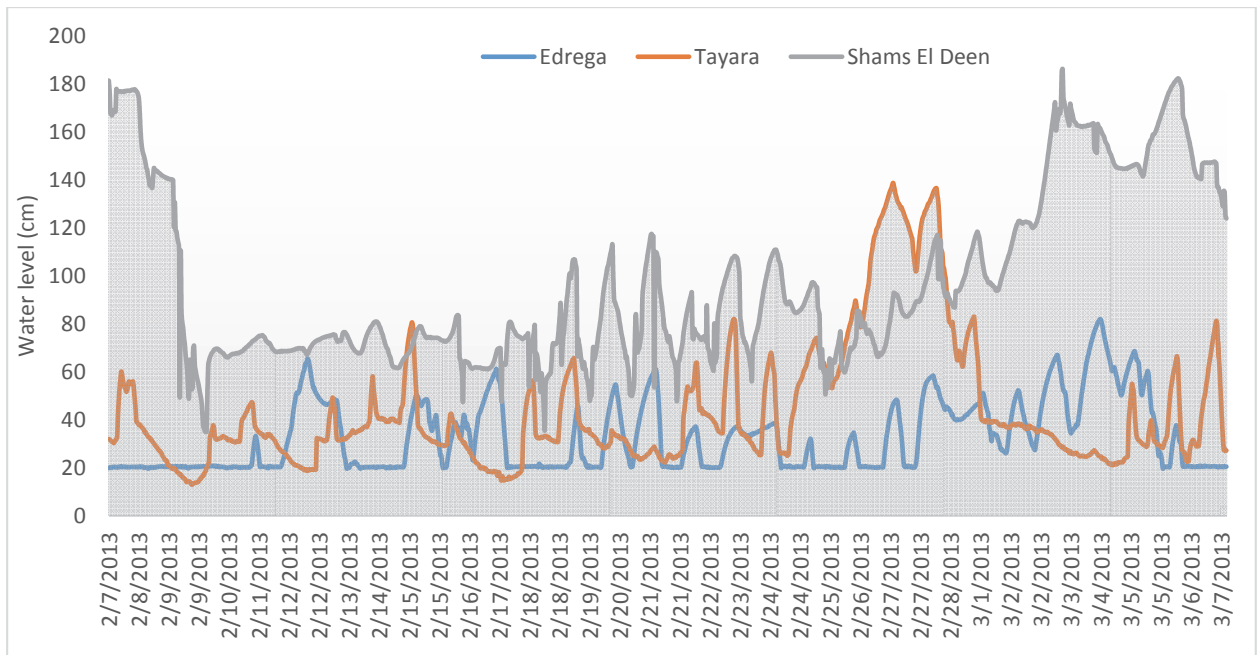


Fig. (6): Water level (cm) along Dakalt for each selected meska from Feb 7 to March 7, 2013

### 3.5. Ground Water Fluctuation

Ground water fluctuation have a direct relation with subsurface drainage condition, crop pattern as well as irrigation events. Therefore, 21 observation wells (3 wells to each Meska) installed from head to tail end of the canal and from canal to drain. Weekly data have collected from all locations and the average values showed in the Figure (7). It is clear that the Meskas allocated at the head of the canal have a shallow ground water level (20-60 cm). Direct 3 and 13 Meskas shows a sharply fluctuation trend during the study period. Ground water recorded deep level from 80 to 140 cm in Shams El Deen Meska. Therefore, it is recommended to continue record ground water level in summer season to clarify the efficiency of subsurface drainage system. Keeping in mind subsurface drainage system installed in Dakalt and direct water to drain No 7 at right side and Drain No 4 at the left side.

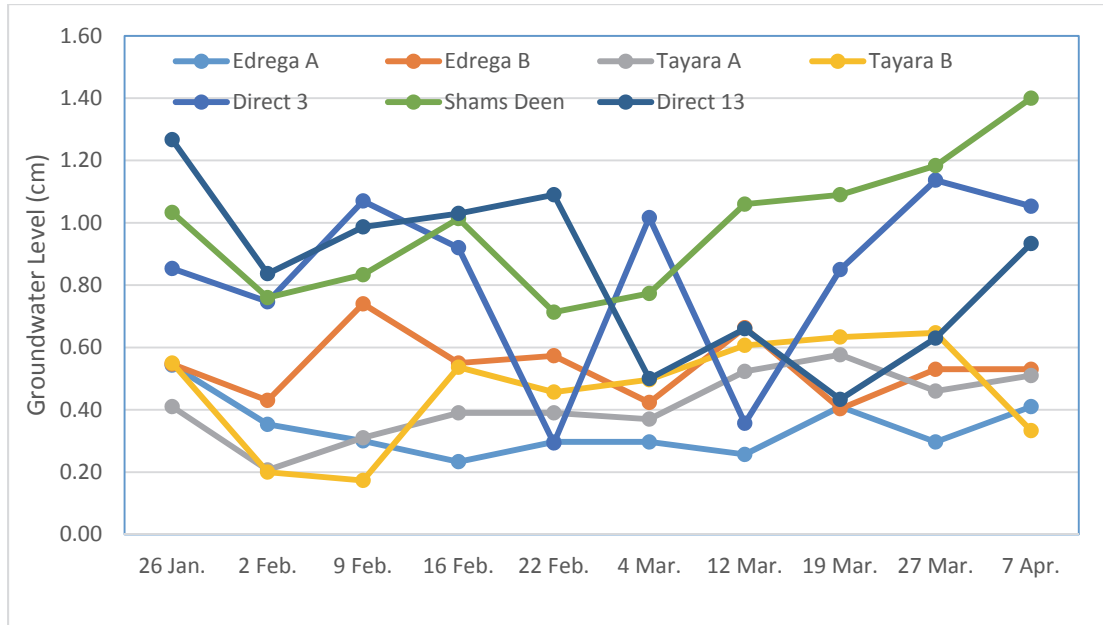


Fig. (7): Groundwater fluctuation (cm) along Dakalt for each selected meska from Jan. 26 to April 7, 2013

### 3.6. Physico-chemical properties of the study area soil

Three observation wells installed at the head, middle and tail of each meska, from canal to drain direction, to assess subsurface water table and quality including salinity. Electric conductivity is the measure of the conductance of the water to an electric current. The assessment of the water samples mainly according to FAO guidelines as presented in Table (3-11).

Table (3. 11): Guidelines for interpretation of water quality for irrigation (FAO, 1985)

Irrigation Problem	Degree of Problem		
	No Problem	Moderate	Severe Problem
<b>Salinity (affects crop water availability):</b> • $EC_w$ (dS/m)	<0.75	0.75-3.0	>3.0
<b>Permeability (affects infiltration rate into soil):</b> • $EC_w$ (dS/m)	>0.5	0.5-0.2	<0.2
pH	(Normal Range 6.5-8.4)		

Soil samples taken from these wells by auger in the depths of 0-25 cm, 25-50, 50-75 and 75-100 cm, consequently to determine soil physical and chemical properties. Mechanical analysis done according to wetted method (hydrometer method). Determination of  $EC_{1.5}$  and pH were made using a portable EC and pH meters in soil-water suspension of 1:5. Determination of

soil Sodium adsorption ratio (SAR<sub>1:5</sub>) were made in soil-water suspension of 1:5. SAR<sub>1:5</sub> were calculating by applying the following Equation.

$$SAR = [Na^+] / \sqrt{([Ca^{2+}] + [Mg^{2+}])/2}$$

Where Na<sup>+</sup>, Ca<sup>2+</sup> and Mg<sup>2+</sup> are expressed in meq L<sup>-1</sup> in irrigation and drainage water. Determination of calcium plus magnesium was done by titration method using versant solution. Ferrochrome black T was used as indicators for (Ca<sup>2+</sup>, Mg<sup>2+</sup>), while ammonium purported was used for determining Ca<sup>2+</sup> (Jackson, 1967). Determination of calcium plus magnesium was done by titration method using versant solution. Ferrochrome black T was used as indicators for (Ca<sup>2+</sup>, Mg<sup>2+</sup>), while ammonium purported was used for determining Ca<sup>2+</sup> (Jackson, 1967). Determination of sodium and potassium was done by the flame photometer (U.S. Salinity Laboratory, 1954). Determination of carbonates and bicarbonates (meq L<sup>-1</sup>) was done by titration against standard solution of potassium hydro-sulphate; phenolphthalein was used as an indicator for carbonates and methyl orange for the bicarbonate (Nelson, 1982). Determination of chlorides was done by titration against standard solution of silver nitrate and using potassium chromate as an indicator according to Mohr's method (Rhoades, 1982). Finally, determination of SO<sub>4</sub><sup>2-</sup> was done by using spectrophotometer.



Soil Sampling

Table (3. 12): Criterion of soil salinity according to Richards (1969)

SOIL	SALINE	SODIC	SALINE - SODIC
EC,dS/m*	>4	<4	>4
ESP, %	<15	>15	>15
PH **	>8.5	>8.5	Rarely >8.5

\*In soil paste extract

\*\* in soil past

Table (3.13): Physico-chemical properties of the Dakalt soil

Depth (cm)	Physical properties				Texture class
	Particle size distribution (%)			Bulk density gm cm <sup>-3</sup>	
	Clay	Silt	Sand		
0-25	62.4	26.9	10.7	1.21	Clayey
25-50	63.3	26.5	10.2	1.27	Clayey
50-75	58.0	30.7	11.3	1.31	Clayey
75-100	54.0	35.1	11.2	1.34	Clayey

Depth (cm)	Chemical properties									
	pH 1:2.5	EC <sub>1:5</sub> (dS m <sup>-1</sup> )	SAR 1:5	Cation (meq L <sup>-1</sup> )				Anion (meq L <sup>-1</sup> )		
				Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>
0-25	8.3	2.57	1.20	1.29	0.04	0.61	0.58	1.51	0.74	0.32
25-50	8.4	2.49	1.35	1.27	0.04	0.54	0.52	1.46	0.74	0.29
50-75	8.5	2.10	1.39	1.10	0.04	0.50	0.46	1.31	0.65	0.14
75-100	8.5	2.19	1.62	1.16	0.05	0.50	0.50	1.31	0.64	0.19

\* Extraction for ions carried out in a soil-water ratio of 1:5

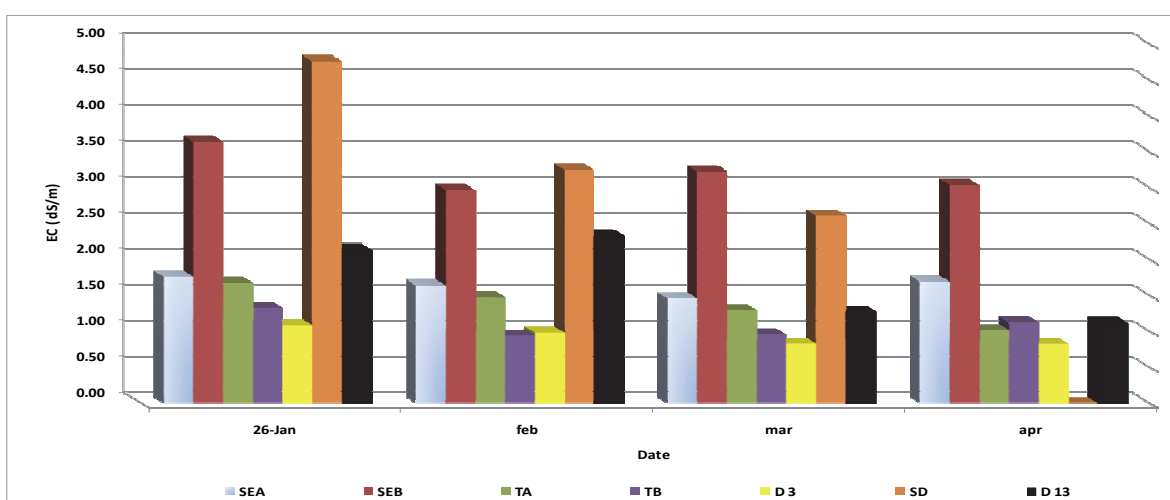
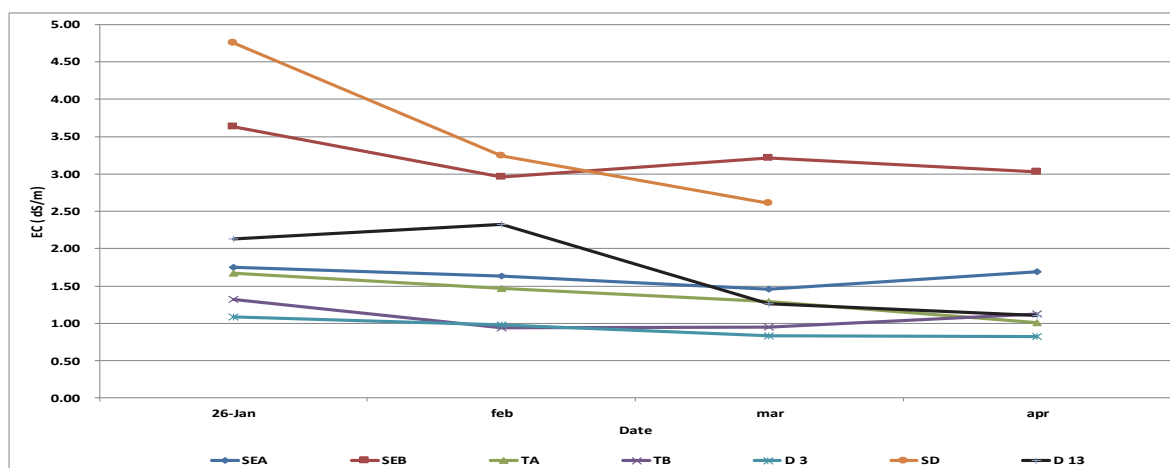


Fig. (8): EC values of subsurface water within selected meskas at Dakalt during winter

Table (3. 14): Monthly average of water analysis for wells at mesquas of Dakalt area

Average of wells	Jan. 26, 2013			Feb. 2013			March. 2013		
Site	Cond.at 25 <sup>0</sup> c (mS/cm)	Salinity (ppm)	TDS (g/L)	Cond. at 25 <sup>0</sup> c (mS/cm)	Salinity (ppm)	TDS (g/L)	Cond.at 25 <sup>0</sup> c (mS/cm)	Salinity (ppm)	TDS (g/L)
<b>SEA</b>	1.75	867	1.14	1.63	842	1.06	1.45	750	0.94
<b>SEB</b>	3.63	1967	2.36	2.96	1583	1.92	3.22	1725	2.09
<b>TA</b>	1.67	833	1.08	1.47	750	0.95	1.29	633	0.84
<b>TB</b>	1.32	650	0.86	1.06	450	0.61	0.95	483	0.62
<b>D 3</b>	1.08	567	0.71	0.98	475	0.64	0.83	408	0.54
<b>SD</b>	4.75	2600	3.09	3.24	1767	2.11	2.61	517	0.58
<b>D 13</b>	2.13	1100	1.38	2.32	1150	1.42	1.27	567	0.73

## **4. CONCLUSION AND RECOMMENDATIONS**

The programs/policies adopted by the Ministry of Water Resources and Irrigation for the management and improvement of water in the country are reviewed. In this respect, the general objective of the Irrigation Improvement Projects was to improve the economic and social economic conditions of Egyptian farmers through the development and use of improved system, water management, and associated practices that promote efficient water use and decrease drainage problems and then increase agricultural production. Therefore, Irrigation Improvement Implementation Programs started from 1993. One of the outputs of improvement is Dakalt area. During field visits, Dakalt farmers re-modified their system according to the current modifications recommended by other projects such as installing electricity instead of diesel pumping system. In order to get the full picture, details field studies started from January 2013 according to the Research Contract with RIHN. Recording pump operation hour will be effective after calibration of each pump discharge in order to calculate amount of water applied and crop pattern. According to the obtained results, it recommended measuring the elevation of the intake of each meska to evaluate the equity of water distribution. Also, it is recommended to continue recording ground water level in summer season to clarify the efficiency of subsurface drainage system as its shallow at the head part of the canal. Monitoring of irrigation and drainage water salinity is needed also at the same time with other data salinity. Finally, within last four months (December 2012 to March 2013) ordering and installing equipments, collection and review of reports done. However, WMRI wish to continue this promising program not only for Egypt but also for worldwide benefit and irrigation improvements.

## 5. REFERENCES

1. Depeweg H, Bekheit K (1997) Evaluation of proposed mesqa improvements. *Irrigation and Drainage Systems*, 11: 299–323.
2. ElKassar G M “Monitoring and Evaluation of Improved Irrigation Delivery System in W/10 Command Area–Egypt”, *Science Water Journal-NWRC-December 2007*.
3. Elshorbagy WE (2000) Impact assessment of an irrigation improvement project in Egypt. *Water Resources Management*, 14: 229–246.
4. EWUP (1984) Finding of the EWUP, Final Report. National Water Research Center, Egypt.
5. FAO (2005) Rapid assessment study: Towards integrated planning of irrigation and drainage in Egypt. Final Report, IPTRID Secreteriat, FAO, Rome, pp. 29.
6. Jackson, M.L. (1967): Soil chemical analysis. Prentice Hall, Englewood Cliffs, 227–261.
7. McDonald & Partners Ltd. (1988) Rehabilitation and improvement of water delivery system in old lands, feasibility study Bahr el Saidi command area. Irrigation Improvement Project, Cairo, Egypt.
8. MERI & WMRI (2005) Technical note on the electrification of meska pumping stations in the Meet Yazied command area. Mechanical and Electrical Res. Institute and Water Management Research Institute, NWRC, Egypt.
9. MWRI (2005) National water resources plan for Egypt-2017 (water for future). Ministry of Water Resources and Irrigation, Planning Sector, Cairo, Egypt.
10. Nelson, R. E. (1982): Carbonate and gypsum. In Black, C.A. eds., *Methods of soil analysis part 2*. Agronomy homograph No.9, “181 -183”.
11. Oad R & Azim R (2002) Irrigation with policy reforms for rice cultivation in Egypt. *Irrigation and Drainage Systems*, 16: 15–31.

12. Rhoades, J.D. (1982) Reclamation and management of salt affected soil after drainage. Proc. of 1<sup>st</sup> Annual Western Provincial Conf., Rationalization of Water and Soil Research and Management Lightbridge, Alberta Canada, 123-197.
13. U.S. Salinity Laboratory (1954) Diagnosis and improvement of saline and alkali soils. U.S. Dept. Agric., Handbook No. 60. U.S. Govt. Printed office, Washington, D.C., 160p.
14. Wichelns D (1999) A cost recovery model for tertiary canal improvement projects, with an example from Egypt. *Agricultural Water Management*, 43: 29–50.
15. WMRI (2008) Monitoring and evaluation of an irrigation improvement project-report in W10 command area in Kafr El-Shiekh, Egypt.

# ANNEX (1)

National Water Research Center  
Water Management Research Institute

Farmer Code

**Project: Design Local Frame Works for Integrated Water Resources Management**

**Socio – Economic Questionnaire  
Winter 2011/2012 and Summer 2012**

*This is Privileged Information and will not be used except for Research Purposes*

**Governorate:**.....

**District:**.....

**Village:**.....

**Name of Farmers (Household)**.....

**Gender:**            Male                       Female

**Age** ..... Years

**Meska Name** .....

**\*Farm Area:**.....

                    Fed      Kerate  
                    .....      .....

**\*(1 Fed=4200m<sup>2</sup> & 1 Kerate = 175 m<sup>2</sup>)**

**Name of Field Data Collector:**.....

**Reviewer Name:**.....

**Name of Data Entry:**.....

# 1- Farm Description

## 1-1 Location

- Main canal (Head – Middle – Tail)
- Branch canal location in main canal command (Head – Middle – Tail)
- Meska (Head – Middle – Tail)
- Meska location (Right hand side – Left hand side)

## 1-2 Land Holding

Properly right <sup>(1)</sup>	Area served	
	F	K
- Own		
- Rent		
- Shar rent (1/2 ,1/3,1/4)		
- Cash rent		
- Land squat		
<b>Area Served on the study meska</b>		

(1) Only the cultivated area by the farmer inside the meska under the study

- **Land rent per Feddan**
  - ..... \* LE/season
  - .....LE/year
- **Annual taxes per Feddan**
  - .....LE /Feddan
- **Land value (sale or purchasing)**
  - .....LE /Feddan

(\* LE is Egyptian Pound)

### 1-3 Status of meska improvement

Status	Type of improvement	
	Raised Lined	Pipeline
Improvement not started yet (.....)	XXXXXXXXXX	XXXXXXXXXX
Improved meska under construction	.....	.....
Improved meska in operation		
Start date :	.....	.....
Season (winter/ summer).....	.....	.....

### 1-4 Cropping pattern and crop production

#### Crop yield and revenue for main crops

Crops	Variety	Area		Main production(Area)			Secondary production(Area)			Input costs <sup>(1)</sup>
		F	K	Unit	Quantity	Price/unit	Unit	Quantity	Price/unit	
<b>Winter Crops:</b>										
<b>Summer Crops:</b>										

<sup>(1)</sup> Input costs without irrigation costs

		Area	Total	<sup>48</sup> No of irrigation from	Average	Time of
--	--	------	-------	-------------------------------------	---------	---------

		F	K		Mixed	Drain	Wells	Canal		
<b>Winter season</b>										
<b>Summer season</b>										

## 2-Irrigation

### 2.1 number of irrigations and source of water

- (1) No of irrigation including agricultural irrigation (first irrigation)  
 (2) Time of irrigation: 1- Early in the morning 2- at noon 3- after sun set 4- night irrigation

### 2-2 System of water flow in canal serves the farm

- 1- Continuous flow ( )                      2- Rotation system ( )

### 2-3 Rotation system

- Winter season                      on – period ( ) days                      off – period ( ) days  
 - Summer season                      on – period ( ) days                      off – period ( ) days  
 - Closure period                      on – period ( ) days                      off – period ( ) days

### 2-4 Water availability

**Did you find enough water in the canal during this season ?**

Winter Season		Summer Season	
Yes ( )	No ( )	Yes ( )	No ( )

**If the answer is (yes) what is the reason?**

- Length of rotation on – period too short ( )  
 - High water table ( )  
 - Meska intake is near from the branch canal ( )  
 - Other (specify) .....( )  
 .....( )

**If the answer is (No), in what months of the season was the water short?**

(Tick the chosen months for one season only)

Winter Season		Summer Season	
October ( )	November ( )	April ( )	May ( )
December ( )	January ( )	June ( )	July ( )
February ( )	March ( )	August ( )	September ( )

**2-5 How do you overcome water shortage problem in your farm?**

.....  
 .....

**2-6 Do you think that farmers at the head of the canal took more water than they needed during this season?**

Yes (.....)                      No (.....)

**2-7 Did you need to irrigate at night during the season?**

Yes (.....)                      No (.....)

**If the answer is (yes), how many times during the season did you irrigate at night?**

..... times.

**2-8 What are the reasons for irrigating at night?**

- 1- Because of rotation system.....(....)
- 2- Insufficient water during the day hours.....(....)
- 3- Weather is more convenient for irrigation of some crops specially in summer season .....(....)
- 4-Other (specify) .....

**3- Drainage:**

**- 3-1 Do you have drainage system in your farm?**

Yes (.....)                      No (.....)

**- 3-2 What is the kind of drainage system in your farm?**

Surface drainage ( )                      tile drainage ( )

**- 3-3 In case of tile drainage: when was it made?**

- Before improvement ..... ( )
- After improvement..... ( )

**4- Irrigation improvement**

**4-1 Type of meska in the farm:**

Unimproved meska ( )

Improved meska ( )

**4-2 Type of improved meska**

Raised lined meska ( )

pipeline ( )

Other ( )

**4-3 what is the construction costs (rinsed lined meska – pipes) ?**

Construction costs.....LE/fed

**4-4 Did you pay these costs?**

Yes (.....)

No (.....)

**Value of annual payment** .....LE /Fed / year

Total Period .....years

**4-5 pumps station**

**No of pumps in the station :**

60 liter/sec. = .....unit

90 liter/sec. = .....unit

**Source of pump energy**

Diesel ( )

Electricity ( )

**4-6 Cost of pump station:**

-Value of annual pump costs ..... LE /Fed

-Total Period .....years

**4-5 Operation costs:**

- Costs of irrigation in winter season ..... LE /Fed

- Costs of irrigation in summer season ..... LE /Fed

- Annual cost of irrigation = ..... LE /Fed

**4-6 Costs of Maintenance for the net works**

a) Lined costs

- Annual maintenance costs ..... LE /Fed

b) Pipes

- Annual maintenance costs ..... LE /Fed

c) methods of payment:

.....  
.....

**4-7 Pump station**

- Annual cost for pump station ..... LE /Fed

- Methods of payment :

.....  
.....

**4-7-1 Maintenance activities for diesel pumps**

1. Oil change..... ( )

2. Change of oil air filters.....( )

3. Cleaning the body of pump..... ( )

4- Other (specify)

.....  
.....

**4-7-2 Maintenance activities for electric pumps**

- Change electric cable and wires..... ( )

- Cleaning the body pump..... ( )

- Other (specify)

.....  
.....

**4-7-3 Replacement of pumps .....**

- Cost /Fed.....

- Methods of payment

- .....  
.....

**4-7-4 Cost of changing source of energy**

Cost /Fed.....

- Methods of payment

.....  
.....

**5- Water users associations (WUAs)**

**5-1 Does the farmer a member in the head quarter of WUAs?**

Yes (.....)

No (.....)

- What is his position in the committee of WUAs ?

.....

**5-2 Does the farmer a member in head quarter of water board (WB) on the canal?**

Yes (.....)

No (.....)

- What is his position in the WB?

.....

.....

**5-3 Does the farmer find enough water when he needs it ?**

Yes (....)

No (.....)

Waiting same time (....)

**5-4 Determining the farmer turn in irrigation:**

- According to the schedule submitted by WUA ..... ( )

- According to the operator schedule ..... ( )
- According to the farmer request from the operator of pump station .....( )
- According to the operation done by the farmer himself ( )

**5-5 How your WUA was formed and when?**

.....  
 .....  
 .....

**5-6 How the head quarter of WUAs was formed?**

- Direct election between farmers .....( )
- Selection a sample of farmers .....( )

**5-7 How the head quarter of water board on the canal was formed?**

- Direct election between farmers .....( )
- Selection a sample of farmers.....( )

**5-8 Style of activities and routine work in WUA**

Items	Response	
	Yes	No
- Does it have a building in the village?		
- Does it have keeping records?		
- Do farmers of WUA held periodical meetings?		
- Do farmers of WUA have communications among themselves?		
- Do farmers of WUA held meeting with Water Board?		
- Do farmers of WUA have communications with Water Board?		
- Do farmers of WUA have a direct communication with irrigation staff?		
- Do irrigation improvement staff pass or meet with farmers of WUA after submitted the irrigation improvement network and pump station ?		

**5-9 Who is the main person responding in solving irrigation problems?**

- The head quarter of WUA
- The head quarter of water board on the canal
- Irrigation staff

**5-10 How irrigation problems be presented?**

- Direct communication

- Phone communication
- Written request

**5-11 How the irrigation problems be solved?**

- Direct response from irrigation staff
- Repeat the request for solving the problem
- Stress by headquarter of WUA or WB on irrigation staff
- Group of farmers go to the irrigation district

**5-12 Who is the main person in WUA head quarter and pump station unit from farmer point of view**

- The chairman of WUA
- Treasurer
- Secretary
- Certain member
- Pump operator

**5-13 Did the irrigation improvement project solve the irrigation problems?**

Yes (.....)                      No (.....)

**5-14 Did the irrigation problem are greater and wider the capabilities of irrigation improvement project?**

Yes (.....)                      No (.....)

**5-15 What are the benefits of irrigation improvement project?**

1. Easier to operate .....(.....)
2. Easier to divide water between farmers for irrigating at the same time....(.....)
3. Easier to ensure that water reaches the tail of the meska.....(.....)
4. Less seepage / water losses from meska .....(.....)
5. Lower pumping costs.....(.....)
6. Easier / less expensive to maintain .....(.....)
7. Easier to repair if there is a problem .....(.....)
8. Takes less land .....(.....)
9. (only if answering P) alfalfa valves are better than turnout gates.....(.....)
10. (only if answering L) turned gates are better than alfalfa valves.....(.....)
11. Other (specify)

.....  
 .....

**5-16 What are the agricultural problems face farmers – specify?**

.....  
.....  
.....

**5-17 What are the irrigation problems face farmers – specify ?**

.....  
.....  
.....

**5-18 Do you feel satisfy concerning irrigation improvement project?**

Completely satisfied ( )      satisfied ( )      accepted ( )  
Unsatisfied ( )      completely unsatisfied

**5-19 What is your recommendation to improve:**

**5-19-1 Irrigation improvement project?**

.....  
.....  
.....

**5-19-2 Water user association (WUA) or Water Board (WB)?**

.....  
.....  
.....

ANNEX 2

Table

(4.1):

No	Meska Name	Irrigation canal	Location (km)	Bank side	Served area		Meska length (km)	Improvement type	Marwa Length (m)	No. of out lets on the Meska	No. of pumping units		note	
					Fed	K					60	90		
1	El Beda A	Dakait	0.860	Right	83	20	0.495	Pipe	734	6	3	-	electricity	
2	El Beda B		0.860	Right	67	6	0.900	Pipe	763	7	1	1	1	electricity
3	El Beda C		0.860	Right	94	17	1.395	Pipe	1375	10	3	-	-	
4	El Beda D		0.860	Right	93	22	1.395	Pipe	1298	9	3	-	-	
5	El Beda E		0.860	Right	132	4	2.250	J-section	1320	17	1	2	2	electricity
6	El Egezy A		0.865	Left	49	12	0.190	Pipe	974	9	2	-	-	electricity
7	El Egezy B		0.865	Left	54	2	0.850	Pipe	885	12	1	1	1	electricity
8	El Egezy C		0.865	Left	44	0	0.945	Pipe	550	4	2	-	-	electricity
9	El Egezy D		0.865	Left	48	16	1.275	Pipe	694	5	2	-	-	electricity
10	El Egezy E		0.865	Left	43	20	1.310	Pipe	460	7	2	-	-	electricity
11	El Egezy F		0.865	Left	36	22	1.860	Pipe	359	8	2	-	-	
12	El Egezy G		0.865	Left	54	17	1.930	Pipe	547	4	1	1	1	
13	El Egezy H		0.865	Left	33	19	2.400	Pipe	578	5	2	-	-	
14	El Egezy I		0.865	Left	39	13	2.625	Pipe	648	8	2	-	-	
15	El Egezy J		0.865	Left	34	20	2.935	Pipe	155	3	2	-	-	
16	El Egezy K		0.865	Left	85	20	3.105	J-section	538	11	3	-	-	
17	Hododa A		1.190	Right	75	12	0.695	Pipe	823	8	1	1	1	
18	Hododa B		1.190	Left	120	3	1.400	J-section	1500	13	2	1	1	electricity
19	Edrega S A		1.490	Right	64	12	0.650	Pipe	731	7	1	1	1	electricity
20	Edrega S B		1.490	Right	108	12	1.233	J-section	1554	11	2	1	1	electricity
21	Edrega N A		1.810	Right	79	3	0.590	Pipe	912	8	3	0	0	electricity
22	Edrega N B		1.810	Right	117	14	1.175	J-section	1472	10	2	1	1	electricity
23	Direct 1		1.850	Left	32	18	0.00	Pipe	290	3	2	0	0	electricity
24	Tamanen A		2.100	Right	67	15	0.495	Pipe	803	7	1	1	1	electricity
25	Tamanen B		2.100	Right	113	14	1.220	J-section	1321	11	2	1	1	electricity
26	Eslah A		2.415	Right	64	20	0.330	Pipe	712	6	1	1	1	
27	Eslah B		2.415	Right	115	12	1.022	J-section	1490	12	2	1	1	electricity
28	Sarhan A		2.730	Right	79	12	0.450	Pipe	718	7	3	0	0	electricity
29	Sarhan B		2.730	Right	191	0	1.116	J-section	1390	14	0	3	3	electricity
30	Direct 2		2.760	Left	41	12	0.00	Pipe	356	6	2	0	0	
31	Om Henesh A		2.930	Right	89	14	0.450	J-section	1075	10	3	0	0	electricity

Current details of each Meska allocated on Dakait canal after improvement

No	Meska Name	Irrigation canal	Location (km)	Bank side	Served area	Meska length (km)	Improvement type	Marwa Length (m)	No. of out lets on the meska	No. of pumping units	note
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Cont.:

No	Master Name	Location (km)	Right/Left	Fed	K	Length (m)	Improvement Pipe type	Length (m)	No. of outlets on the meska	60	90	electricity
32	Om Henesh B	2.930	Right	36	0	0.700	Pipe	575	6	2	0	electricity
33	Om Henesh C	2.930	Right	115	12	1.180	Pipe	850	15	2	1	electricity
34	Om Henesh D	2.930	Right	129	16	1.180	J-section	1130	15	2	1	electricity
35	El Fadel A	3.050	Left	70	13	0.500	Pipe	695	10	1	0	electricity
36	El Fadel B	3.050	Left	45	20	0.915	Pipe	506	7	2	0	electricity
37	El Fadel C	3.050	Left	72	3	1.225	J-section	935	10	1	1	electricity
38	El Fadel D	3.730	Left	46	13	0.00	Pipe	545	5	2	0	electricity
39	Direct 3	4.185	Right	46	0	0.00	Pipe	820	8	2	0	electricity
40	Direct 1	4.260	Left	62	8	0.270	J-section	400	9	1	1	electricity
41	Al aly A	4.260	Left	102	0	0.530	J-section	1075	13	3	0	electricity
42	Al aly B	4.260	Left	71	12	1.380	Pipe	675	8	1	1	electricity
43	Al aly C	4.260	Left	131	0	1.860	J-section	811	13	1	2	electricity
44	Al aly D	4.860	Right	70	0	0.260	J-section	1272	8	3	0	electricity
45	Tayara A	4.860	Right	98	0	0.500	Pipe	862	11	3	0	electricity
46	Tayara B	4.860	Right	63	0	1.040	J-section	625	5	1	1	electricity
47	Tayara C	4.900	Left	27	3	0.00	J-section	261	4	3	0	electricity
48	Raha	5.360	Left	30	0	0.00	J-section	437	3	2	0	electricity
49	Direct 4	5.400	Right	24	2	0.00	J-section	305	4	3	0	electricity
50	Direct 2	5.675	Right	80	0	0.415	J-section	1090	12	1	0	electricity
51	Helal	5.790	Left	55	9	0.555	J-section	585	8	1	1	electricity
52	Manshya A	5.790	Left	45	0	0.580	J-section	832	7	2	0	electricity
53	Manshya B	5.790	Left	65	0	1.030	J-section	800	14	1	2	electricity
54	Manshya C	5.790	Left	75	0	1.2000	J-section	700	8	2	0	electricity
55	Manshya D	6.275	Right	37	0	0.00	J-section	574	8	2	0	electricity
56	Direct 3	6.396	Left	18	5	0.00	J-section	328	4	3	0	electricity
57	Direct 5	6.400	Right	31	9	0.00	J-section	248	5	2	0	electricity
58	Direct 4	6.800	Right	61	4	0.145	J-section	530	8	1	1	electricity
59	Shahayna	7.596	Left	33	0	0.00	J-section	568	6	3	0	electricity
60	Direct 6											

