Appendix-7 Water Quality Survey

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المركز القومى للبحوث
الوحدة الاستشارية للبيئة المائية

Report on the results of water analysis of samples collected at El-Mahala water treatment plant and distribution system:

1- Water quality at the in-take point of the New Water Treatment Plant (El-Malah Canal):

The quality of the raw water supply for the El-Mahala El-Kobra treatment plant is presented in Tables 1-1, 1-2 and 1-3. The water is characterized by relatively high turbidity (11-17 NTU). The pH was in the alkaline range. The other parameters reflect the nature of Nile River water with respect to TDS, total alkalinity, total hardness and chloride.

Algal content of the raw water was relatively high (10134-10208 cells/cm^3) and diatoms were the most dominant species which contribute to the problems of sand-filters clogging and backwash.

2- General characteristics of the wastewater discharged by the new WTP:

The value of COD (dichromate), BOD, Al and Mn are relatively high. The quality of wastewater released by water treatment plants is controlled by items 11 and 15 of the low 48 issued in 1982. Bacteriological examination of the wastewater revealed the presence of low number of total Coliforms, Faecal Coliforms and Faecal Streptococci. Application of chlorine dose of 2 mg/L is suggested to control faecal contamination.

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Quality of water samples collected from various sites at El-Mahala El-Kobra Treatment Plans.

3- Treated water (T):

Water samples were collected from the following sites presented in Tables 1-1 to 1-5. The new WTP effluent after post-chlorination (T_1) was generally complying with the Egyptian drinking water standards. However total Coliforms exceeded the permissible level. The dose of applied chlorine and contact time need to be controlled.

Water collected from the well at the New WTP (T_2) showed high TDS and chloride content, which exceed the acceptable limits of the Egyptian Drinking water standards. The values of the other parameters are within the range of drinking standards.

After post-chlorination of the old WTP water sample (T_3) showed high levels of manganese and iron. Water samples of the Old WTP intake 1 (T_4) showed high iron (3.29 mg/L) and manganese (0.635 mg/L) contents. This water resource needs to be treated to match the water quality according to the Egyptian standards.

Water sample of the Old WTP intake 2 (T5) showed unacceptable characteristics with respect to TDS, chloride, iron, and manganese.

Water of the old WTP intake 3 (T6) and intake 4 (T7), showed high iron, and manganese contents exceeding the permissible level of Egyptian drinking water. In addition, the value of TDS of T6 is not acceptable.

Water supplied by the compact unit 1&2 at Omar Ibn El-Khatab (T8 and T9) were all of good quality with respective to the investigated items.

Meanwhile, all water samples collected from the compact units 1,2,3,4,5 and 6 T10-T15) at Manshiat El-Bakri were of good quality.

On the other hand, water samples of Manshiat El-Bakri, namely well 1,2,3,4 and 5 (T 16-T20), respectively, showed high values with respect to iron, and manganese. In addition, the values of TDS, in case of T 18 exceeded the permissible level according to the Egyptian standards.

Water samples of the compact unit 1 and 2 at Abu-Ali, (T21 and T22) were of good quality except for iron content which slightly exceeds the permissible level.

Water samples collected from wells at Abu Ali (T23 and T24) were of good quality except for manganese content of sample T24 which slightly exceeds the permissible level. Finally water of the compact unit at Kafr El-Geania (T25) was of high quality.

4-Water Quality in the distribution system:

Samples collected from the distribution system lines covered by New WTP, namely S_1, S_2, S_3 and S_4, showed good quality in respect to the investigated parameters except for the value of manganese in case of samples S_1 which is slightly high.

In case of areas covered by the old WTP, namely S_5, S_6, S_7 and S_8, the water quality matched that of the Egyptian Standards except for iron and manganese contents which exceeded the permissible level.

In case of samples collected from the wells of Old WTP, distribution line at S_9 and Omar Ibn El-Khatab (S_{10}), the water was of good quality.

Water samples namely S11 – S23 showed general characteristics that matched the Egyptian drinking water standard. Only, in case of water sample S_{15} (El-Qaisara), the level of manganese was slightly exceeding the permissible level.

Optimal Alum Dose:

Several experiments were run to determine the optimal alum dose to be applied to achieve maximum removal of turbidity. The doses tested ranged between 10 and 40 mg/L. Maximum removal of turbidity was affected by a dose 20 mg/L alum. Use of calcium oxide, as coagulant aid (10 mg/L) has no effect on the coagulation process.

21/9/2002

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الوحدة الاستشارية للبيئة المائية

Results of Water Quality Survey in El-Mahala El-Kobra

Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 22/8/2005

Table (1-1) Raw Water Analysis

Parameters	Unit	Result
Water temperature	°C	28
Turbidity	NTU	17
Odor	-	Odorless
Color	Unit	20
pH	-	8.0
Total Dissolved Solids	mg/l	233
Total Alkalinity ($CaCO_3$)	mg/l	134
Total Hardness ($CaCO_3$)	mg/l	120
Calcium	mg/l	30
Magnesium	mg/l	11
Chloride	mg/l	20
Ammonia (NH_4-N)	mg/l	ND
Nitrite (NO_2-N)	mg/l	ND
Nitrate (NO_3-N)	mg/l	0.081
Iron	mg/l	0.066
Manganese	mg/l	ND
Fluoride	mg/l	0.1

٢٠٠٥/٩/١٨

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Results of Water Quality Survey in El-Mahala El-Kobra

Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 29/8/2005

Table (1-2) Raw Water Analysis

Parameters	Unit	Result
Water temperature	°C	27
Turbidity	NTU	14
Odor	-	Odorless
Color	Unit	17
pH	-	8.1
Total Dissolved Solids	mg/l	240
Total Alkalinity ($CaCO_3$)	mg/l	134
Total Hardness ($CaCO_3$)	mg/l	124
Calcium	mg/l	30
Magnesium	mg/l	12
Chloride	mg/l	22
Ammonia (NH_4-N)	mg/l	ND
Nitrite (NO_2-N)	mg/l	ND
Nitrate (NO_3-N)	mg/l	0.111
Iron	mg/l	0.071
Manganese	mg/l	ND
Fluoride	mg/l	0.069

٢٠٠٥/٩/١٨

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Results of Water Quality Survey in El-Mahala El-Kobra

Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 4/9/2005

Table (1-3) Raw Water Analysis

Parameters	Unit	Result
Water temperature	°C	27
Turbidity	NTU	11
Odor	-	Odorless
Color	Unit	14
pH	-	7.9
Total Dissolved Solids	mg/l	240
Total Alkalinity ($CaCO_3$)	mg/l	134
Total Hardness ($CaCO_3$)	mg/l	126
Calcium	mg/l	30
Magnesium	mg/l	12
Chloride	mg/l	24
Ammonia (NH_4-N)	mg/l	ND
Nitrite (NO_2-N)	mg/l	ND
Nitrate (NO_3-N)	mg/l	0.066
Iron	mg/l	0.038
Manganese	mg/l	ND
Fluoride	mg/l	0.048

٢٠٠٥/٩/١٨

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Results of Water Quality Survey in El-Mahala El-Kobra

Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 22/8/2005

Continue, Table (1-1) Raw Water Analysis

Algal Examination

Parameters	Algal counts (Organisms/ml)
Diatoms	9108
Green Algae	814
Blue-Green Algae	286
Total Algal Counts	10208

٢٠٠٥/٩/١٨

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Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 29/8/2005

Continue, Table (1-2) Raw Water Analysis

Algal Examination

Parameters	Algal counts (Organisms/ml)
Diatoms	9000
Green Algae	860
Blue-Green Algae	274
Total Algal Counts	10134

٢٠٠٥/٩/١٨

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Results of Water Quality Survey in El-Mahala El-Kobra

Sampling site: from the intake point of the new water treatment plant (El-Malah Canal).
Sampling date: 4/9/2005

Continue, Table (1-3) Raw Water Analysis

Algal Examination

Parameters	Algal counts (Organisms/ml)
Diatoms	8725
Green Algae	1000
Blue-Green Algae	300
Total Algal Counts	10025

٢٠٠٥/٩/١٨

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Jar Test (Coagulant effectiveness)

First Run (22/8/2005)

Coagulant dose (mg/l)	Turbidity (NTU)		% Removal
	Raw Water	Treated Water	
10	17	1.5	91.2
20	17	1.3	92.4
30	17	1.6	90.6
40	17	1.7	90

- Alum (Aluminum Sulfate) was used as coagulant material
- % of Aluminum in Alum is 8.5
- The effective dose was 20 mg/l (1.7 mg/l Aluminum)

Second Run (29/8/2005)

Coagulant dose (mg/l)	Turbidity (NTU)		% Removal
	Raw Water	Treated Water	
10	14	1.4	90
20	14	1.2	91.4
30	14	1.5	89.3
40	14	1.5	89.3

- Alum (Aluminum Sulfate) was used as coagulant material
- % of Aluminum in Alum is 8.5
- The effective dose was 20 mg/l (1.7 mg/l Aluminum)

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Third Run (4/9/2005)

Coagulant dose (mg/l)	Turbidity (NTU)		% Removal
	Raw Water	Treated Water	
10	10.5	1.2	88.6
20	10.5	1.0	90.5
30	10.5	1.3	87.6
40	10.5	1.3	87.6

- Alum (Aluminum Sulfate) was used as coagulant material
- % of Aluminum in Alum is 8.5
- The effective dose was 20 mg/l (1.7 mg/l Aluminum)

Third Run (4/9/2005)

Coagulant dose (mg/l) + 10 mg/l CaO	Turbidity (NTU)		% Removal
	Raw Water	Treated Water	
10	10.5	1.5	85.7
20	10.5	1.4	86.7
30	10.5	1.7	83.8
40	10.5	1.6	84.8

- Alum (Aluminum Sulfate) and 10 mg/l Lime (Calcium Oxide) were used as coagulant materials
- % of Aluminum in Alum is 8.5
- The effective dose was 20 mg/l (1.7 mg/l Aluminum)
- The addition of Calcium Oxide as coagulant aid has no effect

٢٠٠٥/٩/١٨

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Results of Wastewater Quality Survey in El-Mahala El-Kobra

Sampling site: from the wastewater basin of the new water treatment plant (El-Malah Canal).
Sampling date: 22/8/2005

Table (1) Wastewater Chemical Analysis

Parameters	Unit	Result
Water temperature	°C	31
pH	-	8.1
Chemical Oxygen Demand (COD, dichromate)	mg O_2/l	35
Chemical Oxygen Demand (COD, permanganate)	mg O_2/l	2
Biochemical Oxygen Demand (BOD)	mg O_2/l	16
Dissolved Oxygen	mg O_2/l	6.0
Total Dissolved Solids	mg/l	461
Suspended Solids	mg/l	35
Color	Unit	25
Oil and Grease	mg/l	3.5
Sulfide	mg/l	2.1
Nitrate (NO_3-N)	mg/l	0.148
Iron	mg/l	0.579
Manganese	mg/l	2.18
Aluminum	mg/l	1.97
Copper	mg/l	0.05
Zinc	mg/l	0.04
Cadmium	mg/l	0.004
Lead	mg/l	0.04
Chlorinated Pesticides	ng/l	293

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Table (2) Wastewater Bacteriological Examination

Parameter	Unit	Result
Total Coliform	MPN/100 ml	17
Faecal Coliform	MPN/100 ml	1
Faecal Streptococci	MPN/100 ml	4

٢٠٠٥/٩/١٨

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Results of Water Quality Survey in El-Mahala El-Kobra

3- Treated Water (T)

Table (1-1)

Parameters	Unit	Sampling Sites				
		T1	T2	T3	T4	T5
Sampling Date	-	29/8/05	22/8/05	29/8/05	29/8/05	29/8/05
pH	-	7.2	7.6	7.4	7.7	7.8
Turbidity	NTU	1.0	2.5	1.2	1.8	2.0
Total Dissolved Solids	mg/l	206	1560	218	881	1606
Total Hardness ($CaCO_3$)	mg/l	118	210	126	250	480
Calcium	mg/l	30	48	32	56	100
Magnesium	mg/l	10	22	11	27	56
Nitrate (NO_3-N)	mg/l	0.066	0.063	0.068	0.219	0.356
Fluoride	mg/l	0.015	0.195	0.012	0.166	0.179
Chloride	mg/l	28	840	28	360	590
Sulfate	mg/l	16	46	44	54	93
Iron	mg/l	0.096	0.215	3.9	3.29	3.53
Manganese	mg/l	ND	0.149	0.787	0.635	0.651
Copper	mg/l	ND	0.211	0.131	ND	0.168
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	0.301	0.215	ND	0.254
Total Coliform	MPN/100 ml	16	1	0.0	0.0	0.0

T1: Reservoir after post-chlorination new WTP
T2: Well at the new WTP
T3: Reservoir after post-chlorination old WTP
T4: Well at old WTP intake (1)
T5: Well at old WTP intake (2)

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Results of Water Quality Survey in El-Mahala El-Kobra

3- Treated Water (T)

Table (1-2)

Parameters	Unit	Sampling Sites				
		T6	T7	T8	T9	T10
Sampling Date	-	29/8/05	29/8/05	22/8/05	22/8/05	29/8/05
pH	-	7.6	7.7	7.4	7.4	7.5
Turbidity	NTU	2.1	1.7	1.2	1.0	0.95
Total Dissolved Solids	mg/l	1420	985	231	240	219
Total Hardness ($CaCO_3$)	mg/l	390	300	118	122	120
Calcium	mg/l	80	68	30	31	30
Magnesium	mg/l	46	32	11	11	11
Nitrate (NO_3-N)	mg/l	0.331	0.233	0.143	0.148	0.119
Fluoride	mg/l	0.175	0.167	0.013	0.018	ND
Chloride	mg/l	450	420	22	25	28
Sulfate	mg/l	78	59	20	21	22
Iron	mg/l	3.411	3.321	ND	0.145	0.052
Manganese	mg/l	0.638	0.642	ND	ND	ND
Copper	mg/l	0.163	0.132	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	0.264	0.194	ND	ND	ND
Total Coliform	MPN/100 ml	0.0	0.0	0.0	0.0	0.0

T6: Well at old WTP intake (3)
T7: Well at old WTP intake (4)
T8: Compact unit 1 at Omar Ibn El-Khatab
T9: Compact unit 2 at Omar Ibn El-Khatab
T10: Compact unit 1 at Manshiat El-Bakri

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Results of Water Quality Survey in El-Mahala El-Kobra

3- Treated Water (T)

Table (1-3)

Parameters	Unit	Sampling Sites				
		T11	T12	T13	T14	T15
Sampling Date	-	29/8/05	29/8/05	29/8/05	29/8/05	29/8/05
pH	-	7.5	7.5	7.7	7.6	7.5
Turbidity	NTU	1.0	1.2	1.4	0.95	1.1
Total Dissolved Solids	mg/l	211	206	216	225	210
Total Hardness ($CaCO_3$)	mg/l	122	120	122	124	120
Calcium	mg/l	31	31	31	32	30
Magnesium	mg/l	11	11	11	12	11
Nitrate (NO_3-N)	mg/l	0.116	0.106	0.113	0.126	0.109
Fluoride	mg/l	ND	ND	ND	ND	ND
Chloride	mg/l	30	28	28	30	28
Sulfate	mg/l	19	17	19	22	19
Iron	mg/l	0.058	0.033	0.051	0.059	0.036
Manganese	mg/l	ND	ND	ND	ND	ND
Copper	mg/l	ND	ND	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	ND	ND	ND
Total Coliform	MPN/100 ml	0.0	0.0	0.0	0.0	0.0

T11: Compact unit 2 at Manshiat El-Bakri
T12: Compact unit 3 at Manshiat El-Bakri
T13: Compact unit 4 at Manshiat El-Bakri
T14: Compact unit 5 at Manshiat El-Bakri
T15: Compact unit 6 at Manshiat El-Bakri

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الوحدة الاستشارية للبيئة المائية

Results of Water Quality Survey in El-Mahala El-Kobra

3- Treated Water (T)

Table (1-4)

Parameters	Unit	Sampling Sites				
		T16	T17	T18	T19	T20
Sampling Date	-	29/8/05	4/9/05	4/9/05	4/9/05	4/9/05
pH	-	7.4	7.5	7.4	7.6	7.3
Turbidity	NTU	1.8	1.6	2.0	1.6	2.0
Total Dissolved Solids	mg/l	972	1131	1235	965	1160
Total Hardness ($CaCO_3$)	mg/l	330	380	420	326	400
Calcium	mg/l	76	96	98	74	98
Magnesium	mg/l	34	35	36	33	35
Nitrate (NO_3-N)	mg/l	0.277	0.298	0.311	0.271	0.291
Fluoride	mg/l	0.133	0.163	0.181	0.128	0.155
Chloride	mg/l	380	430	450	372	434
Sulfate	mg/l	70	93	96	68	94
Iron	mg/l	3.541	0.687	2.361	0.688	0.661
Manganese	mg/l	0.647	0.364	0.812	0.362	0.418
Copper	mg/l	0.121	0.109	0.132	ND	0.118
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	0.132	0.168	0.111	0.148
Total Coliform	MPN/100 ml	0.0	0.0	0.0	0.0	0.0

T16: Well 1 at Manshiat El-Bakari
T17: Well 2 at Manshiat El-Bakari
T18: Well 3 at Manshiat El-Bakari
T19: Well 4 at Manshiat El-Bakari
T20: Well 5 at Manshiat El-Bakari

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تليفون وفاكس: ٣٣٧١٤٧٩

National Research Centre
Environmental Consultation
&
Water Quality Unit

المركز القومى للبحوث
الوحدة الاستشارية للبيئة المائية

Results of Water Quality Survey in El-Mahala El-Kobra

3- Treated Water (T).

Table (1-5)

Parameters	Unit	Sampling Sites				
		T21	T22	T23	T24	T25
Sampling Date	-	22/8/05	22/8/05	22/8/05	22/8/05	29/8/05
pH	-	7.8	7.6	7.6	7.5	7.7
Turbidity	NTU	1.0	0.9	2.1	2.5	0.9
Total Dissolved Solids	mg/l	245	236	1120	1086	260
Total Hardness ($CaCO_3$)	mg/l	120	118	220	200	122
Calcium	mg/l	30	29	44	42	30
Magnesium	mg/l	11	10	27	26	11
Nitrate (NO_3-N)	mg/l	0.135	0.140	0.052	0.061	0.032
Fluoride	mg/l	0.014	0.012	0.026	0.019	ND
Chloride	mg/l	26	22	380	374	26
Sulfate	mg/l	17	18	26	25	19
Iron	mg/l	0.410	0.493	0.077	0.106	ND
Manganese	mg/l	ND	ND	0.269	0.233	ND
Copper	mg/l	ND	ND	0.118	0.121	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	0.132	0.164	ND
Total Coliform	MPN/100 ml	0.0	0.0	0.0	0.0	0.0

T21: Compact unit 1 at Abu Ali
T22: Compact unit 2 at Abu Ali
T23: Well 1 at Abu Ali
T24: Well 2 at Abu Ali
T25: Compact unit at Kafr El-Geaina

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Results of Water Quality Survey in El-Mahala El-Kobra

4- Supplied Water (S)

Table (1-1)

Parameters	Unit	Sampling Sites				
		S1	S2	S3	S4	S5
Sampling Date	-	22/8/05	22/8/05	22/8/05	22/8/05	22/8/05
pH	-	7.5	7.4	7.6	7.4	7.7
Turbidity	NTU	0.7	0.5	0.4	0.7	0.6
Total Dissolved Solids	mg/l	298	327	318	322	232
Total Hardness ($CaCO_3$)	mg/l	124	126	128	126	122
Calcium	mg/l	30	31	30	30	28
Magnesium	mg/l	11	12	11	12	10
Nitrate (NO_3-N)	mg/l	0.150	0.161	0.148	0.156	0.143
Fluoride	mg/l	0.010	0.010	0.011	0.010	0.010
Chloride	mg/l	72	74	72	72	21
Sulfate	mg/l	19	20	20	20	18
Iron	mg/l	0.189	0.209	0.211	0.196	0.124
Manganese	mg/l	0.456	0.122	ND	0.119	ND
Copper	mg/l	ND	0.021	ND	0.018	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	0.025	ND	ND
Total Coliform	MPN/100 ml	0.0	1	0.0	0.0	0.0

S1: Distribution line at area covered by new WTP
S2: Distribution line at area covered by new WTP
S3: Distribution line at area covered by new WTP
S4: Distribution line at area covered by new WTP
S5: Distribution line at area covered by old WTP

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Results of Water Quality Survey in El-Mahala El-Kobra

4- Supplied Water (S)

Table (1-2)

Parameters	Unit	Sampling Sites				
		S6	S7	S8	S9	S10
Sampling Date	-	22/8/05	4/9/05	4/9/05	29/8/05	22/8/05
pH	-	7.5	7.8	7.8	7.6	7.4
Turbidity	NTU	0.5	0.88	1.1	1.0	1.2
Total Dissolved Solids	mg/l	245	268	250	233	446
Total Hardness ($CaCO_3$)	mg/l	122	126	124	132	134
Calcium	mg/l	29	30	29	30	32
Magnesium	mg/l	10	11	10	13	14
Nitrate (NO_3-N)	mg/l	0.154	0.176	0.169	0.175	0.118
Fluoride	mg/l	0.010	ND	ND	0.011	ND
Chloride	mg/l	20	22	20	46	126
Sulfate	mg/l	17	17	17	19	22
Iron	mg/l	0.157	0.164	0.708	ND	0.061
Manganese	mg/l	ND	0.088	0.256	ND	0.012
Copper	mg/l	ND	ND	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	ND	ND	0.01
Total Coliform	MPN/100 ml	ND	ND	ND	ND	ND

S6: Distribution line at area covered by old WTP
S7: Distribution line at area covered by old WTP
S8: Distribution line at area covered by old WTP
S9: Distribution line at area covered by wells of old WTP
S10: Distribution line at area covered by C.U. of Omar Ibn El-Khatab

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Results of Water Quality Survey in El-Mahala El-Kobra

4- Supplied Water (S)

Table (1-3)

Parameters	Unit	Sampling Sites				
		S11	S12	S13	S14	S15
Sampling Date	-	22/8/05	22/8/05	4/9/05	4/9/05	4/9/05
pH	-	7.6	7.8	7.7	7.7	7.9
Turbidity	NTU	0.8	1.2	1.6	1.4	1.5
Total Dissolved Solids	mg/l	232	446	459	451	944
Total Hardness ($CaCO_3$)	mg/l	120	130	220	200	270
Calcium	mg/l	28	28	56	40	68
Magnesium	mg/l	12	12	20	24	40
Nitrate (NO_3-N)	mg/l	0.115	0.158	0.096	0.112	0.125
Fluoride	mg/l	ND	0.043	0.024	ND	0.116
Chloride	mg/l	50	126	150	90	270
Sulfate	mg/l	19	22	19	16	40
Iron	mg/l	ND	0.061	0.133	ND	0.244
Manganese	mg/l	ND	0.0146	ND	ND	0.167
Copper	mg/l	ND	ND	ND	ND	0.171
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	ND	ND	0.011
Total Coliform	MPN/100 ml	0.0	1	ND	ND	ND

S11: Distribution line at area covered by C.U. of Abu Ali
S12: Distribution line at area covered by Wells of Abu Ali
S13: Distribution line at area covered by C.U. of Manshiat El-Bakari
S14: Distribution line at area covered by Wells of Manshiat El-Bakari
S15: In El-Qaisaria

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Results of Water Quality Survey in El-Mahala El-Kobra

4- Supplied Water (S)

Table (1-4)

Parameters	Unit	Sampling Sites				
		S16	S17	S18	S19	S20
Sampling Date	-	4/9/05	29/8/05	29/8/05	29/8/05	4/9/05
pH	-	7.5	7.6	7.7	7.6	7.7
Turbidity	NTU	0.95	1.1	0.95	1.0	0.61
Total Dissolved Solids	mg/l	232	224	236	243	239
Total Hardness ($CaCO_3$)	mg/l	120	122	120	122	150
Calcium	mg/l	30	31	31	32	32
Magnesium	mg/l	10	10	10	10	17
Nitrate (NO_3-N)	mg/l	0.123	0.116	0.109	0.143	0.205
Fluoride	mg/l	ND	ND	ND	ND	ND
Chloride	mg/l	26	26	26	26	60
Sulfate	mg/l	18	17	18	19	22
Iron	mg/l	ND	ND	ND	ND	ND
Manganese	mg/l	ND	ND	ND	ND	ND
Copper	mg/l	ND	ND	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	ND
Zinc	mg/l	ND	ND	ND	ND	ND
Total Coliform	MPN/100 ml	0.0	0.0	0.0	0.0	1.0

S16: In Batina
S17: In Ezbat Toma
S18: In Ezbat Lona Kamar
S19: In Kafr El-Geaina
S20: In Manshiat El-Omara

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Results of Water Quality Survey in El-Mahala El-Kobra

4- Supplied Water (S)

Table (1-5)

Parameters	Unit	Sampling Sites		
		S21	S22	S23
Sampling Date	-	4/9/05	4/9/05	4/9/05
pH	-	7.8	7.9	7.7
Turbidity	NTU	1.2	1.4	1.2
Total Dissolved Solids	mg/l	272	348	285
Total Hardness ($CaCO_3$)	mg/l	260	280	260
Calcium	mg/l	60	64	60
Magnesium	mg/l	26	29	26
Nitrate (NO_3-N)	mg/l	0.064	0.139	0.114
Fluoride	mg/l	ND	0.016	ND
Chloride	mg/l	24	32	28
Sulfate	mg/l	17	19	17
Iron	mg/l	ND	ND	ND
Manganese	mg/l	ND	ND	ND
Copper	mg/l	0.007	ND	ND
Lead	mg/l	ND	ND	ND
Zinc	mg/l	0.01	ND	0.01
Total Coliform	MPN/100 ml	ND	ND	ND

S21: In Mahalat Hassan
S22: In Meit El-Lith Hashim
S23: In Diarb Hashim

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Appendix-8 Social Survey

REPORT OF SOCIAL SURVEY

September 1, 2005

1. Objectives of the Survey

The Objectives of the Survey were basically as follows:

(1) Assess the water service conditions in the Project Area (consumption amount, water pressures, discharge)

(2) Assess the degree of satisfaction of the consumers

(3) Determine the potential revenue from the consumers' willingness-to-pay

2. Survey Methodology

The Survey was carried out through the interviews with consumers in urban and rural areas in four (4) of the Gharbia Governorate's six (6) cities (Markaz). The process followed is briefly described:

(1) Questionnaire Form

The questionnaire form and experience gained in Sharkia were the basis for preparing this survey's questionnaire form. The prepared questionnaire was discussed in detail with GACWASD in two sessions and modified based on the discussions.

The final form was translated into Arabic.

(2) Selection of the Samples

The BD Team proposed that the interviews be conducted in the four cities of Mahalla El Kobra (target city for the project), Tanta (capital city and similar in nature to MK in terms of population), and the two smaller cities of Sammanoud (east of MK) and Qotour (west of MK).

Both urban and rural samples were to be taken from each of these cities.

The BD Team held discussions with GACWASD to select districts in the cities for the urban samples that would reflect the different income levels, and geographical conditions. The same procedure was adopted for selecting the rural samples from certain villages within the 6 cities.

After completing the identification of the districts and villages GACWASD proceeded to draw up names of consumers from their subscribers lists as candidates for the samples. Lists were prepared for each of the target district and village showing the consumer name, address, amount of billed water and value of the bill. The names in the lists were about 3 times the required number.

(3) Training of the Surveyors

A number of surveyors (around 20) living in MK and Tanta were introduced to the BD Team by staff of GACWASD. These surveyors were mainly university students.

Two training sessions were held with the surveyors to explain the questions in the Questionnaire and also on how to use the pressure gauges (for the urban districts of MK).

A pilot survey was done in MK using about 30 samples in order to finalize the questionnaire form and also detect any problems in the questions.

(4) Survey

The interview survey was implemented over 12 days. The surveyors were mobilized into groups of 3 and 4. GACWASD kindly arranged for the tariff collectors to accompany the surveyors in order to introduce them to the households to be surveyed.

For each survey team, a supervisor was assigned to check the completed questionnaire form and instruct the surveyors as required. In many instances the surveyors were sent back to the interviewed household to ask a question they may have missed, clarify an unclear reply or to try once more and obtain an answer for a question that was not answered at the first time.

Basically the GACWASD prepared lists for districts and villages were used. When the selected persons were not found random persons in the vicinity were selected. In such cases the subscriber number was asked in order to obtain data on the household (consumption and billed charge) from GACWASD data bank. When the names on the list were considered too closely clustered together, the surveyors, with the help of GACWASD identified other close by areas in the field.

All the households approached agreed to be interviewed and most were very kind in giving their time and opinions. As the water service is a burning issue for most of the citizens the interviewed households offered more information than was required in many instances. In some households the surveyors were shown samples of the water and

sometimes asked to taste the water for themselves!

(5) Data Input and Valediction

Data input proceeded in parallel with the surveys. The questionnaire forms were input into MS Excel spread sheets, in Arabic and in English.

Each entry was checked for inconsistencies and when these were found, the surveyor responsible for the questionnaire was called in to check the answers mostly be calling the surveyed household or paying a repeat visit.

Concerning the consumption amounts and billed costs, in most cases the data from GACWASD was used.

(6) Analysis

The input data was analyzed using the MS Excel spread. The main results are described hereafter.

3. Survey Coverage Area

Table 1 shows the districts and villages were the survey was implemented.

Table (1) Planned and Achieved Sample of Social Survey in Different Cities

City	Location	District		Sample		(%)*
		Code	Name	Planned	Achieved	
Mahala El-Kobra (210 samples)	Urban (105)	1	Sabae Banat	15	19	1.27
		2	Shokry El-Kowatly (CBD)	15	20	1.33
		3	Sekka El-Westaneya	15	20	1.33
		4	Sooq El-Laban	15	23	1.53
		5	Gomhoreya	15	23	1.53
	Rural (105)	6	Mehalet Hasan	15	20	1.33
		7	Qaysareya Abo Aly	15	23	1.53
		8	Dawakhleya	15	20	1.33
		9	Kafr Hegazy	15	21	1.40
		10	Mehalet Abo Aly	15	21	1.40

City	Location	District		Sample		(%)*
		Code	Name	Planned	Achieved	
Tanta (161 samples)	Urban (79)	11	Estad	15	25	1.67
		12	Kafr Essam	15	20	1.33
		13	Segar	15	17	1.13
		14	Salam	15	17	1.13
	Rural (82)	15	Berma	15	20	1.33
		16	Mehalet Marhoom	15	20	1.33
		17	Ragdeya	15	21	1.40
		18	Sperbay	15	21	1.40
Sammanoud (149 samples)	Urban (61)	19	Sammanoud (Magles El-Madina)	15	18	1.20
		20	Sooq	15	20	1.33
		21	Samaha	15	23	1.53
	Rural (88)	22	Rahebeen	15	20	1.33
		23	Mehalet Zayad	20	24	1.20
		24	Mit Asas	20	24	1.20
		25	Nasereya	15	20	1.33
Qotour (152 samples)	Urban (60)	26	Sharei El-Bahr	15	20	1.33
		27	Qotour El-Balad	15	20	1.33
		28	Mostashfa El-Aam	15	20	1.33
	Rural (92)	29	Beltag	20	21	1.05
		30	Ebshaway El-Malaq	20	25	1.25
		31	Damat	15	26	1.73
		32	Hohowein	15	20	1.33
Total				500	672	1.34

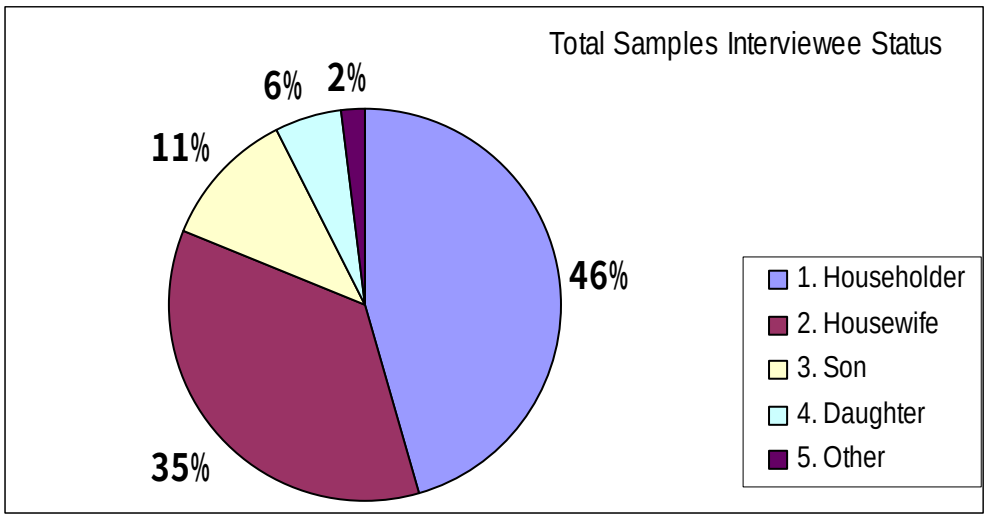
*Note: Achieved/Planned

A total of six-hundred and seventy-two households were surveyed. For MK the share was 31% (or slightly less than 1/3rd of the total sample) to reflect the position of MK as the project location. In terms of urban to rural split, the share was 1 to 1.2.

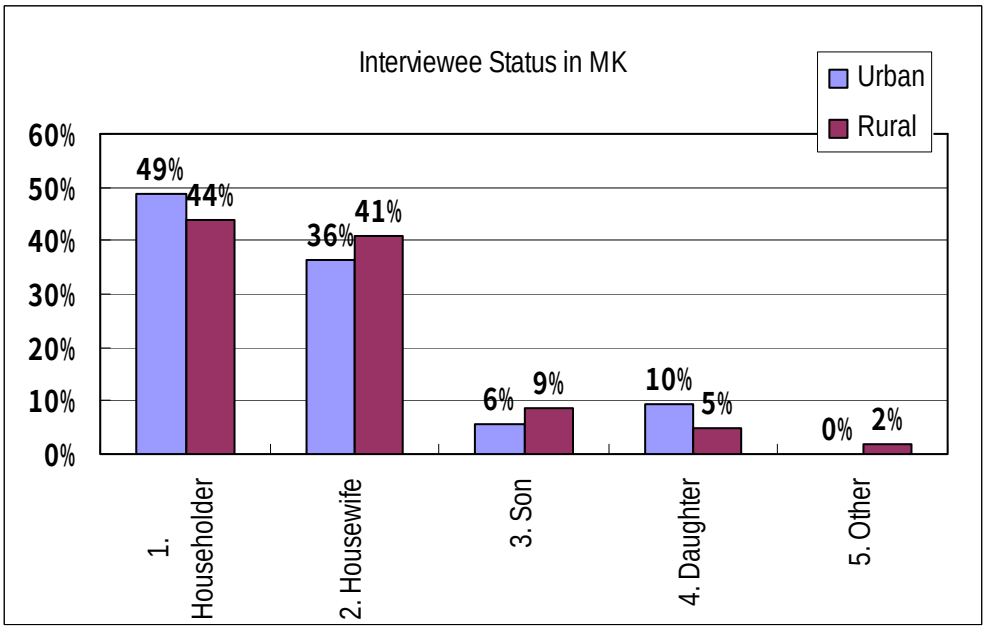
4. Main Results of the Survey

(1) Household Attributes

① Interviewed Person

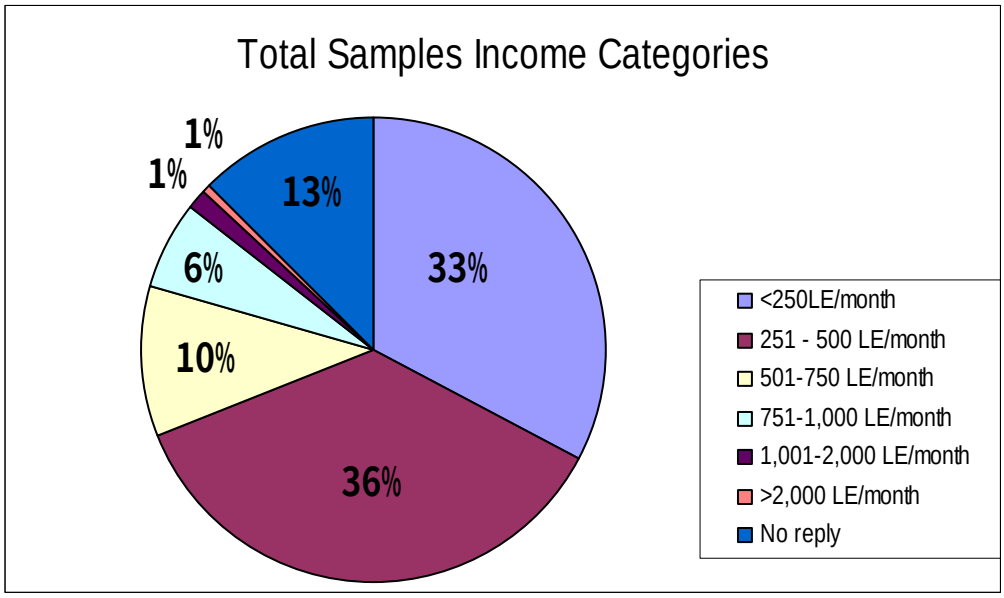


The majority of interviewees were conducted with the householder followed by the wife. In many cases both were present to answer the questions, especially in the rural areas.

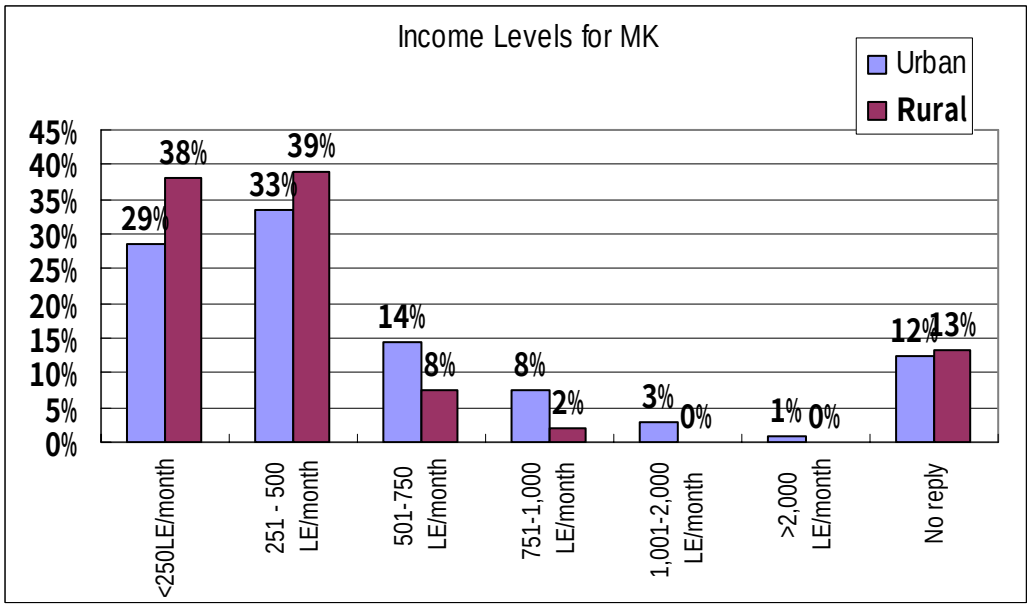


Interviews of MK show the same tendency. There is also slight difference between urban and rural areas.

② Income Data



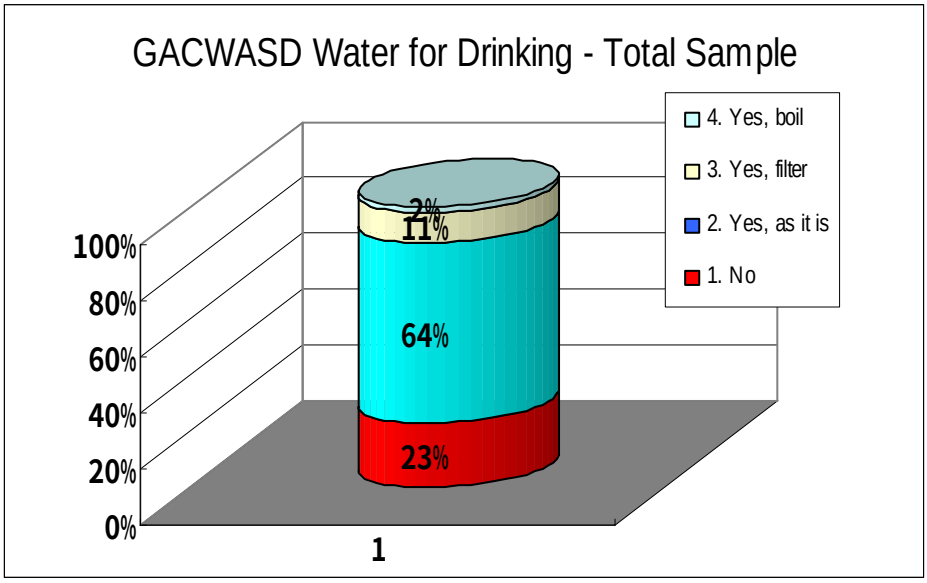
Interviewees were queried on how many people are earning an income within the household and the total income of those people. Surprisingly only 13% of the total queried households refused to answer. On the other hand potential deflation of the incomes could not be completely avoided. 70% of the samples declared incomes of less than 500 LE monthly.



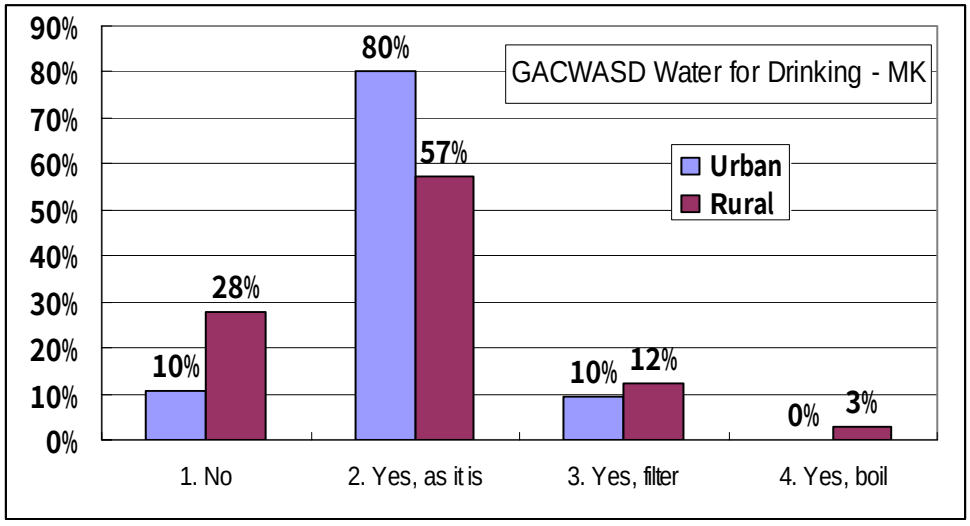
Overall the levels do not differ much in the case of MK only. As expected the households in urban areas declared higher income levels than rural households.

(2) Satisfaction with GACWASD Water Service

① Water as Drinking Source

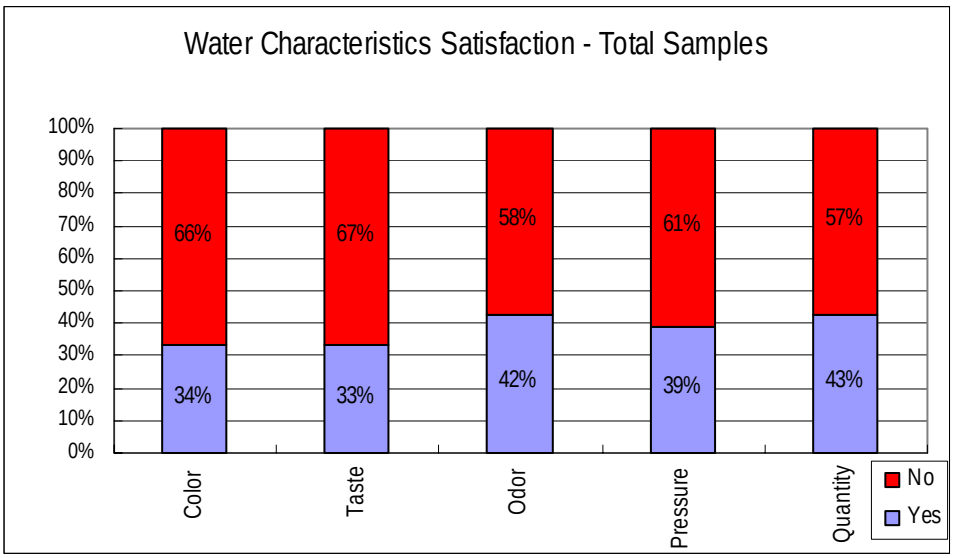


Households were asked whether they drink the GACWASD supplied water. Twenty-three (23%) percent do not drink the water at all, while 64% drink it without any countermeasures. 13% either insert filter or boil the water before drinking.

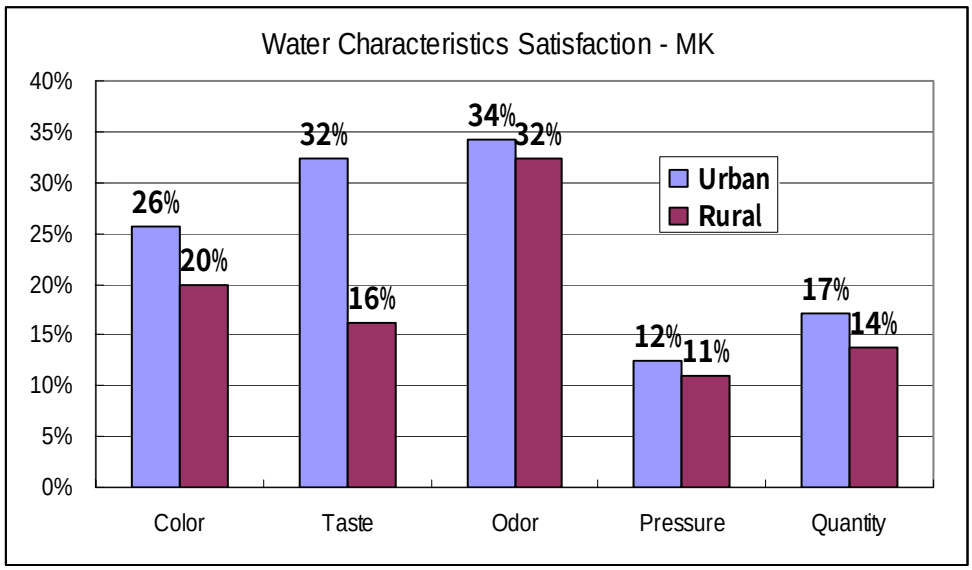


In the case of MK, the percent of households not drinking the GACWASD water was almost three times the respective urban share. This is indicative of the need to improve the service in rural areas. And 80% of the MK urban population drinks the water as it is.

② Specific Water Quality Characteristics



The characteristics with the highest degree of dissatisfaction were the taste and color. None of the five characteristics received even a 50% margin of satisfaction.



In general urban residents were more satisfied with GACWASD supplied water color and taste, than were their counterparts in the rural villages of MK. The largest degree of dissatisfaction was shown for the water pressure and urban residents complained vocally of the lack of water in the higher floors. Once more no quality received a degree of satisfaction higher than 34%.

③ Water Cutoffs

Residents were queried on the occurrence of water cut-offs on a scheduled (residents are informed before the cut-off occurs or are aware of these cutoffs) or random basis. Only 16% of the overall respondents stated that they do not experience any cutoffs. The following table shows the shares of respondents confirming frequent scheduled and random cutoffs by city.

City	Scheduled cuts (%)	Random cuts (%)
MK	48%	37%
Tanta	38%	50%
Samannoud	45%	45%
Qotour	25%	47%
TOTAL	40%	44%

Excluding MK, for all the three other cities, random cuts are more common than scheduled cuts. For MK scheduled cuts are more.

④ Overall Satisfaction Level

As a summation to the above the residents were queried on their overall degree of satisfaction with the GACWASD water services. Eighty-one percent (81%) of the total respondents were not satisfied while in the case of MK the shares of those not satisfied were 91% both in the urban as well as rural areas.

(3) Use of Water other than the GACWASD Supply

① Water Purchase

Despite the widely spread dissatisfaction with GACAWSD water services 86% of the total respondents do not purchase water, mainly due to economical reasons. This was the same figure for MK also. In only a very few cases, less than 5% of the total respondents, we were informed that some water is purchased for drinking for the ailing and sick people in the household.

② Free Water

Most urban and rural residents have access to free water such as wells, both private and public. Almost sixty percent (60%) of the respondents replied that they

take water from wells, mostly on a daily basis, to use for drinking and cooking purposes.

In the case of MK 60% of the rural residents interviewed fetched free water from wells on an almost daily basis for all purposes. The respective figure for MK urban residents was just over half of that, at 34%. Ten (10%) percent of MK urban residents mentioned that they obtain free water from neighbors.

(4) Information on Consumption and Billing

Consumption level	%	LE/HH/m
(1) < 50 l/c/d	21%	2.8
(2) 51 - 100 l/c/d	24%	3.7
(3) 101 - 150 l/c/d	19%	5.1
(4) 151 - 200 l/c/d	12%	6.7
(5) 201 - 250 l/c/d	6%	10.2
(6) 251 - 300 l/c/d	5%	12.3
(7) 301 - 400 l/c/d	6%	12.4
(8) 401 - 500 l/c/d	3%	15.4
(9) >501 l/c/d	5%	17.9
Average	171.8	6.7

The consumption rates summarized for the total samples are shown in the above table, along with the billing per household monthly. The largest share (24%) is for the 51 – 100 l/cap/d category. The average monthly payments correspond well to the categories of consumption. Of the total samples, average consumption and monthly billing were 171.8 l/cap/d and LE 6.7 per household per month.

Consumption Category	Urban		Rural	
	%	LE/month	%	LE/month
(1) < 50 l/c/d	14%	2.9	26%	2.1
(2) 51 - 100 l/c/d	16%	3.0	28%	3.2
(3) 101 - 150 l/c/d	21%	6.0	18%	4.5
(4) 151 - 200 l/c/d	12%	5.9	10%	6.4
(5) 201 - 250 l/c/d	9%	7.7	8%	15.1
(6) 251 - 300 l/c/d	9%	7.3	3%	11.7
(7) 301 - 400 l/c/d	10%	9.8	5%	11.5
(8) 401 - 500 l/c/d	4%	22.0	2%	9.7
(9) >501 l/c/d	5%	31.9	2%	19.8
AVERAGE	200	7.5	129	5.7

The above table shows the respective values for MK. In principle water consumption in rural villages is less than in urban districts (average 200 l/cap/d for urban residents versus 129 l/cap/d for their rural counterparts). Monthly payments correspond well to the respective consumption category.

(5) Willingness to Pay

When asked to select the infrastructure which requires major improvement in their residential area (water supply, waste management, sewage, telephones, electricity, and public transport), 78% of the total respondents selected improvement or water supply as their top priority.

And of all the four cities the figures for MK were the highest, in terms of selection of water supply with a share of 91%, followed by Qotour (76%), Tanta (74%) and Samannoud (65%).

Linked to this question, residents were then asked what additional money they were willing to pay monthly in order to improve the water supply service. The replies were categorized and the shares and are shown in the following table.

Add sum LE/month	Urban	Rural	Total
1. All Samples			
0	52%	43%	47%
0-2	15%	22%	19%
2-5	23%	25%	24%
5-10	7%	7%	7%
10-20	1%	2%	2%
>20	1%	0%	1%
2. MK			
0	53%	38%	46%
0-2	14%	20%	17%
2-5	18%	29%	23%
5-10	11%	9%	10%
10-20	2%	4%	3%
>20	1%	1%	1%
AVERAGE (LE/HH/m)	3.7	3.2	3.3

A clear majority of urban residents were not willing to pay any additional money, while in the case of rural residents; the majority was willing to pay some money. For both urban and rural households willing to pay some money, the amount was mostly less than

LE 5 per month.

Figures are similar for MK, with 53% of the urban respondents refusing to pay any additional money. Of the MK respondents willing to pay additional money the average sum of 3.3 LE/household/month was obtained.

(6) Tap Pressure and Discharge in MK Urban Districts

Tap pressure and discharge were measured in the urban households in MK. The results are shown in the following table.

	No.	%			No.	%
1. Tap Pressure				2. Discharge (cm3/sec)		
< 1.0	11	10%		10 - 20	2	2%
1	4	4%		21 - 30	4	4%
1.5	2	2%		31 - 40	5	5%
2	4	4%		41 - 50	4	4%
2.5	5	5%		51 - 60	1	1%
3	2	2%		61 - 70	5	5%
4	3	3%		71 - 80	3	3%
5	2	2%		81 - 90	2	2%
6	3	3%		91 - 100	1	1%
6.5	1	1%		101 - 110	6	6%
7	1	1%		111 - 120	5	5%
7.5	4	4%		121 - 130	5	5%
8	6	6%		131 - 140	4	4%
9	2	2%		141 - 150	2	2%
10	8	8%		151 - 160	2	2%
11	3	3%		161 - 170	1	1%
12	5	5%		171 - 180	1	1%
14	1	1%		181 - 190	6	6%
16	2	2%		191 - 200	2	2%
18	1	1%		201 - 300	3	3%
No Water	35	33%		301 - 400	6	6%
TOTAL	105			No Water	35	33%
					105	100%
Average	6.1			Average	129.0	

The Project for Upgrading of El Mahala El Kobra Water Treatment Plant in the Arab Republic of Egypt

JICA Basic Design Study Team – August 2005

Social Survey Questionnaire

<table>
<tr><td>Introduction</td><td colspan="2">The Government of Egypt, in cooperation with Japan is implementing the improvement of the water treatment plant in El Mahalla El Kobra through renovation of the existing station, increasing its capacity and constructing another waste treatment unit. This project confirms the GOE's policy to extend drinking water to all the parts of the country.</td></tr>
<tr><td>General Information</td><td colspan="2">1. Sample code |__|__|__| 2. Date |__|__|__|__| 3. Time |__|__|__|__|
4. Surveyor Name: _____ 5. Srvy. Code |__|__|
6. Consumer Name: _____ 7. Area no. |__|__|
8. Consumer number: |__|__|__|__|
9. Dwelling Address: _____
10. Markaz: 1) El Mahalla El Kobra 2) Tanta 3) Sammanoud 4) Qotour |__|
11. Location: 1) Urban 2) Rural |__|</td></tr>
<tr><td rowspan="3">Personal Information</td><td>12. Interviewee Name: _____</td><td>13. Telephone Number: _____</td></tr>
<tr><td>14. Status: 1) Householder 2) Housewife
3) Son 4) Daughter
5) Others _____ |__|</td><td>15. Occupation: 1) Farmer
2) Government employee 3) Labor
4) Shop owner 5) Land owner
6) Others _____ |__|</td></tr>
<tr><td>16. Number of families in dwelling:___ |__|
17. Total dwelling inhabitants: ___ |__|
18. Number of income providers: ___ |__|</td><td>19. Total family monthly income:
1) Less than 250 LE
2) 251 – 500LE 3) 501 – 750LE
4) 751 – 1000LE 5) 1001 – 2000LE
6) More than 2000LE
7) Refused to answer |__|</td></tr>
<tr><td>Company Water consumption data</td><td>20. Water bill amount:
1) Dwelling 2) House |__|
____ m3/ 2 months (summer)
____ LE/ 2 months (winter)
____ m3/ 2 months (summer)
____ LE/ 2 months (winter)</td><td>21. Amount of last electricity bill
_____ LE/month
22. Amount of last telephone bill
_____ LE/month</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">23. Availability of water meter
1) None 2) Independent 3) Shared |__|
4) Number of units sharing meter |__|__|
5) Number of persons sharing meter |__|__|</td><td>24. Arrange water uses
1) Cooking |__|
2) Drinking |__|
3) Dish washing |__|
4) Clothes washing |__|
5) Bathing |__|
6) Others |__|</td></tr>
<tr><td rowspan="2">Public water consumption data</td><td colspan="2">25. Use of public water (multi answer)
1) No |__| 2) Yes, Well or pump |__|
3) Yes, canal |__|
4) Yes, public tap or mosque |__|
5) Yes, Others _____ |__|</td><td>26. Arrange water uses
1) Cooking |__|
2) Drinking |__|
3) Dish washing |__|
4) Clothes washing |__|
5) Bathing |__|
6) Others |__|</td></tr>
<tr><td>27. Distance from public water source
1) ___ meter ___ minutes on foot
2) ___ meter ___ minutes on foot</td><td colspan="2">28. Frequency of water use
1) Daily 2) Once/ 2 days
3) Twice weekly 4) Once weekly
5) Others _____ |__|</td></tr>
<tr><td rowspan="2">Purchased water data</td><td colspan="3">29. Purchase of water |__|
1) No (proceed to Q30)
2) Yes, bottled water ___ liter/time ___ time/ week ___ PT/ liter
3) Yes, water truck ___ liter/time ___ time/ week ___ PT/ liter
4) Yes, from neighbors ___ liter/time ___ time/ week ___ PT/ liter
5) Yes, Others ___ liter/time ___ time/ week ___ PT/ liter</td></tr>
<tr><td>30. Arrange water uses
1) Cooking |__|
2) Drinking |__|
3) Dish washing |__|
4) Clothes washing |__|
5) Bathing |__|
6) Others |__|</td><td colspan="2">31. Do you drink from water tap |__|
1) No
2) Yes; as it is
3) Yes; after filtering
4) Yes; after boiling</td></tr>
<tr><td>Service evaluatio</td><td>32. Toilet type |__|
1) W/ flush 2) W/o flush</td><td>33. Bathroom type |__|
1) W/ shower 2) Without</td><td>34. Washing machine
1) None 2) Ordinary
3) Automatic |__|</td></tr>
</table>

	35. Type of sanitary drainage |__| 1) Don't know 2) Government drainage system 3) Canal/ drain 4) Septic tank	36. Quality of company water 1) Color satisfactory 1) Yes 2) No |__| 2) Taste satisfactory 1) Yes 2) No |__| 3) Odor satisfactory 1) Yes 2) No |__| 4) Pressure satisfactory 1) Yes 2) No |__| 5) Quantity satisfactory 1) Yes 2) No |__|	
	37. Water cut-offs |__| 1) None 2) Regular cut-offs 3) Random cut-offs 4) ___ times a day 5) ___ times a week 6) ___ times a month 7) Cut-off ___ hours/time		
	38. Overall are you satisfied with the company water |__| 1) Yes 2) No 3) Other reasons for not being satisfied _____ _____ _____		
	39. What is the additional sum that you are willing to pay to improve the water service to the degree that satisfies you? _____ LE/month/dwelling		
	40. Arrange your priorities for the following services 1) Water |__| 2) Drainage |__| 3) Transport |__| 4) Electricity |__| 5) Waste |__| 6) Telephone |__|	41. Meter operating 1) Yes 2) No |__| 43. Evaluate dwelling conditions |__| 1) Clean 2) Acceptable 3) Poor	42. Pump available 1) Yes 2) No |__|
Mahalla El Kobra	<u>Specific Questions for El Mahalla El Kobra only</u> (Turn off pump if connected) 44. Water pressure _____ 45. Floor ____ 46. Time required to fill bottle ___ sec		
Remarks	47. Include any remarks that may be useful: _____ _____ _____		