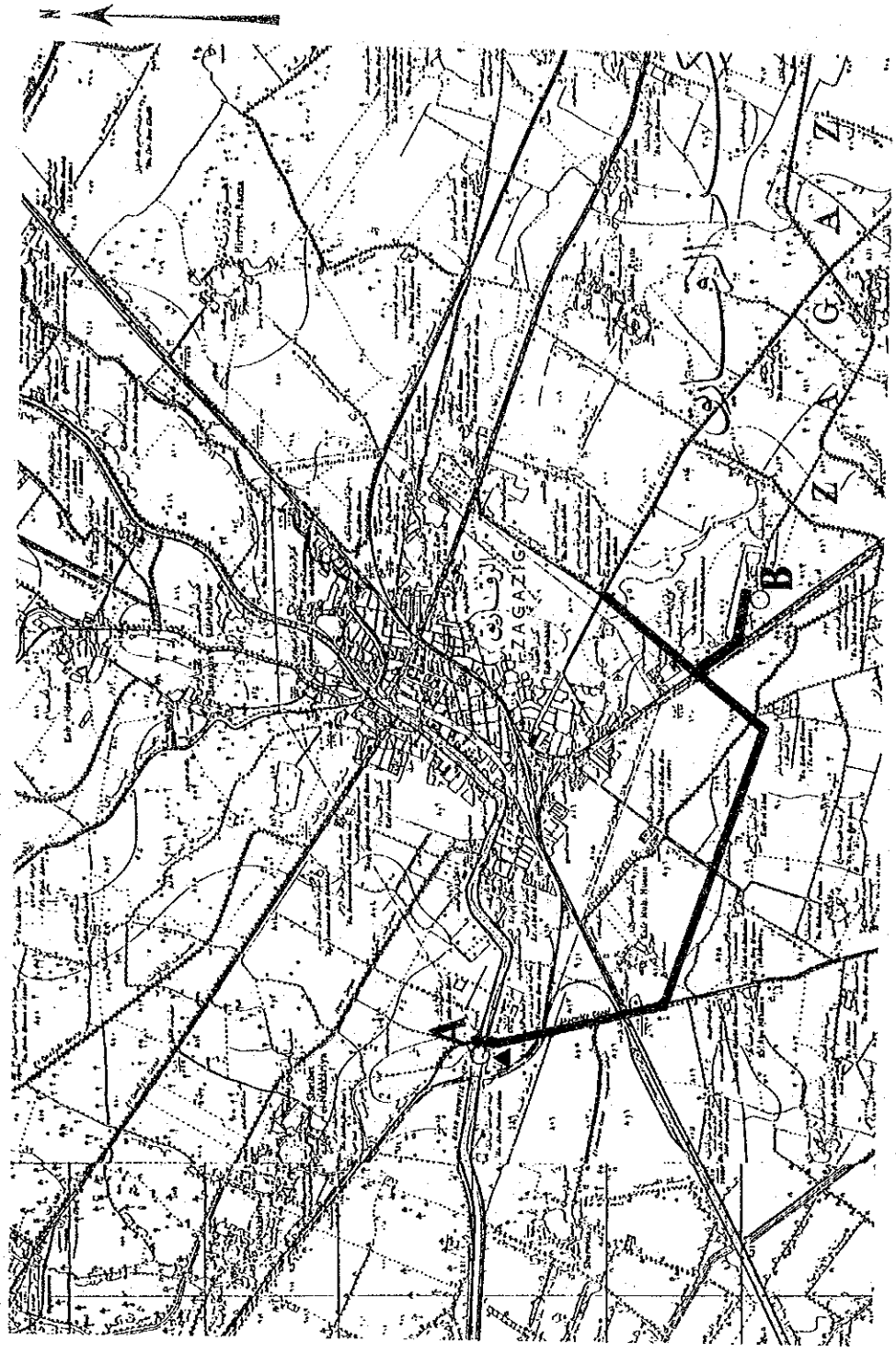
1. Introduction

The study team employed a local subcontractor to carry out the leveling survey in the four cities, namely Zagazig, Bilbeis, Faqus and Minyet El Qamh. They started the field work on 23rd January and finished it on 10th February, 1988. During the field survey, confirmation of the official bench marks were carried out by them under the supervision of the team's engineers. Also seven temporary bench marks to be used for sewerage planning, two in Zagazig, Bilbeis and Minyet El Qamh and one in Faqus, were established.

Leveling survey was carried out along the proposed gravity trunk sewers. The routes of the leveling survey are illustrated on Figures XIX-1 through XIX-4. Ground levels usually at 80 m intervals were measured. Levels of such mian features as curves, crossings of main roads, canals, drains and railways were also measured. Accuracy of the leveling survey is within 20 mm S (where S is one way distance of the survey in km). The results of the leveling survey are plotted on the drawings as longitudinal sections with scales 1:100 vertical, and 1:5,000 horizontal. Drawings are included in Volume Four of the current report.

Locations of the official and temporary bench marks are shown on Figures XIX-1 through XIX-4. Sketches and photographs of the temporary bench marks in the four cities are shown in Figures XIX-5 through XIX-11 and Photos XIX-1 through XIX-7.



LEGEND

Scale : 1/50,000

0 1 km 2 km

: Survey Route

▲ : Official Bench Mark

○ : Temporary Bench Mark

Figure XIX-1 Routes of Leveling Survey in Zagazig City

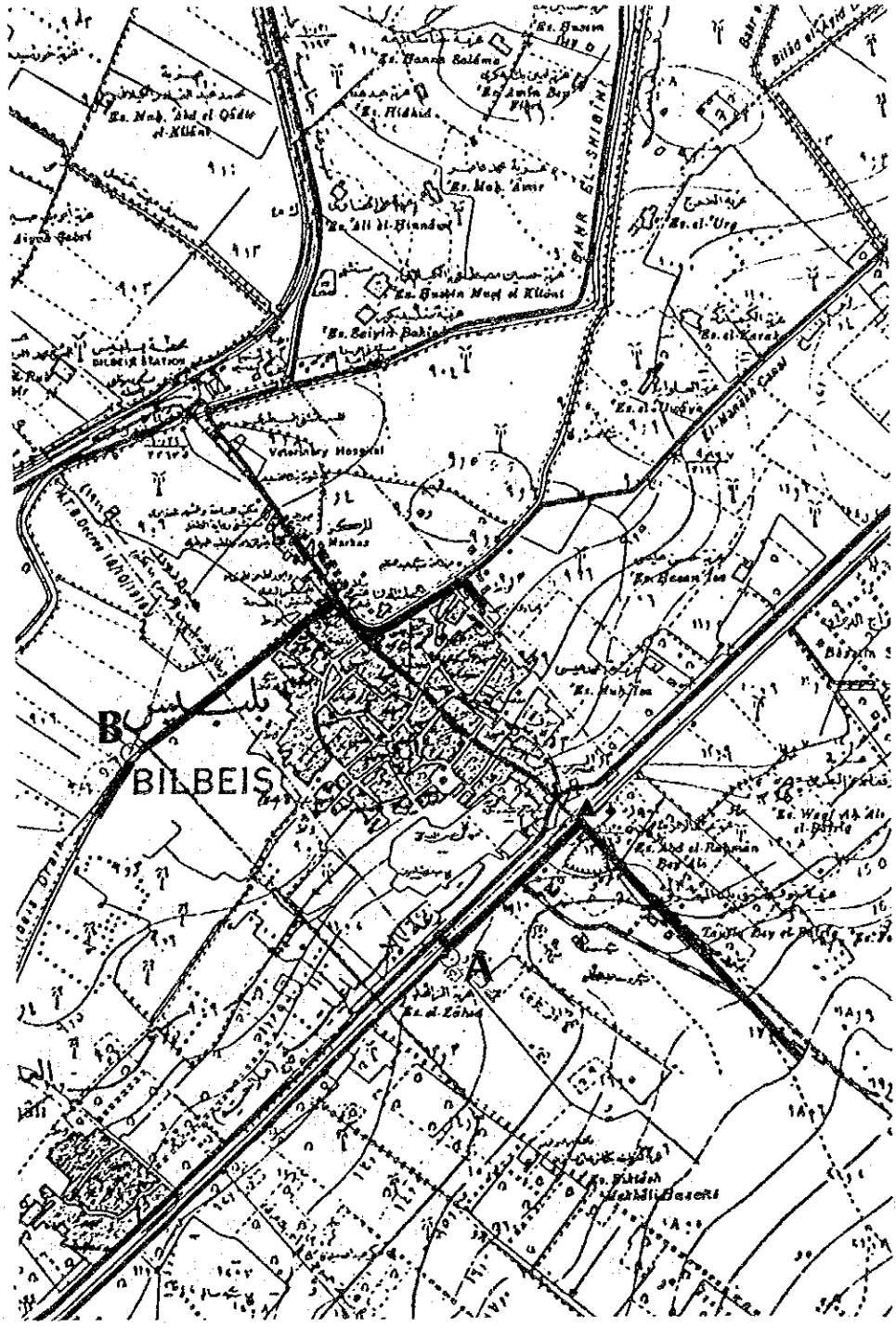
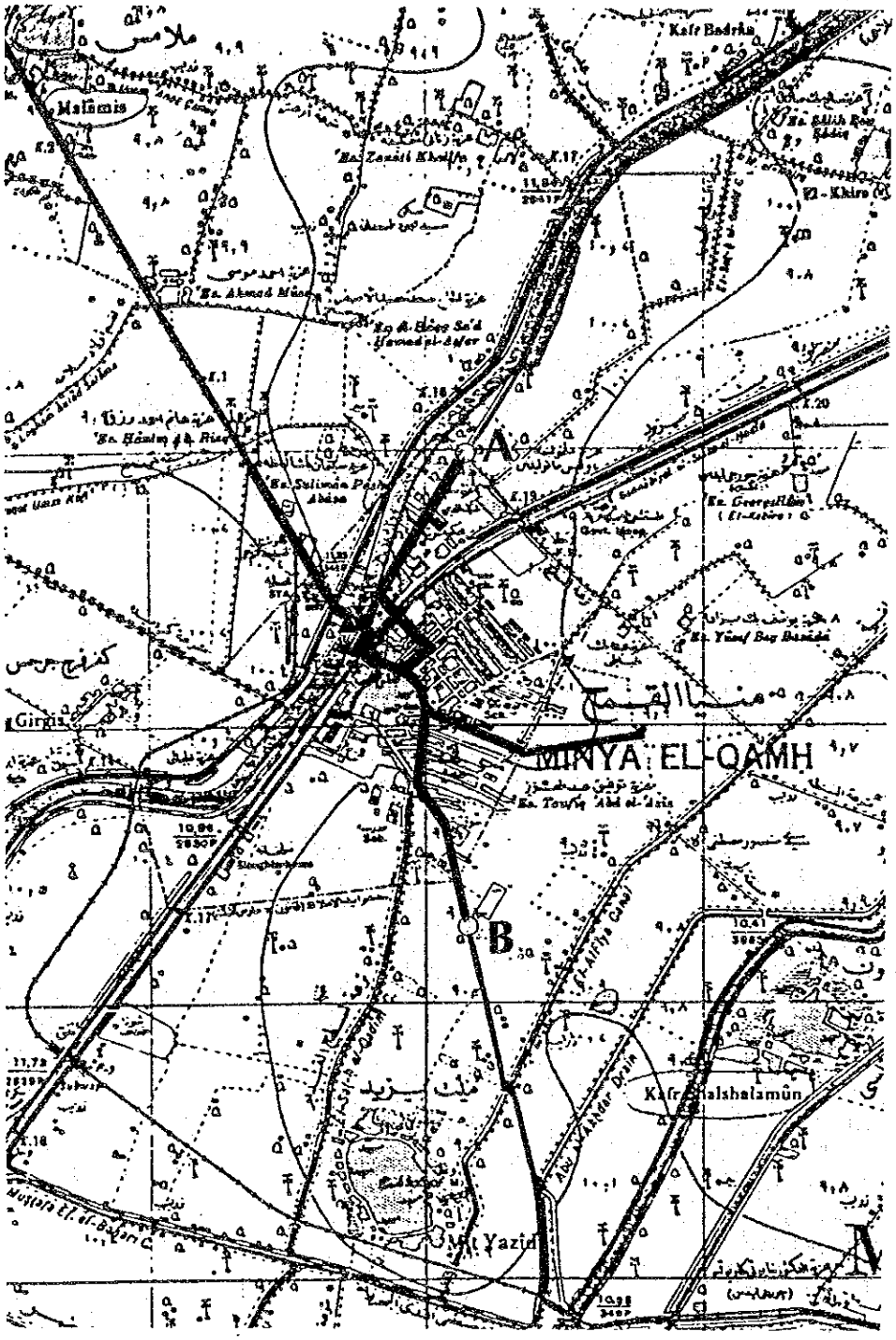


Figure XIX-2 Routes of Leveling Survey in Bilbeis City



LEGEND

Scale : 1/25,000

0 500 m 1 km

: Survey Route

▲ : Official Bench Mark

○ : Temporary Bench Mark

Figure XIX-3 Routes of Leveling Survey in Minyet El Qamh City

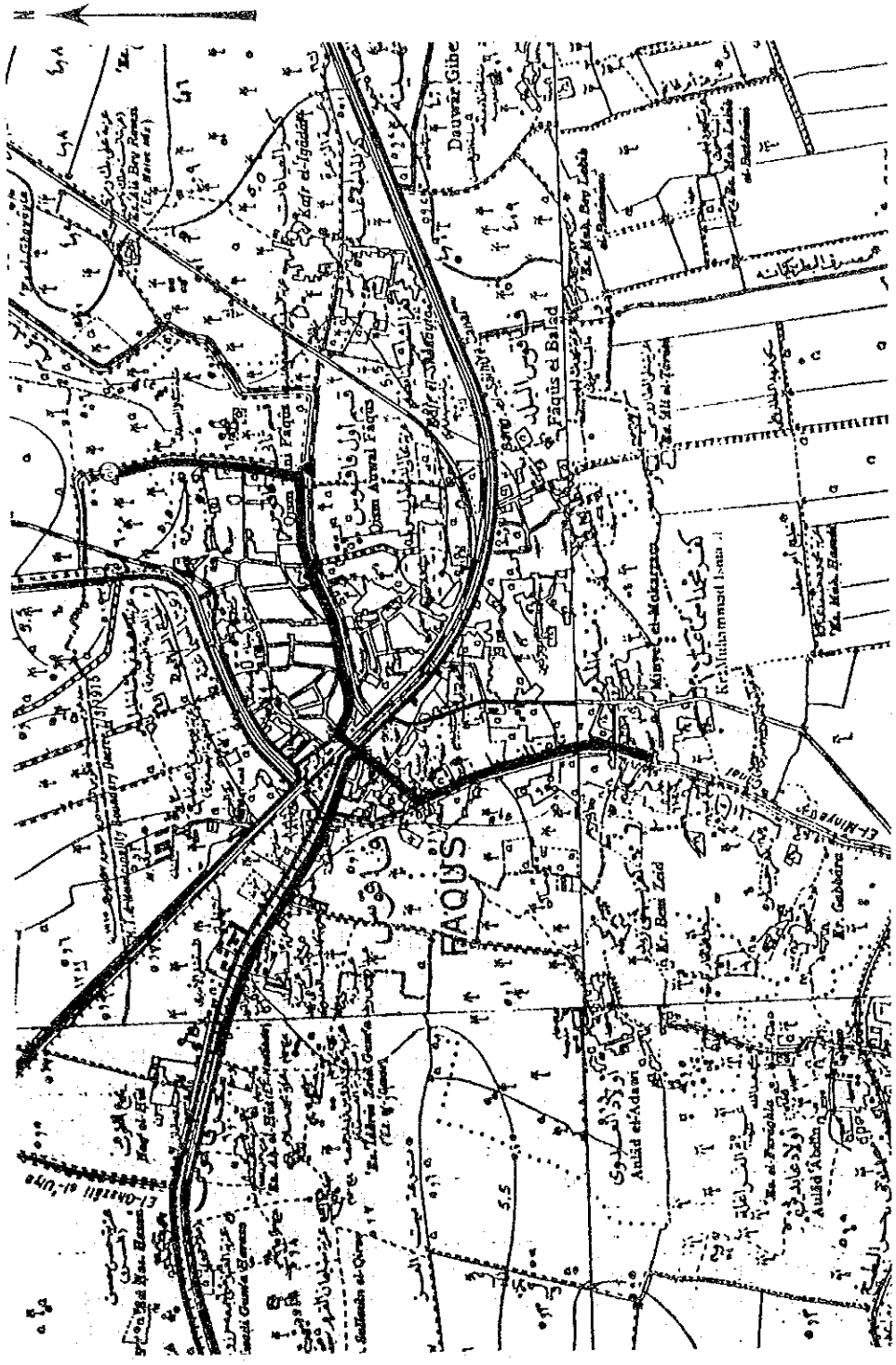


Figure XIX-4 Routes of Leveling Survey in Faqus City

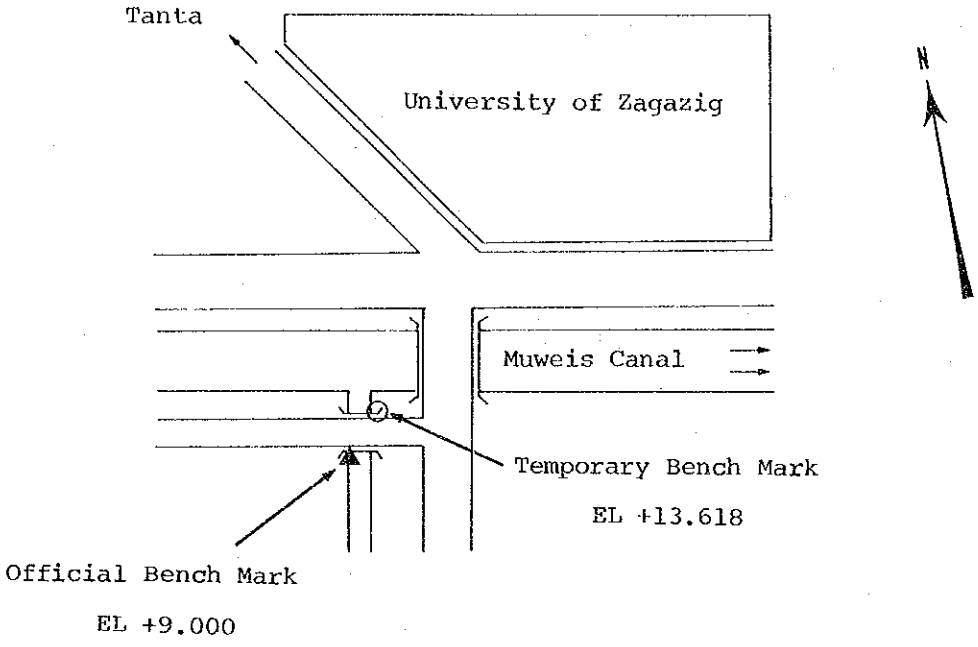


Figure XIX-5 Sketch of Temporary Bench Mark (A) in Zagazig City

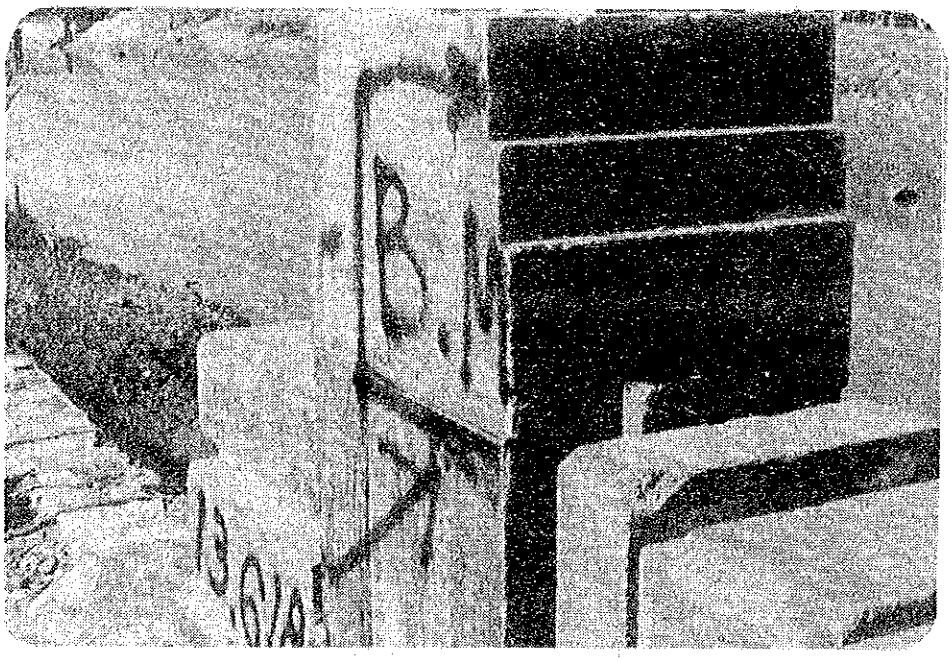


Photo XIX-1 Temporary Bench Mark (A) in Zagazig City

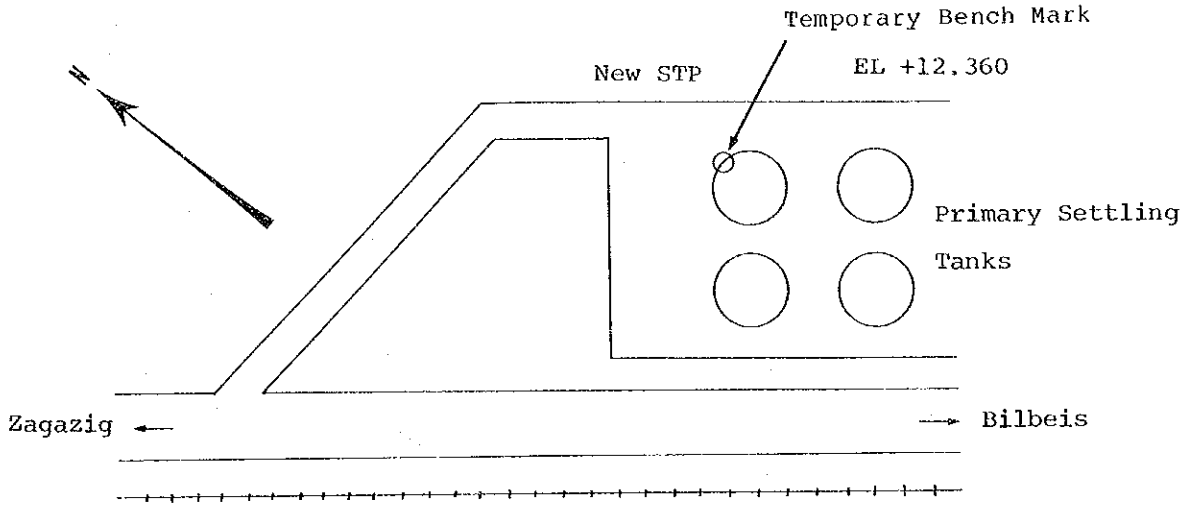


Figure XIX-6 Sketch of Temporary Bench Mark (B) in Zagazig City

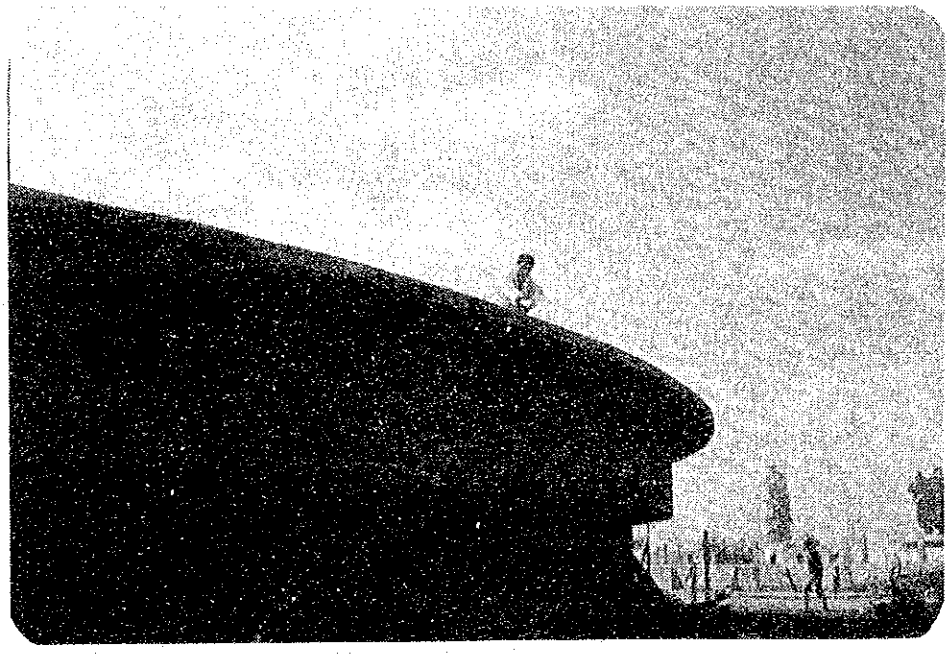


Photo XIX-2 Temporary Bench Mark (B) in Zagazig City

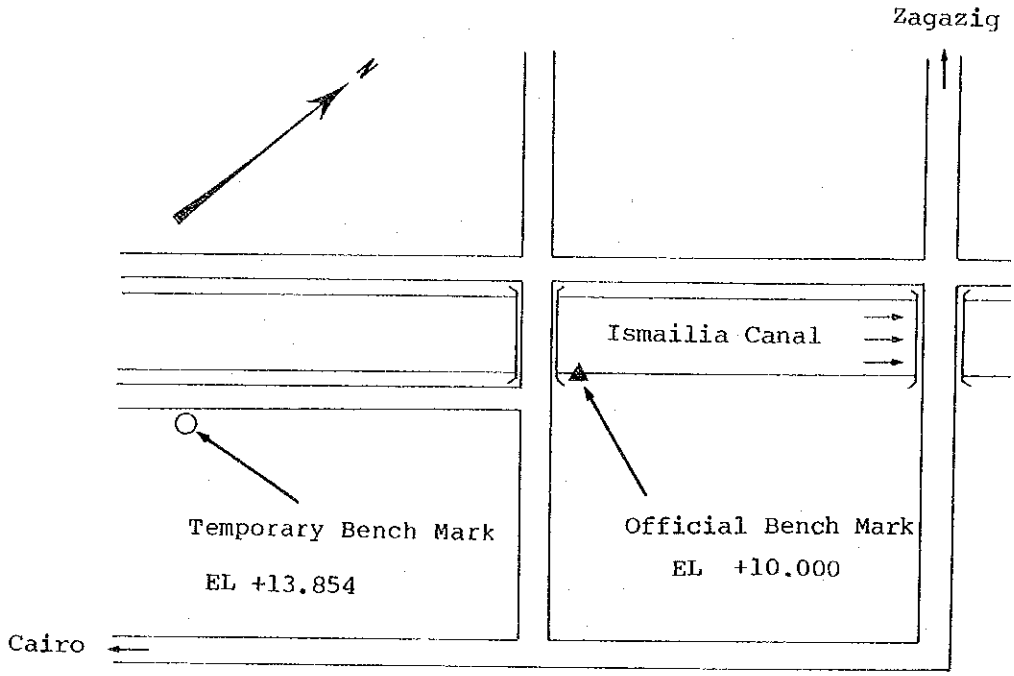


Figure XIX-7 Sketch of Temporary Bench Mark (A) in Bilbeis City

Photo XIX-3 Temporary Bench Mark (A) in Bilbeis City

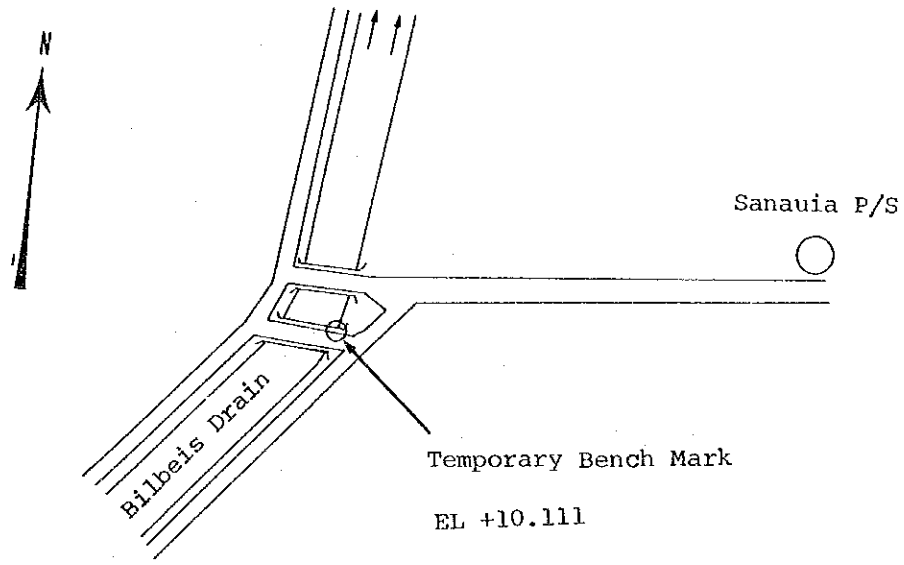


Figure XIX-8 Sketch of Temporary Bench Mark (B) in Bilbeis City

Photo XIX-4 Temporary Bench Mark (B) in Bilbeis City

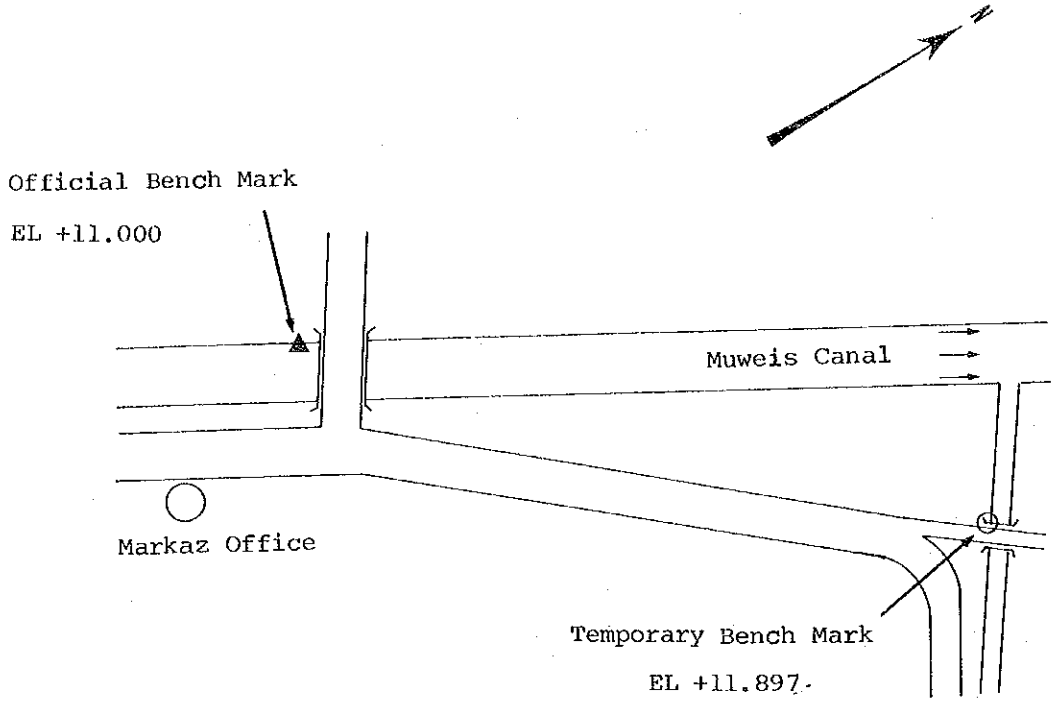


Figure XIX-9 Sketch of Temporary Bench Mark (A) in Minyet El Qamh City

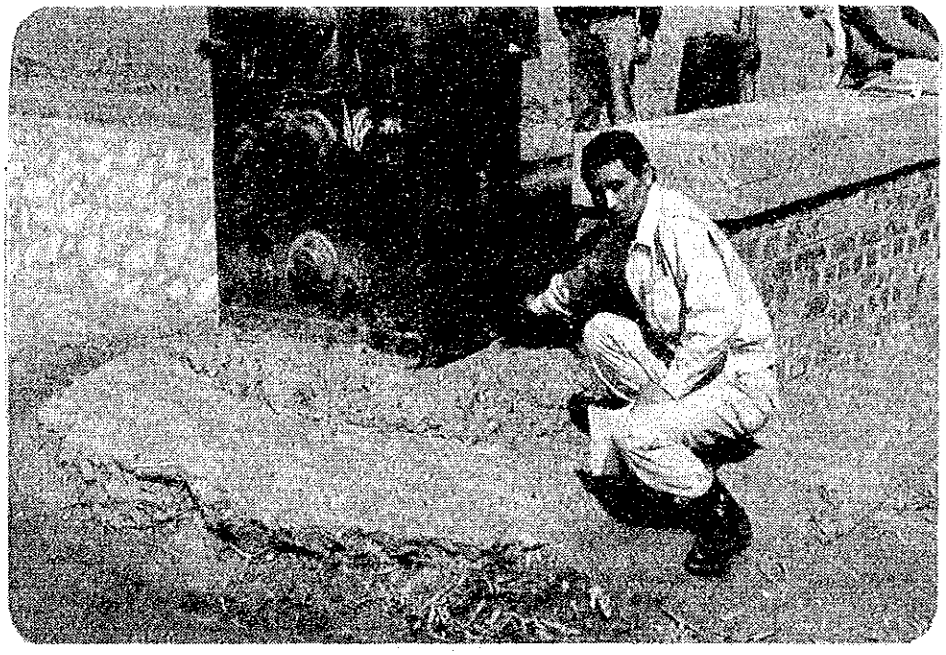


Photo XIX-5 Temporary Bench Mark (A) in Minyet El Qamh City

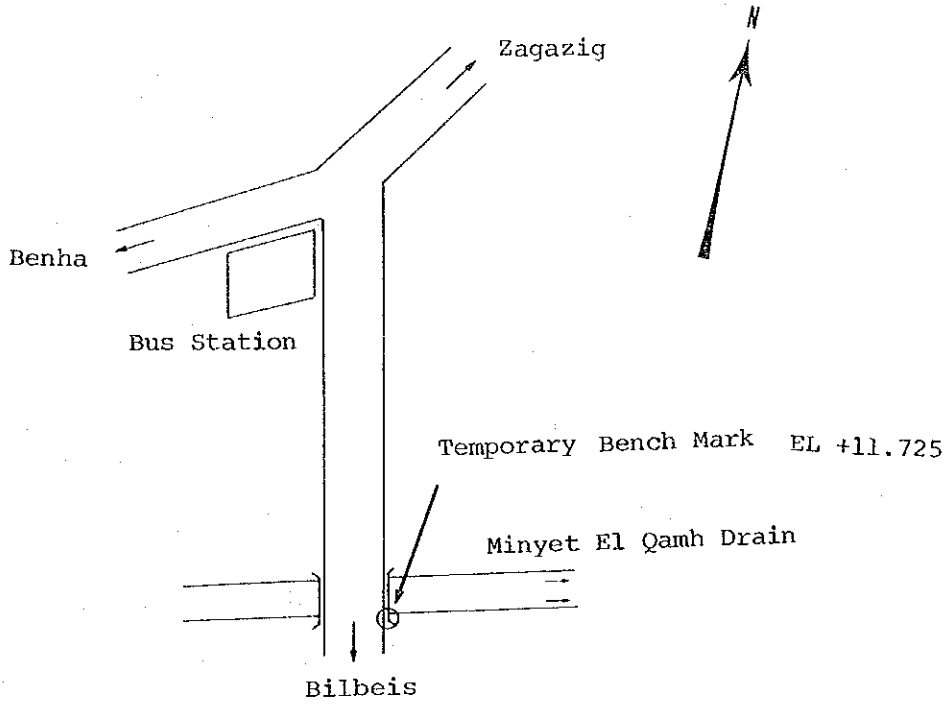


Figure XIX-10 Sketch of Temporary Bench Mark (B) in Minyet El Qamh City

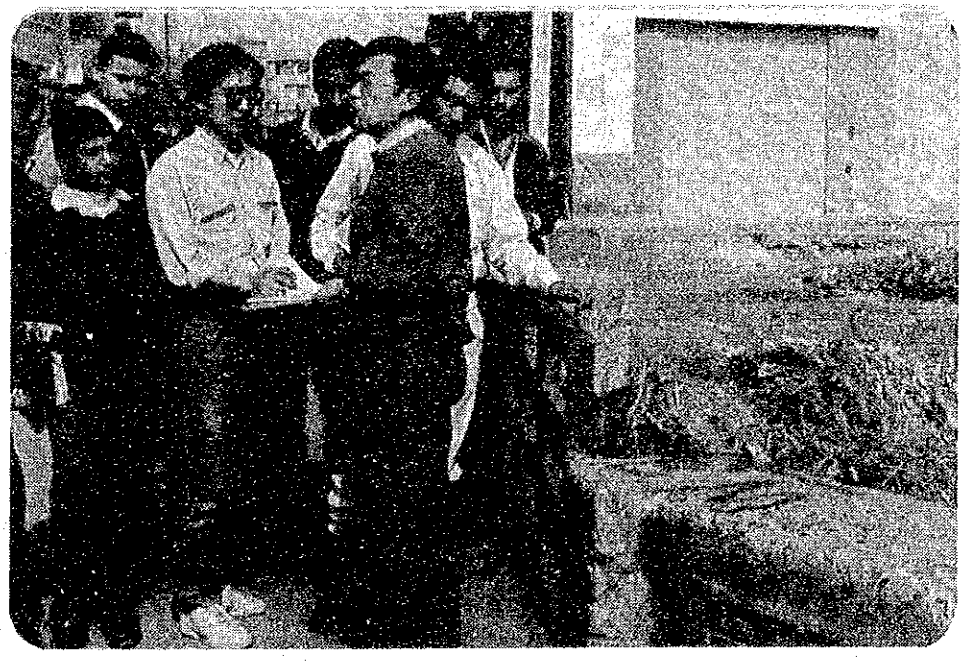


Photo XIX-6 Temporary Bench Mark (B) in Minyet El Qamh City

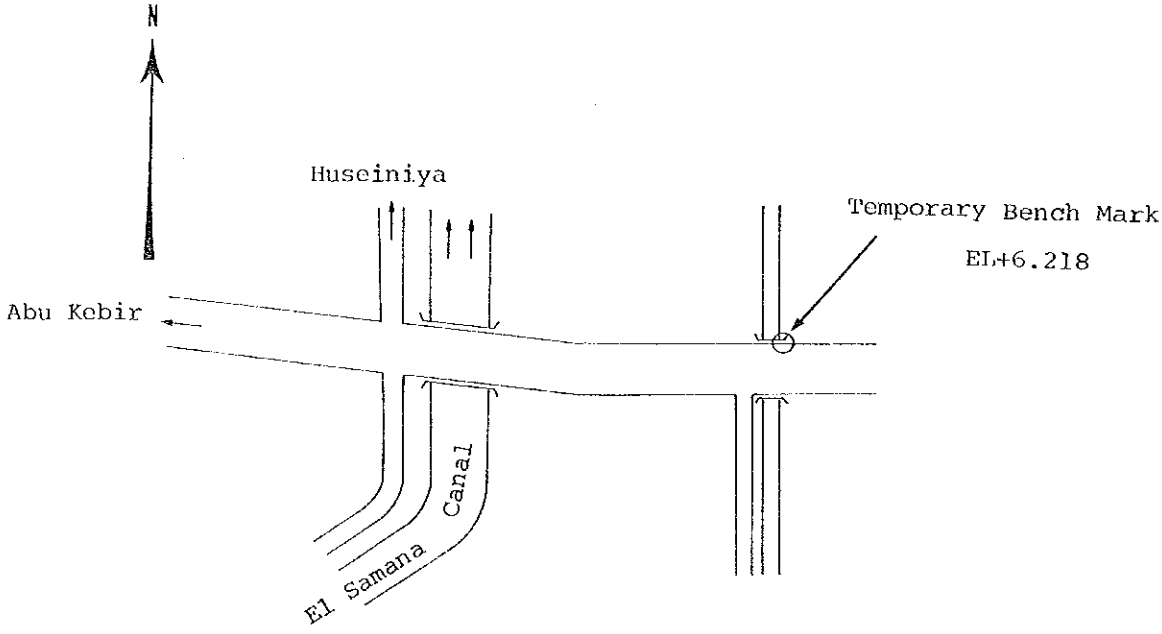


Figure XIX-11 Sketch of Temporary Bench Mark in Faqus City

Photo XIX-7 Temporary Bench Mark in Faqus City

APPENDIX - XX

DESIGN AND HYDRAULIC CALCULATIONS OF SEWERAGE FACILITIES

APPENDIX - XX

DESIGN AND HYDRAULIC CALCULATIONS OF SEWERAGE FACILITIES

Table of Contents

List of Tables

1. Introduction

Design and hydraulic calculations of the sewerage facilities in the four cities, namely Zagazig, Faqus, Bilbeis and Minyet El Qamh, are presented in this Appendix. For each city, a set of tables consisting of four categories, i.e. 1) hydraulic calculations of trunk sewers, 2) design and hydraulic calculations of pumping stations, 3) process design of treatment plants, and 4) hydraulic calculations of treatment plants are prepared. Process design and hydraulic calculations of Zagazig STP by NOPWASD are included in Appendix VI and not presented here.

Hydraulic calculations of trunk sewers are based on the Manning Formula, using a roughness coefficient of 0.012. For gravity sewers, peak flows in the year 2040 are used. For force mains, double lines, one for the peak flows in 2005 and another for the incremental flows from 2005 to 2040 are designed. All pumping stations are designed for flows in 2005. Capacities of pumping stations, i.e. diameters and number of pumps, total heads, and motor powers are calculated based on peak flows in 2005.

Capacities of major process units of treatment plants for three cities together with dimensions of the facilities are calculated. All treatment plants are designed as conventional activated sludge process. Hydraulic calculations are carried out on the basis of assumed water levels of the receiving drains. It should be noted that water levels of the drains should be confirmed with the authority concerned at a later stage.

All of the design drawings presented in Volume Four are completed based on the calculations in this Appendix. Therefore, tables here should be viewed in conjunction with those drawings.

Zagazig

Table XX-1 Sewerage Computation Sheet For Zagazig (1 of 4)

Unit Sewage Flow Per ha 0.001344 m3/sec/ha(in 2040) 0.000614 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Designed Sewer Design Flow m3/s	Designed Sewer Diameter mm	Designed Sewer Slope ‰	Designed Sewer Velocity m/s	Designed Sewer Capacity m3/s	Sewer Invert Elevation Bigin m	Sewer Invert Elevation End m	Ground Elevation Bigin m	Ground Elevation End m	Earth Cover Bigin m	Earth Cover End m	NO of MH	Remark
ZONE-8																		
1		43.8	43.8	860	860	0.059	⊙350	1.8	0.70	0.067	7.233	5.405	8.60	8.70	1.00	2.93	14	
2		57.9	101.7	1,110	1,970	0.137	⊙500	1.3	0.75	0.147	5.255	3.432	8.70	8.85	2.90	4.88	19	
3	4	34.0	135.7	430	2,400	0.182	⊙600	1.1	0.78	0.221	3.332	2.719	8.85	11.96	4.87	8.59	7	
	Flow to No.1 Pumping Station (A8=135.7 ha)																	
4	14	-	135.7	980	3,380	0.083	⊙300	6.3	1.18	0.083	10.645	7.285	11.96	8.60	1.00	1.00	-	Force Main
ZONE-7																		
5		44.4	44.4	860	860	0.060	⊙350	1.8	0.70	0.067	7.533	5.705	8.90	8.80	1.00	2.73	14	
6		45.1	89.5	920	1,780	0.120	⊙500	1.3	0.75	0.147	5.555	4.059	8.80	8.70	2.70	4.10	15	
7	13	65.9	155.4	1,070	2,850	0.209	⊙600	1.1	0.78	0.221	3.959	2.422	8.70	8.60	4.09	5.53	18	
	Flow to No.2 Pumping Station																	
8		55.9	55.9	440	440	0.075	⊙400	1.5	0.70	0.087	6.981	6.181	8.40	8.40	1.00	1.80	7	
9		42.0	97.9	600	1,040	0.132	⊙500	1.3	0.75	0.147	6.081	5.101	8.40	8.60	1.78	2.96	10	
10	12	59.0	156.9	620	1,660	0.211	⊙600	1.1	0.78	0.221	5.001	4.119	8.60	8.60	2.95	3.83	10	
11		63.8	63.8	790	790	0.086	⊙400	1.6	0.72	0.090	7.181	5.657	8.60	8.60	1.00	2.52	13	
12	13	64.7	285.4	900	2,560	0.384	⊙900	0.7	0.82	0.519	3.819	2.889	8.60	8.60	3.79	4.72	15	
	Flow to No.2 Pumping Station (A7=440.8 ha)																	
13	-	-	440.8	770	3,620	0.271	⊙450	7.7	1.70	0.271	7.112	7.112	8.60	8.60	1.00	1.00	-	Force Main
ZONE-4																		
14	24	-	576.5	2,240	5,860	0.354	⊙500	7.5	1.80	0.354	7.058	8.568	8.60	10.11	1.00	1.00	-	Force Main

Table XX-1 Sewerage Computation Sheet For Zagazig (2 of 4)

Unit Sewage Flow Per ha : 0.001344 m3/sec/ha(in 2040) 0.000614 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area	Sewerage Area Cumulated Area	Sewer Length Increment Length	Sewer Length Cumulated Length	Designed Sewer Design Flow	Designed Sewer Sewer Diameter	Designed Sewer Slope	Designed Sewer Velocity	Designed Sewer Capacity	Sewer Invert Elevation Bigin	Sewer Invert Elevation End	Ground Elevation Bigin	Ground Elevation End	Earth Cover Bigin	Earth Cover End	NO of MH	Remark
		ha	ha	m	m	m3/s	mm	‰	m/s	m3/s	m	m	m	m	m	m		
ZONE-4																		
15		28.4	28.4	430	430	0.038	⊙250	3.5	0.78	0.038	11.168	9.523	12.43	11.44	1.00	1.66	7	
16		53.7	82.1	280	710	0.110	⊙450	1.4	0.73	0.116	9.323	8.831	11.44	10.51	1.63	1.19	5	
17		73.2	155.3	320	1,030	0.209	⊙600	1.1	0.78	0.221	8.681	8.229	10.51	10.77	1.18	1.89	5	
18		86.1	241.4	720	1,750	0.324	⊙750	0.8	0.77	0.341	8.079	7.263	10.77	10.11	1.68	2.04	12	
19	24	56.3	297.7	640	2,390	0.400	⊙900	0.7	0.82	0.519	7.113	6.445	10.11	10.11	2.01	2.68	11	
	Flow to No.3 Pumping Station																	
20		73.7	73.7	720	720	0.099	⊙450	1.4	0.73	0.116	8.782	7.534	10.27	9.97	1.00	1.95	12	
21	24	43.5	117.2	720	1,440	0.158	⊙600	1.1	0.78	0.221	7.384	6.352	9.97	10.11	1.94	3.11	12	
	Flow to No.3 Pumping Station																	
22		24.0	24	370	370	0.032	⊙250	2.6	0.67	0.033	7.988	6.906	9.25	9.50	1.00	2.33	6	
23	24	58.5	82.5	530	900	0.111	⊙450	1.4	0.73	0.116	6.706	5.784	9.50	10.11	2.31	3.84	9	
	Flow to No.3 Pumping Station (A4=497.4 ha)																	
24	36	-	1073.9	1,650	7,510	0.659	⊙700	4.4	1.73	0.666	8.360	8.570	10.11	10.32	1.00	1.00	-	Force Main
ZONE-2																		
25		194.8	194.8	750	750	0.262	⊙750	0.8	0.77	0.341	6.190	5.330	8.00	8.10	1.00	1.96	13	
26	28	95.0	289.8	770	1,520	0.389	⊙900	0.7	0.82	0.519	5.180	4.381	8.10	8.20	1.93	2.83	13	
	Flow to No.4 Pumping Station																	
27	28	98.9	98.9	460	460	0.133	⊙500	1.3	0.75	0.147	6.858	6.100	8.40	8.20	1.00	1.56	8	
	Flow to No.4 Pumping Station (A2=388.7 ha)																	
28	35	-	388.7	2,660	4,180	0.239	⊙450	6.0	1.50	0.239	6.712	7.422	8.20	8.91	1.00	1.00	-	Force Main

Table XX-1 Sewerage Computation Sheet For Zagazig (3 of 4)

Unit Sewage Flow Per ha 0.001344 m3/sec/ha(in 2040) 0.000614 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Designed Sewer Design Flow m3/s	Designed Sewer Sewer Diameter mm	Designed Sewer Slope ‰	Designed Sewer Velocity m/s	Designed Sewer Capacity m3/s	Sewer Invert Elevation Bigin m	Sewer Invert Elevation End m	Ground Elevation Bigin m	Ground Elevation End m	Earth Cover Bigin m	Earth Cover End m	NO of MH	Remark
ZONE-3																		
29		43.3	43.3	610	610	0.058	⊙350	1.8	0.70	0.067	7.133	5.835	8.50	9.00	1.00	2.80	10	
30		90.1	133.4	1,200	1,810	0.179	⊙600	1.1	0.78	0.221	5.585	3.865	9.00	9.44	2.77	4.92	20	
31	33	96.1	229.5	240	2,050	0.308	⊙750	0.8	0.77	0.341	3.715	3.443	9.44	8.91	4.92	4.66	4	
32		105.3	105.3	560	560	0.142	⊙450	2.1	0.89	0.142	8.602	7.246	10.09	8.91	1.00	1.18	9	
33	34	-	334.8	200	2,250	0.450	⊙900	0.7	0.82	0.519	3.293	3.093	8.91	9.00	4.63	4.92	3	
	Flow to No.5 Pumping Station (A3=334.8 ha)																	
34		-	334.8	200	2,450	0.206	⊙400	8.3	1.64	0.206	7.581	7.491	9.00	8.91	1.00	1.00	-	Force Main
35		-	723.5	660	4,840	0.444	⊙600	4.5	1.58	0.446	7.260	8.670	8.91	10.32	1.00	1.00	-	Force Main
36		-	1,797.4	710	8,220	1.104	⊙900	3.2	1.74	1.109	8.330	8.000	10.32	9.99	1.00	1.00	-	Force Main
	Flow to STP																	
ZONE-1			(A1=220.0 ha)															
ZONE-5			(A5=325.0 ha)															
ZONE-6			(A6=383.6 ha)															
Total			2,726.0															

FEASIBILITY STUDY ON SHARQIYA SEWERAGE SYSTEM

Table XX-1 Sewerage Computation Sheet For Zagazig (4 of 4)

Unit Sewage Flow Per ha 0.001344 m3/sec/ha(in 2040) 0.000614 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area		Sewer Length		Design Flow	Designed Sewer				Sewer Invert Elevation		Ground Elevation		Earth Cover		NO of MH	Remark
		Increment Area	Cumulated Area	Increment Length	Cumulated Length		Sewer Diameter	Slope	Velocity	Capacity	Bigin	End	Bigin	End	Bigin	End		
		ha	ha	m	m	m3/s	mm	%	m/s	m3/s	m	m	m	m	m	m		
	Design Flow of No.1 Pumping Station					0.083	m3/sec											
	Design Flow of No.2 Pumping Station					0.271	m3/sec											
	Design Flow of No.3 Pumping Station					0.305	m3/sec											
	Design Flow of No.4 Pumping Station					0.239	m3/sec											
	Design Flow of No.5 Pumping Station					0.206	m3/sec											

Table XX-2 Calculation Sheet of Pumping Station for Zagazig

City Name	Items		Unit		Pump No 1	2	3	4	5	6	7	8	9
										Main			
ZAGAZIG	Wastewater		m3/sec	Qs	0.083	0.271	0.305	0.239	0.206	0.488			
			m3/min	Qm=Qs*60	5.0	16.3	18.3	14.3	12.4	29.3			
	Inlet Pipe	Diameter	m		0.6	0.6	0.6	0.5	0.9	1.2			
		Elevation	m	Ep	2.72	2.42	6.35	6.10	3.09	5.00			
	Ground Elevation		m	Et	9.99	9.99	9.99	9.99	9.99	9.99			
	Pump	Nos.		N	2	3	3	3	3	3			
		Q/Unit	m3/min	Qp=Qm/N	2.5	5.4	6.1	4.8	4.1	9.8			
		Dia. in need	mm	D=146*(Qp/2.0)(1/2)	162.9	240.3	255.0	225.7	209.5	322.4			
		Diameter	mm	Dp	150	250	250	200	200	300			
	Pump Loss	Force Main Length	m	L	5,580	5,370	2,360	4,030	1,370	2,000			
		Loss in Pipe	m	H1=L*.01	55.8	53.7	23.6	40.3	13.7	20.0			
		Water Head		H2=Et-Ep	7.3	7.6	3.6	3.9	6.9	5.0			
		+a	m	H3=4.0(2.0)	4.0	4.0	4.0	4.0	4.0	4.0			
		Total Loss	m	H=H1+H2+H3	67.1	65.3	31.2	48.2	24.6	29.0			
	Pump Capacity		KW	Ps=0.163*H*Qp/0.6	45.4	96.1	51.8	62.6	27.5	76.8			
	Moter Capacity		KW	P=Ps*(1+0.1)	49.9	105.7	56.9	68.8	30.3	84.5			
	Pump Spec	Diameter	mm		150	250	250	200	200	300			
		Quantity	m3/min		2.5	5.4	6.1	4.8	4.1	9.8			
		Loss	m		67.1	65.3	31.2	48.2	24.6	29.0			
		Moter Capacity	KW		55	90	55	75	30	90			
		Nos.		1 Standby	3	4	4	4	4	4			

Faqus

Table XX-3 Sewerage Computation Sheet For Faqus (1 of 3)

Unit Sewage Flow Per ha 0.001271 m3/sec/ha(in 2040) 0.000808 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area		Sewer Length		Designed Sewer				Sewer Invert Elevation		Ground Elevation		Earth Cover		NO of MH	Remark
		Increment Area	Cumulated Area	Increment Length	Cumulated Length	Design Flow	Sewer Diameter	Slope	Velocity	Capacity	Begin	End	Begin	End	Begin	End	
		ha	ha	m	m	m3/s	mm	‰	m/s	m3/s	m	m	m	m	m	m	
ZONE-1																	
1		20.9	20.9	320	320	0.027	⊙ 250	2.6	0.67	0.033	4.008	3.048	7.27	7.46	3.00	4.15	6	
2		10.6	31.5	320	640	0.040	⊙ 300	2.2	0.70	0.049	2.998	2.166	7.46	7.38	4.15	4.90	6	
3	7	14.9	46.4	400	1,040	0.059	⊙ 350	1.8	0.70	0.067	2.116	1.236	7.38	9.23	4.90	7.63	8	
4		26.2	26.2	200	200	0.033	⊙ 250	2.6	0.67	0.033	6.008	5.408	7.27	7.30	1.00	1.63	4	
5		12.8	39.0	380	580	0.050	⊙ 350	1.8	0.70	0.067	5.308	4.472	7.30	7.40	1.63	2.56	8	
6		8.9	47.9	460	1,040	0.061	⊙ 350	1.8	0.70	0.067	4.472	3.460	7.40	9.23	2.56	5.40	9	
7	12	2.7	97.0	250	1,290	0.123	⊙ 500	1.3	0.75	0.147	1.086	0.661	9.23	9.74	7.60	8.54	5	
8		16.0	16.0	290	290	0.020	⊙ 200	3.2	0.64	0.020	5.020	3.976	6.23	6.86	1.00	2.67	6	
9		15.0	31.0	350	640	0.039	⊙ 300	2.2	0.70	0.049	3.876	2.966	6.86	6.32	2.67	3.04	7	
10		20.3	51.3	350	990	0.065	⊙ 350	1.8	0.70	0.067	2.916	2.146	6.32	7.37	3.04	4.86	7	
11		7.9	59.2	300	1,290	0.075	⊙ 400	1.6	0.72	0.090	2.096	1.496	7.37	9.74	4.86	7.83	6	
12	16	2.2	158.4	200	1,490	0.201	⊙ 600	1.1	0.78	0.221	0.561	0.261	9.74	7.00	8.53	6.09	4	
13		18.2	18.2	210	210	0.023	⊙ 250	2.6	0.67	0.033	4.238	3.608	5.50	6.00	1.00	2.13	4	
14		13.9	32.1	250	460	0.041	⊙ 300	2.2	0.70	0.049	3.558	2.908	6.00	6.30	2.13	3.08	5	
15		14.3	46.4	560	1,020	0.059	⊙ 350	1.8	0.70	0.067	2.858	1.626	6.30	7.00	3.08	5.01	11	
16		8.3	213.1	530	2,020	0.271	⊙ 750	0.8	0.77	0.341	0.111	-0.525	7.00	6.25	6.08	5.97	11	
17		12.7	225.8	290	2,310	0.287	⊙ 750	0.8	0.77	0.341	-0.525	-0.873	6.25	5.70	5.97	5.76	6	

Table XX-3 Sewerage Computation Sheet For Faqus (2 of 3)

Unit Sewage Flow Per ha: 0.001271 m3/sec/ha(in 2040), 0.000608 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Designed Sewer Design Flow m3/s	Designed Sewer Sewer Diameter mm	Designed Sewer Slope ‰	Designed Sewer Velocity m/s	Designed Sewer Capacity m3/s	Sewer Invert Elevation Begin m	Sewer Invert Elevation End m	Ground Elevation Begin m	Ground Elevation End m	Earth Cover Begin m	Earth Cover End m	NO of MH	Remark
18	19	13.1	238.9	200	2,510	0.304	⊙ 750	0.8	0.77	0.341	-0.873	-1.113	5.70	5.50	5.76	5.80	4	
	Flow to No.1 Pumping Station (A1=238.9 ha)																	
19	24	-	238.9	700	3,210	0.145	⊙ 350	8.4	1.51	0.145	4.081	4.871	5.50	6.29	1.00	1.00		Force Main
ZONE-3																		
20		10.0	10.0	150	150	0.013	⊙ 200	3.2	0.64	0.020	4.790	4.250	6.00	6.25	1.00	1.79	3	
21		13.3	23.3	190	340	0.030	⊙ 250	2.6	0.67	0.033	4.200	3.630	6.25	6.50	1.79	2.61	4	
22		20.9	44.2	140	480	0.056	⊙ 350	1.8	0.70	0.067	3.530	3.222	6.50	6.76	2.60	3.17	3	
23		6.6	50.8	330	810	0.065	⊙ 350	1.8	0.70	0.067	3.222	2.496	6.76	6.29	3.17	3.43	7	
24	28	4.0	293.7	340	3,550	0.373	⊙ 900	0.7	0.82	0.519	1.946	1.572	6.29	6.18	3.35	3.62	7	
25		15.1	15.1	310	310	0.019	⊙ 200	3.2	0.64	0.020	6.790	5.674	8.00	7.40	1.00	1.52	6	
26		14.5	29.6	400	710	0.038	⊙ 300	2.2	0.70	0.049	5.574	4.534	7.40	6.80	1.51	1.95	8	
27		9.6	39.2	420	1,130	0.050	⊙ 350	1.8	0.70	0.067	4.484	3.560	6.80	6.18	1.95	2.25	8	
28	38	3.9	336.8	260	3,810	0.428	⊙ 900	0.7	0.82	0.519	1.572	1.286	6.18	5.56	3.62	3.28	5	
ZONE-2																		
29		33.8	33.8	410	410	0.043	⊙ 300	2.2	0.70	0.049	4.685	3.619	6.00	5.80	1.00	1.87	8	
30	33	11.2	45.0	310	720	0.057	⊙ 350	1.8	0.70	0.067	3.569	2.887	5.80	5.60	1.86	2.35	6	
	Flow to No.2 Pumping Station																	
31		37.1	37.1	230	230	0.047	⊙ 300	2.2	0.70	0.049	4.685	4.087	6.00	5.80	1.00	1.40	5	
32	33	17.4	54.5	320	550	0.069	⊙ 400	1.6	0.72	0.090	3.987	3.347	5.80	5.60	1.39	1.83	6	

Table XX-3 Sewerage Computation Sheet For Faqus (3 of 3)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Unit Sewage Flow Per ha 0.001271 m3/sec/ha(in 2040) 0.000608 m3/sec/ha(in 2005) Design Flow m3/s	Designed Sewer Diameter mm	Slope ‰	Velocity m/s	Capacity m3/s	Sewer Invert Elevation Begin m	Sewer Invert Elevation End m	Ground Elevation Begin m	Ground Elevation End m	Earth Cover Begin m	Earth Cover End m	NO of MH	Remark
	Flow to No.2 Pumping Station (A2=99.5 ha)																	
ZONE-3																		
33		10.6	110.1	240	960	0.140	⊙ 500	1.3	0.75	0.147	4.058	3.650	5.60	5.60	1.00	1.41	5	
34	37	12.7	122.8	250	1,210	0.156	⊙ 600	1.1	0.78	0.221	3.550	3.175	5.60	5.60	1.40	1.78	5	
35		10.7	10.7	260	260	0.014	⊙ 200	3.5	0.66	0.021	6.790	5.789	8.00	7.00	1.00	1.00	5	
36		7.3	18.0	660	920	0.023	⊙ 250	2.6	0.67	0.033	5.739	3.759	7.00	5.60	1.00	1.58	13	
37		15.9	156.7	390	1,600	0.199	⊙ 600	1.1	0.78	0.221	3.175	2.590	5.60	5.56	1.78	2.32	8	
38	39	-	493.5	50	3,860	0.627	⊙1,000	0.7	0.87	0.687	1.186	1.131	5.56	5.56	3.27	3.33	1	
	Flow to No.3 Pumping Station (A3=176.6 ha)																	
39		-	515.0	2,400	6,260	0.313	⊙ 450	10.3	1.97	0.313	3.910	2.850	5.56	4.50	1.00	1.00		Force Main
	Flow to STP																	
Design Sewage Flow of No.1 Pumping Station						0.145	m3/sec											
Design Sewage Flow of No.2 Pumping Station						0.060	m3/sec											
Design Sewage Flow of No.3 Pumping Station						0.313	m3/sec											

Table XX-4 Calculation Sheet of Pumping Station for Faqus

City Name	Items		Unit		Pump No 1	2	3	4	5	6	7	8	9
FAQUS	Wastewater		m3/sec	Qs	0.145	0.060	0.313						
			m3/min	Qm=Qs*60	8.7	3.6	18.8						
	Inlet Pipe	Diameter	m		0.75	0.35	1.00						
		Elevation	m	Ep	-1.11	-2.88	-1.33						
	Ground Elevation		m	Et	6.29	5.60	5.00						
	Pump	Nos.		N	2	2	2						
		Q/Unit	m3/min	Qp=Qm/N	4.4	1.8	9.4						
		Dia. in need	mm	D=146*(Qp/2.0)(1/2)	215.3	138.5	316.4						
		Diameter	mm	Dp	200	150	300						
	Pump Loss	Force Main Length	m	L	700	-	2,400						
		Loss in Pipe	m	H1=L*.01	7.0		24.0						
		Water Head		H2=Et-Ep	7.4	8.5	6.3						
		+a	m	H3=4.0(2.0)	2.0	2.0	4.0						
		Total Loss	m	H=H1+H2+H3	16.4	10.5	34.3						
	Pump Capacity		KW	Ps=0.163*H*Qp/0.6	19.4	5.1	87.6						
	Moter Capacity		KW	P=Ps*(1+0.1)	21.3	5.6	96.3						
	Pump Spec	Diameter	mm		200	150	300						
		Quantity	m3/min		4.4	1.8	9.4						
		Loss	m		16.4	10.5	34.3						
		Moter Capacity	KW		22	5.5	110						
		Nos.		1 Standby	3	3	3						

Table XX-5 Process Design of STP for Faqus (1 of 3)

Facility	Items		Unit		
Condition	Daily Max		m3/day	Qd	20,481
	Hourly Max		m3/day	Qh	27,052
Grit Chamber	Surface Load(1,800)		m3/m2/day	A	(1,800)
	Area in Need		m2	Qh/A	(15.0)
	Shape	Width	m	W	1.0
		Length	m	L	7.5
		Depth	m	H	1.0
		Nos.		N	2
	Area		m2	A=W*L*N	15.0
	Volume		m3	V=W*L*H*N	15.0
	Surface Load		m3/m2/day	Qh/A	1,803.5
	Retention Time		sec	V*86400/Qh	47.9
Primary Sedimentation Tank	Surface Load(25-50)		m3/m2/day	A	(40)
	Area in Need		m2	Qd/A	(512.0)
	Shape	Diameter	m	D	18.0
		Depth	m	H	3.5
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	508.7
	Volume		m3	V=A*H	1,780.4
	Surface Load		m3/m2/day	Qd/A	40.3
	Retention Time		hours	V*24/Qh	1.6

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-5 Process Design of STP for Faqus (2 of 3)

Facility	Items		Unit		
Aeration Tank	BOD-SS Load(0.2-0.4)		kg/kg/day	BO	(.4)
	Aeration Time(6-12)		hours	T	(10.0)
	Return Sludge Ratio		%	a	25.0
	MLSS		mg/l	ML=(152*1.0+8,000*0.25)/1.25	1,722.0
	BOD Removed		kg/day	BR=(315-30)*10(-3)*Qd	5,837.1
	Volume in Need		m3	V=Qd*T/24	(8,533.8)
	Shape	Width	m	W	10.0
		Length	m	L	10.0
		Depth	m	H	5.0
		Nos.		N	20
	Tank Volume		m3	V=W*L*H*N	10,000.0
	SS in Tank		kg	SS=V*1722*10(-3)	17,220.0
	BOD-SS Load		kg/kg/day	BR/SS	.34
	Sludge Age		days	V*1722/Qd/152	5.5
	Aeration Time		hours	V*24/Qd	11.7
Final Sedimentation Tank	Surface Load(20-30)		m3/m2/day	A	(30.0)
	Area in Need		m2	Qd/A	(682.7)
	Shape	Diameter	m	D	22.0
		Depth	m	H	3.5
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	759.9
	Volume		m3	V=A*H	2,659.6
	Surface Load		m3/m2/day	Qh/A	27.0
	Retention Time		hours	V*24/Qh	3.1
Chlorine Contact Tank	Contact Time(15)		min		(15.0)
	Shape	Width	m	W	3.0
		Length	m	L	20.0
		Depth	m	H	2.0
		Channel		N	2
	Tank Volume		m3	V=W*L*H*N	240.0
	Contact Time		min	T=V*1440/Qd	16.9

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-5 Process Design of STP for Faqus (3 of 3)

Facility	Items		Unit		
Sludge	Dry Solid		kg/day	DS=(460-30)*10(-3)*Qd	8,806.8
Sludge Thickner	Sludge Volume		m3	Q=DS/0.01*.001	880.7
	Solid Load(60)		m2/kg/day	SL	(60.0)
	Area in Need		m2	DS/SL	(146.8)
	Shape	Diameter	m	D	10.0
		Depth	m	H	4.0
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	157.0
	Volume		m3	V=A*H	628.0
	Sludge Load		m2/kg/day	DS/A	56.1
	Retention Time		hours	V*24/Q	4.3
Drying Bed	Sludge Volume		m3	Q=DS/0.05*.001	176.1
	Retention Time		day	RT	(5.0)
	Thickness		m	TH	(.5)
	Volume in Need		m3	V=Q*RT	(880.7)
	Area in Need		m2	A=V/TH	(1,761.4)
	Shape	Width	m	W	10.0
		Length	m	L	10.0
		Depth	m	H	.5
		Nos.		N	20
	Tank Volume		m3	V=W*L*H*N	1,000.0
	Retention Time		day	V/Q	5.7

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-6 Hydraulic Calculation Sheet of STP for Faqus (1 of 5)

Faqus City

Facility	Items		Unit		Daily Max	Hourly Max
Initial Condition	Ground Level of STP		m	GL	5.5	5.5
	Water Level of Drain		m	WL	3.5	3.5
	Wastewater		m3/day	Qd	20,481	27,052
			m3/sec	Qs=Qd/86,400	0.237	0.313
Chlorine Contact Tank	Wastewater		m3/sec	Qs	0.237	0.313
	Pipe	Diameter	m	D	0.5	0.5
		Length	m	L	25	25
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.209	1.597
				I=V(2)*0.012(2)/R(4/3)	0.003368	0.005876
	Loss of Pipe		m	H1=L*I	0.084	0.147
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.112	0.195
	Total Loss		m	H=H1+H2	0.196	0.342
	out well		m	WLc1=WL+H	3.696	3.842
	Barrage	Width	m	B	3.0	3.0
		Height	m	GH	3.8	3.8
	Height of Overflow		m	H3=(Qs/1.84/B)(2/3)	0.123	0.148
	Water Level		m	WLc2=GH+H3	3.923	3.948

Table XX-6 Hydraulic Calculation Sheet of STP for Faqus (2 of 5)

Faqus City

Facility	Items		Unit		Daily Max	Hourly Max
Final Sedimentation Tank	Wastewater		m3/sec	Qs	0.237	0.313
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.209	1.597
				I=V(2)*0.012(2)/R(4/3)	0.003368	0.005876
	Loss of Pipe		m	H1=L*I	0.084	0.147
	Loss of out		m	H2=1.0*V(2)/19.6	0.075	0.130
	Wastewater		m3/sec	Q=Qs/2	0.119	0.157
	Pipe No.2	Diameter	m	D	0.4	0.4
		Length	m	L	86	86
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.940	1.242
				I=V(2)*0.012(2)/R(4/3)	0.002744	0.004786
	Loss of Pipe		m	H3=L*I	0.236	0.412
	Loss of in		m	H4=0.5*V(2)/19.6	0.023	0.039
	Total Loss		m	H=H1+H2+H3+H4	0.418	0.728
	out of FST		m	WLf1=WLc2+H	4.341	4.676
	Notch	Dia. of Notch	m	Dia	21.0	21.0
		Num. of Notch	per	N=3.14*Dia/0.15	440	440
		Hight		NH	4.800	4.800
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.031	0.035
	Water Level		m	WLf2=NH+H3	4.831	4.835

Table XX-6 Hydraulic Calculation Sheet of STP for Faqus (3 of 5)

Faqus City

Facility	Items		Unit		Daily Max	Hourly Max
Aeration Tank	Wastewater		m3/sec	Q=Qs/2	0.119	0.157
	Pipe No.1	Diameter	m	D	0.4	0.4
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Qs/A	0.940	1.242
				I=V(2)*0.012(2)/R(4/3)	0.002741	0.004786
	Loss of Pipe		m	H1=L*I	0.069	0.120
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.068	0.118
	Total Loss		m	H=H1+H2	0.137	0.238
	out of Distribution Tank		m	WLa1=WLf2+H	4.968	5.073
	Distribu. Well	Width	m	B	1.0	1.0
		Height	m	GH	5.1	5.1
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.161	0.193
	Water Level of Dist.Well		m	WLa2=GH+H3	5.261	5.293
	Wastewater		m3/sec	Q=Qs	0.237	0.313
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.209	1.597
				I=V(2)*0.012(2)/R(4/3)	0.003368	0.005876
	Loss of Pipe		m	H4=L*I	0.084	0.147
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.112	0.195
	Total Loss		m	H=H4+H5	0.196	0.342
	out of Aeration Tank		m	WLa3=WLa2+H	5.457	5.635
	Wastewater		m3/sec	Q=Qs/4	0.059	0.078
	Barrage	Width	m	B	10.0	10.0
		Height	m	GH	5.7	5.7
	Height of Overflow		m	H6=(Qs/1.84/B)(2/3)	0.022	0.026
	Water Level of AT		m	WLa4=GH+H6	5.722	5.726

Table XX-6 Hydraulic Calculation Sheet of STP for Faqus (4 of 5)

Faqus City

Facility	Items		Unit		Daily Max	Hourly Max
Primary Sedimentation Tank	Wastewater		m3/sec	Q=Qs/8	0.030	0.039
	Barrage	Width	m	B	0.4	0.4
		Heigt	m	GH	5.4	5.4
		Water Depth	m	h=WLa4-GH	0.322	0.326
	Cross Area		m2	A=B*h	0.129	0.130
	Velocity		m/sec	V=Q/A	0.233	0.300
	Loss of in & out		m	H1=1.5*V(2)	0.081	0.135
	Water Level of AT inflow		m	WLp1=WLa4+H1	5.803	5.861
	Wastewater		m3/sec	Q=Qs	0.237	0.313
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	10	10
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Q/A	1.208	1.595
				I=V(2)*0.012(2)/R(4/3)	0.00336	0.005861
	Loss of Pipe		m	H1=L*I	0.034	0.059
	Loss of out		m	H2=1.0*V(2)/19.6	0.074	0.130
	Wastewater		m3/sec	Q=Qs/2	0.119	0.157
	Pipe No.2	Diameter	m	D	0.4	0.4
		Length	m	L	86	86
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.940	1.242
				I=V(2)*0.012(2)/R(4/3)	0.002744	0.004786
	Loss of Pipe		m	H3=L*I	0.236	0.412
	Loss of in		m	H4=0.5*V(2)/19.6	0.023	0.039
	Total Loss		m	H=H1+H2+H3+H4	0.367	0.639
	out of FST		m	WLp2=WLp1+H	6.170	6.500
	Notch	Dia. of Notch	m	Dia.	17.0	17.0
		Num. of Notch	per	N=3.14*Dia/0.15	356	356.0
		Hight		NH	6.7	6.7
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.034	0.038
	Water Level of PST		m	WLp3=NH+H3	6.734	6.738

Table XX-6 Hydraulic Calculation Sheet of STP for Faqus (5 of 5)

Faqus City

Facility	Items		Unit		Daily Max	Hourly Max
Grit Chamber	Wastewater		m3/sec	Q=Qs/2	0.119	0.157
	Pipe No.1	Diameter	m	D	0.4	0.4
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.943	1.246
				I=V(2)*0.012(2)/R(4/3)	0.002762	0.004817
	Loss of Pipe		m	H1=L*I	0.083	0.145
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.023	0.040
	Total Loss		m	H=H1+H2	0.106	0.184
	out of Distribution Well		m	WLg1=WLp3+H	6.840	6.922
	Distribu. Well	Width	m	B	1	1
		Hight	m	GH	7.000	7.000
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.161	0.193
	Water Level of Dist. Well		m	WLg2=GH+H3	7.161	7.193
	Wastewater		m3/sec	Q=Qs	0.237	0.313
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Q/A	1.208	1.595
				I=V(2)*0.012(2)/R(4/3)	0.00336	0.005861
	Loss of Pipe		m	H4=L*I	0.101	0.176
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.037	0.065
	Total Loss		m	H=H4+H5	0.138	0.241
	Watwer Level of out of GT		m	WLg3=WLg2+H	7.299	7.434
	Loss of Screen		m	H6	0.1	0.1
	Water Level of GT Inflow		m	WLg4=WLg3+H6	7.399	7.534

Bilbeis

Table XX-7 Sewerage Computation Sheet For Bilbeis City (1 of 3)

Unit Sewage Flow Per ha 0.003427 m3/sec/ha(in 2040) 0.001007 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Designed Sewer Design Flow m3/s	Designed Sewer Sewer Diameter mm	Designed Sewer Slope ‰	Designed Sewer Velocity m/s	Designed Sewer Capacity m3/s	Sewer Invert Elevation Begin m	Sewer Invert Elevation End m	Ground Elevation Begin m	Ground Elevation End m	Earth Cover Begin m	Earth Cover End m	NO of MH	Remark
ZONE-1																		
1		33.6	33.6	460	460	0.115	⊙450	2.0	0.87	0.138	16.512	15.412	19.00	17.00	2.00	1.10	9	
2		30.4	64.0	440	900	0.219	⊙600	1.1	0.78	0.221	14.350	13.706	17.00	16.00	2.00	1.64	8	
3		23.6	87.6	400	1,300	0.300	⊙750	0.8	0.77	0.341	13.190	12.710	16.00	15.00	2.00	1.48	8	
4	16	7.8	95.4	480	1,780	0.327	⊙750	0.8	0.77	0.341	12.190	11.626	15.00	14.10	2.00	1.66	9	
	Flow to No.1 Pumping Station																	
5		13.8	13.8	270	270	0.086	⊙350	4.0	1.04	0.100	17.605	16.425	19.92	17.99	2.00	1.25	5	From Army Camp 0.039(0.032)
6		15.2	29.0	240	510	0.138	⊙450	2.0	0.87	0.138	15.502	14.942	17.99	17.23	2.00	1.80	4	
7	9	27.1	56.1	450	960	0.231	⊙600	1.5	0.91	0.258	14.580	13.725	17.23	15.66	2.00	1.28	9	
8		8.0	8.0	500	500	0.027	⊙250	2.6	0.67	0.033	13.738	12.238	15.00	15.66	1.00	3.16	10	
9	15	10.4	74.5	450	1,410	0.294	⊙750	0.8	0.77	0.341	11.738	11.198	15.66	14.28	3.11	2.27	9	
10		5.1	5.1	180	180	0.017	⊙200	3.0	0.62	0.019	12.230	11.630	13.44	13.78	1.00	1.94	3	
11		8.2	13.3	250	430	0.046	⊙300	2.2	0.70	0.049	11.530	10.880	13.78	13.03	1.94	1.84	5	
12	14	5.9	19.2	300	730	0.066	⊙350	1.8	0.70	0.067	10.830	10.170	13.03	13.59	1.81	3.03	6	
13		11.3	11.3	380	380	0.039	⊙300	2.2	0.70	0.049	12.685	11.709	14.00	13.59	1.00	1.57	7	
14		3.5	34.0	240	970	0.117	⊙450	1.5	0.75	0.120	10.070	9.630	13.59	14.28	3.03	4.16	4	
15		6.6	115.1	350	1,760	0.433	⊙900	0.7	0.82	0.519	9.180	8.795	14.28	14.10	4.11	4.32	7	

Table XX-7 Sewerage Computation Sheet For Bilbeis City (2 of 3)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Unit Sewage Flow Per ha: 0.003427 m3/sec/ha(in 2040) / 0.001007 m3/sec/ha(in 2005) — Designed Sewer: Design Flow m3/s	Sewer Diameter mm	Slope ‰	Velocity m/s	Capacity m3/s	Sewer Invert Elevation Begin m	Sewer Invert Elevation End m	Ground Elevation Begin m	Ground Elevation End m	Earth Cover Begin m	Earth Cover End m	NO of MH	Remark
	Flow	to No.1 Pumping Station		(A1=210.5 ha)														
16		-	210.5	500	2,260	0.244	⊙400	11.7	1.94	0.244	12.681	8.581	14.10	10.00	1.00	1.00	10	Force Main
ZONE-2																		
17		40.5	251.0	440	2,700	0.285	⊙450	8.5	1.79	0.285	8.512	7.972	10.00	9.46	1.00	1.00	8	From No.2 P/S Force Main
ZONE-3																		
18		79.1	330.1	650	3,350	0.364	⊙500	7.9	1.85	0.364	7.918	8.668	9.46	10.21	1.00	1.00	13	From No.3 P/S Force Main
ZONE-4																		
19	21	97.0	427.1	100	3,450	0.462	⊙500	12.8	2.36	0.463	8.668	8.708	10.21	10.25	1.00	1.00	2	From No.4 P/S Force Main
ZONE-5																		
20		41.6	41.6	1,000	1,000	0.042	⊙200	14.0	1.34	0.042	7.290	9.040	8.50	10.25	1.00	1.00	20	From No.5 P/S Force Main
21		-	468.7	330	3,780	0.504	⊙600	5.8	1.79	0.507	8.600	8.300	10.25	9.95	1.00	1.00	6	Force Main
ZONE-6																		
22	25	28.5	497.2	550	4,330	0.533	⊙600	6.5	1.90	0.536	8.300	7.200	9.95	8.85	1.00	1.00	11	From No.6 P/S Force Main
ZONE-7																		
23	25	55.9	55.9	650	650	0.056	⊙250	7.6	1.14	0.056	7.238	7.588	8.50	8.85	1.00	1.00	13	From No.7 P/S Force Main
ZONE-8																		
24		48.3	48.3	950	950	0.049	⊙250	5.8	1.00	0.049	7.238	7.588	8.50	8.85	1.00	1.00	19	From No.8 P/S Force Main
25		-	601.4	160	4,490	0.638	⊙600	9.2	2.26	0.638	7.200	7.490	8.85	9.14	1.00	1.00	3	Force Main
ZONE-9																		
26		65.6	667.0	350	4,840	0.704	⊙600	11.2	2.49	0.704	7.490	7.650	9.14	9.30	1.00	1.00	7	From No.9 P/S Force Main
	Flow	to Treatment Plant																

Table XX-7 Sewerage Computation Sheet For Bilbeis City (3 of 3)

NO of Sewer	Flow to	Sewerage Area		Sewer Length		Unit Sewage Flow Per ha 0.003427 m3/sec/ha(in 2040) 0.001007 m3/sec/ha(in 2005)													
							Designed Sewer				Sewer Invert Elevation		Ground Elevation		Earth Cover		NO of MH	Remark
		Increment Area	Cumulated Area	Increment Length	Cumulated Length	Design Flow	Sewer Diameter	Slope	Velocity	Capacity	Begin	End	Begin	End	Begin	End		
		ha	ha	m	m	m3/s	mm	‰	m/s	m3/s	m	m	m	m	m	m		
Design Sewage Flow of No.1 Pumping Station						0.212	m3/sec											
Design Sewage Flow of No.2 Pumping Station						0.041	m3/sec											
Design Sewage Flow of No.3 Pumping Station						0.080	m3/sec											
Design Sewage Flow of No.4 Pumping Station						0.098	m3/sec											
Design Sewage Flow of No.5 Pumping Station						0.042	m3/sec											
Design Sewage Flow of No.6 Pumping Station						0.029	m3/sec											
Design Sewage Flow of No.7 Pumping Station						0.056	m3/sec											
Design Sewage Flow of No.8 Pumping Station						0.049	m3/sec											
Design Sewage Flow of No.9 Pumping Station						0.066	m3/sec											

Table XX-8 Calculation Sheet of Pumping Station for Bilbeis

City Name	Items		Unit		Pump No 1	2	3	4	5	6	7	8	9
BILBEIS	Wastewater		m3/sec	Qs	0.212	0.041	0.080	0.098	0.042	0.029	0.056	0.049	0.066
			m3/min	Qm=Qs*60	12.7	2.5	4.8	5.9	2.5	1.7	3.4	2.9	4.0
	Inlet Pipe	Diameter	m		0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
		Elevation	m	Ep	8.80	7.00	6.46	7.21	5.50	6.95	5.50	5.50	6.14
	Ground Elevation		m	Et	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
	Pump	Nos.		N	2	1	2	2	1	1	1	1	1
		Q/Unit	m3/min	Qp=Qm/N	6.4	2.5	2.4	2.9	2.5	1.7	3.4	2.9	4.0
		Dia. in need	mm	D=146*(Qp/2.0)(1/2)	260.4	161.9	159.9	177.0	163.9	136.2	189.2	177.0	205.4
		Diameter	mm	Dp	250	150	150	200	150	150	200	200	200
	Pump Loss	Force Main Length	m	L	3,080	2,580	2,140	1,490	2,390	1,060	1,160	1,460	350
		Loss in Pipe	m	H1=L*.01	30.8	25.8	21.4	14.9	23.9	10.6	11.6	14.6	3.5
		Water Head		H2=Et-Ep	0.0	1.8	2.3	1.6	3.3	1.9	3.3	3.3	2.7
		+a	m	H3=4.0(2.0)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
		Total Loss	m	H=H1+H2+H3	34.8	31.6	27.7	20.5	31.2	16.5	18.9	21.9	10.2
	Pump Capacity		KW	Ps=0.163*H*Qp/0.6	60.1	21.1	18.1	16.4	21.4	7.8	17.3	17.5	10.9
	Moter Capacity		KW	P=Ps*(1+0.1)	66.1	23.2	19.9	18.0	23.5	8.6	19.0	19.2	12.0
	Pump Spec	Diameter	mm		250	150	150	200	150	150	200	200	200
		Quantity	m3/min		6.4	2.5	2.4	2.9	2.5	1.7	3.4	2.9	4.0
		Loss	m		34.8	31.6	27.7	20.5	31.2	16.5	18.9	21.9	10.2
		Moter Capacity	KW		75	30	22	22	30	11	22	22	15
		Nos.		1 Standby	3	2	3	3	2	2	2	2	2

Table XX-9 Process Design of STP for Bilbeis (1 of 3)

Facility	Items		Unit		
Condition	Daily Max		m3/day	Qd	44,606
	Hourly Max		m3/day	Qh	60,864
Grit Chamber	Surface Load(1,800)		m3/m2/day	A	(1,800)
	Area in Need		m2	Qh/A	(33.8)
	Shape	Width	m	W	1.2
		Length	m	L	7.5
		Depth	m	H	1.0
		Nos.		N	4
	Area		m2	A=W*L*N	36.0
	Volume		m3	V=W*L*H*N	36.0
	Surface Load		m3/m2/day	Qh/A	1,690.7
	Retention Time		sec	V*86400/Qh	51.1
Primary Sedimentation Tank	Surface Load(25-50)		m3/m2/day	A	(40)
	Area in Need		m2	Qd/A	(1,115.2)
	Shape	Diameter	m	D	19.0
		Depth	m	H	3.5
		Nos.		N	4
	Area		m2	A=3.14*D*D/4*N	1,133.5
	Volume		m3	V=A*H	3,967.4
	Surface Load		m3/m2/day	Qd/A	39.4
	Retention Time		hours	V*24/Qh	1.6

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-9 Process Design of STP for Bilbeis (2 of 3)

Facility	Items		Unit		
Aeration Tank	BOD-SS Load(0.2-0.4)		kg/kg/day	BO	(.4)
	Aeration Time(6-12)		hours	T	(10.0)
	Return Sludge Ratio		%	a	25.0
	MLSS		mg/l	ML=(152*1.0+8,000*0.25)/1.25	1,722.0
	BOD Removed		kg/day	BR=(315-30)*10(-3)*Qd	12,712.7
	Volume in Need		m3	V=Qd*T/24	(18,585.8)
	Shape	Width	m	W	12.0
		Length	m	L	12.0
		Depth	m	H	5.0
		Nos.		N	28
	Tank Volume		m3	V=W*L*H*N	20,160.0
	SS in Tank		kg	SS=V*1722*10(-3)	34,715.5
	BOD-SS Load		kg/kg/day	BR/SS	.37
	Sludge Age		days	V*1722/Qd/152	5.1
	Aeration Time		hours	V*24/Qd	10.8
Final Sedimentation Tank	Surface Load(20-30)		m3/m2/day	A	(30.0)
	Area in Need		m2	Qd/A	(1,486.9)
	Shape	Diameter	m	D	22.0
		Depth	m	H	3.5
		Nos.		N	4
	Area		m2	A=3.14*D*D/4*N	1,519.8
	Volume		m3	V=A*H	5,319.2
	Surface Load		m3/m2/day	Qh/A	29.4
	Retention Time		hours	V*24/Qh	2.9
Chlorine Contact Tank	Contact Time(15)		min		(15.0)
	Shape	Width	m	W	3.0
		Length	m	L	20.0
		Depth	m	H	2.0
		Channel		N	4
	Tank Volume		m3	V=W*L*H*N	480.0
	Contact Time		min	T=V*1440/Qd	15.5

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-9 Process Design of STP for Bilbeis (3 of 3)

Facility	Items		Unit		
Sludge	Dry Solid		kg/day	DS=(460-30)*10(-3)*Qd	19,180.6
Sludge Thickner	Sludge Volume		m3	Q=DS/0.01*.001	1,918.1
	Solid Load(60)		m2/kg/day	SL	(60.0)
	Area in Need		m2	DS/SL	(319.7)
	Shape	Diameter	m	D	10.0
		Depth	m	H	4.0
		Nos.		N	4
	Area		m2	A=3.14*D*D/4*N	314.0
	Volume		m3	V=A*H	1,256.0
	Sludge Load		m2/kg/day	DS/A	61.1
	Retention Time		hours	V*24/Q	3.9
Drying Bed	Sludge Volume		m3	Q=DS/0.05*.001	383.6
	Retention Time		day	RT	(5.0)
	Thickness		m	TH	(.5)
	Volume in Need		m3	V=Q*RT	(1,918.1)
	Area in Need		m2	A=V/TH	(3,836.1)
	Shape	Width	m	W	10.0
		Length	m	L	10.0
		Depth	m	H	.5
		Nos.		N	40
	Tank Volume		m3	V=W*L*H*N	2,000.0
	Retention Time		day	V/Q	5.2

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-10 Hydraulic Calculation Sheet of STP for Bilbeis (1 of 5)

Bilbeis City

Facility	Items		Unit		Daily Max	Hourly Max
Initial Condition	Ground Level of STP		m	GL	9.3	9.3
	Water Level of Drain		m	WL	7.3	7.3
	Wastewater		m3/day	Qd	44,606	60,864
			m3/sec	Qs=Qd/86,400	0.516	0.704
Chlorine Contact Tank	Wastewater		m3/sec	Qs	0.516	0.704
	Pipe	Diameter	m	D	0.8	0.8
		Length	m	L	20	20
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Qs/A	1.028	1.402
				I=V(2)*0.012(2)/R(4/3)	0.001301	0.00242
	Loss of Pipe		m	H1=L*I	0.026	0.048
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.081	0.15
	Total Loss		m	H=H1+H2	0.107	0.198
	out well		m	WLc1=WL+H	7.407	7.498
	Barrage	Width	m	B	3.0	3.0
		Height	m	GH	7.4	7.4
	Height of Overflow		m	H3=(Qs/1.84/B)(2/3)	0.206	0.253
	Water Level		m	WLc2=GH+H3	7.606	7.653

Table XX-10 Hydraulic Calculation Sheet of STP for Bilbeis (2 of 5)

Bilbeis City

Facility	Items		Unit		Daily Max	Hourly Max
Final Sedimentation Tank	Wastewater		m3/sec	Qs	0.516	0.704
	Pipe No.1	Diameter	m	D	0.8	0.8
		Length	m	L	10.0	10.0
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Qs/A	1.028	1.402
				I=V(2)*0.012(2)/R(4/3)	0.001301	0.00242
	Loss of Pipe		m	H1=L*I	0.013	0.024
	Loss of out		m	H2=1.0*V(2)/19.6	0.054	0.100
	Wastewater		m3/sec	Q=Qs/2	0.258	0.352
	Pipe No.2	Diameter	m	D	0.6	0.6
		Length	m	L	90	90
		Cross Area	m2	A=3.14*D(2)/4	0.283	0.283
			m	R=D/4	0.150	0.150
	Velocity		m/sec	V=Q/A	0.912	1.244
				I=V(2)*0.012(2)/R(4/3)	0.001502	0.002795
	Loss of Pipe		m	H3=L*I	0.135	0.252
	Wastewater		m3/sec	Q=Qs/4	0.129	0.176
	Pipe No.3	Diameter	m	D	0.4	0.4
		Length	m	L	45	45
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	1.024	1.397
				I=V(2)*0.012(2)/R(4/3)	0.003252	0.006053
	Loss of Pipe		m	H4=L*I	0.146	0.272
	Loss of in		m	H5=0.5*V(2)/19.6	0.027	0.050
	Total Loss		m	H=H1+H2+H3+H4+H5	0.375	0.698
	out of FST		m	WLf1=WLc2+H	7.981	8.351
	Notch	Dia. of Notch	m	Dia	21.0	21.0
		Num. of Notch	per	N=3.14*Dia/0.15	440	440
		Hight		NH	8.600	8.600
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.032	0.037
	Water Level		m	WLf2=NH+H3	8.632	8.637

Table XX-10 Hydraulic Calculation Sheet of STP for Bilbeis (3 of 5)

Bilbeis City

Facility	Items		Unit		Daily Max	Hourly Max
Aeration Tank	Wastewater		m3/sec	Q=Qs/4	0.129	0.176
	Pipe No.1	Diameter	m	D	0.4	0.4
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Qs/A	1.024	1.397
				I=V(2)*0.012(2)/R(4/3)	0.003253	0.006055
	Loss of Pipe		m	H1=L*I	0.081	0.151
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.080	0.149
	Total Loss		m	H=H1+H2	0.161	0.300
	out of Distribution Tank		m	WLa1=WLf2+H	8.793	8.937
	Distribu. Well	Width	m	B	1.0	1.0
		Height	m	GH	8.900	8.900
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.170	0.209
	Water Level of Dist.Well		m	WLa2=GH+H3	9.070	9.109
	Wastewater		m3/sec	Q=Qs	0.516	0.704
	Pipe No.1	Diameter	m	D	0.8	0.8
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Qs/A	1.028	1.402
				I=V(2)*0.012(2)/R(4/3)	0.001301	0.00242
	Loss of Pipe		m	H4=L*I	0.033	0.061
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.081	0.150
	Total Loss		m	H=H4+H5	0.114	0.211
	out of Acration Tank		m	WLa3=WLa2+H	9.184	9.320
	Wastewater		m3/sec	Q=Qs/4	0.129	0.176
	Barrage	Width	m	B	12.0	12.0
		Height	m	GH	9.400	9.400
	Height of Overflow		m	H6=(Qs/1.84/B)(2/3)	0.032	0.04
	Water Level of AT		m	WLa4=GH+H6	9.432	9.440

Table XX-10 Hydraulic Calculation Sheet of STP for Bilbeis (4 of 5)

Bilbeis City

Facility	Items		Unit		Daily Max	Hourly Max
Primary Sedimentation Tank	Wastewater		m3/sec	Q=Qs/8	0.065	0.088
	Barrage	Width	m	B	0.4	0.4
		Height	m	GH	5.5	5.5
		Water Depth	m	h=WLa4-GH	3.932	3.940
	Cross Area		m2	A=B*h	1.573	1.576
	Velocity		m/sec	V=Q/A	0.041	0.056
	Loss of in & out		m	H1=1.5*V(2)	0.003	0.005
	Water Level of AT inflow		m	WLp1=WLa4+H1	9.435	9.445
	Wastewater		m3/sec	Q=Qs	0.516	0.704
	Pipe No.1	Diameter	m	D	0.8	0.8
		Length	m	L	10	10
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Q/A	1.027	1.401
				I=V(2)*0.012(2)/R(4/3)	0.001299	0.002418
	Loss of Pipe		m	H1=L*I	0.013	0.024
	Loss of out		m	H2=1.0*V(2)/19.6	0.054	0.100
	Wastewater		m3/sec	Q=Qs/2	0.258	0.352
	Pipe No.2	Diameter	m	D	0.6	0.6
		Length	m	L	50	50
		Cross Area	m2	A=3.14*D(2)/4	0.283	0.283
			m	R=D/4	0.150	0.150
	Velocity		m/sec	V=Q/A	0.912	1.244
				I=V(2)*0.012(2)/R(4/3)	0.001502	0.002795
	Loss of Pipe		m	H3=L*I	0.075	0.140
	Wastewater		m3/sec	Q=Qs/4	0.129	0.176
	Pipe No.3	Diameter	m	D	0.4	0.4
		Length	m	L	35	35
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	1.024	1.397
				I=V(2)*0.012(2)/R(4/3)	0.003252	0.006053
	Loss of Pipe		m	H4=L*I	0.114	0.212
	Loss of in		m	H5=1.0*V(2)/19.6	0.053	0.100
	Total Loss		m	H=H1+H2+H3+H4+H5	0.244	0.455
	out of PST		m	WLp2=WLp1+H	9.679	9.900
	Notch	Dia. of Notch	m	Dia.	18.000	18.000
		Num. of Notch	per	N=3.14*Dia/0.15	377	377
		Hight		NH	10.100	10.100
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.045	0.052
	Water Level of PST		m	WLp3=NH+H3	10.145	10.152

Table XX-10 Hydraulic Calculation Sheet of STP for Bilbeis (5 of 5)

Bilbeis City

Facility	Items		Unit		Daily Max	Hourly Max
Grit Chamber	Wastewater		m3/sec	Q=Qs/2	0.258	0.352
	Pipe No.1	Diameter	m	D	0.8	0.8
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Q/A	0.514	0.701
				I=V(2)*0.012(2)/R(4/3)	0.000325	0.000604
	Loss of Pipe		m	H1=L*I	0.010	0.018
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.007	0.013
	Total Loss		m	H=H1+H2	0.016	0.031
	out of Distribution Well		m	WLg1=WLp3+H	10.161	10.183
	Distribu. Well	Width	m	B	1	1
		Hight	m	GH	10.200	10.200
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.27	0.332
	Watwer Level of Dist. Well		m	WLg2=GH+H3	10.470	10.532
	Wastewater		m3/sec	Q=Qs	0.516	0.704
	Pipe No.1	Diameter	m	D	0.8	0.8
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.502	0.502
			m	R=D/4	0.200	0.200
	Velocity		m/sec	V=Q/A	1.027	1.401
				I=V(2)*0.012(2)/R(4/3)	0.001299	0.002418
	Loss of Pipe		m	H4=L*I	0.039	0.073
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.027	0.050
	Total Loss		m	H=H4+H5	0.066	0.123
	Watwer Level of out of GT		m	WLg3=WLg2+H	10.536	10.655
	Loss of Screen		m	H6	0.1	0.1
	Water Level of GT Inflow		m	WLg4=WLg3+H6	10.636	10.755

Minyet El Qamh

Table XX-11 Sewerage Computation Sheet For Minyet El Qamh (1 of 2)

Unit Sewage Flow Per ha: 0.003244 m3/sec/ha(in 2040), 0.001004 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Designed Sewer Design Flow m3/s	Sewer Diameter mm	Slope ‰	Velocity m/s	Capacity m3/s	Sewer Invert Elevation Bigin m	Sewer Invert Elevation End m	Ground Elevation Bigin m	Ground Elevation End m	Earth Cover Bigin m	Earth Cover End m	NO of MH	Remark
ZONE-1																		
1		9.7	9.7	280	280	0.031	⊙250	2.3	0.63	0.031	9.738	8.974	11.00	12.00	1.00	2.76	6	
2	4	11.9	21.6	360	640	0.070	⊙350	2.0	0.73	0.071	8.874	8.014	12.00	13.00	2.76	4.62	7	
3		13.4	13.4	330	330	0.043	⊙300	2.0	0.66	0.047	10.685	9.885	12.00	13.00	1.00	2.80	7	
4		18.7	53.7	360	1,000	0.174	⊙500	1.8	0.88	0.174	7.864	7.076	13.00	11.13	4.59	3.51	7	
5	8	15.2	68.9	320	1,320	0.224	⊙600	1.2	0.81	0.230	6.976	6.472	11.13	10.95	3.50	3.83	6	
6		10.3	10.3	240	240	0.033	⊙250	2.6	0.67	0.033	9.628	8.904	10.89	10.87	1.00	1.70	5	
7		10.9	21.2	240	480	0.069	⊙350	1.9	0.72	0.069	8.804	8.248	10.87	10.95	1.70	2.33	5	
8	9	-	90.1	50	1,370	0.292	⊙750	0.8	0.77	0.341	6.322	6.262	10.95	10.50	3.82	3.43	1	
	Flow to No.1 Pumping Station				(A1=90.1 ha)													
ZONE-2																		
9	11	-	90.1	1,150	2,520	0.090	⊙300	7.3	1.27	0.090	9.185	9.265	10.50	10.58	1.00	1.00	23	Force Main
10		30.3	30.3	230	230	0.030	⊙200	7.0	0.95	0.030	9.470	9.370	10.68	10.58	1.00	1.00	5	From No.2 P/S Force Main
11	18	-	120.4	190	2,710	0.121	⊙350	5.9	1.26	0.121	9.213	9.733	10.58	11.10	1.00	1.00	4	Force Main
					(A2=30.3 ha)													
ZONE-3																		
12		20.7	20.7	350	350	0.067	⊙350	1.8	0.70	0.067	10.033	9.263	11.40	11.40	1.00	1.77	7	
13		14.5	35.2	350	700	0.114	⊙450	1.4	0.73	0.116	9.163	8.533	11.40	11.47	1.75	2.45	7	
14	17	5.4	40.6	80	780	0.132	⊙500	1.3	0.75	0.147	8.483	8.339	11.47	11.40	2.45	2.52	2	
	Flow to No.3 Pumping Station																	

Table XX-11 Sewerage Computation Sheet For Minyet El Qamh (2 of 2)

Unit Sewage Flow Per ha: 0.003244 m3/sec/ha(in 2040), 0.001004 m3/sec/ha(in 2005)

NO of Sewer	Flow to	Sewerage Area Increment Area ha	Sewerage Area Cumulated Area ha	Sewer Length Increment Length m	Sewer Length Cumulated Length m	Design Flow m3/s	Designed Sewer Diameter mm	Designed Sewer Slope ‰	Designed Sewer Velocity m/s	Designed Sewer Capacity m3/s	Sewer Invert Elevation Bigin m	Sewer Invert Elevation End m	Ground Elevation Bigin m	Ground Elevation End m	Earth Cover Bigin m	Earth Cover End m	NO of MH	Remark
15		19.9	19.9	270	270	0.065	⊙350	1.8	0.70	0.067	10.033	9.447	11.40	11.40	1.00	1.59	5	
16	17	6.9	26.8	300	570	0.087	⊙400	1.6	0.72	0.090	9.397	8.797	11.40	11.40	1.58	2.18	6	
	Flow to No.3 Pumping Station (A3=67.4 ha)																	
17		-	67.4	280	1,060	0.068	⊙250	11.0	1.38	0.068	10.138	9.838	11.40	11.10	1.00	1.00	6	Force Main
18		-	187.8	860	3,570	0.189	⊙400	7.0	1.50	0.189	9.681	8.401	11.10	9.82	1.00	1.00	17	Force Main
	Flow to STP																	
ZONE-4																		
19		24.0	24.0	290	290	0.078	⊙400	1.6	0.72	0.090	10.021	9.437	11.44	11.00	1.00	1.14	6	
20		11.8	35.8	350	640	0.116	⊙450	1.4	0.73	0.116	9.387	8.757	11.00	10.50	1.13	1.26	7	
21		12.1	47.9	240	880	0.155	⊙600	1.0	0.74	0.210	8.607	8.267	10.50	10.00	1.24	1.08	5	
22	25	13.9	61.8	300	1,180	0.200	⊙600	1.0	0.74	0.210	8.267	7.847	10.00	9.77	1.08	1.27	6	
23		13.2	13.2	280	280	0.043	⊙300	2.2	0.70	0.049	9.235	8.499	10.55	10.25	1.00	1.44	6	
24		12.3	25.5	390	670	0.083	⊙400	1.6	0.72	0.090	8.399	7.615	10.25	9.77	1.43	1.74	8	
25		-	87.3	80	1,260	0.283	⊙750	0.8	0.77	0.341	7.265	7.161	9.77	9.82	1.69	1.85	2	
	Flow to STP (A4=87.3 ha, A5=24.9 ha)																	
	Total Area 300.0 ha																	
	Design Flow Rate of STP Pumping Station						0.113 m3/sec											
	Design Flow Rate of NO.1 Pumping Station						0.090 m3/sec											
	Design Flow Rate of NO.2 Pumping Station						0.030 m3/sec											
	Design Flow Rate of NO.3 Pumping Station						0.068 m3/sec											

Table XX-12 Calculation Sheet of Pumping Station for Minyet El Qamh

City Name	Items		Unit		Pump No 1	2	3	4	5	6	7	8	9
								STP					
MINYET EL QAMH	Wastewater		m3/sec	Qs	0.090	0.030	0.068	0.113					
			m3/min	Qm=Qs*60	5.4	1.8	4.1	6.8					
	Inlet Pipe	Diameter	m		0.75	0.25	0.50	0.75					
		Elevation	m	Ep	6.26	7.68	8.34	6.16					
	Ground Elevation		m	Et	10.3	10.3	10.3	10.3					
	Pump	Nos.		N	2	1	2	2					
		Q/Unit	m3/min	Qp=Qm/N	2.7	1.8	2.0	3.4					
		Dia. in need	mm	D=146*(Qp/2.0)(1/2)	169.6	138.5	147.5	190.1					
		Diameter	mm	Dp	150	150	150	200					
	Pump Loss	Force Main Length	m	L	2,200	1,280	1,140	-					
		Loss in Pipe	m	H1=L*.01	22.0	12.8	11.4	-					
		Water Head		H2=Et-Ep	4.0	2.6	2.0	4.1					
		+a	m	H3=4.0(2.0)	4.0	4.0	4.0	4.0					
		Total Loss	m	H=H1+H2+H3	30.0	19.4	17.4	8.1					
	Pump Capacity		KW	Ps=0.163*H*Qp/0.6	22.0	9.5	9.6	7.5					
	Moter Capacity		KW	P=Ps*(1+0.1)	24.2	10.4	10.6	8.2					
	Pump Spec	Diameter	mm		150	150	150	200					
		Quantity	m3/min		2.7	1.8	2.0	3.4					
		Loss	m		30.0	19.4	17.4	8.1					
		Moter Capacity	KW		30	11	11	11					
		Nos.		1 Standby	3	2	3	3					

Table XX-13 Process Design of STP for Minyet El Qamh (1 of 3)

Facility	Items		Unit		
Condition	Daily Max		m3/day	Qd	19,118
	Hourly Max		m3/day	Qh	26,026
Grit Chamber	Surface Load(1,800)		m3/m2/day	A	(1,800)
	Area in Need		m2	Qh/A	(14.5)
	Shape	Width	m	W	1.0
		Length	m	L	7.5
		Depth	m	H	1.0
		Nos.		N	2
	Area		m2	A=W*L*N	15.0
	Volume		m3	V=W*L*H*N	15.0
	Surface Load		m3/m2/day	Qh/A	1,735.1
	Retention Time		sec	V*86400/Qh	49.8
Primary Sedimentation Tank	Surface Load(25-50)		m3/m2/day	A	(40)
	Area in Need		m2	Qd/A	(478.0)
	Shape	Diameter	m	D	18.0
		Depth	m	H	3.5
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	508.7
	Volume		m3	V=A*H	1,780.4
	Surface Load		m3/m2/day	Qd/A	37.6
	Retention Time		hours	V*24/Qh	1.6

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-13 Process Design of STP for Minyet El Qamh (2 of 3)

Facility	Items		Unit		
Aeration Tank	BOD-SS Load(0.2-0.4)		kg/kg/day	BO	(.4)
	Aeration Time(6-12)		hours	T	(10.0)
	Return Sludge Ratio		%	a	(25.0)
	MLSS		mg/l	ML=(152*1.0+8,000*0.25)/1.25	1,722.0
	BOD Removed		kg/day	BR=(315-30)*10(-3)*Qd	5,448.6
	Volume in Need		m3	V=Qd*T/24	(7,965.8)
	Shape	Width	m	W	10.0
		Length	m	L	10.0
		Depth	m	H	5.0
		Nos.		N	20
	Tank Volume		m3	V=W*L*H*N	10,000.0
	SS in Tank		kg	SS=V*1722*10(-3)	17,220.0
	BOD-SS Load		kg/kg/day	BR/SS	.32
	Sludge Age		days	V*1722/Qd/152	5.9
	Aeration Time		hours	V*24/Qd	12.6
Final Sedimentation Tank	Surface Load(20-30)		m3/m2/day	A	(30.0)
	Area in Need		m2	Qd/A	(637.3)
	Shape	Diameter	m	D	22.0
		Depth	m	H	3.5
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	759.9
	Volume		m3	V=A*H	2,659.6
	Surface Load		m3/m2/day	Qh/A	25.2
	Retention Time		hours	V*24/Qh	3.3
Chlorine Contact Tank	Contact Time(15)		min		(15.0)
	Shape	Width	m	W	3.0
		Length	m	L	20.0
		Depth	m	H	2.0
		Channel		N	2
	Tank Volume		m3	V=W*L*H*N	240.0
	Contact Time		min	T=V*1440/Qd	18.1

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-13 Process Design of STP for Minyet El Qamh (3 of 3)

Facility	Items		Unit		
Sludge	Dry Solid		kg/day	DS=(460-30)*10(-3)*Qd	8,220.7
Sludge Thickner	Sludge Volume		m3	Q=DS/0.01*.001	822.1
	Solid Load(60)		m2/kg/day	SL	(60.0)
	Area in Need		m2	DS/SL	(137.0)
	Shape	Diameter	m	D	10.0
		Depth	m	H	4.0
		Nos.		N	2
	Area		m2	A=3.14*D*D/4*N	157.0
	Volume		m3	V=A*H	628.0
	Sludge Load		m2/kg/day	DS/A	52.4
	Retention Time		hours	V*24/Q	4.6
Drying Bed	Sludge Volume		m3	Q=DS/0.05*.001	164.4
	Retention Time		day	RT	(5.0)
	Thickness		m	TH	(.5)
	Volume in Need		m3	V=Q*RT	(822.1)
	Area in Need		m2	A=V/TH	(1,644.1)
	Shape	Width	m	W	10.0
		Length	m	L	10.0
		Depth	m	H	.5
		Nos.		N	20
	Tank Volume		m3	V=W*L*H*N	1,000.0
	Retention Time		day	V/Q	6.1

Note: Figures in parentheses are guidelines for calculation of capacities.

Table XX-14 Hydraulic Calculation Sheet of STP for Minyet El Qamh (1 of 5)

Minyet El Qamh City

Facility	Items		Unit		Daily Max	Hourly Max
Initial Condition	Ground Level of STP		m	GL	10.3	10.3
	Water Level of Drain		m	WL	9.3	9.3
	Wastewater		m3/day	Qd	19,118	26,026
			m3/sec	Qs=Qd/86,400	0.221	0.301
Chlorine Contact Tank	Wastewater		m3/sec	Qs	0.221	0.301
	Pipe	Diameter	m	D	0.5	0.5
		Length	m	L	25	25
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.128	1.536
				I=V(2)*0.012(2)/R(4/3)	0.002932	0.005436
	Loss of Pipe		m	H1=L*I	0.073	0.136
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.097	0.181
	Total Loss		m	H=H1+H2	0.17	0.317
	out well		m	WLc1=WL+H	9.47	9.617
	Barrage	Width	m	B	3.0	3.0
		Height	m	GH	9.5	9.5
	Height of Overflow		m	H3=(Qs/1.84/B)(2/3)	0.117	0.144
	Water Level		m	WLc2=GH+H3	9.617	9.644

Table XX-14 Hydraulic Calculation Sheet of STP for Minyet El Qamh (2 of 5)

Minyet El Qamh City

Facility	Items		Unit		Daily Max	Hourly Max
Final Sedimentation Tank	Wastewater		m3/sec	Qs	0.221	0.301
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.128	1.536
				I=V(2)*0.012(2)/R(4/3)	0.002932	0.005436
	Loss of Pipe		m	H1=L*I	0.073	0.136
	Loss of out		m	H2=1.0*V(2)/19.6	0.065	0.120
	Wastewater		m3/sec	Q=Qs/2	0.111	0.151
	Pipe No.2	Diameter	m	D	0.4	0.4
		Length	m	L	86	86
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.877	1.194
				I=V(2)*0.012(2)/R(4/3)	0.002386	0.004426
	Loss of Pipe		m	H3=L*I	0.205	0.381
	Loss of in		m	H4=0.5*V(2)/19.6	0.020	0.036
	Total Loss		m	H=H1+H2+H3+H4	0.363	0.673
	out of FST		m	WLf1=WLc2+H	9.980	10.317
	Notch	Dia. of Notch	m	Dia	21.0	21.0
		Num. of Notch	per	N=3.14*Dia/0.15	440	440
		Hight		NH	10.400	10.400
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.030	0.034
	Water Level		m	WLf2=NH+H3	10.430	10.434

Table XX-14 Hydraulic Calculation Sheet of STP for Minyet El Qamh (3 of 5)

Minyet El Qamh City

Facility	Items		Unit		Daily Max	Hourly Max
Aeration Tank	Wastewater		m3/sec	Q=Qs/2	0.111	0.151
	Pipe No.1	Diameter	m	D	0.4	0.4
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Qs/A	0.877	1.194
				I=V(2)*0.012(2)/R(4/3)	0.002386	0.004423
	Loss of Pipe		m	H1=L*I	0.060	0.111
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.059	0.109
	Total Loss		m	H=H1+H2	0.119	0.220
	out of Distribution Tank		m	WLa1=WLf2+H	10.549	10.654
	Distribu. Well	Width	m	B	1.0	1.0
		Height	m	GH	10.7	10.7
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.153	0.188
	Water Level of Dist.Well		m	WLa2=GH+H3	10.853	10.888
	Wastewater		m3/sec	Q=Qs	0.221	0.301
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	25.0	25.0
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Qs/A	1.128	1.536
				I=V(2)*0.012(2)/R(4/3)	0.002932	0.005436
	Loss of Pipe		m	H4=L*I	0.073	0.136
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.097	0.181
	Total Loss		m	H=H4+H5	0.170	0.317
	out of Aeration Tank		m	WLa3=WLa2+H	11.023	11.205
	Wastewater		m3/sec	Q=Qs/4	0.055	0.075
	Barrage	Width	m	B	10.0	10.0
		Height	m	GH	11.300	11.300
	Height of Overflow		m	H6=(Qs/1.84/B)(2/3)	0.021	0.026
	Water Level of AT		m	WLa4=GH+H6	11.321	11.326

Table XX-14 Hydraulic Calculation Sheet of STP for Minyet El Qamh (4 of 5)

Minyet El Qamh City

Facility	Items		Unit		Daily Max	Hourly Max
Primary Sedimentation Tank	Wastewater		m3/sec	Q=Qs/8	0.028	0.038
	Barrage	Width	m	B	0.4	0.4
		Height	m	GH	9.2	9.2
		Water Depth	m	h=WLa4-GH	2.121	2.126
	Cross Area		m2	A=0.5*h	0.848	0.850
	Verocity		m/sec	V=Q/A	0.033	0.045
	Loss of in & out		m	H1=1.5*V(2)	0.002	0.003
	Water Level of AT inflow		m	WLp1=WLa4+H1	11.323	11.329
	Wastewater		m3/sec	Q=Qs	0.221	0.301
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	10	10
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Q/A	1.126	1.534
				I=V(2)*0.012(2)/R(4/3)	0.002922	0.00542
	Loss of Pipe		m	H1=L*I	0.029	0.054
	Loss of out		m	H2=1.0*V(2)/19.6	0.065	0.120
	Wastewater		m3/sec	Q=Qs/2	0.111	0.151
	Pipe No.2	Diameter	m	D	0.4	0.4
		Length	m	L	86	86
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.877	1.194
				I=V(2)*0.012(2)/R(4/3)	0.002386	0.004426
	Loss of Pipe		m	H3=L*I	0.205	0.381
	Loss of in		m	H4=0.5*V(2)/19.6	0.020	0.036
	Total Loss		m	H=H1+H2+H3+H4	0.319	0.591
	out of FST		m	WLp2=WLp1+H	11.642	11.920
	Notch	Dia. of Notch	m	Dia.	17.0	17.0
		Num. of Notch	per	N=3.14*Dia/0.15	356	356.0
		Hight		NH	12.200	12.200
	Height of Overflow		m	H3=(Q/1.55/N)(2/5)	0.033	0.038
	Water Level of PST		m	WLp3=NH+H3	12.233	12.238

Table XX-14 Hydraulic Calculation Sheet of STP for Minyet El Qamh (5 of 5)

Minyet El Qamh City

Facility	Items		Unit		Daily Max	Hourly Max
Grit Chamber	Wastewater		m3/sec	Q=Qs/2	0.111	0.151
	Pipe No.1	Diameter	m	D	0.4	0.4
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.126	0.126
			m	R=D/4	0.100	0.100
	Velocity		m/sec	V=Q/A	0.880	1.198
				I=V(2)*0.012(2)/R(4/3)	0.002401	0.004454
	Loss of Pipe		m	H1=L*I	0.072	0.134
	Loss of in & out		m	H2=1.5*V(2)/19.6	0.020	0.037
	Total Loss		m	H=H1+H2	0.092	0.170
	out of Distribution Well		m	WLg1=WLp3+H	12.325	12.408
	Distribu. Well	Width	m	B	1	1
		Hight	m	GH	12.400	12.400
	Height of Overflow		m	H3=(Q/1.84/B)(2/3)	0.153	0.188
	Watwer Level of Dist. Well		m	WLg2=GH+H3	12.553	12.588
	Wastewater		m3/sec	Q=Qs	0.221	0.301
	Pipe No.1	Diameter	m	D	0.5	0.5
		Length	m	L	30	30
		Cross Area	m2	A=3.14*D(2)/4	0.196	0.196
			m	R=D/4	0.125	0.125
	Velocity		m/sec	V=Q/A	1.126	1.534
				I=V(2)*0.012(2)/R(4/3)	0.002922	0.00542
	Loss of Pipe		m	H4=L*I	0.088	0.163
	Loss of in & out		m	H5=1.5*V(2)/19.6	0.032	0.060
	Total Loss		m	H=H4+H5	0.120	0.223
	Watwer Level of out of GT		m	WLg3=WLg2+H	12.673	12.811
	Loss of Screen		m	H6	0.1	0.1
	Water Level of GT Inflow		m	WLg4=WLg3+H6	12.773	12.911

APPENDIX - XXI

STUDY ORGANIZATION AND MINUTES OF THE OFFICIAL MEETINGS

APPENDIX - XXI

STUDY ORGANIZATION AND MINUTES OF THE OFFICIAL MEETINGS

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