THE MOVEMENT OF SAND DUNES AND ITS EFFECTS ON WATER CHANNELS IN THE PROJECT OF SOUTH VALLEY

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ABSTRACT

Toshka project is located in a desert area where sand dunes spread making it an exhibition on a permanent basis to sand, in addition to low water velocity most of the year, and low water depth in many reaches, all these factors make an ideal environment for the growth and spread of weeds in water. The reaches affected by sand movement in Sheikh Zayed canal from kilometer 24.750 to kilometer 43.000 with different lengths. The accumulative quantities, of sand that expected to fall in Sheikh Zayed canal and its branches ranged between 221.74m^3/year to 8948.16 m^3/year. Differences between actual and design water levels results from deposits and low drawn water, physical and chemical properties of water and soil for canals varying from site to other. (SOBEK program) shows that the main canal required 333m3/s to reach to design water level.

Key words: sand dunes- hydrolic efficiency- deposits

INTRODUCTION

Toshka project located in a desert area where sand dunes spread making it an exhibition on a permanent basis to the sand, which falls into water channels with its load into water, lack of speed of water most of the year, intensity of the brightness of the sun and low water depths in many reaches, all these factors make an ideal environment for the growth and spread weeds

in the water. The weed growth in the water channels makes it otherwise trap to catch the sand that moved by the movement of sand dunes thus leading to effect on the hydraulic efficiency of water channels. as well as their impact on water quality within the main canal and its branches and the content of the most important living organisms like fish.

Many researches work have been carried out to study climate and impacts of climate changes, causes of desertification phenomenon and studying, forms, types, and the methods to follow-up and fixation of sand dunes.

Mohammad Tawfiq, Unpublished MA Thesis. (dry climate dimensions and its impact on human activity in the Nile Valley) in 1996 study dry climate dimensions and its impact on human activity in the NileValley. Prof. Mahmoud Ibrahim Abu Shouk, and others puplished paper entitled(fixation of Saudi sand dunes using bentonite ore) in 2004 ,they studied the fixation of Saudi sand dunes using bentonite ore and they reached to that Mixing and compaction with bentonite powder gave best results in improved engineering properties.

Channel maintenance research institute excuted technical report entitled (final technical report on the study to complete the follow-up of sand dunes movement and deposits and the growth and spread of aquatic weeds and algae and its impact on water quality in project of south Valley) in 2010 to follow-up sand dunes movement , deposits , the growth and spread of aquatic weeds and its impact on water quality in project of South Valley.

METHODOLOGY

To achieve the objectives of the study, the study will be based on a number of field and laboratory measurements and programs as follows:

1 Using satellite images to measure lengths of affected sites on the main canal: sand dunes are spread in the study area affected directly on the water channels of the project. Satellite images will be use to determine the effected sites and their locations on sheikh zayed canal.

2 Estimation of accumulative sand quantities per year

Sand collectors

The Channel Maintenance Research Institute designed special sand collectors with inclined vents for trapping and recording the accumulated sand inside the collector for monitoring the quantity of accumulated sand monthly. Sand collectors designed in two sizes, (50 cm width, 50 cm length, 15 cm height) and (25cm width, 50cm length, 15cm height).

Eighty sand collectors fixed on the both sides of water channels in the direction of wind to collect sand and determine the reaches on different canals of the project that suffer from the movement of sand dunes and estimate the amounts of sand that will fall within water channels channels per year from februry 2015 to january 2016 as follows:

- Main canal: 26 sand collectors were fixed on right and left sides of the main canal.
- Conductor for branch 1 and 2: 8 sand collectors were fixed on right and left sides of the main canal.
- Branch 1: 16 sand collectors were fixed on right and left sides.
- Branch 2: 14 sand collectors were fixed on right and left sides.

- Branch 3: 16 sand collectors were fixed on right and left sides.

3 Survey cross-sections on Sheikh Zayed Canal:

The cross-sections that will be chosen located at kilometers (25.000, 27.500, 30.000, 32.500, 35.000, 37.500, 40.000, and 45.00) of Sheikh Zayed Canal.

4 Collecting of water samples and soil samples from different sites on the canals to determine the physical and chemical properties:

It will be collected 18 water and samples from different locations of the study area as shown in table (1) and figure (1) during four visits, June 2015 , August 2015, November 2015, and the fourth during January 2016 .

Table (1): locations of sampling site

Site No	Site	
1	Suction basin	
2	3.315	Main canal
3	7.400	
4	13.100	
5	17.170	
6	25.512	
7	29.980	
8	35.000	
9	42.000	
10	49.000	Conductor of branch1 and branch 2
11	57.000	
12	63.000	
13	70.000	
14	0.100	Branch2
15	3.000	
16	8.000	
17	5.000	Branch1
18	10.000	

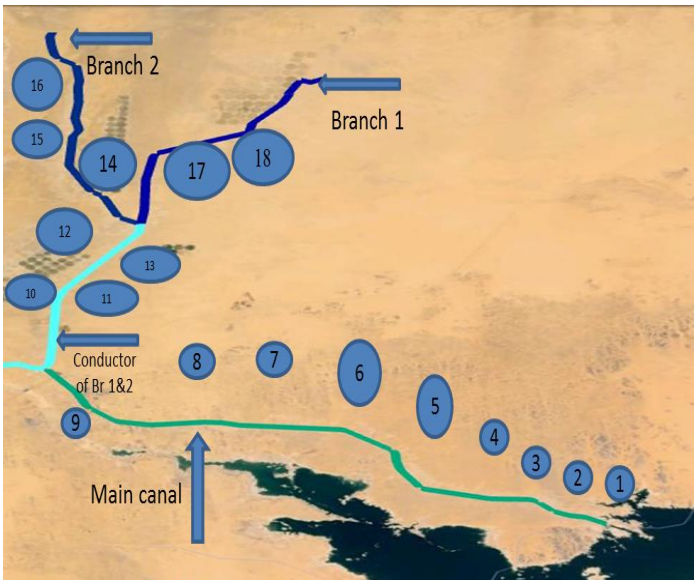

Figure (1): locations of sampling sites

5 Mathematical Model: The mathematical model will be made by using (SOBEK – RURAL 1D) program. SOBEK is a one-dimensional modeling system for open-channel networks; data of surveyed eight cross-sections on the main canal will be entered to determine the hydraulic efficiency of the main canal.

RESULTS AND DISCUSSION

1 Determination the most reaches in the main canal affected by sand movement

The results showed that the reaches that suffer from sand dunes movement on Sheikh Zayed Canal were turned out to be 12 sites as shown in table (2), figure (2) shows satellite image for site 2 at kilometer 26.500 and figure (3) shows comparisons between lengths of 12 sites

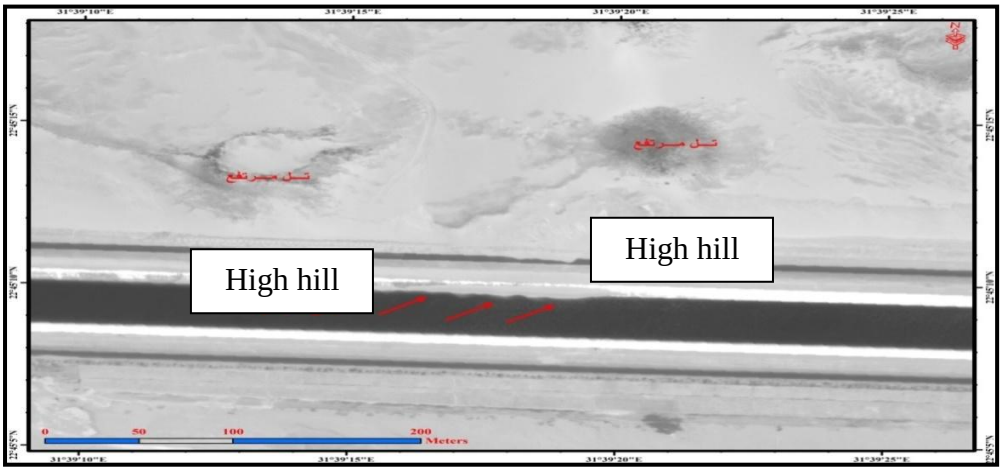

Figure (2): satellite image for site 2 at kilometer 26.500

Table (2): affected sites on the main canal

Site no	Reach(Km)		Length(M)	Side
	From	To		
1	24.750	24.900	150	right
2	26.500	26.830	330	right
3	31.875	32.035	160	right
4	36.150	36.500	350	right
5	36.900	37.450	550	right
6	37.675	37.845	170	right
7	38.930	39.110	180	right
8	39.450	39.680	230	right
9	39.975	40.225	250	right
10	40.250	40.450	200	right
11	40.580	40.930	350	right
12	43.750	44.030	280	right

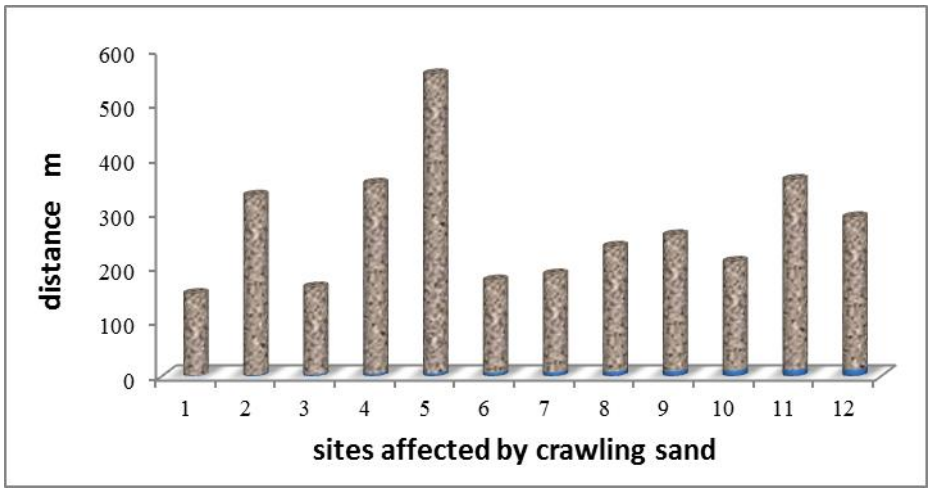

Figure (3): lengths of the affected sites on the main canal

2 Estimation of accumulative sand quantities per year:

sand collectors:

Results of eighty sand collectors fixed on the both sides of water channels in the project and follow up the weights of sand in the collectors per one year from februry2015 to january2016, showed the following:

For the Main canal the amount of fine sand expected to fall into the main canal is equivalent to 4391.53 m3 / year,for Conductor of branches 1 and 2 the amount of sand that expected to fall in the conductor is estimated to about 221.74 m3 / year. For Branch 2 the amount of sand that expected to fall in branch 2 is equal to 2247.68 m3 / year. For Branch 1 ,the amount of sand that expected to fall in branch 1 is 8948.16 m3 / year. For Branch 3 ,the amount of sand expected to fall into branch 3 is estimated to 6265.76 m3 / year.

Tables (3),(4) show quantities of sand per year and quantities of sand after correction that expected to fall in branch3.

Table (3): quantities of sand collected from the sand collectors for branch 3

collector no	Water channel	Kilo-metrage	side	Amount of sand(gm)											
				Feb 2015	Mars 2015	April 2015	may 2015	June 2015	July 2015	August 2015	Sept-ember 2015	October 2015	Nove-mber 2015	Dece-mber 2015	January 2016
69	Branch 3	1.500	left	163.97	167.10	168.66	160.85	662.35	936.52	229.37	252.30	280.33	88.65	99.43	112.44
70		1.500	right	43.97	44.81	45.23	43.13	101.27	133.37	10.978	12.07	13.42	24.08	27.00	30.53
71		4.500	left	0	0	0	0	0	0	2.354	2.58	2.88	37.02	41.52	46.95
72		4.500	right	631.4	643.47	649.49	619.42	1011.5	1232.46	40.843	44.92	49.91	127.78	143.32	162.07
73		7.500	left	0.95	0.97	0.98	0.93	0.318	0	1.133	1.24	1.38	1.66	1.86	2.112
74		7.500	right	1251.9	1275.7	1287	1228.08	1314.10	1377.13	192.214	211.43	234.92	420.79	471.95	533.70
75		10.500	left	0	0	0	0	0	0	2.937	3.23	3.586	6.05	6.78	7.667
76		10.500	right	0	0	0	0	0	5.6	357.5	393.25	436.94	133.12	149.30	168.85
77		13.500	left	0	0	0	0	0	0	198.85	218.74	243.05	37.08	41.60	47.03
78		13.500	right	1803.2	1837.5	1854.77	1768.90	4089.78	5372.37	3851.67	4236.83	4707.59	1749.51	1962.24	2218.98
79		16.500	left	1.33	1.35	1.3716	1.30	0.44	0	0	0	0	6.254	7.0192	7.93
80		16.500	right	4.69	4.78	4.82	4.60	1.57	0	0	0	0	66.55	74.64	84.41
81		19.500	left	0	0	0	0	0	3.50	2.93	3.23	3.58	49.75	55.81	63.118
82		19.500	right	6.84	6.97	7.049	6.72	2.30	0	0	0	0	2831.36	3175.6	3591.14
83		22.500	left	0	0	0	0	0	10.22	2.871	3.1581	3.51	2.5758	2.889	3.267
84		22.500	right	0	0	0	0	0	0	5.258	5.7838	6.424	35.85	40.22	45.485

*Sizes of sand collectors are 50*50 cm

Table (4): total amounts of sand collected after making the correction process

Collector no	Water channel	Kilo-metrage	side	Amount Of sand	Quantity collected by creep 70%	Quantity collected by suspension 21%	Quantity collected by saltation 9%	Slope angle	Correction factor	Quantity by creep after correction	Quantity of sand after correction(gm)
69	Branch 3	1.500	right	3322.03	2325.42	697.62	298.98	23.73	2.49	5790.29	6786.90
70		1.500	left	529.89	370.92	111.27	47.69	23.73	2.49	923.61	1082.57
71		4.500	right	133.33	93.33	27.99	11.99	42.16	1.49	139.06	179.06
72		4.500	left	5356.68	3749.68	1124.90	482.10	42.16	1.49	5587.02	7194.03
73		7.500	right	13.57	9.49	2.8498	1.22	70.67	1.06	10.069	14.14
74		7.500	left	9799.79	6859.85	2057.95	881.98	70.67	1.06	7271.44	10211.38
75		10.500	right	30.25	21.179	6.35	2.72	70.67	1.06	22.45	31.52
76		10.500	left	1644.57	1151.20	345.36	148.011	70.67	1.06	1220.27	1713.64
77		13.500	right	786.38	550.46	165.14	70.77	83.66	1.01	555.97	791.88
78		13.500	left	35453.46	24817.42	7445.22	3190.81	83.66	1.01	25065.59	35701.63
79		16.500	right	27.02	18.91	5.67	2.43	39.12	1.59	30.074	38.18
80		16.500	left	246.10	172.27	51.68	22.14	39.12	1.59	273.91	347.74
81		19.500	right	178.43	124.90	37.47	16.05	83.66	1.01	126.15	179.68
82		19.500	left	9628.05	6739.63	2021.89	866.52	83.66	1.01	6807.03	9695.45
83		22.500	right	28.49	19.94	5.98	2.56	83.66	1.01	20.14	28.69
84		22.500	left	139.03	97.32	29.19	12.513	83.66	1.01	98.30	140.01

*sizes of sand collectors (50*50) cm

3 survey cross-sections on Sheikh Zayed Canal:

- Slope of design water level and design bed level are 8cm/kilometer.
- Side slopes (Z)= 2:1,Bed width = 30 m.Roughness coefficient =0.17.
- Existing water level is low in comparison with design water level and constant somewhat because of low drawn water and low cultivated area

Table (5): data of surveyed cross-sections

Cross-section kilometer	Design Bank level(m)	Design water level (m)	Existing water level (m)	Design Bed level (m)	Volume of deposits m^3/m
25.000	198.628	197.628	193.097	191.628	2.01
27.500	198.428	197.428	193.084	191.428	2.50
30.000	198.228	197.228	193.070	191.228	2.60
32.500	198.028	197.028	193.058	191.028	2.70
35.000	197.828	196.828	193.058	190.828	3.15
37.500	197.628	196.628	193.055	190.628	4.50
40.000	197.428	196.428	193.058	190.428	4.10
45.000	197.028	196.028	193.057	190.028	3.25

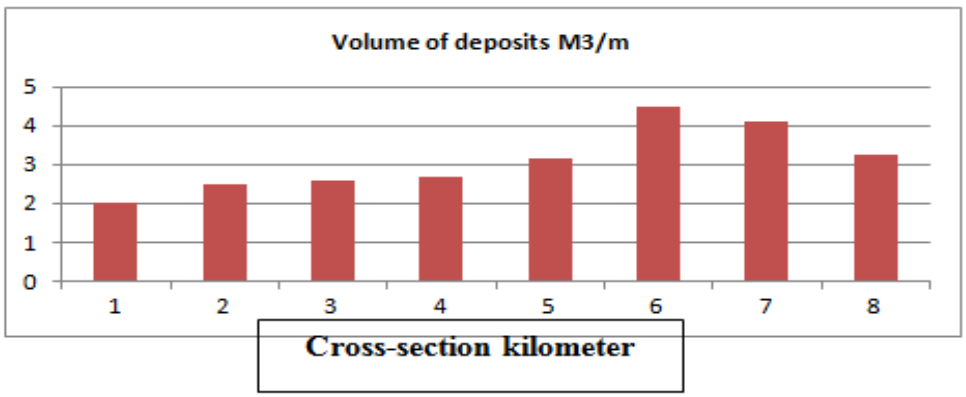

Figure (4): volume of deposits

4 Physical and chemical properties of water and soil for Sheikh Zayed Canal and its branches

4-1 The results of physical measurements for water samples

Table (6): min and max values of physical measurements for water samples

Parameter	Low	High	Unit	law(48/1982)	Date
Temp.	26.3°	29.9°	c°	5 °c up to normal	August 2015
PH	8.2	9.8	-	7-8.5	August 2015
DO	4.26	6.67	Mg/L	≥ 5	August 2015
EC	187	288	µmhos/cm	-	August 2015
Transparency	35	165	Cm	-	August 2015

4-2 The results of chemical measurements for water samples

Table (7): min and max values of chemical measurements for water samples

Parameter	Low	High	Unit	law(48/1982)	Date
NH_4	0.47	8.9	Mg/L	< 0.5	August 2015
NO_2	0.012	8.9	Mg/L	-	August 2015
NO_3	4	12	Mg/L	≤ 45	August 2015
SO_4	187	17	Mg/L	≤ 200	August 2015
PO_4	0.27	0.53	Mg/L	-	August 2015
Sio_2	4	8	Mg/L	-	August 2015

- Heavy metals

Table (8): min and max values of chemical measurements for heavy metals in water samples

Parameter	Low	High	Unit	law(48/1982)	Date
cu	0.2	0.14	Mg/L	≤ 1	August 2015
Fe	0.05	1.07	Mg/L	≤ 1	August 2015
Mn	0.1	2.2	Mg/L	0.5	August 2015

4-3 The results of physical and chemical analysis of soil samples

The results of the hydrometric and mechanical analysis

Laboratory results showed that the sand in most samples exceeding the ratio of 85% .the granulation tissue type is "sandy" for most samples during various visits to study area with the exception of several sandy silt sites. The results also showed that the tissue “sandy silt "(silt less than 20%) in some locations at the end of the main canal and the beginning of the conductor of branch 1 and 2 during June 2015

The results of physical and chemical analysis for soil samples

Table (9): min and max values of physical measurements for soil sample

Parameter	Low	High	Unit	The law GESAMP(1982)	Date
pH	7	8	-	-	January 2016
EC	197.8	695	µmhos/cm	-	January 2016

Table (10): min and max values of chemical measurements for soil samples

Parameter	Low	High	Unit	The law GESAMP(1982)	Date
Organic matter(om)	0.34	14.69	%	-	January 2016
K	17	42	Mg/L	-	January 2016
Na	80	187	Mg/L	-	January 2016
No_3	5	34	µg/g	-	January 2016
PO_4	1	4	µg/g	-	January 2016

Table (11): chemical measurements for heavy metals in soil sample

Parameter	Low	High	Unit	The law GESAMP (1982)	Date
Fe	60.4	126.7	µg/g	41000	January 2016
Mn	29	582.8	µg/g	770	January 2016

Table (12): analysis of physical and chemical measurements of water for the main canal and its branches during August2015

Location No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	The law (48/1982)
Physical Parameters																			
Temperature (c°)	26.3	28.4	29.2	28.3	26.8	26.5	26.6	27.8	29.5	26.7	28.3	28.4	28.6	28.6	28.7	26.8	29.7	29.9	5 c° up to normal
pH	8.6	9.8	9.2	8.3	8.5	8.4	8.7	8.9	8.7	8.5	8.6	8.5	8.7	8.3	8.2	8.4	8.8	8.5	7-8.5
Dissolved oxygen (O_2) mg/l	6.6	7.8	6.67	4.69	6.3	5.70	5.80	5.33	5.35	6.65	5.08	4.44	4.65	4.87	4.26	4.56	5.42	5.15	≥ 5
Electrical Conductivity (EC) µmhos/cm	213	187	189	243	273	255	232	230	227	238	242	245	288	253	279	276	240	252	-
Transparency (cm)	165	35	105	155	165	185	135	125	120	120	160	135	125	85	75	65	165	70	-
Some chemical parameters (mg/L)																			
Ammonia NH_4	0.64	0.59	0.65	0.79	0.65	0.85	0.47	2.52	3.55	2.20	8.05	4.9	8.7	5.9	7.3	8.3	8.9	8.8	< 0.5
Nitrite NO_2	0.06	0.014	0.015	0.026	0.053	0.037	0.025	0.017	0.028	0.012	0.055	0.082	0.048	0.051	0.057	0.029	0.073	0.049	-
Nitrate NO_3	5	9	7	8	7	8	7	11	10	12	11	4	6	7	5	8	7	5	≤ 45
Sulfate SO_4	8	13	11	14	12	13	10	13	11	12	13	12	14	13	18	14	15	17	≤ 200
Phosphate PO_4	0.51	0.52	0.53	0.66	0.48	0.41	0.45	0.33	0.44	0.38	0.53	0.27	0.38	0.33	0.39	0.52	0.43	0.39	-
Silica Sio_2	5	4	6	5	6	5	7	5	7	6	6	7	5	4	8	6	5	5	-
Copper Cu	0.03	0.02	0.06	0.07	0.04	0.08	0.07	0.08	0.06	0.03	0.12	0.14	0.09	0.14	0.12	0.13	0.06	0.14	≤1
Iron Fe	0.05	0.08	1.07	0.65	0.22	0.42	0.18	0.18	0.22	0.26	0.13	0.18	0.06	0.03	0.04	0.18	0.03	0.06	≤1
Manganese Mn	0.6	0.20	1.6	0.7	0.10	0.7	1.4	0.20	0.40	0.30	0.10	0.30	0.20	0.80	0.50	1.5	2.3	0.8	0.5

Table (13): hydrometric and mechanical analysis of sediments of the main canal and its branches during June 2015

Site no	Hydrometric analysis			Mechanical analysis(sieve diameter mm)								Granulation tissue type
	sand	silt	clay	2.000	0.850	0.600	0.425	0.300	0.212	0.106	0.063	
	(%)	(%)	(%)	The ratio of passing grain size%								
1	95.75	3.00	1.25	74.60	66.14	63.00	57.10	54.00	47.12	12.10	2.72	Sandy
2	94.98	5.02	-	75.20	65.58	64.00	66.10	58.25	52.45	11.02	3.40	Sandy
3	Sediments mixed with weeds											
4	Sediments mixed with weeds											
5	97.10	2.90	-	78.23	67.38	64.22	59.35	54.15	46.75	15.30	2.88	Sandy
6	Limestone sample											
7	81.75	16.10	2.15	72.34	53.28	47.20	42.20	37.20	31.87	22.57	9.54	Sandy silt
8	82.79	15.00	2.21	87.74	76.58	70.84	65.10	58.86	52.55	42.36	16.61	Sandy silt
9	94.00	6.00	-	87.87	77.63	70.89	62.69	53.09	43.12	17.91	3.94	Sandy
10	80.55	15.90	3.55	87.74	76.58	70.84	65.10	95.14	51.20	42.36	15.40	Sandy silt
11	88.14	11.86	-	85.56	71.82	65.94	59.78	58.45	45.60	28.50	12.30	Sandy
12	90.50	9.50	-	57.64	39.66	34.92	26.9	23.46	17.43	16.62	9.24	Sandy
13	81.10	15.67	3.23	79.84	65.40	60.26	55.12	49	42.58	24.75	17.99	Sandy silt
14	90.78	9.20	-	91.88	85.11	80.37	70.46	51.80	42.12	29.32	9.30	Sandy
15	96.45	3.55	-	92.84	89.78	88.03	84.05	67.44	46.22	15.54	3.62	Sandy
16	91.02	8.98	-	94.56	85.73	82.20	79.33	76.07	72.28	48.89	9.00	Sandy
17	92.90	7.10	-	95.10	91.30	89.79	87.56	81.69	71.98	27.95	6.55	Sandy
18	84.00	16.00	-	97.45	96.20	95.48	94.85	88.73	74.22	28.76	8.01	Sandy silt

Table (14): analysis of physical and chemical measurements of soil for the main canal and its branches during January 2016

Location No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	The law GESAMP (1982)
Physical Parameters	pH	8.0	7.8	7.6	7.2	7	7.5	7.2	7.6	7.6	7.8	7.6	7.4	7.6	7.7	7.40	7.9	7.8	7.4	-
	(EC) µmhos/cm	213	592	405	483	695	507	280	197.8	546	435	349	234	345	569	450	278	325	725	-
Some chemical parameters (mg/L)	Organic Matter OM.%	1.35	14.69	10.78	14.69	14.69	8.06	6.72	6.05	4.70	0.34	0.35	4.03	4.70	1.34	0.36	1.35	2.03	2.70	-
	Potassium K	25	23	17	35	29	28	34	35	33	19	22	23	22	40	42	39	37	39	-
	Sodium Na	113	80	100	186	151	133	164	133	165	187	147	112	117	100	101	154	113	115	-
	Nitrate NO_3	26	27	28	25	34	24	15	28	23	23	12	18	27	10	8	5	5	8	-
	Phosphate PO_4	1.53	1.13	1.80	1.20	1.00	1.04	2.45	3.20	3.00	4.00	1.1	2.5	2.7	2.7	1.2	3.51	3.50	2.7	-
	Iron Fe	60.7	64.8	61.2	74.7	60.74	93.16	61.2	126.7	60.4	61.3	62.1	76.4	64.32	61.3	64.0	66.1	63.1	64.0	41000
	Manganese Mn	342.6	346.8	272.8	582.9	449.2	190.8	263.7	29.80	202.0	157.8	393.5	301.6	239.9	75.8	34.3	102.3	154.4	578.8	770

4-5 Mathematical model:

- Q design and design water levels are used for actual and design cross-sections.
- From results it noticed that the actual water level is less than the design water level with 26.5 cm ,where design water level is 199.1232 m and actual water level is 198.8583 m at the beginning of the main canal because of the presence of deposits.

4-5-1 velocities:

- design velocities that result from passing the design discharge (300 m3/s) with design level (195.628m) at the end of main canal are ranged between 1.19 m/s to 1.33 m/s.
- from passing design discharge (300 m3/s) and design water level(195.628m) but on the actual cross-sections ,the velocities are ranged between 1.16 m/s to 1.38 m/s.

4-5-2Using Try and error method to reach the design water level of the main canal

- When passing discharge (333 m3/s) it gives an actual water level almost equal to the design water level (199.1232) .
- ΔQ=Q (required) – Q(design) so ΔQ = 333-300 =33 m3/s.
- The main canal requires 33m3/s to reach to Q design because of sediments and deposits in main canal.

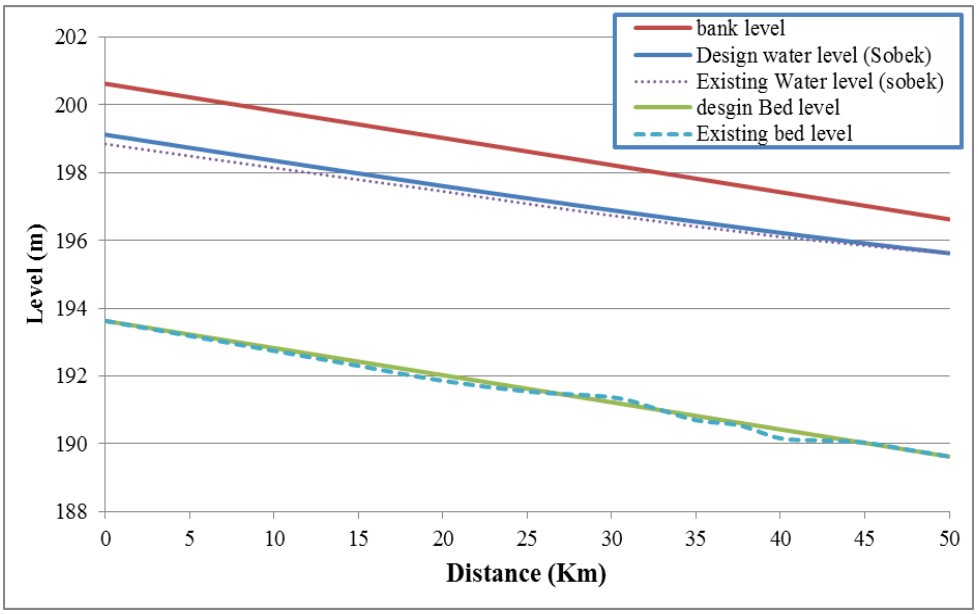

Figure (5): comparison between actual and design longitudinal sectio

CONCLUSIONS AND RECOMMENDATIONS

1 Conclusion:

This research program is carried out to study the problems of Toshka project, The research program is based mainly on steps including ,making analysis of satellite images to know the lenghs of reaches on the main canal that suffered from the movement of sand dunes, Estimation of accumulative sand quantities per year for 80 sand collectors on the sides of main canal, conductor of branch 1 and 2,branch1,branch2 and branch3 to estimate the amount of sand that falls annualy in water channels, also make survey for 8 cross-section in the main canal, study water quality for the main canal and the conductor of the branch 1 and 2 and branch 1 and branch 2 in the project by collecting of 18 water and soil samples from the canals in different seasons,

making the mathematical model by using SOBEK program and input data of 8 cross-sections to determine the hydraulic efficiency of the main canal.

After execution of methodology it was concluded that:

- There are 12 affected reaches with different lengths on the main canal, the most reaches on the main canal that suffered from the movement of sand dunes are located between kilometer 24.750 to kilometer 43.750.
- Based on the amount of sand that found in sand collectors It turns out that the areas around each of the kilometer 40.000 on main canal and kilometer 8.000 on branch 2 and kilometer 16.500 kilometer on Branch 1 and kilometer 13,500 on Branch 3 are the sites strongly suffered from active sand.
- It was noticed that existing water level is low and constant somewhat In comparison with design water level because of low cultivated area and low drawn water .
- The study of the physical properties, chemical properties for water shows that PH tends to be alkaline.
- Results of the sedimensts analysis showed that they are rich in nutrients and abundance in all sites.nutrients are renewed at intervals from the source (khor Toshka) which come annually to(khor Toshka) and allow for the growth and proliferation of all types of aquatic weeds in the case of the availability of appropriate conditions and the source of infection .
- when passing the design discharge (300 m3/s) and design level (195.628m) at the end of main canal it gives design velocities ranged between 1.19 m/s to 1.33 m/s

- when passing the design discharge (300 m3/s) and the design water level (195.628) m but on the actual cross-sections it gives actual velocities ranged between 1.16 m/s to 1.38 m/s.
- The main canal required 33m3/s to reach to Q design due to the presence of deposits in the main canal.

Recommendations for the future work:

1) In dry areas away from water channels it can cover the surface of the sand dunes that fronting the wind by deposits of coarse grit ,Sprinkle the surface of the sand dunes fronting the wind by the remnants of heavy petroleum oil or chemicals.
2) Try to cover an active sand dune with broken stones or heavy mud in the direction of the most common wind and study the effects of covering with broken stones on the active sand dunes.
3) The sediment depositions could be removed once every four year from the most exposed reaches to the active dunes by utilizing: Long Boom Excavator with suitable desalting bucket,Hydraulic Excavator with rotor dredger bucket and suction system. Amphibious Mounted long reach excavator with pontoon.
4) The management of toshka project shoud cultivate the right side of the main canal with wooden trees (4 rows), especially the confrontation areas of winds from the beginning of kilometer 25,000 to kilometer 50,000.
5) Follow-up water quality and sediments in sheikh zayed Canal and its branches periodically and comparing the results of water quality of water channels with the source water (Nasser lake),the importance of this follow-

up study is to identify the impact of irregular operation for the water channels on water quality.

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حركة الكثبان الرملية وتأثيراتها على المجارى المائية بمشروع جنوب الوادى

[٨]

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المستخلص

يقع مشروع توشكى في منطقة صحراوية حيث تنتشر الكثبان الرملية مما يجعله معرضا بصفة دائمة للرمال وعدم وجود سرعة للمياه في معظم أوقات السنة نتيجة لقلة سحب المياه وقلة أعماق المياه في العديد من الاحباس فتجتمع كل تلك العوامل السابقة لتكون بيئة مثالية لنمو وانتشار الحشائش الضارة للمياه. الاحباس التي تعاني من زحف الكثبان الرملية فى ترعة الشيخ زايد تصل الى ١٢ موقعا و تختلف الاطوال من موقع إلى آخر، وتقع جميع تلك المواقع بين الكيلومتر ٢٤,٧٥٠ حتى الكيلومتر ٤٣,٧٥٠ على القناة الرئيسية.كميات الرمال المتوقع سقوطها داخل الترعة الرئيسية وفروعها تتراوح بين ٢٢١,٧٤ م٣/سنة الى ٨٩٤٨,١٦ م٣/سنة ، توجد فروقات بين القطاعات الفعلية والتصميمية نتيجة لوجود الترسيبات وقلة سحب المياه.

تختلف الخواص الفيزيائية والكيميائية للمياه والتربة من موقع لاخر للترعة الرئيسية وفروعها وقد تم عمل نموذج رياضي باستخدام برنامج سوبك لتمثيل القناة الرئيسية للمشروع وتحديد الكفاءة الهيدروليكية للترعة الرئيسية وتبين أن الترعة الرئيسية تحتاج الى زيادة التصرف المار فيها ليصل الى ٣٣٣ م٣/ث وذلك للوصول إلى المنسوب التصميمي للترعة الرئيسية.