

WASTEWATER POLLUTION CONTROL IN EL-KALAA DRAIN - ALEXANDRIA GOVERNORATE

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ABSTRACT

The aim of this study is assessing the impact of domestic and industrial wastewater on the water quality in El-kalaa drain and how to control the wastewater pollution in the drain. Pollution resources in the drain are resulting from disposal of the effluent of the East wastewater treatment plant, Smouha drain, drain of the faculty of agriculture, the hydrodrome drain and branch of the Alexandria water canal. Samples were collected from six points during one year along the drain and analyzed in Sanitary Engineering Laboratory-Faculty of Engineering- Alexandria University according to the Standard Methods. Based on the obtained results several suggestions for reducing pollution within the body of the drain had been proposed. According to the mass balance procedure and the obtained results, it can be concluded that the advanced primary treatment at the sampling point No. 5 is the best proposal to achieve the environmental requirements.

Keywords: Kalaa drain, Pollutants, Maryout Lake, Pollution control, Environmental legislations.

INTRODUCTION

EL-kalaa drain is considered as the most important drain in Alexandria because it receives about 70% for a wastewater from Alexandrian city and serves about 14000 acre. The main sources of wastewater in El-kalaa drain are the effluent of East Wastewater Treatment Plant (EWTP), Agricultural drain, EL-Zohra drain, Hydrodrome drain and EL-Amlak drain as shown in Figure (1)^[1].

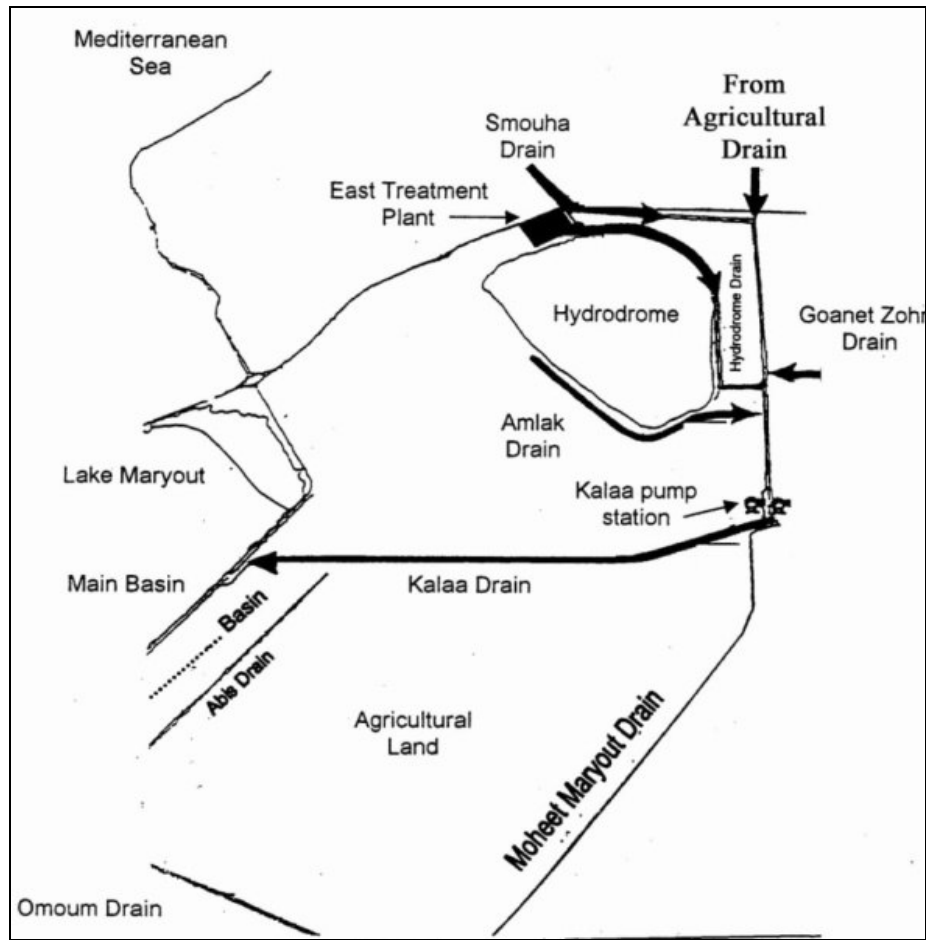


Figure (1): Main sources of wastes in El-kalaa drain

There are two pump stations to lift the wastes from El Kalaa drain to Maryout Lake. The first pump station consists of three pumps (two in due and one standby) and the discharge is about 302,400 cubic meter/day/pump. The second consists of two pumps (one in due and one standby) with discharge about 432,000 cubic meter/day/pump^[2].

SOURCES OF WASTES

Effluent of East Treatment Plant (EWTP)^[3]

The East Treatment Plant receives wastewater from the majority of the eastern portion of Alexandria which is lifted to the plant via three pump stations. These lines enter the plant site at the north end of the Headwork's structure. The Average Flow is 410 ML/day and the Design Peak Flow is 470 ML/day. The plant is working for primary treatment only with BOD removal 33% and removes 51% of T.S.S.

Smouha Drain

The main sources of the wastes in this part come from the nearby residential area and the over flow from (EWTP) with an average flow 120,000 m³/d.

Agricultural Drain

The main sources of the wastes in this drain are the wastewater resulting from the nearby residential area, agriculture drainage from the buildings of the College of Agriculture, Izbet Sekena Elgededa, Izbet Sekena Elkadema, Cows and sheep farm and slaughterhouse wastewater. This drain serves area about 7000 fed; the average flow of this drain is 140,000 m³/d.

EL-Zohra Drain

It serves area about 5870 fed, the main sources wastes in this drain is the wastewater resulting from the nearby houses, some farmland and Izbet Khurshid al Qibliyah. The average flow of this drain is 117,400 m³/d.

Hydrodrome Drain

The main source wastes in this drain are the wastewater resulting from the nearby houses, Helesh drain and the primary treated effluent from EWTP. The average flow of this drain is 402,800 m³/d.

EL-Amlak Drain

It serves area about 10240 fed. The main sources wastes in this drain are farmlands, Izbet nady El-sade, Elashrah, Elmanshiah elgededa and some Abis villages like (no. 1, 2, 4, 7, 8, and Oraby). The average flow of this drain is 204,800 m³/d.

Branch from Alexandria water canal

The main source of water in this branch is the over flow from the agriculture drains. The average flow of this branch is 51,800 m³/d.

METHODOLOGY

The main aim of this study is assessing the impact of domestic and industrial wastewater on the water quality of El-Kalaa drain and how to control the wastewater

pollution in the drain. To attain this aim many samples at different locations along the drain were withdrawn and analyzed according to the standard methods.

Sampling:

Samples were collected (every two weeks) from six locations distributed along 11 kilometers, started at April 2007 till December 2007. Figure (2) ^[4] shows the location of the sampling points.

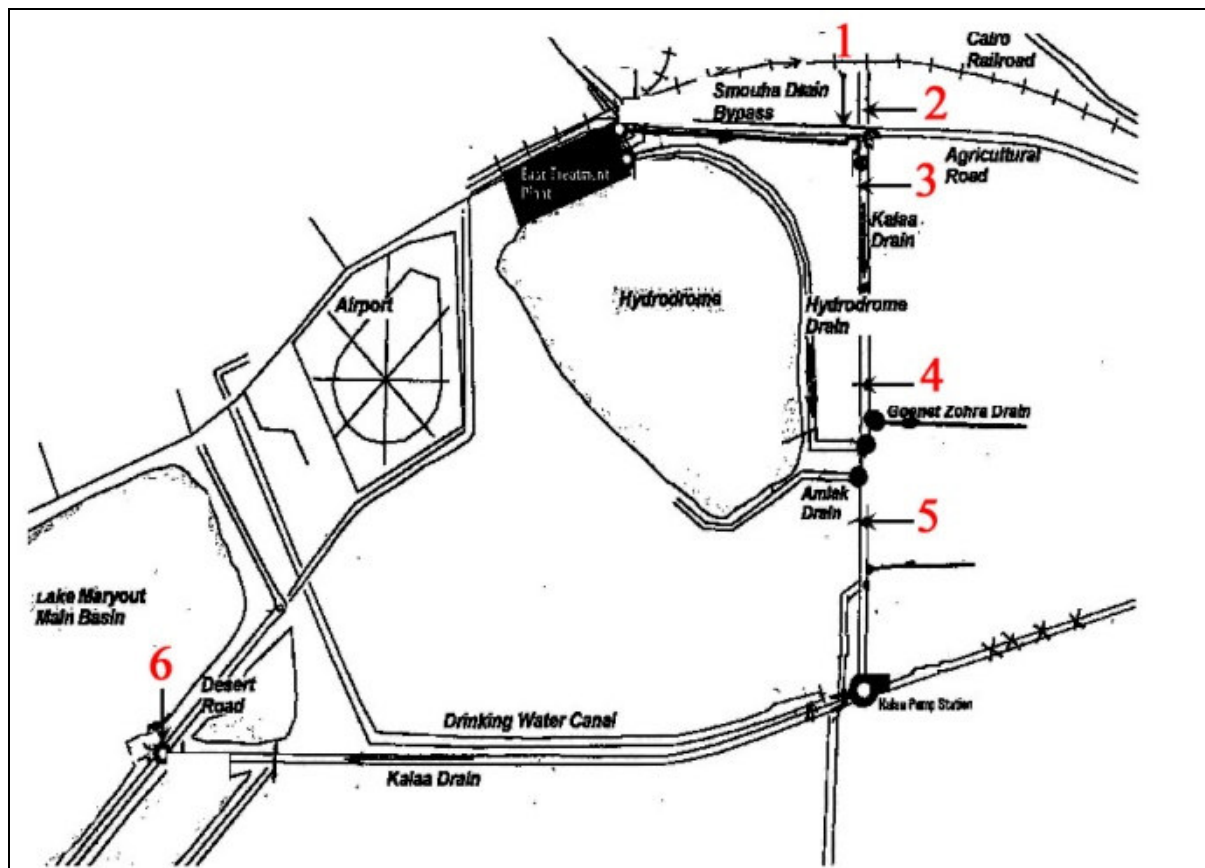


Figure (2): Location of the sampling points

To evaluate the drain status some parameters were determined according to The American Standards Methods for the Examination of Water and Wastewater ^[5]. These parameters were: pH, Temperature, T.S, S.S, D.S, Dissolved Oxygen (D.O), Chemical Oxygen Demand (COD), Bio-chemical Oxygen Demand (BOD), and Nutrients Phosphate (P) & Nitrite (NO₂) & Nitrate (NO₃) & Ammonia (NH₄).

RESULTS AND DISCUSSIONS

This study investigated the pollutants along the EL-Kalaa drain. It must be mentioned that the values in the following figures are the average values for each sampling point along a period of nine months from April 2007 to December 2007.

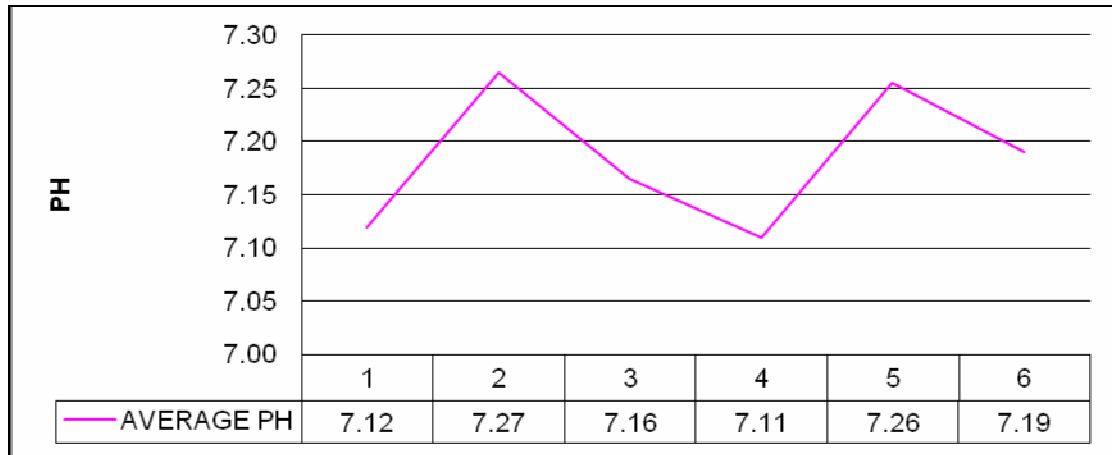


Figure (3): Average PH values for all samples during the period from April 2007 till December 2007

The figure shows that wastewater is almost neutral along the path of the drain.

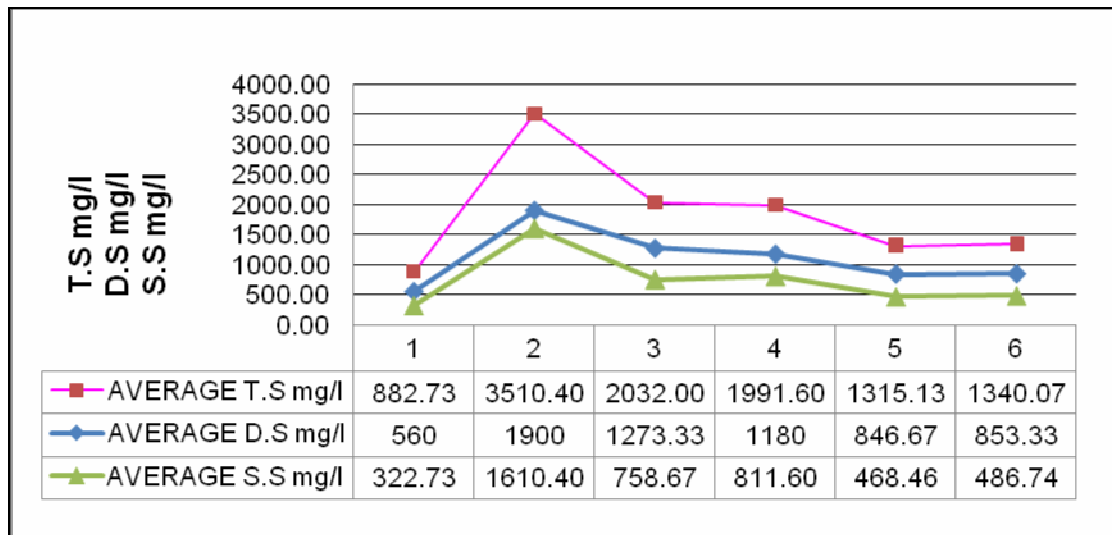


Figure (4): Average T.S, D.S & S.S values for all samples during the period from April 2007 till December 2007

As illustrated in Figure (4), the total solids concentration is in the range between 882 - 3510 mg/l with an average value of 1845 mg/l. The highest value was 3510 mg/l at

sampling point number (2). The dissolved solids concentration is in the range between 560 - 1900 mg/l with an average value of 1100 mg/l. The highest value was 1900 mg/l at sampling point number (2). The suspended solids concentration is in the range between 322 - 1610 mg/l with an average value of 743 mg/l. The highest value was 1610 mg/l at sampling point number (2). This may be referred to the presences of the slaughterhouse wastes, sheep and cattle's farms. The minimum concentrations of T.S, S.S and D.S were 882 mg/l, 560 mg/l and 322 mg/l respectively at sampling point 1. The decrease of T.S, & S.S and D.S values after point 2 maybe due to the dilution resulted from the mixing of wastewater between points 1&2.

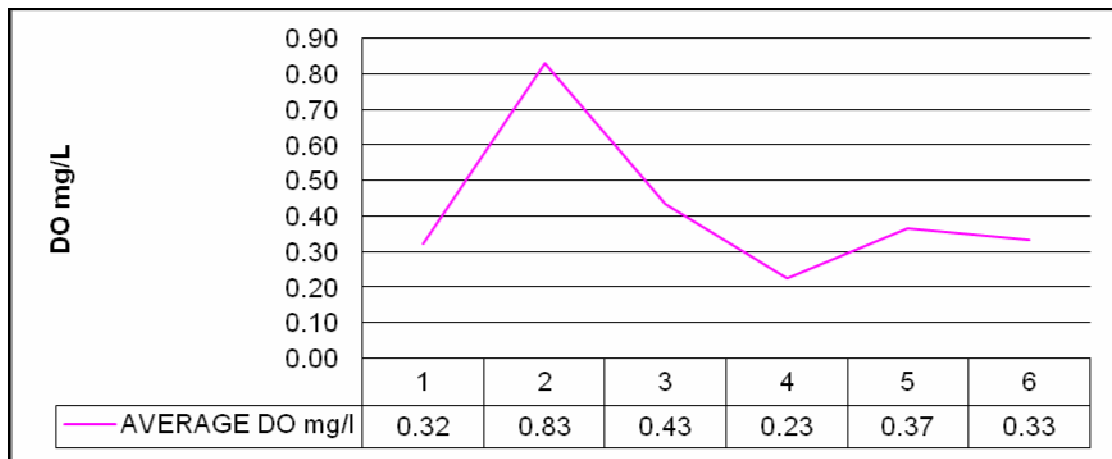


Figure (5): Average D.O values for all samples during the period from April 2007 till December 2007

Figure (5) shows that the average D.O concentration values is between 0.23 - 0.83 mg/l along the El-Kalaa drain. It is obvious that the dissolved oxygen is absent. It simply means the presence of malodors' because of the activities of facultative and anaerobic bacteria. D.O depletion may cause a big danger to the aquatic life.

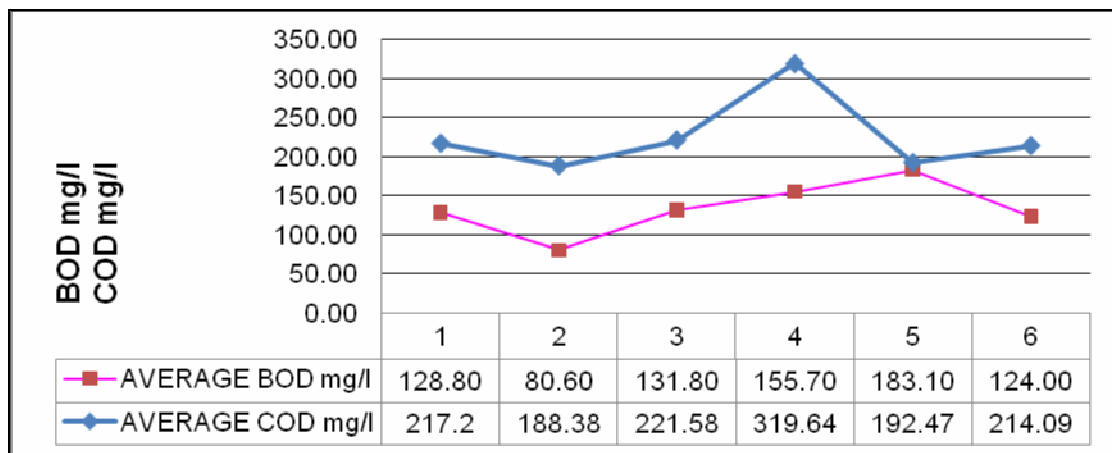


Figure (6): Average BOD values for all samples during the period from April 2007 till December 2007

As shown in figure (6) the BOD values are between 80 -183 mg/l. It is increasing along the El-Kalaa drain from sampling point (2) with an average value of 80 mg/l to 183 mg/l at sampling point (5). This behavior can be interpreted by the disposal of wastewater with high organic concentration along the path of the drain.

The COD values are in the range between 188 -319 mg/l with an average value of 225 mg/l. It is increasing along the asphalt road from 188.38 mg/l at sampling point (2) to 319.64 mg/l at sampling point (4). This behavior can be interpreted by the disposal of domestic wastewater, dissolved fertilizers from the nurseries farmland and decomposition of dead plants.

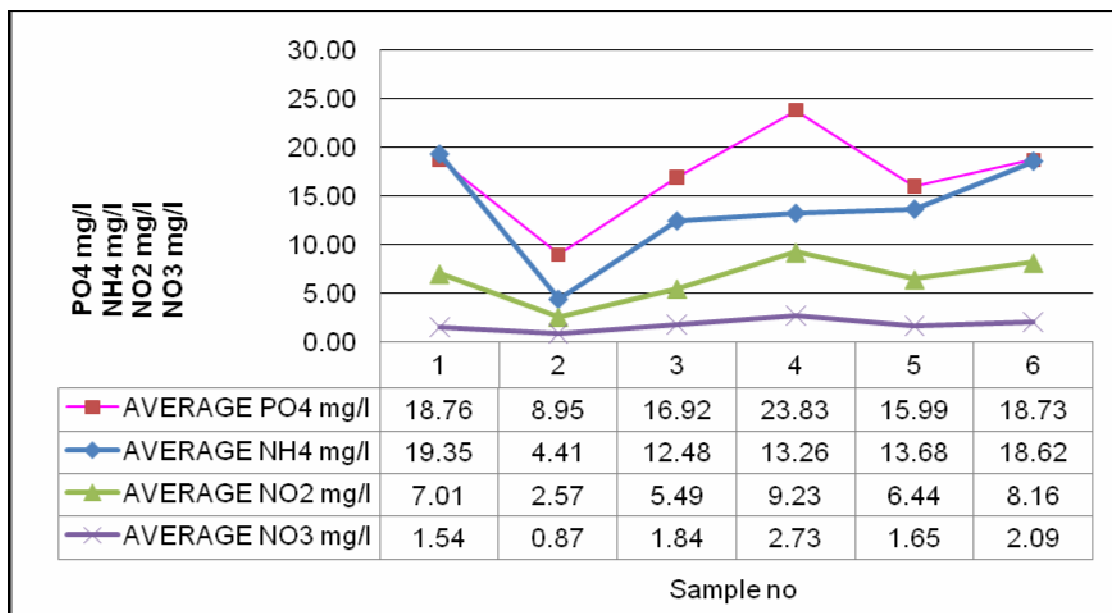


Figure (7): Average PO₄ values for all samples during the period from April 2007 till December 2007

As illustrated in Figure (7), the maximum concentration of PO₄ is 23 mg/l at point (4). This may be due to disposal of dissolved fertilizers from the nearby farmlands and decomposition of dead plants along the asphalt road. The maximum concentration of NO₂ is 9 mg/l at point (4). The maximum concentration of NO₃ is 2.75 mg/l at point (4). This may be due to disposal of dissolved fertilizers from the nearby farmlands and decomposition of dead plants along the asphalt road. NH₄ along the drain ranged between 4.5-18.5 mg/l as shown in Figure (7), it is clear that the maximum value at point (6) 18.5 mg/l. While the minimum value is 4.5 mg/l at point (2), the high concentration of NH₄ is toxic to fish.

To control the Environmental pollution in this drain a set of five technical suggestions for effluent disposal have been proposed. Each of these alternatives will be evaluated from both an Engineering and Environmental point of view, and a conceptual cost estimate will be developed for each suggestion. These suggestions are as following:

- **Suggestion A**

Expanding the primary treatment in the EWTP and neglecting the overflow before disposal into Lake Maryout.

- **Suggestion B**

Expanding the primary treatment in the EWTP and maintaining the overflow before disposal into Lake Maryout.

- **Suggestion C**

Secondary treatment in the EWTP and maintaining the overflow before disposal into Lake Maryout.

- **Suggestion D**

Secondary treatment in the EWTP and neglecting the overflow before disposal into Lake Maryout.

- **Suggestion E**

Constructing an expansion primary treatment plant at point (5).

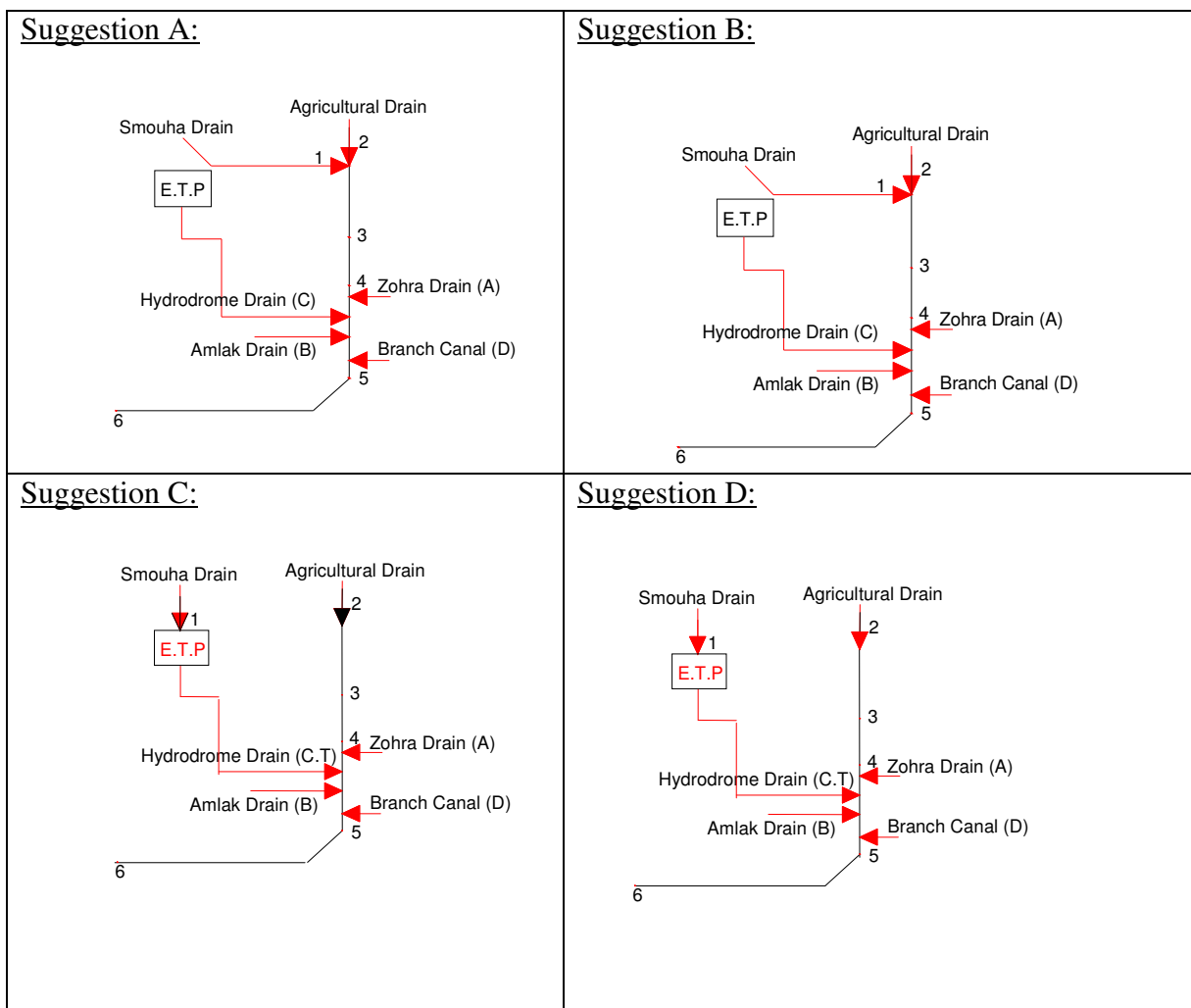


Figure (8) Different suggestions to control the pollution in the drain

Based on the previous suggestions as shown in Figure (8) and applying the mass balance method, the expecting results have been tabulated in Table (1).

Table (1): Expected results of different concentrations at point (5) for all previous suggestions

Conc. Mg/l Suggestion	D.S	BOD	p	NH4	COD	S.S	NO2	NO3
Egyptian law (48/1982).	2000	60	5	3	100	60	-	50
Suggestion A	785.46	78.82	16.93	10.25	154.17	444.97	3.43	1.23
Suggestion B	815.09	101.2	18.85	11.3	198.77	425.44	3.90	1.40
Suggestion C	805.75	88.13	17.91	10.33	177.03	420.05	3.55	1.33
Suggestion D	772.87	61.46	15.66	8.95	124.88	437.72	2.96	1.13
Suggestion E	102.11	31.53	4.23	7.69	61.67	57.85	2.57	0.92

From the previous table it is obvious that, suggestion E is the best of all suggestions.

7- CONCLUSIONS AND RECOMMENDATIONS

The drainage system in Egypt suffers from increasing pollution loads caused by the discharge of untreated and primary treated domestic wastewater in the water streams. The drainage water quality data show that the open drains are highly contaminated by oxygen demanding substances and total suspended solids exceeding the permissible standards of the Egyptian law (48 /1982).

Based on this study it can be concluding that:

- 1- Construction of a small WWTP at the points of pollution source like (poultry farm, Cows and sheep farm, slaughterhouse) will support the control the pollution in the drain.
- 2- Constructing an expansion primary treatment plant at point (5) is the most effective technical suggestion to reduce the pollution levels from rural wastewater and increasing the possibility for safe drainage water into the Lake Maryout.
- 3- Upgrading of the E.T.P was not enough to remove the most sources of pollution.

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