Case Study:
EO and In-situ for Monitoring of Water Pollution in North Coastal Lagoons of Egypt

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1. Introduction

Coastal zone of Egypt is densely populated with large number of big cities, small rural areas that are supported by the local natural resources and livelihoods (Abou El-Magd and Hermas, 2010). The administration of the coastal areas is under the governorates that are responsible about the human development within the admin territory of the governorate. Unfortunately, the authoritative control on the natural resources thematic areas are diverse from Environmental Agency that is responsible about protectorate areas and inland lakes are ministry of agriculture and fisheries institute. Such conflict of responsibilities creates some pressure on the governorate on the process of developmental plans and implementation of Egypt agenda 2030 for sustainable development (Ali and Abou El-Magd, 2016).

2. Area of study

The area of study is located west Port Saeid city and southern the airport. It located between 32 ° 12′ 30″ E to 32° 15′ 30″ E and 31° 15′ 20″ N to 31° 17′ 20″ N. The area is mixed with an area isolated from Lake Manzala as an open water mass and bare land occupied by landfill together with urbanized areas and waste station. The area under consideration of remediation and development plan is about 5 Km2.

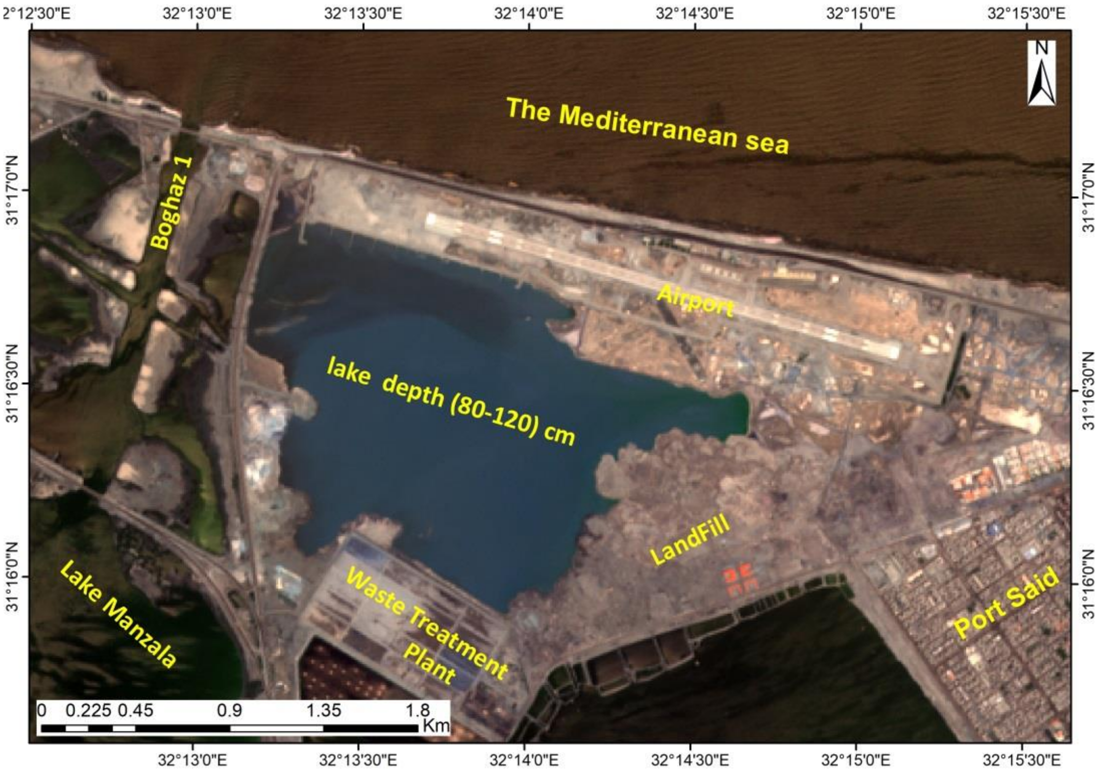

Figure 1 – Area of study

3. Methods

Image processing Enhancement technique was adopted to visualize and discriminate the land use and land cover of the area of study. To quantify the different categories and feature classes in the area, supervised clustering of maximum likelihood was used based on the training samples obtained from the area of study.

GPS was used to locate the sampling locations of In-situ measurements of water quality and sediment quality. The samples were analyzed in the laboratory to determine the water quality variables and the trace metals. Figure (2) shows the locations of the water samples, however, table (1) shows the list and the status of the water quality samples measured.

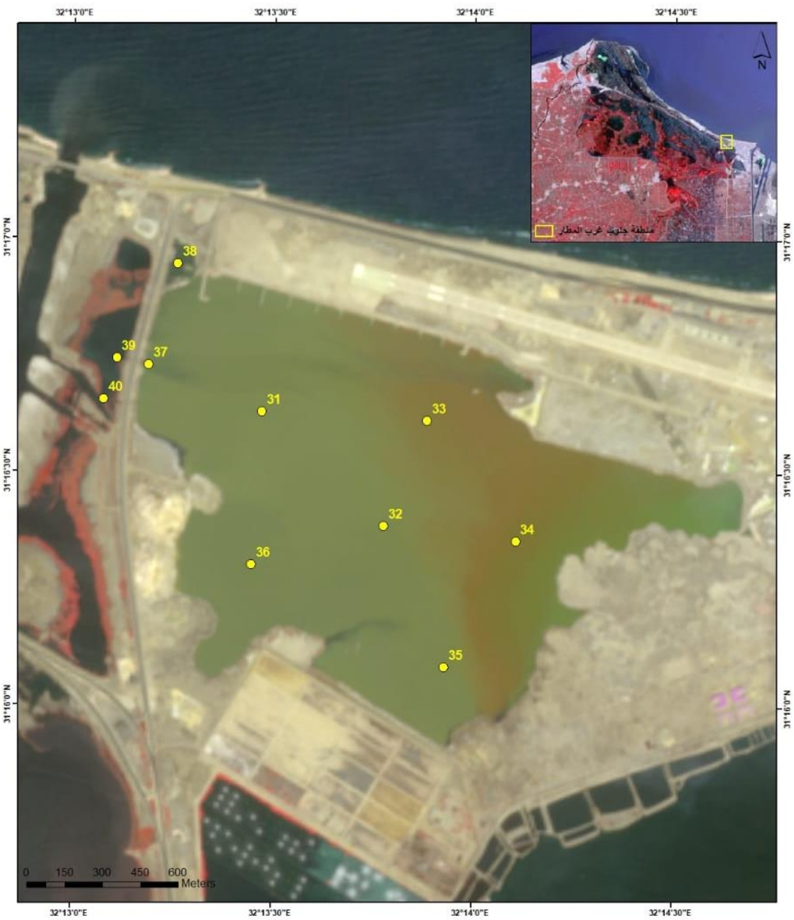

Figure 2 – Point location of the water quality samples

Table 1 – list of laboratory analysis of water quality variables

point	Nitrite mg/L	Nitrate mg/L	Phosphate mg/L	Ammonia mg/L	Cd mg/L	Pb mg/L	Cr mg/L	Ni mg/L	Organic Matter %(w/v)	PH	Tubidity NTU	TDS g/L	Salinity PUS
31	0.09	0.07	3.4	0.5	0.4	0.73	0.13	0.53	5.4972	7.2	189	339.92	305.2
32	ND	0.1	3.2	0.4	0.27	0.84	0.14	0.55	5.2606	7.3	197	328.39	304.1
33	0.02	0.5	3.3	0.3	0.37	0.94	0.14	0.49	5.3842	7.5	193	332.52	299.3
34	ND	0.8	3.3	0.2	0.29	0.78	0.14	0.65	4.8448	7.8	201	301.82	275.9
35	ND	0.8	3.6	0.1	0.4	1.2	0.15	1.2	4.7918	8	155	245.73	226.3
36	ND	0.7	3.4	0.1	0.43	1.18	0.16	1.15	3.7656	8	124	215.93	204.6
37	0.05	1.1	3.7	0.2	0.4	1.08	0.18	1.1	1.6394	7.8	168	223.88	221.6
38	ND	0.9	3.5	0.4	0.17	0.66	0.14	0.28	2.601	7.4	206	322.02	316.4
39	ND	0.5	3.6	0.3	0.03	0.12	0.02	0.12	0.2806	8.8	14.7	15.23	14.15
40	ND	0.03	3.6	0.2	0.02	0.15	0.01	0.12	0.143	8.9	17.7	11.74	11.13

Water Quality Index WQI formula was applied to estimate the status of the water quality based on the results of analysis of chemical and biological elements, it is found that the water quality ranges from minimum at 40% (fair) to the maximum of 53% (on the border of average status. This means that there is lack of biological and plant equivalence that support the ecological balance of the water. Conversely, there is high level of trace metals that are harmful and not good for the biological biota in the water.

Figure 3 – Outcomes of water quality index of the water mass area

4. Results

Figure (5) is a graph shows the distribution of the environmental parameters of water in comparison with the minimum and maximum limits allowed by the World Health Organization in regard to fisheries. It shows a decrease in the chemical elements that support the growth of living organisms and fish such as nitrates and phosphates and at the same time shows steady increase in heavy metals such as cadmium and lead that have a negative health impact on the living organisms and fish within this region.

Figure (6) shows the spatial distribution of the simulation of the water quality parameters and the sediment parameters. It shows high correlation between the treatment plant and the impact of its discharge in to the water mass and the environmental disturbance of the water mass such as the increase of trace metals. The isolation of the water mass with low rate of water inflow and circulation and high rate of evaporation was the main driver of increasing the salinity, which has also made further environmental problems.

Figure 5 – Results of laboratory analysis of water quality parameters in comparison with the WHO standards.

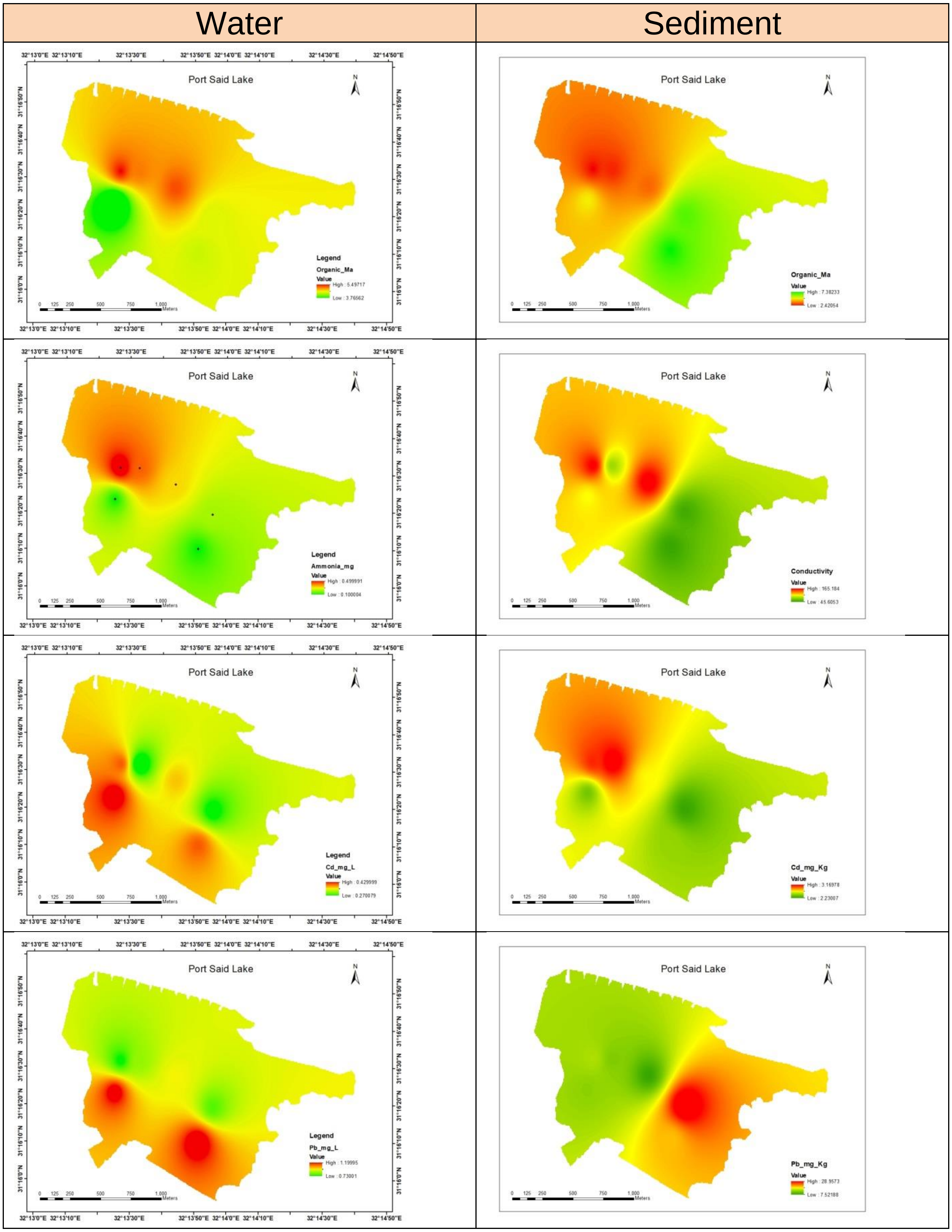

Figure 6. Example of spatial distribution of environmental variables and trace metals in water and sediment

6. Conclusion

It could be concluded that using modern techniques of satellite data in integration with laboratory analysis of water, soil, field observations and geological analysis could be an efficient tool for informed decisions for planning and sustainable development. The operational data sources of satellite data provide realistic picture of the environmental and natural situation as well as the human activities within the area of study, which aided in the analytical options for development. Spatial analysis of data provided more realistic picture of the water mass in the area and also provided quantification of the different options of development. Indeed, this is a supporting information system to local authorities, but further economic studies is need to ensure the maximum value added from the proposed options. It is recommended that local authorities have to have an operational office of spatial analysis to provide day to day solution to the governorates hot issues.

7. References

- Armstrong, M.P., Rushton, G., Honey, R., Dalziel, B.T., Lolonis, P., and Densham, P.J., 1991. Decision support for regionalization: A spatial decision support system for regionalizing service delivery systems. Computers, Environment and Urban Systems, 15, pp. 37-53.
- Malczewski, J., Chapman, T., Flegel, C., Walters D., Shrubsole, D., and Healy, M.A., 2003. GIS-multicriteria evaluation with ordered weighted averaging (OWA): case study of developing watershed management strategies. Environment and Planning A, 35, pp. 1769-1784.
- Ali, E.M., and Abou El-Magd. I., 2016. Impact of human interventions and coastal processes along the Nile Delta coast, Egypt during the past twenty-five years, Egyptian Journal of Aquatic Research 42 (1), DOI: 10.1016/j.ejar.2016.01.002
- Abou El-Magd, I., and Hermas, E., 2010. Human Impact on the Coastal Landforms in the Area between Gamasa and Kitchner Drains, Northern Nile Delta, Egypt, Journal of Coastal Research 26(3), pp. 541-548, DOI: 10.2112/08-1172.1