

Lakefront Development; Conflicting and Competing Interests

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1. Introduction:

Lakes and water bodies have always attracted and shaped many urban developments, resulting in a close and integrated water-city relation (Butuner, 2006; Breen et al., 1996). Dramatic changes occurred due to the industrial revolution affecting the relationship with water bodies, yet by the mid-20th century industrial activities began to move to outer city zones, leaving vast lands and presenting an opportunity for revitalising these areas (Butuner, 2006). Lakes have an unquestionable value as an ecological, recreational and economic resource to urban areas. Nonetheless, lakes are subject to serious pollution problems as they function as sinks for streams and lakeside activities, both from point sources such as domestic and industrial and non-point sources such as agricultural run-off and land use activities (Abdullah, 2009; Golubev, 1989). A sustainable approach should find a balance between human needs and the ability of the water resource to recover and regenerate. Such an approach need recognise the intricate relationship between the land activities and the water body. Planning practices often disregard the lake ecosystem resulting in permanent damage and costly remedial action to restore it (Dinar et al., 1995). Land Use Planning (LUP) can be a way forward as it aims to adopt land uses in the most efficient manner, so as to satisfy the various needs of society, reflecting the economic and social conditions, maximising the use of land and water potentials whilst conserving the fragile ecosystems (Leung, 2003).

Lakefronts are considered densely populated developed areas on a lake. Land uses include residential, recreational, commercial, shipping or industrial uses (CZMA, 1972). Lakefronts are of the most complex and challenging urban lands, considered a national asset yet expected to fulfil daily needs of local residents. They have a strong potential to provide diversified opportunities for economic development, public enjoyment and civic identity. The variety of land uses reduce the economic vulnerability to one use, such as tourism, eagerly adopted in revitalization plans (Dong, 2004; Craig-Smith et al., 1995). Yet the compatibility of uses with each other and with the ecological conditions of the lake is a precondition for a lakefront sustainable use. Craig-Smith et al. (1995) also point to the level of integration with the lake and the degree of dependency which can act as a patron to the conservation of a lake rather than the neglect and abandonment some have witnessed. Seven principles were developed by the Lake Environment Committee (ILEC, 2003) of Japan in collaboration with the UNEP, for sustainable lake management, these are: a harmonious relationship between humans and nature; a lake drainage basin for planning and management actions; long-term preventative approach to causes of degradation; sound science and best available information to be

the base of policy decision making; resolution of conflicts among competing users (nature, present and future generations); stakeholder participation to identify and resolve critical problem; and finally, good governance system based on fairness, transparency and empowerment of all stakeholders. These principles are quite useful in uncovering the underlying problems faced in the area of the case study as well as providing a blueprint for the sustainable management of a lakefront.

Lake Mariout is an underutilised, deteriorated resource of the city of Alexandria, located at its south edge, extending 80 km along the North West Coast and 30 km to the South. The lake front is occupied by ill-suited industries, warehouses and informal housing, polluting the lake and compromising the livelihoods of the fishermen community. The area suffers many planning problems. Land use planning (LUP) can help to systematically assess the physical, social and economic conditions of an area with the aim of selecting and adopting the land use option that increases its productivity and efficiency, whilst meeting needs of current and future generations (FAO, 1996). The increased demand and competition on land for various purposes and the increase in population in developing countries becomes more pressing every year, which is very true of the study area. It must be recognised that some groups will be subject to greater stress than others and levels of involvement might vary, yet an efficient LUP would safeguard all users from unacceptable environmental problems and aspire to distribute losses and gains equally to different users of land whilst committing to private and public interests (Leung, 2003). The problems faced in the Lake Mariout study area are explained through the analytical framework of planning support systems (PSS), namely; population and economy; governance system; environment and land use; and transportation and infrastructure, which can track current conditions and trends in the area (Berke et al., 2006). An efficient inclusive land-use is proposed to ensure future allocation of land uses that meet the needs of local residents, maximises the use of land and water, whilst ensuring natural resources are prudently used. The paper is divided into five sections. Following the introduction, the research reflects on Land Use Planning procedures, adopting planning support systems to facilitate the process of understanding the urban systems and their relations by sorting, analysing and viewing information of the study area. In the third section, the case study area of Lake Mariout is presented and analysed. The fourth section displays conflicts followed by the land use strategic visions of the area and finally, the sixth section provides concluding remarks on the way forward.

2. Land use planning and Planning support systems

As explained, Land use planning can help to systematically assess the physical, social and economic conditions of an area. It is a conception of the spatial arrangement of land uses (Leung, 2003), carefully matching human activities to the physical environment. In order to do so, information is needed on the environmental, economic and social aspects of an area, in an organised and accessible manner to facilitate the process. Planning Support Systems (PSS) provide key inputs to the land use plan-making process on data concerning its components, (Berke, et al., 2006). It should be able to accurately answer critical questions about the location, nature, rate, and amount of land use change taking place in a community; provide information about the changes of composition and

size of the population and economy, and their implications for land use; explain the environmental systems workings and forecast the impacts of land use alternatives on the environment; and identify current and projected capacities and locations of transportation and infrastructure systems and their effects on future land use. These form the four components of a PSS. The primary function of a PSS is to generate knowledge about public interest issues in addition to the legislation policies of each system to avoid further conflicts, enabling communities identify, understand and deal with development changes and policy alternatives (Brail, et al., 2001; Malczewski, 2004).

The four components identified by Berke et al. (2006) are: population and economy; environment; land use; and transport and infrastructure.

Population and economy dynamics are the main drive of the urban growth, thus they are fundamental components to start an analysis of the past and present conditions of a community. Population projections are used to estimate the demand of the land for the housing, public facilities, transportation, and institutional and retail uses, whilst employment forecasts are used to estimate the demand for the various economic sectors, including commercial and industrial uses.

Understanding the *Environment* helps inform the local decisions on shaping a liveable and desirable community by protecting and improving air and water quality; conserving farming, forestry, and wildlife resources; reducing exposure to natural hazards; and maintaining the natural features and built environment (Daniels and Daniels, 2003). The outcome should identify the different types of land uses that are most suitable for the land; offer facts on the environmental impacts of alternative land use patterns; and propose solutions for diminishing environmental impacts resulting from future land use change (Berke et al., 2006).

The *land use* information may serve in developing policies that address land use conflicts; establish relationships between land use and water quality; and identify areas of feasible development. Three main actors influence land use change: (1) the real estate developers who seek financial return; (2) the local officials who have authority for land use management; and (3) the community interest groups or residents who require satisfying their essential needs of life. They all struggle to maintain, convert, develop, and redevelop the land use (Logan and Molotch, 1987). Governance issues are central to this debate. The study area is governed and managed by various authorities and equally, there are many interest groups with a stake but lack a say in the development of the area, hence in this study, governance will be pulled out as a main component. And land use included with environmental issues.

Transportation and infrastructure information is needed to identify locations of demand and capacity to allow or encourage or avoid land development in certain areas, bearing in mind the land use requirements for proper functioning.

The PSS components are interconnected and each component builds the foundation of the next. The outcome of the process should include population and economy forecasts, environmental priorities and suitability analyses, land use constraints and opportunities, and infrastructure needs to

support building a sustainable community. The following section uses the four components to analyse the case study area of Lake Mariout.

3. Lake Mariout case study

Lake Mariout is one of four shallow water bodies in the north of the Nile Delta. It is an artificial lake dating back to the Middle Kingdom (2160-1788 BC) (Biswas, 1967). It was linked to the Nile River through the Canopic branch from the 12th to the 18th century functioning as a deep fresh water reservoir (Shata, 1955; Shafie, 1952). The branch filled up with silt cutting the lake off the Nile. Further, the demolishment of a dam in the early 19th century, separating the Mediterranean Sea from an adjoining lake, flooded the lake water and vast areas of lands and villages around the lake, creating the current status of a shallow salty water lake (Yehia, 2008). It is considered one of the important natural features affecting the environmental equilibrium of the city, yet suffers continuous environmental abuse from man-made violations. It has been subject to unplanned urbanization, agricultural land reclamation as well as discharge of heavy industrial pollutants. Population growth, economic problems and poor governance shaped high environmental pressure on the lake and its land vicinity. Its area has shrunk from 252 sq km in 1889 to 71.4 sq km in 1995 (Massoud, 2008). An important issue to point out is the multiplicity of authorities managing the area each in its own capacity resulting in many management and economic problems. This is further discussed in section 3.2. An intervention is needed to prevent more encroachment and unplanned development. In the following subsections the planning support systems of the Lake Mariout area will be analysed based on interviews, questionnaires and document analysis.

Before analysing the planning support systems, the location and boundaries of the study area will be briefly shown. The lake stretches along four sections and the study is concerned with the main section labelled as Lake Mariout which occupies 25.2 sq km and constitutes 12.7% of the total lake area (see fig 1).

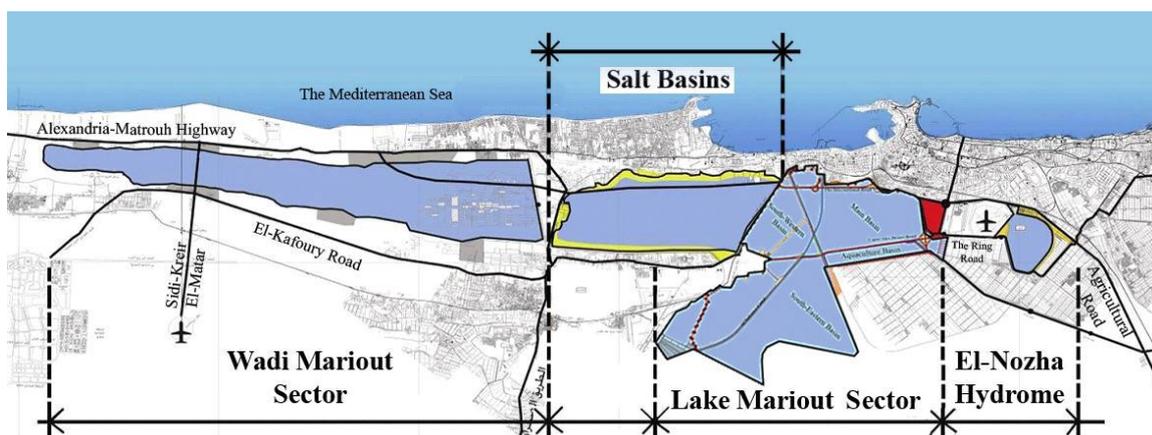


Fig 1- the four sections of the Lake

Lake Mariout sector is bordered geographically (see fig 2 and fig 3) in the north by the districts of Moharam Beik (containing Al-Manshia Al-Gadeeda; an official registered industrial zone and Al-Sobhia settlement), Karmouz (containing Gheit Al-'Enab east & west slum settlement), and Mina Al-

Basal (containing Naga' Al-Arab and Ma'wa Al-Sayadeen slum settlement). To the west, Al-Dekheila district is home to a number of large industrial firms including petrochemical industries. Al-Amria district is located to the east and south-east considered the largest administrative and populated area of Alexandria, designed as an industrial area, thus including a major percentage of industrial plants. Questionnaires were distributed in residential areas in all surrounding districts except for Al-Dekheila, whose bordering land uses are industrial plants.

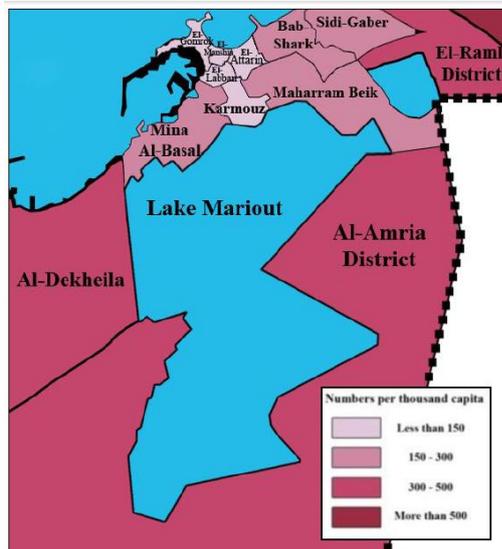


Fig 2- the geographical borders of the study area



Fig 3 – Questionnaire spatial locations

The following analysis was based on data gathered through qualitative and quantitative methods. Field visits and observations enabled the acquisition of direct information of current land uses and the local community status and activities. Documents helped calibrate data of land use and the population. Questionnaires were used to gather data from a number of respondents (130) to allow for statistical analysis of the population's inclination towards the current land uses of the study area, identifying their preferences and priority projects and to discern the necessary actions for development based on their needs. Interviews were conducted with various stakeholders (government officials from the public sector, professional bodies from the business sector, interest groups, NGOs, casual interviews with the local community). The interviews helped identify the various conflicts and debates and possible common grounds between different stakeholders including residents.

3.1 Population and economy

The population is composed of three social groups as observed from the field study; fishermen, farmers, and poor communities living in slum settlements. The fishermen communities as a whole form a poor and destitute group, although it is the most important and lake-dependant activity in the area. They spread across the north and north-east shore of the lake and in islands inside the lake. Farmers constitute the small percentage of the population in the study area. The poor communities

represent the highest percentage, and they are concentrated in two slum settlements called Naga' Al-Arab and Ma'wa Al-Sayadeen,

The exact population of the study area is not readily available; instead figures from the residential quarters have been used as indicative (table 1). Inhabitants complain of lack of health services and they suffer skin diseases, respiratory problems and high child mortality rates, caused by industrial exhausts, obnoxious odour of Lake eutrophication, and insects breeding in the area.

Quarter/ Sub-district name	No. of inhabitants	District name
Al-Sobhia, Al-Manshia Al-Gadeeda, Al-Medyasa	48,845	Moharam Beik
Gheit Al-'Enab East	33,685	Karmouz
Gheit Al-'Enab West	17,492	
Al-Metras, Naga' Al-Arab, Naga' Esso	107,476	Mina Al-Basal
Al-Mafrouza East (Ma'wa Al-Sayadeen)	27,600	
Total	235,098	

Table 1 – Population size of quarters in Lake Mariout vicinity (CAMPUS, 2006)

There are numerous local economic activities, where industrial use is one of the main job generators for the Lake area and Alexandria (CEDARE, 2009). The percentage of workforce working in various sectors are: 20% in manufacturing, 18% in trade and equipment maintenance, 12% in construction, 10% in storage and transport and only 10% in fishing. El-Refai's study (2009) verified by the micro credit organization working with the informal sector suggest that people in the informal sector constituting 30%, work in scattered jobs such as general trading activities, fixing or maintenance of cars, tires, and electrical appliances, the manufacturing or processing of foods, garments sewing, detergent mixing, simple farming, animal husbandry, fishing, poultry and hatching of eggs. Those in day labour jobs consider themselves unemployed. The income of the working class is very low and despite the low price of housing in the area, many cannot afford it (El-Refai, 2009).

The fishing community is estimated to be 20,000 fishermen, and approximately 7,000 are with traditional rights to fish in the lake. Two types exist, free fishermen and fish farmers, 75% are under 60, 22% suffering one or more disease, individual income 200 EGP or less and responsible for a family of 4.6 members in average (~92,000 inhabitants rely on fishing activities) (El-Refai, 2009). The fishing activities are declining due to land encroachment, deteriorated water quality and excessive small-scale commercial fishing. In idle periods, fishermen lack alternative employment, affecting their livelihoods, causing a large number to abandon fishing and seek vocational work, consequently increasing the ratio of industrial workforce in the area to the fisheries workforce.

The farming community faces pressures of loss of land although it was found from interviews that stakeholders do not recommend any type of development on the land and that farmers consider their lands an important asset and their only source of income. Yet urbanization is a threat, expanding farmer families are granted construction license on agricultural land and some entrepreneurs buy

agricultural land and divide them to be sold off as urban land (these are rare in the area till now but can change as indicated from practices post the 2011 revolution).

The majority of the population live in slums (fig 4). Naga' Al-Arab and Ma'wa Al-Sayadeen are two slum areas lying directly on the lake. The earlier construction took place towards the north of the settlement and is densely populated with 3-5 storey buildings and 4-6m wide streets, those to the south contain squatters as one storey mud houses in very poor condition. Naga' Al-Arab is mainly populated by migrants and continues to grow fast. The field study and interviews showed that there is a vast variance in income. Solid and construction waste is dumped on the banks, sorted and sold, which is considered a main source of income to some residents. The residents suffer low incomes (average of 470 EGP), high illiteracy rate (35% of males and 62% of females aged 30-65 are completely illiterate, while 19% of boys and 13% of girls aged 12-14 dropped out of school), lack of convenient healthcare services and schools, isolated by a railway line and complete absence of community facilities. And finally, poor structural conditions of houses (cracks, leaks...etc).

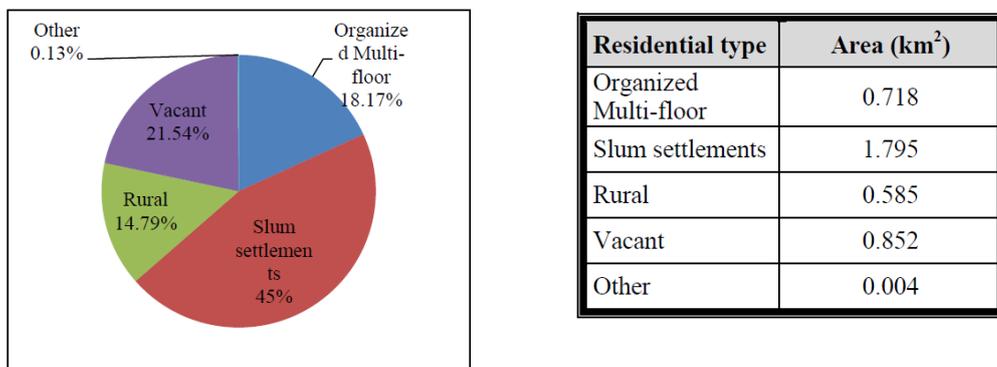


Fig 4 – Distribution of residential types

In summary, the area clearly lacks basic services, has a high crowding index in the residential units, has an unbalanced social composition, and a deteriorating state of the slum settlements. The economy clearly depends on the industrial zones, despite their negative environmental effects on the lake and its vicinity. Agriculture, fishing, and informal activities employ the main workforce in the study area. The land use does not support economic or social needs of various groups and steps are needed to recover fisherman activities.

3.2 Governance system

The governance system is where the core of the problem lies. A well-integrated governance system usually results in well-planned urbanization and preserved and productive water resources. However, several parties are involved in terms of responsibilities and ownership both in the lake and its hinterland. They are either national or local government authorities or organizations (table 2). Moreover, the built residential area lies across many districts and the residents do not participate in the decision of uses in the area. As shown, there is no single authority managing the study area. The numerous authorities do not have an integrated plan or management system for the lake and its

surrounding land, and each develops their strategies with no coordination with the other. Also, there is no integrated monitoring, each authority collects its sectorial information, hence knowledge of the state of the lake and its surroundings is fragmented. Moreover, prospects to implement developed solutions are minimal as the relationship between the authorities on the one hand and the NGOs, researchers and associations on the other is not regular nor structured, hence participation in the decision making is minimal (CEDARE, 2009). In response, research groups of Medcities and CEDARE developed an action plan following the Integrated Coastal Zone Management approach, however, it has not been approved by governmental bodies because of the fragmented governing system.

National authority	Role	Local authority	Role
Ministry of Agriculture – The General Authority for Fish Resources Development (GAFRD)	Owner of the Lake, preserves lake quality, prevents encroachment, attains effective use of lake in fish production under Law 124 of 1983	Alexandria Governorate – Urban Planning Department	Owns some of the vacant land surrounding the lake. Cooperates with GAFRD to prevent encroachment. Seeks investment opportunities
Ministry of Irrigation and Water Resources	Maintains lake water level and canals/channels draining into it	Alexandria Company for Sanitary Drainage – National Organization for Potable Water and Sanitary Drainage	A Dept. of the Ministry of Housing and Reconstruction, implements & upgrades secondary treatment plants that drain into the lake
Ministry of Environment – The Environmental Affairs Agency	Environmental quality control, supervision of industrial drainage (direct/indirect)	Industrial enterprises	Ratified through several authorities starting with the Investment Commission which approves an industrial activity or not. Large firms which discharge into the lake or use the water for cooling seek approval. Small informal ones do not.
Ministry of Interior – Water Bodies and Environment Unit	Protection against illegal activities including infringement. Enforcement of the Environment Law 4 of 1994		

Table 2 – Lake Mariout governing jurisdiction; national and local

A sense of belonging and willingness to upgrade and develop an area is an important aspect for good governance. It is enhanced by ownership and a clear decision making process which the area lacks as shown from the responses. Private ownership of buildings is 88% and undefined ownership in need of registration and legalization is about 12% (CEDARE, 2009). The field study showed that buildings on landfill over the lake are illegally owned by inhabitants, without official tenure. These buildings are built, infrastructure added, rent out or sold with low prices by certain residents of the area, who then protect it against confiscation. Almost all housing units are occupied, and land-lot sizes in most cases are small (100m², built up area 80m²) resulting in a high crowding index (EL-Refai, 2009).

Their inclination to development was also gauged. 35.21% of the residents were not ambitious about their area; they need basic living conditions and better service facilities quality. While 51.21% prefer

the development to be commercial oriented, including commercial areas for fishing and agriculture products, and wholesale trade and retail. 10.48% preferred the mixed uses development, while only 3.1% asked for the residential development, where they were concentrated in Gheit Al-Enab East. The overall observation from the informal interviews showed that most of the youth main requirement is creating job opportunities regardless the type of development planned. In terms of the relation of Lake Mariout to the inhabitants, it was inferred that 38.34% of the residents merely consider Lake Mariout a place they live in its surrounding, and surprisingly 51.65% of them do not consider the lake existence to be important to them or to the area (reaching to 93% in Ma'wa Al-Sayadeen), while Lake Mariout is the source of fishing to 10% of the residents. These responses show the disconnection between the residents and their surrounding and the unawareness of the importance of the lake to the city, particularly on environmental grounds as will be shown in the next section.

3.3 Existing environment and land uses

This section is concerned with the ecological functioning of the Lake and the lakefront, affecting their environmental sustainability. It also highlights the land use and preferences of dwellers. The Lake, as explained, no longer receives water from the Nile, it receives it from irrigation drainage and untreated industrial wastewater. Excess water (beyond the 3m level) is pumped out to the sea. The quality of water of the lake has been significantly affected by discharged wastewater and sewage. From 1986 till 1993, the Lake received untreated sewage as the municipality diverted it from the sea to the Lake. In association with USAID, the municipality developed two treatment plants and dewatered solids are transported to a facility in the desert 40 km away (Metcalf, 1997), salvaging the quality of water. The soil in the study area varies from relatively saline to non-saline (loose or compact) (Helmy, 2006). The vegetation consists of both aquatic and terrestrial. Vegetation covers 60% of the lake and only 50% is needed for fishing activities where fishermen commented that the reeds are most suitable to set up their cages, excessive vegetation however obstructs fishing activities and is the responsibility of the GAFRD to maintain to an acceptable level. Migratory birds are most famous in the area. Their numbers have decreased significantly due to loss of habitat and decrease in fish stock in the lake as well as changing climatic conditions. The loss of habitat not only has environmental effects, economic impacts are measured in loss of GDP (see table 3).

The main environmental problems are caused by land encroachment and pollution causing, among others, spread of vegetation with increased organic matter. The first land reclamation occurred in 1937 where the Property Authority reclaimed 1.7 km² followed by 0.92 km² and a further 97km² by 1955, to be farmed lands (El-Refai, 2009). Large areas of shallow water in the north part have been filled to be occupied by petroleum companies. Urban settlements appeared on unused land on the lakefront on an area of 14.5km², and further plans envision the creation of a new comprehensive urban development (Friends of the Environment Association in Alexandria, 2000).

Environmental degradation issues	Economic losses (millions EGP)	Percentage of Governorate GDP
Health cost, related to inadequate water, sanitation and hygiene, particularly close to El-Mahmodeya canal, Lake Mariout , Abu Qir and El-Max industrial areas	130 - 287	0.50 - 1.10
Health effects of outdoor air pollution	173 - 544	0.66 - 2.08
Beach and shoreline degradation	123 - 155	0.47 - 0.59
Loss of tourism, estimated to 100,000 local visitors daily if Lake Mariout was clean	730	2.80
Economical loss due to fish production reduction (11,000 tons in 1976 to 6,378 tons in 2004) in Lake Mariout , where the second value including the cost of fish currently being produce but unsuitable for human consumption due to high heavy metal load	69.33 -165	0.27 - 0.63
Loss of agricultural land converted to urban area	1.06	0.005
Loss of land value due to pollution of Lake Mariout	69.3	0.27
Recreational losses due to uncontrolled construction, urbanization and industrial discharges	68.18	0.26
Loss of aesthetic values, biological diversity and cultural values	125	0.48
Loss of the 186 km ² of Lake Mariout wetland reclaimed	49 - 107	0.19 – 0.41
Total	1517 - 2251	5.6 – 8.5

Table 3- Economic impact of environmental degradation for the city of Alexandria (METAP, 2007)

It becomes difficult to argue for the preservation of the Lake when the authorities consider desiccation of the lake as a viable option under the enormous pressures for providing for an ever increasing population. Yet, environmentalists and academics argue for the Lake's preservation and interviews have shown a growing trend against desiccation amongst government officials and various stakeholders. Nonetheless, the questionnaires found that 46.4% of the inhabitants prefer the purification of the lake rather than its desiccation; reasons varied between the fact of the lake's natural existence and preserving the fishermen source of income. Despite the Law 124 of 1983 that renders it illegal to desiccate any area of natural lake unless fishing is no longer viable, and supported by a decree from the Managerial Court of Alexandria to prevent any encroachment, infringement, or landfilling, however, weak enforcement causes on going abuse of the lake and land as shown by satellite images taken in years 2002 and 2007 (fig 5), showing a change in the area of the lake of 15.7% and in the main basin of 8.1% (CEDARE, 2009).

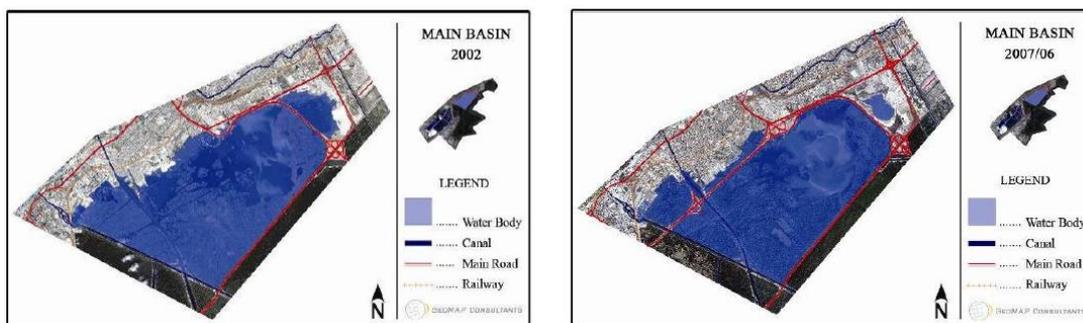


Fig 5 – Change detection satellite image for the main basin years 2002 and 2007 (CEDARE 2009)

The land uses in the area varies, where industry constitutes the main use (fig 6). Industry constitutes 18% of the area, vegetation 33%, residential 8%, services 11% and vacant land 11%. In terms of determining the land use, respondents prioritised land use differently according to their age group. 30.1% regarded affordable housing as the most important land use, they were mostly young participants, while 49.8% regarded health care services as a priority and they were mostly elderly. Some 7% stated their preference for educational service (these were mostly mothers), a further 7% indicated their preference for small scale industries and only 6% regarded commercial centres as a first priority.

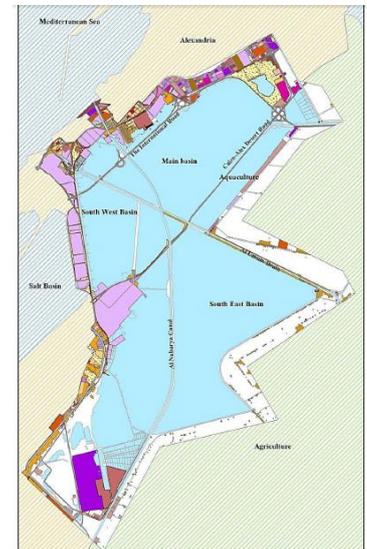
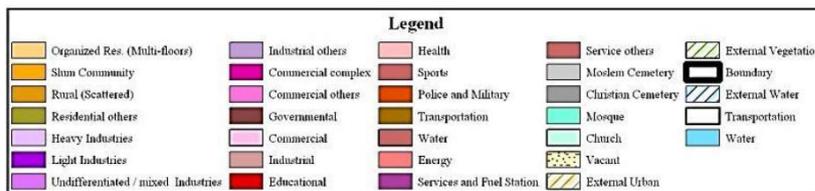


Fig 6 – Land uses in the area of Study (CEDARE, 2009)

To summarise, the urban hinterland of the Lake witnessed a cycle of development, deterioration, neglect, and reuse resulting from the uncoordinated governance system of the lake and the disregard to the interactions of economic factors, environmental stewardship, changes in technology, and social needs.

3.4 Transportation and infrastructure

The lake was first separated by the transportation network of roads, railway and bridges as well as drainage routes. The total area of transportation routes across the area is approximately 3.5 km², representing about 7% of the study area. These networks did not take the Lake into consideration and no outlets for water passage were made. The transportation network resulted in major transformations using up areas of the Lake.

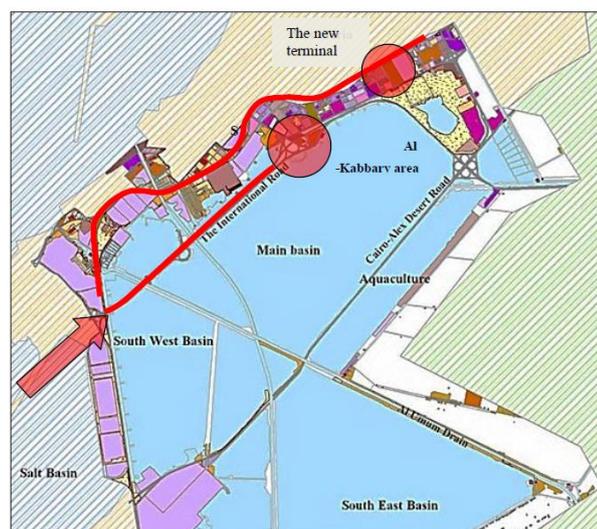


Fig 7 – Transportation nodes in the study area

The study area is surrounded and divided by a number of regional and local roads including; Cairo-Alexandria desert road, the Ring Road of Alexandria, a part of the Coastal International Road, Al-Ta'meer Corridor, and Al-Qabbary highway. However the slum areas were not formally planned and hence the inner streets are very narrow inaccessible for vehicles (including emergency vehicles), causing a main complaint in the questionnaire as they have to walk long distances from the residential units to the nearest transportation node. Yet, the nodes (fig 7) allow easy access locally and regionally explaining a satisfaction rate of 62% with the transportation.

In terms of the infrastructure, field visits and observations revealed that the slum settlements, including the fishermen communities at the northern area of the lake, face the worse. The basic infrastructure network is extremely limited or non-existent. This is due to many factors, including the illegality of the lands constructed on, consequently the illegality of the residential units ownerships; removing the residents' right to apply for infrastructure utilities in their areas. Another crucial reason is that the sanitation system is based on sanitary wells established by the residents' efforts, with no consideration to the essential technical basics (El-Refai, 2009). Therefore, the sanitation network is facing frequent blockage causing repetitive flowing off of the sewage water, which causes an offensive odour and pollution. 99.5% of residential units are connected to potable water, 99.6% to electricity and 69% to sanitary service.

There are clearly supply and demand issues in the area and despite a good road network coverage and connectivity to other parts of Alexandria and the region, the area suffers serious inappropriate spatial distribution in land/open spaces. Infrastructure in slum and fishermen areas suffers technical and capacity problems. These issues diminish chances of initiating investment opportunities in the study area.

4. Conflicts between stakeholders

Stakeholders interviewed showed different inclinations towards development options, what to do with the lake and legal ownership. The stakeholders involved as mentioned earlier are government officials from the municipality and the environmental affairs; planning consultancy from the professional bodies; investors in the housing sector and tourism and health; NGOs in fishing and friends of the environment; and finally local residents. Before getting into the conflicts, there are certain points that all stakeholders agreed on; first, an emphasis on preserving the lake sustainability, whether from pollution or land encroachments. Second, the important role of the governance system integration in encouraging investment and achieving the desired urban development in the area, and third, The common projects recommended for the future development were the water dependent and water-related tourism projects, to be located on the lake shore.

4.1 Development conflict

Stakeholders did not agree on the best course for development. Investors and planning consultancy regarded the slum settlements in a negative light, calling for their removal and

reallocation/compensation. Tourism investors saw the potential of the human resource while fishing NGOs were disturbed with the effect of drainage on the lake water quality. The Environment NGO and municipality suggested an upgrade of some sort and the local residents called for staying as they were but to improve the services. In terms of industrial uses, again the planning consultancy and investors called for the relocation of light industries, while others were not concerned except for treatment of discharges. A major point of disagreement was land encroachment and lake desiccation. The planning consultant, housing investors and environment NGO regarded investment on the banks along existing coast line as the best way to halt the trend, officials suggested maintaining the status quo through law enforcement, while residents called for more land for residential units. Local residents were inclined to encouraging development so as to create job opportunities, investors were equally keen. Environment officials and environment NGOs agreed on development but under sustainability criteria. And when asked where the development should start, each chose to begin with their area, be it fishing or housing, showing the lack of a common vision.

4.2 Resource conflict

As mentioned earlier, stakeholders saw the lake differently, with some affinity to it or none at all. Investors and planners consider tourism activities as the way forward. Residents see it as potential desiccated land, and so did the officials till recently. Debates around future use of the Lake allowed voices of NGOs to be heard halting the trend. Yet illegal actions continue to take place, whether polluting the lake or desiccating it. It is no surprise that all parties suggested purifying the lake, otherwise it will be of no environmental value and might as well be included in future urban development plans.

4.3 Property conflict

Investment is possible if investors reached a deal with land owners. Occupation of the land is an important issue, as the law grants compensation to occupiers even if they are not owners. Compensation can be monetary with a current value of the land or unit of resident, value assigned after development. On the other hand, the occupier can be a shareholder of the project to be established on the land or develop the land according to the new land use plan and regulations. However, different individuals or groups claim ownership or use rights over the same land plot, as a result of the poor recognition of local land rights. This case was found in the slum settlements most, where some inhabitants claim the ownership of a land already owned by the governorate. Consequently, the conflict of ownerships will cause challenging debate for investors and authorities to negotiate in the compensation plans, especially with the high population size and crowding index of the residential areas. All parties recognise the fragmentation of decision making and the numerous authorities who have to approve a single application which has resulted in many illegal developments. It is of no surprise that investors and NGOs alike asked for firm implementation of the law.

It was noticed that the most significant issues of conflict were on the slum residents' relocation and the lake purification. Investors see that the existence of slum residents in the area is not acceptable in

case of any development, at the time that the slum residents see the opposite. Meanwhile, the applicability of the lake purification is contradicting between the governmental officials; who consider the purification as a difficult and unfeasible task, and the local residents and NGOs; who give proofs and ideas of basic and affordable purification solutions.

5. Land use strategic visions

To arrive at a vision, it is necessary to consider the potentials and constraints of the area. Potentials can be summarised as the presence of the lake as a water body, the strong human resource and workforce, and the bad building conditions and low land values of the study area which form good incentive for investors, providing a sound relocation plan. The total percentage of the land supply was calculated to be 20% of the total study area, which consist of the slum settlements, the light industries and the vacant lands. The constraints revealed hindrances to the development in the study area. It was found that the major cause of the lake problems is the disintegrated governance system responsible for the lake. Other constraints includes, the governmental possessions of the major lands, the conflicts of the buildings ownerships between local residents and government, the high cost of the lake preservation, the high cost of improving and enhancing the existing infrastructure and facilities systems to accommodate the future plan. The total percentage of the fully developed lands was also calculated to be 42% of the total study area, which consists of the heavy industries and the agriculture lands.

The vision statement reads: *“Within the next ten years, Lake Mariout and its vicinity would be an investment magnet, a job creator, a visitors’ attraction spot, and a sustainable lake and lakefront within the city of Alexandria, to be enjoyed by all.”* The broad aim is to create a socioeconomic, environmental, urban, and infrastructure foundation that would initiate a successful lakefront development. The vision can be displayed according to the PSS each in a set of objectives.

Population and Economy: creating a fertile base of investment in the area through a catalyst project; socially accepted relocation/compensation of the slum inhabitants through building economic housing while sustaining their existing crafts; upgrading the socioeconomic conditions of the fishermen and increasing their existence by upgrading their communities and establishing a fish market and designating the lake as a natural reserve;

Environment and land use: purifying the lake from sources of pollution by building internal plants for heavy industry and secondary wastewater treatment plants as well as opening tunnels for water flow; preventing more land encroachment by constructing a belt (recreational); rational rearrangement of uses through establishing a buffer zone between future development and heavy industry, relocation of military uses, relocation of light industries to Borg-Al-Arab, rehabilitation of old warehouses; establishing future land uses that meet inhabitants needs and nature of the area through water dependent uses and water related uses.

Governance: founding a single authority for lake management able to issue guarantees, incentives and legally binding agreements; use of market based instruments such as planning gain or

impact fees to resolve investment issues and encourage development; firm implementation of laws; establishing a mechanism of participation.

Transportation and Infrastructure: enhancing and adopting the existing transport network by increasing capacity and quality and redistribution of nodes geographically in the area as well as developing new connections to Borg-Al-Arab and reuse of derelict railway line; designing and building a network of roads connecting the area with historical sites in Mariout Depression; increasing the capacity and quality of existing sewerage and water systems for future plans; building services to serve existing residents and future plans.

6. Conclusions

Due to increased pressures of population growth, urbanisation and social and economic demands of the city and due to the lake's proximity, it has been most popular for land reclamation and city expansion, wasting an important water body resource. Conflicting interests of industry, fishing, and residential occupation and ever increasing demand on the limited resources called for an efficient planning system to ensure a balanced development of the area.

In order to carry out a LUP, learning about the stakeholders and gathering knowledge of all four components was essential. The four components are interrelated where large population size and low educational qualification result in low economic conditions and high unemployment rate causing a neglect of the surrounding environment resulting in an unplanned layout and deteriorated environment. The high population count resulted in the creation of the two slums and the economic decline resulted in light industries on land plots that were not designated as industrial. Besides, the vast unrelated variety in land uses indicates the lack of a common development theme for the study area (e.g. recreational, tourism, residential ... etc.). Moreover, it was found that the governing system of Lake Mariout is facing critical integration problems. There is unclear institutional setup that governs the lake; it is currently managed by a wide range of authorities at both local and national levels and local residents do not have a clear mechanism to voice their views, resulting in mismanagement, large number of stakeholders with conflicting interests, and information conflict.

The existing status of the transportation, infrastructure, and services signals deteriorated living conditions. Transportation network were found concentrated in two nodes and two paths, both clustered in the northern zone of the lake. The infrastructure and services were found randomly located and categorized, and their capacities are not sufficient and do not match with the existing inhabitants size or living conditions.

However, the area carried some potential, yet key to the success of any plan is a single governing system and law enforcement. The lake as a water body still remains an asset in need of purification, allowing for growth of fish breeding and bird migration. After implementing the suitable compensation plans; the deteriorated conditions of the slum settlements (which represent 4% of the total study area), the flexibility of the light industries relocation (5%), and the availability of vacant lands (11%), would create a 20% total net land supply for the future development, which is considered a suitable

base for initiating a catalyst project. The bad conditions of the existing buildings and the low land values would attract more investors to buy lands with under-priced rates for future overpriced profits. Also, the high percentage of the youth age groups (62%) and the high population size (235,098 inhabitants) are considered as an asset for strong labour workforce.

The research shed light on an important water body in the city of Alexandria which is rich because of its location and potential. Conflicts and competing interests have been shown to degrade the quality of water and land. A land use strategic vision has been proposed building on an analysis of four critical interrelating components, providing a way forward for a sustainable lake and lakefront management.

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