Sustainable Urban Planning for Protecting Salt Lakes; case Study Bardawil Lake, North Sinai, Egypt

Amany A. Ragheb
Department of Architectural Engineering,
Delta University for Science and Technology, Mansoura, Egypt

Abstract— Egypt has a highest priority objective to develop Sinai Peninsula and to create new sustainable and magnetize communities that should ensure a stable, economic and sustainable environment in enormous desert zones.
In the last years, a growing public consciousness has developed concerning the quality of urban lakes and special organization plans in several urban areas have been started wide-reaching in order to restore and maintain the recreational value of these water bodies, to improve their educational power, and to avoid sanitary facilities emerge from the decadence of their water quality.
To provide a good quality of life for all Lakes communities by enabling development of a well-designed, efficient, healthy, and safely built environment. This increases community identity, allows development to co-exist with the natural environment, and encourages sustainability.
The major objective of this research is to maintain spatial development in the Bardawil Lake area in North Sinai, Egypt.
This study explores how focusing particularly on Lake Bardawil which represent as a case study to work as a coastal region sustainable development. Its drive to explore the ways in which the lakes, their incomes and their residents have been evaluated, and to analyze how underlying preconceptions, goals and constructions of specialized converse impact such evaluations. The view is that environmental planning is in reality not a rational plan but a process. Egypt is now trying to develop an articulate strategy to remedy its environmental problems without harmfully disturbing economic growth.

Index Terms— urban planning, Lakes Protection, shoreline, wetland, watershed, Buffer zone, Bardawil lake, Sustainability, North Sinai, Egypt.

1 Introduction

Sustainable development 'the famous twin word has become a popular catch phrase over the last two decades. Planners, especially urban planners are gradually showing seriousness to infuse their work with the worldwide expressed regard for sustainability in the process of progress and growth. Urban planning has a very efficient, role in attain development through sustainable growth and by integrating the "principles of sustainable development" into urban planning strategies, policies, programs and projects Fig. 1.

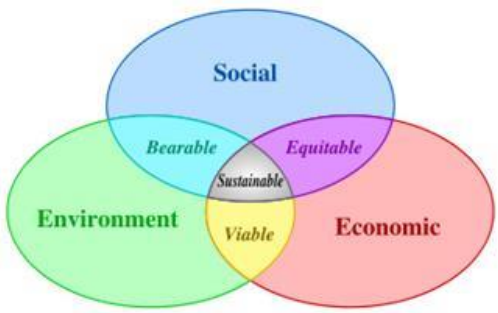

Fig. 1. The concept of sustainability.

Urban lakes and wetlands have been created to stock rainwater and include supply for local use and for agriculture, Architects and planners were aware that, even when relatively small and shallow water bodies significantly improved the good life in urban areas by increasing amenity, providing entertaining and educational natural process, and even contributing to mitigate the urban climate [1].

A lake protection regulation (LPR) is particularly critical around urban lakes, to guide how and where new expansion will occur. Historically, there has been limited guidance on how to craft an effective LPR that protects lake resources, maintains the value of the recreational experience, and accommodates the property rights of property owner. Traditionally, most LPRs have primarily focused on a relatively narrow ring of land around the shoreline where development is most visible. However, given that lakes are so strongly affected by runoff from their watersheds, they often need to be managed from a watershed perspective figs.2 &3.

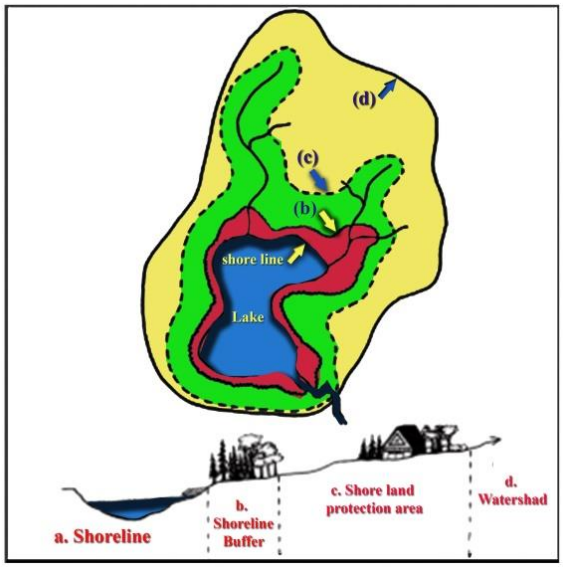

Fig. 2. The Four Zones of Lake Protection.

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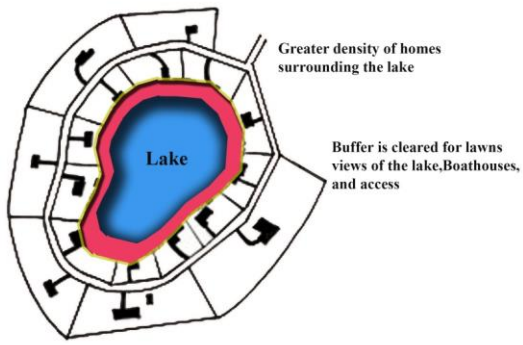

Fig. 3. Typical Development Pattern around a Lake [2].

Bardawil Lake is a large coastal lagoon on the Mediterranean coast of Sinai, Egypt. Although it is shallow and oligotrophic, it is one of the most significant lakes in Egypt as a source of respectable quality fish and a habitat for wildlife. Phytoplankton biomass is generally low but is highest in summer. The Government faces major problems facing many problems (economic, population, tourist, recreational, etc.). Therefore, consideration must be given to the potential and riches of nature, from which we can address many of the problems. El-Bardawil Lake is an important economic source in additional Lake Bardawil and zaraniq become big problems affect they are one of the primary lakes in the export of fish and birds and rare plants are protected, Fig. 4.

Fig. 4. Bardawil Lake (study area) is located in North Sinai coast.

The aim of this research is to summaries the main problems affecting urban lakes such as El-Bardawil Lake as a case study and the possible remedies that have been adopted to manage them and promote their valuable part in improving the good of life in urban areas.

2. ISSUES AND CHALLENGES.

2.1 Sustainable development Planning

One of the main target goal in all countrywide and worldwide important development plans and conferences is Sustainable development. Sustainable development has been defined from the view point of the reducing world resources, stressing the conservation of natural resources in the next words: "Development is sustainable if the average of use of renewable resources do not overtake their average of regeneration, the rates of use of non-renewable resources do not exceed the rate at which sustainable renewable substitutes are developed, and pollution rates do not exceed environment's assimilative capacity" [3].

2.1.1. Meaning of sustainable development planning.

Sustainable development reflects three wide dimensions that are carefully and inter-linked between: environmental, economic and social characteristics. Moreover, these three can hardly be implemented if not supported by institutional and political backing [4].

a. The environmental dimension: deals with maintaining a certain stock of natural resources above a certain quality threshold. A number of criteria to asses this dimension can be put forward. These include:

- Biodiversity preservation measured against species richness, abundance, diversity, high number of endemic species and high number of important gene pools.
- Average of irreversible resource depletion
- Grade and reversibility of degradation of renewable resources
- Use rate of non-renewable resources against the potential use by future generations and/or the orderly transition to renewable energy sources
- Reduction of adverse global impacts.

b. The economic dimension can be assessed as follows;

- Continuous stream of income at different levels: individual households, communities, countries
- Increased food availability, real income and cash.
- Conservation of productivity in the face of stress or shocks like human health natural disasters, economic conjuncture, social conflicts
- Real benefits derived from land management
- Efficiency of investment through cost/benefit analysis
- Maintenance a main level of expenditure over time [4].

c. The social dimension has been less addressed in the sustainable growth treatment, it embraces a wide range of take that should be considered if sustainable development aims at being socially acceptable:

- Equitable access to resources
- Equitable access to selective information and services
- Tribute of acquired rights
- Redistribution of wealth derived from landed estate use and management
- Active participation of all stakeholders in policy a law development
- Governmental and local accountability for resource use and good management
- Respect for and valuing indigenous knowledge, local diversity and rural populations' livelihood strategies
- Room for social and cultural evolution without abrupt disruption
- Fulfilling people's cultural and spiritual needs [5].

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2.1.2. Basic principles on sustainable development planning.

Sustainable development is becoming a popular concept among planners and researchers because it guides resource use in a system that purposes to meet the needs of today's populations without compromising the facility for future populations to meet their requirements [5]. Using the principle of sustainable development, the environmental, social and economic impacts can be managed to maximize positive impacts while minimizing negative effects, Fig. 5.

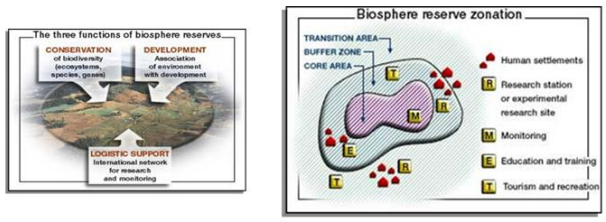

Fig. 5. Functions of biosphere reserves

2.1.3. Land use actions toward sustainability.

- Guide and contain urban growth to existing developed areas, control urban expansion into outlying undeveloped areas and encroachment upon nature.
- Secure the compact development by a community activity integration area: workplaces, shops, parks, housing, schools, civic facilities etc. - inside walking or bicycling distance.
- Undertake remediation and redevelopment of 'brown field' sites and other developed lands that suffer from environmental or other constraints.
- Raising the human-scaled development which is pedestrian-friendly and focused around public transportation.
- Introduce home-based occupations and work that reduce the need to drive and/or commute.
- Raising the urban and regional designs which convenient, acceptable and respectable the ecosystems and natural functions inclusive local food production that decrees need for transport of food.

2.2. Lakes Issues and solutions.

Many challenges and threats facing governmental sector and have great effect on Lakes, their watersheds, and the societies that benefit from them which increasing human populations and changes in land use. For example, the deforestation and nutrient pollution come from the watershed. also, this affect lakes from outside the watershed, or example atmospherically-deposited toxic substances, climate change and invasive species, As the threats to the status of lake health evolved from both inside and outside the watershed, national and international approaches may be necessary, depending on the induvial unique situation of every and each lake.

2.2.1. The Benefits of Lake Protection.

The benefits of lake management differ from community to community. Some benefits may spread across more than one generation. For these reasons, the actual value of a lake management project can't be calculated [7].

- Many communities were built around a lake. The visual quality of these societies mainly depends on the state of the lake shore and water body. Also, Important part of the quality of life for lakeshore property owners and the entire community is the natural beauty of the lake
- A properly managed lake provides recreational opportunities for fishing, swimming, and boating. A lake and its adjacent wetlands provide habitat for game fish and other wildlife. The quality of a lake directly affects community property values and, therefore, the local tax base [8].
- Dynamic long-term management of the lake is an intricacy task that must deal with biology as well as sociology. It is training in compromise, balancing the needs of civilization and with need of nature. Management of lake need selection: between weed beds for fishermen and sandy bottoms for swimmers; between groomed lawns and control of nutrients and pesticides in the lake; and, among the needs of agriculture, industry, taxpayers and the tourist bureau.
- The future of some lakes is better left to nature. The normal process by which lakes release, into marshes and wetlands produce much needed wildlife habitat. Many things must be taken in consider before any decision about to restoring or protection the lake for example the decision must be based on study of the lake watershed, as well as the of time commitment and money required for long-term management.
- Protection of a lake may be as simple as the care training by lake property owners and others who use and entertain the lake. Lake repair, on contrast the lake repair, can be a expensive, complex, time-consuming, and often frustrating effort [7].
- Each lake is unique, and each management process is as complex as the concerns it addresses. But the environmental, social, and economic benefits of a well-managed lake can extent generations. And an obligation, to stewardship of water resources put on us responsible for preserving and protecting our lakes – not only for ourselves, but for those who follow as well [7].

2.2.2. The Four Zones of Lake Protection.

The four primary zones of lake protection are:

a. The shoreline.

The shoreline represented as the mean high-water marks that meeting the land. Given the grandness of the shoreline to lake ecology and environment balance, it is essential that this zone be retained in a natural development city, with minimal disturbance of native vegetation. Lake shoreline are a valuable art object of real estate, and command premium land prices. Purchasers often use these slews to build summertime family or cottage and seek both goodness access to the water and an unobstructed sentiment of the lake. Therefore, separate homes are oriented in the direction of the lake. Over time, a ring of development is formed around the lake, with the greatest density of homes within D feet of the lake, and less density further away. Subsequently, the individual homes should face toward the lake. Over time, a ring of development is formed around the lake, with the greatest density of homes within 500 feet of the lake, and less density further away [9].

b. Shoreline buffer.

The important of the buffer shoreline are preserved with the

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protect the integrity of the shoreline, provide habitat for wildlife and fish, reduce the likelihood of corrosion, and help to decrease runoff and poison loads [10]. In addition, natural shoreline buffers accession, buffer zone supports the aesthetic and recreational values economic value that make lakefront development and sustainable development so lead to desirable and economically attractive. Natural shoreline buffers also protect the physical and ecological integrity of lakes by providing shade, leaf litter, litter, woody debris, junk, erosion protection, shelter, and habitation [11].
A common base width stand breadth for a shoreline buffer is 75 feet [12], although widths breadth s typically ranges from 50 to 150 feet. If a lake is used as a source of drinking drunkenness water or is very pristine, buffer widths of 200 to 300 feet are often used [9]. The base width of a shoreline buffer should be expanded to include steep slopes slope or wetlands or contracted when pre-existing development is located close closing to the shoreline. Some societies set the base size of the shoreline buffer based on the shallow open area of the individual lake and require wider buffers around their larger lakes.

c. Shore land protection area
The protection area of shoreland expand after the shoreline buffer and is initially intended to regulate nature and the geometry of development of the choice sustainable lake. The shoreland protection area is a special overlay zone for buildup development area, which includes various hindrances, impervious cover zone and forestry conservation requirements.
shoreland protection area width as measured from the shoreline are typically ranges from 250 to 1,000 feet, Minnesota State has a similar area where shoreland standards apply to all land within range of 1,000 feet of the lake [13].

d. The lake's contributing watershed
Establishing shoreline buffer zones may not always be enough to protect a lake from the impact of land development, particularly if it is sensitive to increased phosphorus inputs. If we have noteworthy land development is expected in a lake watershed, the LPO should be designed to generate a fourth management zone that comprehends the watershed as a whole.
Residential land in the watershed is often zoned for large-lot development, with minimum lot sizes of one, two, five or even 20 acres. The basic reasoning is that large lots have comparatively low impervious cover, even if it spreads development over a potentially greater area than would otherwise occur. In addition, communities may allow developers the option to cluster development within these large lot zones, if shared septic systems are allowed.

Commercial and industrial zones are often minimized or excluded from the watershed in order to minimize spill risk, and to reduce impervious cover. Often these zones are not feasible for development if a community elects not to extend sewer into the watershed, given the larger volumes of wastewater that they generate.

2.2.3. Techniques for protecting lakes.
Techniques for protecting lakes are significantly different from those used to protect streams. A watershed designer must evaluate the main nine parameters that are exclusive to balance in between the ecology of lakes and the nature of the request development that occurs around them:
1. Shoreline development is an exclusive form of the sustainable development.
2. Lake protection emphases on phosphorus lessening.
3. Critical situation of a natural shoreline.
4. Effect of shoreline vegetation on the growth rate of fish and wildlife.
5. Powerful pressures for shoreline enhancement and clearing.
6. Recreational issues are paramount management concern.
7. Prominence of septic systems.
8. Lake associations available for enforcement or education.
9. Lake protection ordinances must be customized for unique lake conditions and water quality goals.

3. Lake Bardawil (as a Case study)
The Bardawil lake is one from the Five lakes located along the northern coast of Egypt. They are signified as 25% of the outstanding wetland habitation in the Mediterranean basin. Bardawil lake has a by tradition exploited a wide diversity of natural resources that importance for sustainable developments.
If we don't start today to build the success sustainable development planning for the Bardawil lake it will be face and suffer from threats to their existence such as other lakes in Egypt and counting large-scale recovery and water pollution. Agricultural authorities, self-confidence, engineers, fishery managers, and conservationist in Egypt and abroad debate about how best to manage and develop the lake region's part 's resources, but few of these groups understand or communicate with one another, or with residents of lake communities. community of interests.

- **The importance of Lake Bardawil to build planning of sustainable planning related to many factors and reason such as:**
  - Bardawil Lake is one of the most important points of Urban Development in the northern Sinai (as there are a lot of resistors and different developmental projects that are multi-source strong attraction).
  - The investment opportunities in the tourism sector in the governorate (no integrated tourism projects in western Lake Bardawil).
  - Ecological importance taken on the increase.
  - Bardawil that Egypt's second largest lake after Manzala Lake and before Brolos Lake, is the last clean lakes of Egypt, so the fishes ask Europe specifically, the management of the lake, which pays for most of the export production
  - Include lake significant employment opportunities thereby acting the 3,000 families from all centers of the province and comes in the foreground center Bir al-Abed and El Arish and is working to revive the economic life at these

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centers in the fishing season are required Fish the lake in many countries of Europe and the Mediterranean, such as Greece, Cyprus, Italy and others due to its purity and after pollution.
- Water surface of the lake, 168 thousand (longitudinally line of 32 kilometers to 65 kilometers) wide 10 kilometers 0.8 kilometers with an average of 5 kilometers.
- Of major importance for birds owing to the presence of protected Zaranik, which is part of Lake Bardawil.
- There is a major port for fishing boats.

➢ **The suffer threats of the study area represent as:**
- The lack of attention to the human factor, which helps in the development of the lake and the northern Sinai.
- Affected by environmental problems of the lake.
- Fish production has become less.
- some extinct species of fish and crustaceans increase because of the environmental factor influenced the lake.
- Do not provide services to the lake and lack of maintenance, which can lead to environmental problems that affected the lake.
- Fishing offending shelf and this is causing problems in fish production.
- The rate of sedimentation over a year in the harbor master, which feeds Lake Bardawil in fish and water. He arrived along the silting in some cases to 3 meters while the depth of the lake could be up to five meters. This means that after a period of time is not long up rate of sedimentation to 5 meters, which will work on the formation of a sand barrier prevents the entry of the lake, up the fish and the water completely. This is due to lack of maintenance and care for the lake.

3.1. The significant characteristics of the study area.

Bardawil lake is located in between latitude 31°13.75' and 30°00' N and longitudes 33°37.7' and 33°30' E along the northern cost of Sinai. The area of Bardawil lake about 850 km with max depth 6 m and 83 km long with max width about 23 km separates the lagoon from the Mediterranean narrow strip of sand, including a number of openings to connect its Portal are considered a major source of wealth of fish in Egypt, this lagoon considers as one of the most significant area in the northern part of Sinai Coastal zones the Bardawil lake of the are imperative issues in the international debate on the environment and sustainable development.

It be made up of the border between land and sea in such a calculation where the marine space and recourses are as important as earthly ones. It is being one of the most important sources of marine fisheries (characterized by diversity species) in the Sinai and Egypt in general. It is a relatively shallow, between half a meter deep and three meters, and a sandy bottom, covered with patches of (grass ditch), or (Alganzlad, or Hamoul); also has a number of islands. The fish production up to 2500 tons per year; mostly of fish and high economic value, such as fish reefs and family Alboraat. And lives in the lake, large numbers of birds (small hook, or Dgbz), and (Alqtqat Abu warheads); collects and large, compared to the lakes of the world.

- The main features such as building capacity and natural resources that support our urban sustainable planning such as;
- The extension of El-Salam drains which characterize as the main flow of fresh water for agriculture development in this region, Fig. 6a.
- The main electricity power line which will be the main source of industrial development along both side of the study area, Fig. 6b.
- Small clusters of the population fisher village around the El-Bradawl Lake, Fig. 6c & 8.
- Residential area along the main international coastal Road in the North of Sinai, Figs. 6d & 7.
- The network traffic road that extend from the main international coastal Road in the North of Sinai, Fig. 6e.
- Zaranik protected area at the eastern side beside of the Bardawil lake is the important part for the sustainable development in this region and characterized by variety of natural world, Fig. 6f.
- The observed cluster agriculture land that is need to be the central part for revolution agriculture development in this region Fig. 6g.
- The distribution of the saline lakes that can be used to get different factory that depend on the saline natural resources, Fig. 6k.

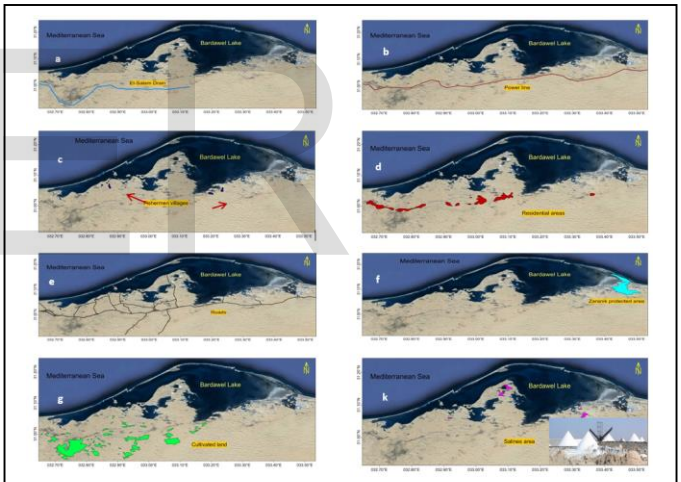

Fig. 6. The feature characteristics of the study area (natural resources, building capacity, cultivated land, residential area and industrial are for saline lakes) related to the field survey.

3.2. Zaranik protected area.

Zaranik protected area added a positive potential for the Bardawil lake that represent as a main key point for bird migration in the world and the first stop for bird migration from Europe and Asia heading Africa during the fall is facing tourism demand and economic interests. The negative impact that could arise as a result of these interests is used to define the importance of enhancing suitable sustainable development for its natural and heritage resources. The investigation of the natural, historical and cultural characteristics, land-use pattern, potential and constraints of the protected area is used to define a system of land classifications that embraces areas markedly sensitive to

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spatial development.

3.3. Lake Division Strategic Plan.

The key development criteria for the Lake is within four zones (table 1), the development criteria within each of the four zones are often different and include the following Zone geometry, Vegetative target, Allowable uses, Restricted uses, Septic system siting, Storm water, treatment practice design, Residential lot design requirements, Zoning, Enforcement and Education. The four-zone protection process, is considering as the most tied at the shoreline, and is more elastic, as one progresses further up into the watershed. Maximal detail on the key features for a lake protection ordinance is provided in the following points:

- ✓ Create an Efficient and Effective Division.
- ✓ Engage the public.
- ✓ Develop Advanced Solutions.
- ✓ Make available the Highest Level of Qualified Planning Service [14].

Table 1: Development Criteria for El-Bardawil Zones.

Bardawil Zones		Development Criteria
1	Shoreline	• high water mark (HWM) • Maintain natural shoreline, no disturbance without permit. • Restricted Uses Boathouses and other accessory structures, bulkheads. • No pipe outfalls to lake.
2	Shoreline Buffer	• 150 m from HWM, 300 m for source water. • Forest or native vegetation, maximum view corridor of 30 feet. • Allowable Uses walkways, boathouses within the view corridor.
3	Transition Zone	• 500 to 750 m from HWM. • residential homes, septic systems • Commercial or industrial zones, uses with hazmat spill risk. • Maximum clearance limits on different lots of 25 to 50%
4	Watershed Zone	• Acceptable Uses most are allowed. • Limited Uses with hazmat fall risk. • Septic Systems design, feasibility or inspection criteria to reduce failure.

For preparing a good vision the study was reviewed as follows:

- Residential/Commercial/Industrial Site Plans, including expedited review of Economic Development Projects (Figure 6).
- Public facility and new residential development.
- Lot Splits and Lot Line Deviations.
- Zoning Clearances.
- Other types of site development projects through the development review process.
- Improvements to, and maintenance of, the Comprehensive Plan. Bardawil Lake City Planning Partition.

Bardawil Lake City Planning Division is responsible for:

- Developing Master Plans to provide visions and goals for future development in the lake region.
- Reviewing current planning applications to ensure orderly development.
- Creating land use development and their implementation.
- Creating and investigation, the City's Zoning Ordinance to confirm that minimum requirement of developmental standards.
- Protecting districts and sites of historic significance.
- Making and applying the Subdivision Regulation to ensure the division of land is carried out in a way that ensures adequate sized lots for development and contact the property.

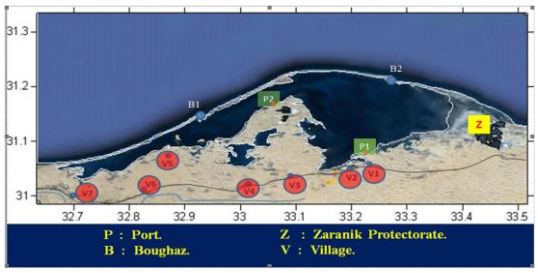

Fig. 7. Bardawil Lake residential Site Plans.

Fig. 8. Bardawil Lake residential Site Plans.

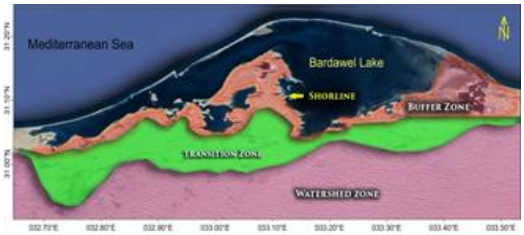

Fig. 9. Bardawil Lake Zones.

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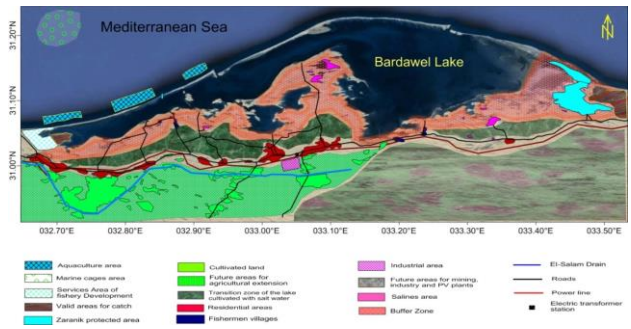

Fig. 10. Master Plans to provide visions and goals for future development in the lake region.

CONCLUSION

From previous work it we agree that sustainable urban planning for the Bardawil lake now is a top priority objective to develop the northern part of Sinai Headland. It is vital to generate new sustainable urban development and interesting as new societies that should confirm a stable, economic and sustainable atmosphere. In additional we need to increase public awareness about the importance of the sustainable development regarding to the quality of urban design that need all the request parameter and factor for special management plans in several urban areas around this part.

This paper focus on the importance of restore and maintain the recreational value of these water bodies. It is introducing a case study for how to protecting Bardawil lake as one from five lakes along the northern coastal part of Egypt that are markedly different from individuals used to keep streams. A watershed director must account for nine issues that are unique to the ecology of lakes and the nature of development that happens around them.

The review of Bardawil Lake resources shows that these resources are all valuable regionally, nationally and internationally Combination of the land-uses with physiographic climate, cultural and historical patterns produces a series of landscape types with varying qualities need conservation.

El-Bardawil Lake City Planning Division is responsible for developing Master Plans to provide visions and goals for future development in the lake region.

Although the Egyptian government and scientific communities introduce a several struggle efforts have been made shuffle to support and protect the Bardawil Lake such as increase the production of fisheries, and save the ecosystem balance such as environment regulation, but the increase of fish production need addition regulation such as sorting grids and controlling about using of mesh size to give chance for the juveniles and small fish to growth that lead to increase the production. In additional it can be divided the lakes (that characterized by a wide extension) in two parts where exchange each one for fishermen along the year.

Previous development studies provided for El-Bardawil Lake region are also reviewed to figure out their impact on the protected area. The criteria and proposed outlines for adapting ecotourism development in the protected area are defined. Finally, a land-use plan and management guidelines for ecotourism development in El-Bardawil Lake region are proposed.

This developed procedure would have a significant application to other Lakes areas in Egypt, particularly coastal ones with wetlands and marine life with similar landscape and land-use practice and pressure on their resources resulting from recreational and economic interests. Therefore, the findings of this study could contribute to the formulation of the planning of these Lakes areas.

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