CHAPTER II

Environmental Conditions of Abu Qir region

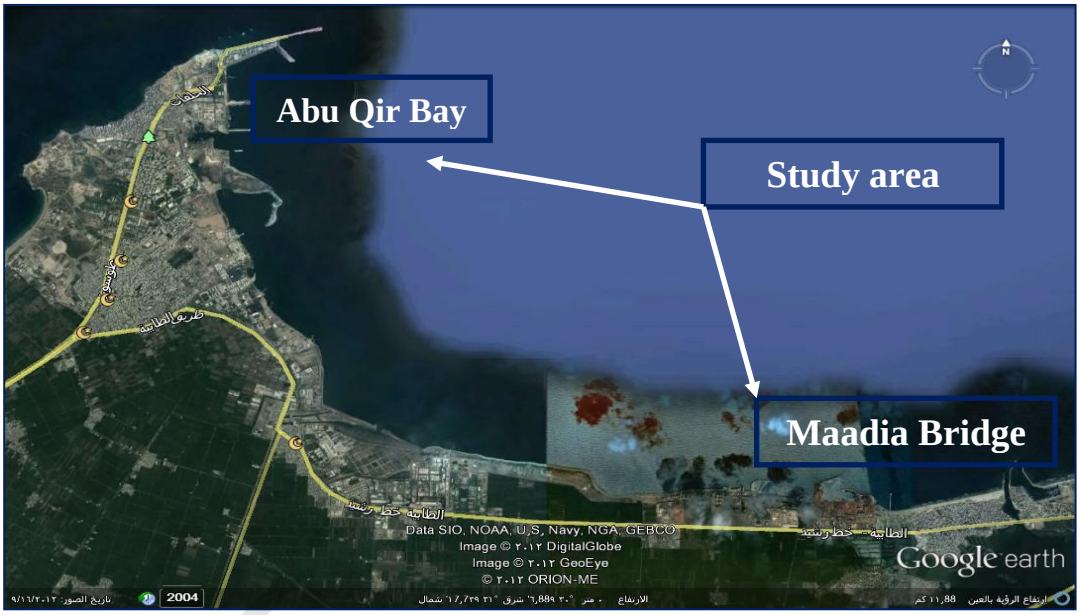
In this chapter two main issues are discussed: the first is the geographic location of Abu Qir city and the second is a general survey of Environmental conditions and risk of Abu Qir city and vicinity

II.1 Abu Qir region (study area)

Geographically, Alexandria City is located approximately at 30°50' to 31°40' north and 29°40' to 32°35' east. Abu Qir City is located the eastern side of Alexandria City to the west of Abu Qir Bay and Rosetta branch of the River Nile. It extends about 20 miles (32 km) along the coast of the Mediterranean Sea. The area is characterized by the irregular hills in the southern parts with an elevation that varies from -5 meters below mean sea level to 40 meters above mean sea level and slopes towards the Mediterranean Sea in the northward. Abu Qir region, hosts a highly vulnerable community Butzer (1960)[48]. It is mainly a poor community of low education, high density of population and low employment rates. Yet, the region has many important developmental resources. (Khatri, et al., 2007) [20].

Abu Qir Bay region is well known promising resource for tourism, industry and agricultural activities. The coastal zone hosts important ecological habitats, economic centers and agricultural resources. (El Raey, et al.,2010)[50]. During summer of 2006, Alexandria received about 63 cruise ships containing 70,000 tourists and its hotels provided the equivalent of 47,000 visitor nights. During the same summer, Alexandria beaches received 3 million local visitors and 250,000 daytrip visitor (Soliman and Reeve, 2007) [53].

The Rosetta branch of the River Nile provides excess water supply to the region and Idku Lake is an important sanction to migrating birds and aquaculture. However, development in the region has been limited by low quality water resources due to excessive industrial water pollution and soil salinization which led to continuous deterioration of land productivity in the region. In addition, the lack of infrastructure, shortage of institutional capabilities and low awareness constitute strong obstacles against development in the region (El Raey. et al., 2010) [50].



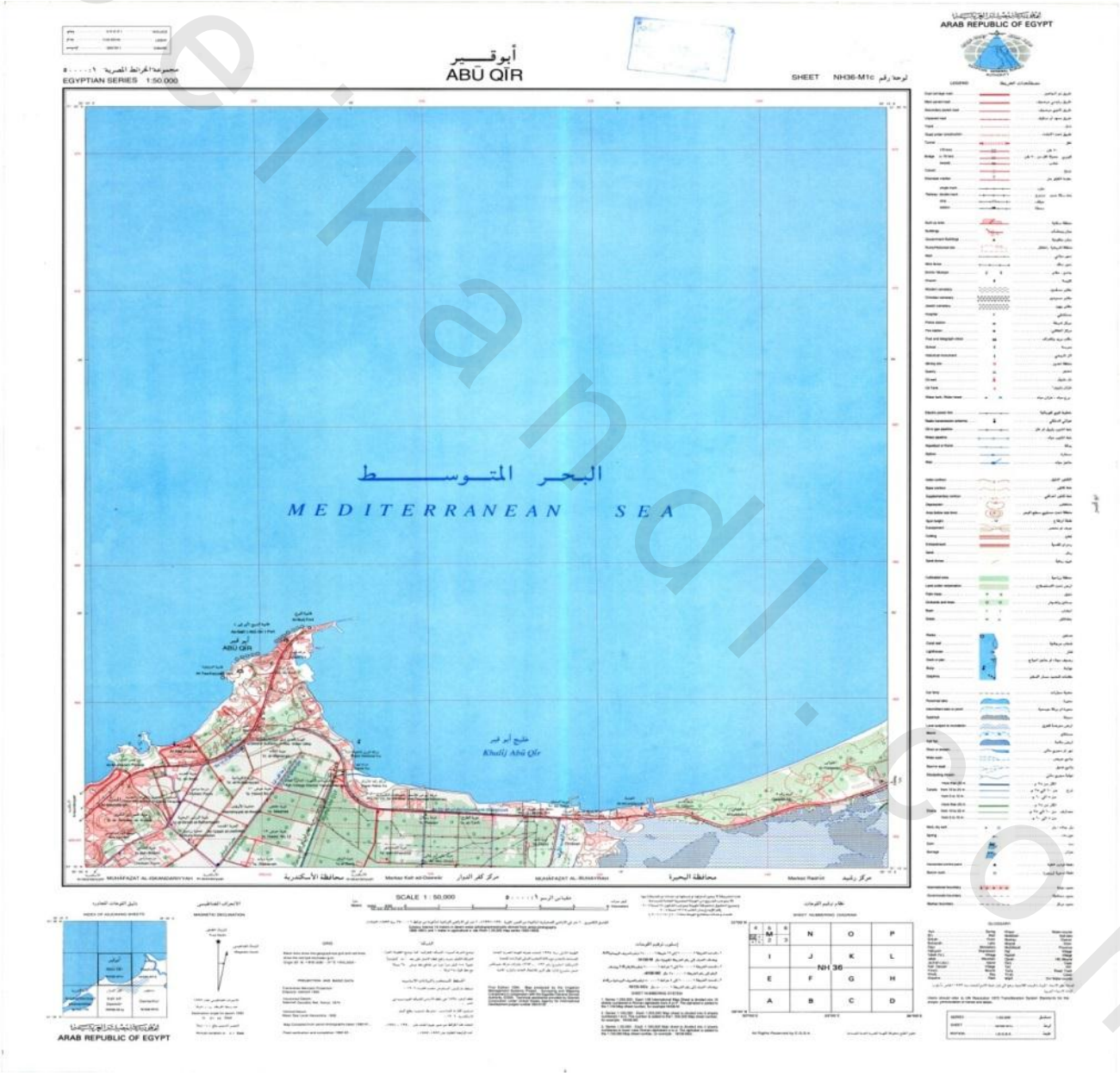
(Figure II -1)Satellite image from Abu Qir Bay to Maadia Bridge (Google earth 16 / 6 /2014)

Idku Lake and adjacent region is bounded from the south by Mahmoudia Canal. It is supplies the region and Alexandria City with fresh water through the Rosetta branch of the River Nile. The region hosts an important resource of high bio diversities of palm trees of national recognition. A number of highly populated historic cities and large areas, fertile agricultural land are included and are undergoing large unplanned changes. The region is considered an important underutilized resource of agriculture, tourism and industrial production in Egypt.

In general, the northern Mediterranean coastal zone of Egypt suffers from a high rate of population growth, unplanned urbanization, land subsidence in the Delta region, excessive erosion rates, saltwater intrusion, soil salinization, land use interference, ecosystem pollution and degradation, and lack of appropriate institutional management systems. The shortage of institutional capabilities for planning, monitoring, assessment and pollution control in addition to lack of awareness among stakeholders, have rendered this region into a highly degraded and continuously deteriorating environment.(El Raey 2010)[19].

Table (II -1): Coordinates of the four corner points of Abu Qir region.

Name	Longitude	latitude	Long.UTM	Lat.UTM
bottom left corner	30° 00° E	31° 15° N	214416.7667	3460881.0320
Upper left corner	30° 00° E	31° 30° N	214416.7667	3470122.2440
Upper right corner	30° 15° E	31° 30° N	238224.2295	3470122.2440
bottom right corner	30° 15° E	31° 15° N	238224.2295	3460881.0320



(Figure II -2)Base map of Abu Qir region.

II.2 Environmental conditions

Abu Qir region is changed because of excessive unplanned urbanization after the revolution 25 Jan, 2011 due to shortage of security. We found that some of these buildings are non-conforming with city regulations putting people's lives at risk. These buildings are built less than 10m from shoreline, putting the foundations in saline water which makes it highly vulnerable to erosion and SLR and especially storm waves.

There are a number of main environmental conditions affecting the study area:

II.2.1Climate

The study area has a semi-arid Mediterranean climate, characterized by a brief, mild, rainy winter (November to March) and long warm summer months (May to September), it has also clear sky, high radiation, and there is relatively no rain. The picture changes in October when a windy and relatively rainy winter begins.

The main factors, which control the climate of this region, are the general circulation of the atmosphere and the orientation of the coast with respect to wind direction (Fouda,2004) [95].

A. Rainfall

The average amount of rainfall in the study area is 140 mm/yr. Rainfall variability is high as it is in other arid climates. Most of the rainfall occurs in winter reaching its maximum value in December and January. While summers are virtually dry, precipitation is considered as the main source of recharge of groundwater aquifers in the northwestern Mediterranean coastal zone and affects greatly the amount of water stored in such aquifers (Said, 1979)[49].Abu Qir is a one of the wettest area of Alexandria Egypt, which has an average annual precipitation of About 200millimeters, which is more compared to the nation annual average precipitation rate of 80 millimeters. Most of rainfall along the coastal area and it decreases suddenly moving southwards. The humidity in the Abu Qir Alexandria is very high; however sea breeze keeps the moisture down to comfortable level (Khatriet al., 2007)[20].

B. Air temperature

The average annual temperature ranges between minimum 14^{o}C in winter and maximum 30^{o}C in summer. The average annual temperature increase moving southward from the Delta to the Sudanese border, where temperature variations are similar to those of the open deserts (Khatriet al., 2007) [20].

C. Wind

Winds are generally light, but blows strongly during winter and early spring. The average wind velocity is About 20 to 25 km/hr. The end of summer records many calm days and the average speed dropped to 15 km/hr (Abbas, 1988) [57], (Tolba, 1990) [58], (Ahmed, 1996) [59]. A hot spring wind that blows across the country, known as (Khamsin for Egypt) is an important climatic phenomena in Egypt. Higher velocity of wind (up to 140km/hr) accompanied by sand and dust from the deserts can increase the air temperature suddenly about 20^{o}C within two hours. It appears usually in April and occasionally in March and May (Frihy. 2003) [60], (Khatri et al., 2007) [20].

II.2.2Coastal conditions:

The coastal conditions affect strongly any strategic plan that could be established for development in the area, those conditions are:

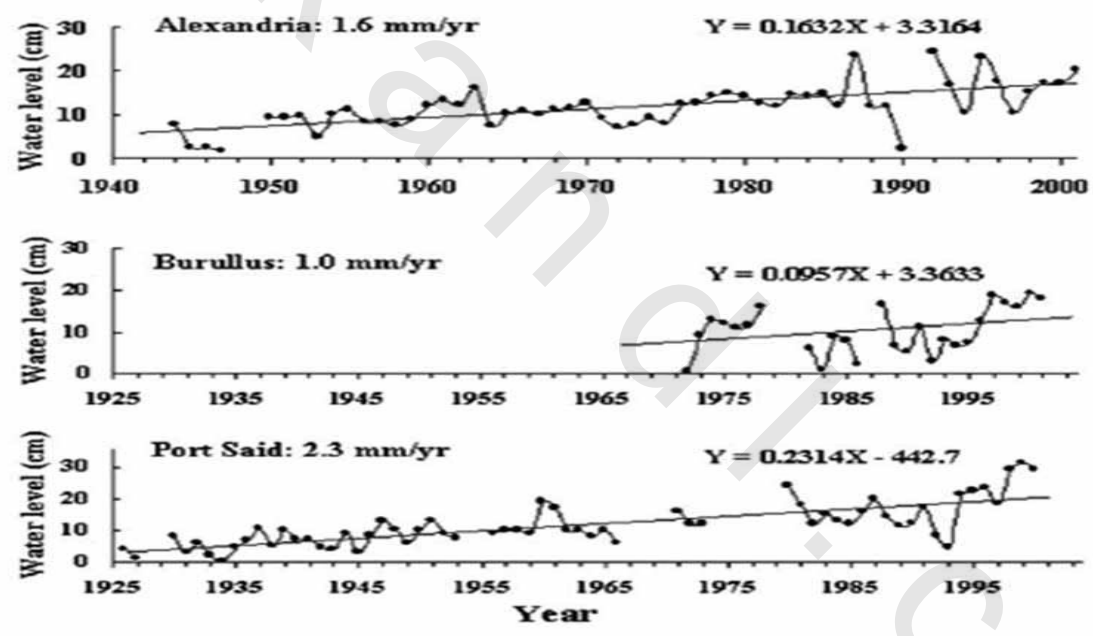
A. Currents and waves

The estimated surface current velocity in the area ranges from 9.26 to 13.5 cm/sec during summer. It declines to 4.46 cm/sec during Autumn, sharply increases due to the strong wind during Winter to 23.14 cm/sec and declines again due to the calm weather during Spring to 8.4 cm/sec (Anon, 1983)[61].It has been shown that the system of waves in the Bay of Abu Qir mixed in intensity and direction with the wind system prevailing in the region, and we find that the average wave height and duration, respectively, 0.94 m and 6.5 seconds. The trend of the waves is a trend northwestward and up high waves to 4 meters wave winter and summer storms **(Abdallah , 2006)**[62].

II.3 Land subsidence

The Nile River deltaic plain is vulnerable to a number of aspects, including beach erosion, inundation, and relatively high rates of land subsidence. Analysis of historical

records obtained from tide gauges at Alexandria, Rosetta, Burullus, Damietta, and Port Said show a continuous rise in mean sea level fluctuating between 1.8 and 4.9 mm/year. As a result, large areas of the coastal plain have been subsided, but some sectors have been uplifted in response to tectonic activities of thick underlying older strata Projection of averaged sea-level rise trend reveals that not all the coastal plain of the Nile Delta the coastal plain of the Nile Delta and Alexandria is vulnerable to accelerated sea-level rise at the same level due to wide variability of the land topography, that includes low-lying areas, high-elevated coastal ridges and sand dunes, accretionary beaches, and artificially protective structures. the coast of the Nile Delta has been designated as a vulnerable zone to beach erosion as a consequence of ongoing coastal processes and accelerated sea-level rise, in addition to human influences (Frihy et al 2009)[125].



(Figure II -3): relative sea level rise at Alexandria, Burullus, and Port Said: Source: Frihy(2003) [28].

II.4 Topography and ground water resources

The shoreline of Alexandria is generally undulation and interrupted by rocky headlands producing small embayment and pocket beaches. The city originally was developed on the remnants of three parallel and intermittent calcareous sandstone and limestone ridges or hills, with elevations that vary between 5 and 30 meters above

mean sea level. South of the limestone ridges is an extensive lowlands, that are present between the west and east harbors as well as at the outlets of the Mahmoudia Canal and El-Mex Bay. South and east of Alexandria lay Lake Maryut and a large agriculture area, both at 1-3 m below sea level, with a width of more than 20 km. Most of this low land lies in Behaira Governorate (Strzepek, 2000)[63].

Abu Qir and Maryut Lake lowlands are separated by the ridge of the Mahmoudia Canal on which Alexandria – Tanta road and railway and several towns, including Kafr El- Dawwar are located. Abu – Qir lowland and Idku lagoon are separated by a ridge, 1 m above sea level , that follows the course of the former Canopic branch of the Nile. The eastern shore of Abu–Qir Bay is flanked by a sandy plain up to 6 km wide, with scattered low dunes. Parts of the plain are below sea level and become flooded during rain storms (El-Hussein, 2005)[108]. There is a discontinuous narrow strip of 1-2m dunes by the beach. As will be discussed in this thesis, this whole area is vulnerable to inundation, water logging, increased flooding, and salinization given accelerated sea level rise. The average variation of mean sea level in Alexandria does not exceed 40 cm. Groundwater in the region occurs under both artisan and non-partisan conditions. All the groundwater that is used for agricultural and domestic purposes comes from considerable depths. West of Alexandria, groundwater is the most important source of water for agricultural uses. The water table lies at or near sea level around Alexandria. The depth of the water table varies from less than a meter to 50 meters depending on the locality, topography, and season. The highest water level occurs from February to April depending on the rainy season. Under these conditions, water logging is already observed to be a problem in several areas west and south of Alexandria. It has been associated with excessive urbanization of surrounding areas such as El-Agamy area. Preliminary estimates suggested that the area in the Governorate which experience water logging is increasing with time (El-Raey et al, 1995) [64].

II.5 Socioeconomic Systems and Conditions

Mainly there are three economic poles in the study area: agriculture, fishing and industrial. Those economic sectors not only form economic bases but also adjust the social life for the peoples in the study are. The three socio-economic poles interact and integrate to draw the individuality of the study area. In this part we discuss: Maine activities sectors.

II.5.1 Population

The total number of population in Abu Qir is 359872people (51.16 % male, 48.85 % female), which represents 11 % of the total population of Alexandria. (C.A.M.P.A.S., 2006)[56].Abu Qir region is divided to Eastern, Western Abu Qir, El-M'amourah, Mandara Kebly and Ezbet El Nakhl there are in El-Montazah district two with total number of populations 319321people), which represents 88% of the total populations in Abu Qir and ElMontazah district one with total number of populations 40551 people which represents 12% of the total populations in Abu Qir

(Table II -2) Population in Abu Qir region Source (C.A.M.P.A.S., 2006) [56]

El-Montazah district two	Number of populations
Eastern Abu Qir	29465
Western Abu Qir	8102
El-M'amourah	34754
Mandara Kebly with Ezbet El Nakhl	247000
El-Montazah district one	Number of populations
Mandara bahry	40551

II.5.2Education and employments

The number of high-educated students of Alexandria is 71000 students, which represents 11.1 % of all of Egyptian students. Alexandria is the third Governorate in Egypt from this point of view. The number of students below university level is 886516 students representing 5.7 % of total Egyptian students. The number of employees is 926.000 people which represent 9.37 % of the total Egyptian employment power (Fouda, 2003)[55].Alexandria is the fourteenth Governorate in employment, (C.A.M.P.A.S, 2006)[56].

(Table II -3) Employment in Montazah district Source (C.A.M.P.A.S, 200٦)[56].

District name	Unemployed	Workers
El-Montazah district	39659	338123

(Table II -4)-The position of the work Source (C.A.M.P.A.S, 2006)[56].

District name	Intermittent nature of the work units	Seasonal nature of the work units	Temporary nature of the work units	Permanent nature of work units
El-Montazah district	50965	12536	28839	245783

(Table II -5) Education in Montazah district Source (C.A.M.P.A.S, 2006)[56].

District name	Number of people with University degree and higher	Qualified above average	Qualified average	Number of people Less qualified than the average	Reads and writes	Illiterate
El-Montazah district	156656	55738	282454	231948	104130	127098

II.5.3Agriculture activity

The cultivated area is 204.109 acres, which represents 2.27 % of total cultivated lands in Egypt. Alexandria is the fourteenth Governorate from this point of view. There is also 33066 acres, which could be reclaimed and added to the cultivated lands in the west and southeast of the Governorate. (Information description of Egypt 1995)[65].

The agriculture in the study area is characterized by the irrigated cultivation of date palms, fruit trees and traditional crops. Animal husbandry is very limited and there is little production of milk or milk products. Very few people produce honey. Beekeeping is mostly confined to the plantations of orange trees. Some of the agricultural land is permanently under cultivation, some parts are only cultivated for a

certain period of time during the year. In rare cases fields are abandoned or neglected. (Fouda, 2003)[55].

II.5.4 Fisheries activity

Abu Qir City: It is located on the western side of Abu Qir Bay that receives large amounts of three types of waters; Rosetta mouth of the river Nile, Lake Idku via Boughaz El Maadiya and Tapia pumping station (Fouda,2004) [95].The bay was considered as a fertile marine habitat when compared with other Egyptian Mediterranean coastal waters apart from agriculture, fisheries and aquaculture there are other important sources of income in the project region. About 30 fish farms are located at the western edge of Lake Idku, east of Kawm at Tarfayah. These belong to the Fishing Authority. Currently, the north-western tip of Lake Idku is converted into fish-farms. Marine Fishing is very important in Maadia. There are more than 270 boats registered in the Maadia fishing port. Fish catches have risen from 1.500 tons in 1984 to About 11.500 tons in 1996(Fouda, 2003)[55].

II.5.5 Industrial activities

Up until recently, industry played a major role within the study area. Apart from some heavy industry west of Maadia there was almost exclusively light industry. This was concentrated in Rashid, Idku and Khadrah. (Fouda, 2004) [95].Along the coast of Abu-Qir Bay there are About 22 different factories representing food processing and canning, paper mill, fertilizers, textile manufacturing and gas exhausts.(El-sayed., 2012)[66]. Small-scale industries for baskets, ropes, tiles and carpentry as well as car repair shops were common. Traditional fishing boat and yacht building was also important. The companies include Abu Qir Fertilizer and Chemical Industries Co. (Taib, 2011) [67].

II.5.6 Cultural Heritage and Archaeology and touristic site

Abu Qir Bay lies ~20 km to the east of Alexandria, and its western margin is delineated by the carbonate peninsula on which the ancient Greek settlement of Canopus (modern Abu Qir) was built. Two cities built by the Greeks in Ptolemaic have been rediscovered at depths of 5 to 7 m in the bay off the NW Nile delta (Stanley., 2004) [68].Each site was originally settled near channel mouths of the Nile's Canopic branch .They were established as trading and toll centers through which

ships had to pass to enter the delta. Heraklion City was partially submerged by the first century CE, while activity at Eastern Canopus continued, albeit in much reduced fashion. Progressive relative sea-level rise, caused by depositional failure and sediment remobilization associated with Nile flooding and perhaps seismicity, was in large part responsible for lowering and submergence of the cities that had originally been positioned near the channel outlets (Stanley et al., 2004) [68].The long-term rate of relative sea-level rise has been >3.0 mm/yr during the past 1300 years, since Eastern Canopus was submerged (Stanley et al,2004) [68].As the delta margin subsided during the past ~2500 years, the Abu Qir Bay shore migrated to its present position About 5 km south of the original coastline.

A. Cultural Heritage and Archaeology

For the clarification of the tourism potential possessed by the region, it was important to survey all available tourist areas that may form an attraction poles for internal and external tourism.

B. On Land archaeology

The inland monuments constitute a set of 9 forts ruins and the restored recognized monument of Qait-Bay Castle and "Sidi Abdel Razek" shows the location of most important archaeological sites along the bay.

C. Submerged Archeological Sites

The archeological sites submerged under the western part of Abu Qir bay are an attractive salvage operation for marine archeologists and would also stimulate the tourist industry.

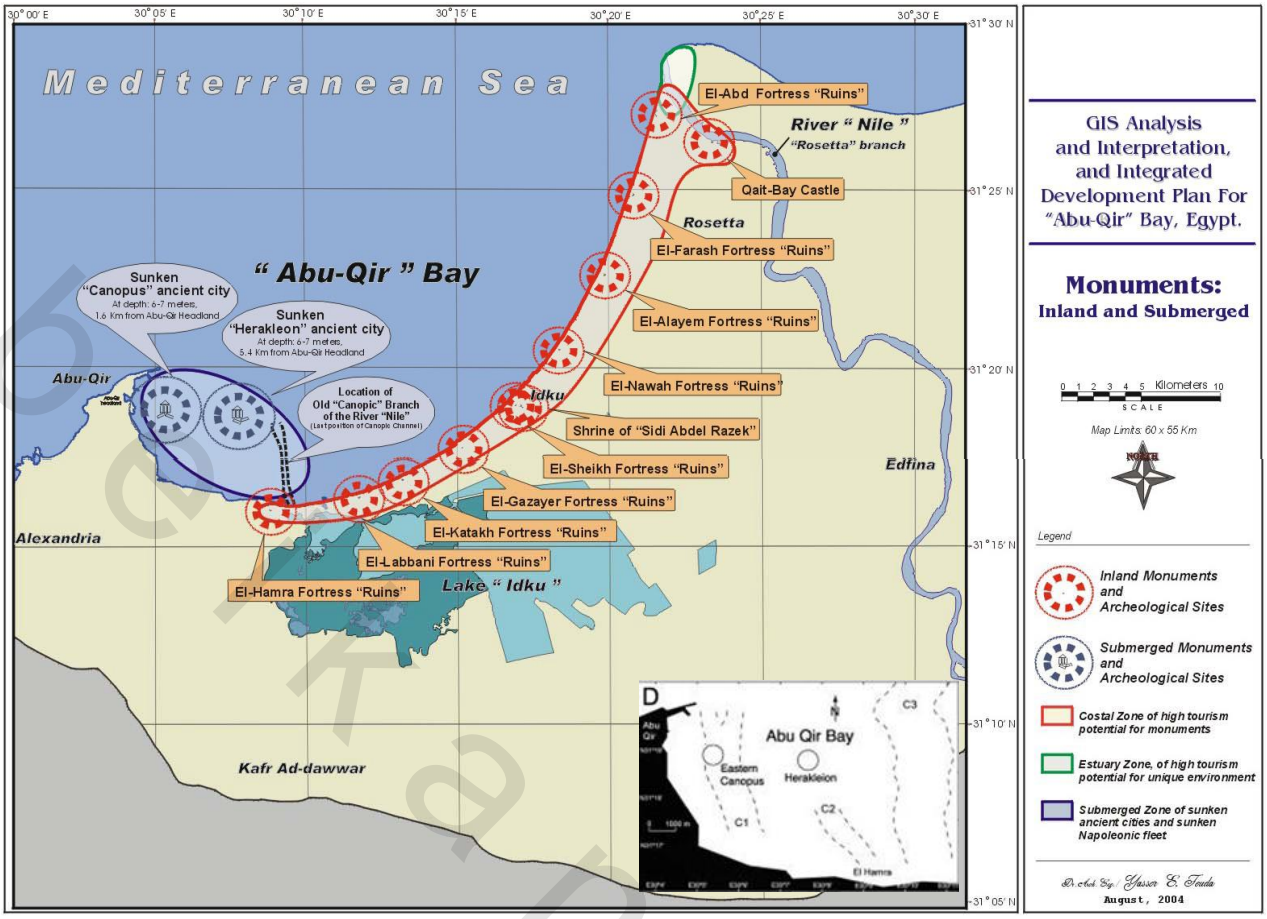


Figure (II -4): GIS coverage of the monuments: Inland (forts ruins and shrines), submerged in Abu-Qir Bay (sunken Herakleon and Canopus cities and the Napoleonic fleet).(El Raey et al,2005) [28].

Figure (II -5): Pictures for archeological sites in Abu Qir