

## 14.1.2 Natural Conditions

### 1) Topography

The Sinai Peninsula lies between the Gulf of Aqaba and Gulf of Suez. South Sinai Peninsula covers an area of approximately 34,000 km<sup>2</sup>. In general, the Sinai Peninsula comprises basement rocks in its southern territory and mainly sedimentary rocks of different ages and environments in its northern territory.

The basement rocks has been subject to indense weathering and erosion processes during a very long period of time. In addition, tectonic effects are represented by the formation of deep and narrow valleys due to uplifting and subsidence in the basement rocks. In addition, the Gulf of Aqaba and the Gulf of Suez are tectonism products formed during a long period of time.

South Sinai shows different geomorphological features as described below.

- (1) At the eastern part along the Gulf of Aqaba the basement rocks are directly adjacent to the Gulf shore in most case with no sedimentary cover.
- (2) The western part along the Gulf of Suez is commonly characterized by wide plains such as El Qaa plain and El Tur plain.
- (3) The central part is characterized by very rugged high mountaines such as Gebel Katharina (2,642 m), Gebel Musa (2,285 m) and Gebel Umm Shaumar (2,586 m), deep valleys and strongly tectonized rocks, with the highest elevations in Egypt.
- (4) The northern part is formed with a vast and flat desert plain, such as the surrounding of Nakhl.

Especially, the St. Catherine area lies within the high topography and very rugged mountainous zone of South Sinai. It is mostly covered by hard granitoid and volcanic rocks forming a mountainous landscape with high peaks raising up to 2,642 m at Gebel Katharina itself.

Also, the regional area surrounding St. Catherine domain is characterized by relatively low relief and mild topographic features. Wadi Isla, Wadi Hibran, Wadi Nasb, Wadi Madsus, Wadi Zaghra and Wadi El Tur are the most common famous geomorphological features characterizing this broad domain.

## 2) Hydrology and Meteorology

South Sinai has a desert climate. It lies in the arid belt of North Africa and belong to the Saharan Mediterranean climate area (Emberger, 1951). In most parts of South Sinai the climate is extremely arid, with a long, hot and rainless summer and mild winter.

Rain is very irregular and falls in very small amount. Sometimes it rains in torrents producing flash floods that destroy everything on its way.

Generally, the climatic features of the South Sinai south of 29° N latitude varies between the 7 districts of the deserts of Sinai and Israel described by Danin (1983), based on geomorphological, climatic and edaphic factors. Areas in the 7 districts are shown in Fig 14.1.2-1. General climatic data of the 7 districts in South Sinai is as follows:

General climatic data of 7 districts in South Sinai

No	District Name	Mean annual Rainfall (mm)	Mean annual Temp. (°C)
1	Table mountains of western and central Sinai	50 - 100	16 - 20
2	Coastal plain of the Suez Gulf	10 - 30	22 - 24
3	Coastal plains and foothills of Aqaba Gulf	5 - 30	23 - 26
4	Tiran & Sinafir Islands	5 - 20	25 - 26
5	Sandstone belt	30 - 50	17 - 22
6	Lower Sinai massif	30 - 50	15 - 22
7	Upper Sinai massif	70 - 100	9 - 15

## 3) Flora

Generally, vegetation in South Sinai is scarce under desert climate. Grass grows up temporarily after rain along many wadis and gullies. For instance, larger acacia trees are dotted along some of the wadis.

Nevertheless, a flora of total 480 species is recorded in South Sinai. These include species of *pteridophyta*, *gymnospermae* and *angiospermae*. 389 of these species are rare species, which have a limited distribution. Out of these rare species 31 are endemic, 23 endangered, 16 vulnerable, and 3 "extinct" species. The list of these 59 species is shown in Table 14.1.2-1.

Mt. St. Catherine, Wadi El Arbaeen, Gebel Musa, the surrounding of the famous monastery and Wadi El Deir are extraordinarily rich in species with a considerable amount of endemic species. There are also several endangered and vulnerable species. About 36.1 % of the endemic species are recorded from Mt. St. Catherine and Wadi El Deir. Moreover 54.5 % of the endangered and vulnerable species are found in Mt. St.

Catherine, Gebel Musa and Wadi El Deir. Some of these endemic species have very limited populations and are very endangered, for example *Primula boveana*, known from Ain Shinnara, Gebel Catherine. The natural regeneration of some old trees or subshrubs is nearly stopped, in most cases, due to overgrazing. The main species are as follows:

<i>Atraphaxis spinose</i>	: G. Catherine, only very few and old plants
<i>Crataegus sinaica</i>	: G. Catherine
<i>Cotoneaster orbicularis</i>	: G. Catherine
<i>Ficus pseudocycnorus</i>	: Wadi El Arbacen
<i>Phammus dispermus</i>	: G. Catherine
<i>Rosa arabica</i>	: G. Catherine

Three "extinct" species are included. These are *Crataegus azarolus*, which is only known from one location on the top of Gebel Catherine, *Rhus coriaria* near the monastery and *Leucas inflata* from the mountainous region.

There are also some valuable woody species in North of Nabq and the coastal area of Gulf of Aqaba. These scientifically and economically valuable species are *Avicennia marina* (Mangrove), growing on muddy soil on fossil coral reefs and the coastal shore, *Limonium axillare*, on the salty coastal soil, and *Salvadora persica*.

Further, Sinai is known to be the main Egyptian province in which the inhabitants still use medical plants for curing several diseases. Some of these plants are rare, endangered or vulnerable.

#### 4) Fauna

##### (1) Mammals

A variety of mammals inhabit South Sinai, some of which are either endangered or vulnerable to immediate extinction. The mammal's fauna of South Sinai includes only 7 orders representing 16 families, 26 genera and 34 species. The list of these mammals is shown in Table 14.1.2-2.

Endangered species of wild mammals include *Caracal caracal schmitzi* (Caracal), *Panthera pardus jarvisi* (Leopard), *Capra ibex nubiana* (Ibex) and *Gazella dorcas* (Dorcas gazelle). Vulnerable species include *Jaculus orientalis* (Greater Egyptian jerboa) and *Procavia capensis syriaca* (Hyrax). There are 11 species found to be rare, two of them are threatened include *Hyaena hyaena dubbah* (Striped hyena) and *Felis sylvestris tristrami* (Wild cat). Also, in these mammals *Gazella dorcas* and *Panthera pardus jarvisi* are protected under Article 117 of Law No. 53 (1966).

Mammals in South Sinai generally inhabit Wadis and mountain areas such as St. Catherine Monastery. Distribution of vulnerable and endangered species of mammals is shown in Fig 14.1.2-2.

(2) Birds

There are some 264 species of birds that have been recorded in South Sinai on a temporary transient basis; either on migration during spring and autumn, or as winter visitors. There are also about 50 species of birds known to breed in South Sinai. The list of these breeding species is shown in Table 14.1.2-3. Four primary habitat types, which are used by bird communities, can be identified in the inland parts of South Sinai. These are as follows:

- i) Highland: Includes hilly, mountainous country and slopes, as well as narrow small wadis, gullies and ravines above 1,000 m.
- ii) Wadis: Mainly larger wadis below 1,500 m.
- iii) Plains and plateaus: Includes open flat or slightly undulating plains, very wide wadi beds (over 1 km width) and high plateaus.
- iv) Oases: Includes typical oases, orchards and other man sustained farmland.

(3) Reptilia

Herpetofauna of total 45 species is recorded in South Sinai. There is not any endemic species of herpetofauna in South Sinai, however 14 species are restricted to Sinai in their distribution in Egypt. Most of these species are found in the core area of the protected area. The list of reptilia in South Sinai is shown in Table 14.1.2-4.

*Uromastix ocellatus ornatus* (Ornate dabb-lizard) and *Dermochelys coriacea* (Leatherback) in these species are endangered species. Especially, *Caretta caretta* (Red-brown loggerhead turtle) and *Chelonia mydas* (Green turtle) had been exposed to severe collection for exportation before designation of protected area.

*Uromastix aegyptius* (Egyptian dabb-lizard), *Uromastix ocellatus ornatus* and *Chelonia mydas* are protected under Decree No. 1403 (1990). Distribution of vulnerable and endangered species of reptilia is shown in Fig 14.1.2-3.

5) Sea Fauna and Flora

Gulf of Aqaba is much narrower and deeper than that of Suez, being a part of the great Syrian-East African Rift. It extends for 180 km; from the straits of Tiran to the port of Eliat. At its northernmost point, it is 5 km wide and reaches a maximum width of 28 km opposite to Dahab. There are 2 major basins; the northern one extends south to Nuweiba

and reaches a maximum depth of 1,000 m, while the southern one extends to the straits of Tiran and sounds at 1,800 m. This is varied topography result in many different species of sea fauna and flora.

### (1) Fish

A total of 180 species fish is recorded in Gulf of Aqaba. These species belong to 106 genera, 55 families and 15 orders. The list of fish in Gulf of Aqaba is shown in Table 14.1.2-5. Ras Mohamed area has the largest number of fish species, being 172 species (represented 96 % of the total recorded species), followed by Abou Galoum which includes 54 species (30.0 %). Then, Nabq has the lowest number of species 42 species, representing 23 % of the total recorded species.

Number of species, genera, families and orders recorded in different localities

Locality	Species	Genera	Families	Orders
Ras Mohamed	172 (95.5%)	99 (93.4%)	51 (92.7%)	14 (93.3%)
Nabq	42 (23.3%)	31 (29.2%)	18 (32.7%)	9 (60.0%)
Abou-Galoum	54 (30.0%)	29 (27.4%)	17 (30.9%)	7 (46.7%)
Total	180 (100%)	106 (100%)	55 (100%)	15 (100%)

Source: Fish of Aqaba Bay (Red Sea) Final Report, 1995, EEAA

Number of species, genera, families and orders recorded during different seasons from South Sinai protected areas are shown below:

The largest number of species is recorded during spring, being 124 species (representing 69 % of the total recorded species).

Number of species, genera, families and orders during different seasons

Season	Species	Genera	Families	Orders
Summer	52 (28.9%)	40 (37.7%)	23 (41.8%)	6 (37.5%)
Autumn	35 (19.4%)	30 (28.3%)	23 (41.8%)	8 (50.0%)
Winter	79 (43.9%)	56 (52.8%)	32 (58.2%)	11 (68.8%)
Spring	124 (68.9%)	80 (75.5%)	45 (81.8%)	15 (93.8%)
Total	180 (100%)	106 (100%)	55 (100%)	16 (100%)

Source: Fish of Aqaba Bay (Red Sea) Final Report, 1995, EEAA

### (2) Coral

Coral reefs play an important role in the coastal ecosystem. They provide habitats for a wide variety of marine species and protect coastal lands from erosion and storm damage. They also provide a protected environment for the development of coastal vegetation such as sea-grasses and salt marshes. Several district reef communities have been recognized within the Gulf of Aqaba. These include lagoon, platform, contour, and coral islets. 56 coral species belonging to 16 families is recorded in the three sites of Ras Mohamed, Nabq and Abu Galum; 32 species in Ras Mohamed, 27 species in Nabq and 33 in Abu Galum. The list of coral in the three sites is shown in

The number of species, genera and families in the Gulf of Aqaba

Locality	Species	Genera	Families
Ras Mohamed	32	24	14
Nabq	27	19	10
Abou-Galoum	33	29	12
Total	56	-	16

Source: Corals of Aqaba Bay (Red Sea) Final Report, 1995, EEAA

### (3) Mangroves and Seagrasses

Mangroves also make a significant contribution in the coastal ecosystem. They provide habitats for animals, birds and fishes, and control coastal erosion and contribute to shoreline accretion. The mangrove of Sinai is a type, which grows on hard bottoms without being connected with a riverine estuary. The Sinai mangroves, with exception of Ras Mohamed, are situated on the alluvial fan of Wadi Kid. There are 5 mangrove areas in South Sinai, one at Ras Mohamed protected area (mangrove channel) and 4 at Nabq protected area (Al-Gharqana, Abou Zabad, El-Rewissiah and El-Monqateah). El-Rewissiah is the biggest of the mangrove forests, followed by those at Abou Zabad.

Seagrasses are fairly widespread along the coasts of the Gulf of Aqaba. They tend to be concentrated in shallow water areas such as lagoons. Of the ten (10) seagrass species in the entire Red Sea, seven (7) species have been recorded along the coasts of Gulf of Aqaba.

## 14.2 Relevant Laws and Conventions

### 14.2.1 Environmental Law and Regulation

#### 1) Egyptian Environmental Affairs Agency

Environmental laws in Egypt have been implemented and enforced by a number of different government ministries, under powers conferred under Article 157 of the Constitution.

However, following the acceptance of the Stockholm Declaration concluded during *United Nations Conference on the Human Environment* held in Stockholm, Sweden in 1972, the Egyptian Government began discussing the formulation of a national body responsible for the management and administration of the environment.

In 1982, the Egyptian Environmental Affairs Agency (EEAA) was established under Presidential Decree No. 631 of 1982. The Agency is attached to the Presidency of the Council of Ministers and is responsible for preparing Egypt's policy on the management

Presidential Decree No. 631 of 1982. The Agency is attached to the Presidency of the Council of Ministers and is responsible for preparing Egypt's policy on the management of the environment and natural resources. This authority has environmental enhancement department in each government.

Subsequent to the establishment of a single agency for the protection of the environment, public concern for the deteriorating situation concerning the protection of natural resources, and the pollution of aquatic resources from industrial activity, led to the approval of the following laws:

- (1) Law No. 48 (1982) for the Protection of the River Nile and Water Channels;
- (2) Minister of Industry's Decree No. 380 (1982);
- (3) Law No. 102 (1983) for Natural Reserves and Conservation of Nature;
- (4) Law No. 124 (1983) for Fishing, Aquatics and Regulating Fish Farm;
- (5) Law No. 12 (1984) for Drainage and Irrigation

The activities of EEAA since its establishment have concentrated on the accumulation of the scientific and technical data needed for the formulation and preparation of the country's National Environmental Action Plan, which was released in March 1992.

## 2) Law Number 4 on Protection of the Environment

The Egyptian Government issued Law No. 4 in 1994 as a new environmental law. This law spells out the powers of the EEAA. Furthermore it includes sections on protection of land, air and water pollution, and procedures for Environmental Impact Assessment (EIA). Although the law specifies legal enforcement and penalties including permitting procedures, in reality the success of the EEAA in enforcing the law requires collaboration with a number of line ministries. Law No. 4 also included penalty provision for non-compliance with Law No. 48.

Law No. 4 consists of the following parts and chapters.

### Preliminary Part

- |           |  |
|-----------|--|
| Chapter 1 | General Provisions                           |
| Chapter 2 | Egyptian Environmental Affairs Agency (EEAA) |
| Chapter 3 | Environment Protection Fund                  |
| Chapter 4 | Incentives                                   |

### Part 1 Protection of Land Environment from Pollution

### Part 2 Protection of Air Environment from Pollution

### Part 3 Protection of Water Environment from Pollution

- |           |   |
|-----------|---|
| Chapter 1 | Pollution from Ships                    |
| Chapter 2 | Pollution from Land Sources             |
| Chapter 3 | International Certificates              |
| Chapter 4 | Administrative and Judiciary Procedures |

#### Part 4 Penalties

### 3) Conservation and Protection of Natural Resources

The Egyptian government has initiated two programs in an attempt to reverse the deteriorating state of the country's natural resources, namely:

- (1) Development of environmental map of natural resources
- (2) Establishment of marine resources management plan

Law No. 102 (1983) for Natural Reserves and the Conservation of Nature is the principal law relating to the protection of natural resources. Certain activities which may cause deterioration of or damage to the natural environment of protected areas are prohibited under the provisions of Article 2, which include:

- (1) hunting, transportation or disturbance of any flora, fauna or organic material, or any other activity which may affect their existence;
- (2) destruction of the habitat or geological features of the area;
- (3) introduction of any exotic species which is not indigenous to the area;
- (4) pollution of the soil, water or air within any designated area;
- (5) construction of any house or road, or any agricultural, commercial or industrial activities except as authorized by EEAA acting in accordance with Regulations issued by the Prime Minister.

Convention on Wetlands of International Importance Especially As Waterfowl Habitat (RAMSAR): (1) *Lake Bardawil* and (2) *Lake Burullus* were designated in 1988, but to date have not been protected by national legislation.

With accession to the Convention Concerning the Protection of the World Cultural and Natural Heritage, 5 historical sites were designated as World Heritage Sites, namely (1) *Abu Mina Monastery*, (2) *Abu Simbel*, (3) *Islamic Cairo*, (4) *Philae* (Nubia) and (5) *the monuments at Luxor and Giza* (Thebes and Memphis).

A variety of species of flora and fauna have been protected under the provision of Decree No. 28 of 1961, Decree No. 66 of 1983, Decree No. 1227 of 1988 and Decree No. 90 of 1990.

Bird taxa protected by Decree 28 (1967), Decree 66 (1983), Decree 1227 (1988) and Decree 90 (1990) are shown in Bird Section.

Article 117 of law No. 53 (1966) as read with Decree 28 (1967) extends protection to 6 species of mammals, including (1) *Barbary Sheep*, (2) *Nubia Ibex*, (3) *Slender-horned Gazelle*, (4) *Dorcas Gazella*, (5) *Cheetah* and (6) *Sinai Leopard*.



Decree No. 1403 (1990) has been enacted to afford protection to the 13 reptile species.

List of reptiles protected by Decree 1403 in 1990

No	Scientific Name	Common Name
1	<i>Testudo Kleinmanni</i>	Egyptian Tortoise
2	<i>Testudo graeca</i>	Greek Tortoise
3	<i>Trionyx triunguis</i>	Nile Soft-shell Turtle
4	<i>Chelonia mydas</i>	Green Turtle
5	<i>Uromastyx aegyptius</i>	Egyptian Spiny-tailed Lizard
6	<i>Uromastyx ocellatus</i>	Spotted Spiny-tailed Lizard
7	<i>Uromastyx ornatus</i>	Ornate Spiny-tailed Lizard
8	<i>Uromastyx acanthinurus</i>	Black Spiny-tailed Lizard
9	<i>Chamaeleo chamaeleon</i>	Common Mediterranean
10	<i>Chamaeleo africanus</i>	African Chameleon
11	<i>Eryx colubrinus</i>	Kenya Sand Boa
12	<i>Eryx jaculus</i>	Egyptian or Spotted Sand Boa
13	<i>Varanus griseus</i>	Desert Monitor

#### 14.2.2 Ratification to International Conventions

The main trend of Egypt's environmental policy are governed by national development priorities which have been influenced by fundamental principles established in various international environmental treaties and agreements to which the country has acceded. Some of these environmental treaties and conventions are listed as follows:

- (1) African Convention on the Conservation of national Resources  
: Entry into force for Egypt on May 12, 1972
- (2) Convention Concerning the Protection of the World Cultural and Natural Heritage: Entry into force for Egypt on December 17, 1975
- (3) Convention on International Trade in Endangered Species of Wild Fauna and Flora (as amended): Entry into force for Egypt on April 4, 1978
- (4) Convention for the Protection of the Mediterranean Sea against Pollution  
: Entry into force for Egypt on September 23, 1978
- (5) Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources: Entry into force for Egypt on June 17, 1983
- (6) Convention on the Conservation of Migratory Species of Wild Animals  
: Ratified by Egypt on July 11, 1983
- (7) United Nations Convention on the Law of the Sea  
: Ratified by Egypt on July 11, 1983
- (8) Protocol Concerning Mediterranean Specially Protected Area  
: Entry into force for Egypt on March 23, 1986
- (9) Convention on Wetlands of International Importance Especially as Waterfowl Habitat: Entry into force for Egypt on February 1, 1987
- (10) Framework Convention on Climate Change: Signed by Egypt on June 9, 1992
- (11) Convention on Biological Diversity: Signed on Egypt on June 9, 1992
- (12) World Charter and Agenda 21: Signed on Egypt on June 9, 1992

### 14.2.3 Protected Area in South Sinai

There are 16 protected areas in Egypt. Five 5 areas in these protected areas have been declared under Law No. 102 in South Sinai. The protected areas in South Sinai are as follows:

- (1) Ras Mohamed National Park
- (2) Saint Catherine Protectorate
- (3) Nabq Protectorate
- (4) Abu Galum Protectorate
- (5) Taba Protectorate

In addition, Taba resource protected area is proposed as new protected area. These protected areas are shown in Fig 14.2.3-1.

#### 1) The Ras Mohamed National Park

The Ras Mohamed National Park is the first and only national park in Egypt. The park was declared in 1983 with an area of 97 km<sup>2</sup>, but it has since then grown to an area of 480 km<sup>2</sup>. The Park includes marine and terrestrial areas at the Ras Mohamed peninsula and the island of Tiran, and all shorelines to the highest annual tide between the main Sharm El Sheikh harbour and the southern boundary of the Nabq managed resource protected area. Many mammals inhabit the park, some of which are protected under law. The number of fish is also rich and consists of 172 species. Therefore, many facilities for visitors are established in the park.

#### 2) The Saint Catherine Protectorate

The Saint Catherine Protectorate declared in 1987 has the widest area of the four protected areas of South Sinai. The protected area includes the 6-century monastery and the surrounding area.

This area is characterized by very rugged high mountains such as Gebel Catherine (2,642 m), Gebel Musa (2,285 m) and Gebel Umm Shaumar (2,586 m). These mountains have the highest elevations in Egypt. Therefore, flora and fauna are rich and include a large number of valuable and rare species.

Many monasteries also exist in the area. St. Catherine monastery has been a center of Christian worship and thought for over 1,600 years, containing one of the world' most ancient and important monastic libraries.

3) The Nabq Protectorate

The Nabq Protectorate located 35 km north of Sharm El Sheikh, is an outstanding natural area containing varied ecosystems and habitat types. Of these, the most notable are the ones located at the mouth of Wadi Kid and the largest mangrove (*Avicennia marina*) stand on the Gulf of Aqaba.

Other habitat types can be found in the mountainous regions of the protectorate wherever conditions permit plant growth. With an area of over 600 km<sup>2</sup>, Nabq contains 134 plant species of which 86 are perennial. The mangrove stand at Nabq fronts the shoreline at the mouth of Wadi Kid.

4) The Abu Galum Protectorate

The Abu Galum Protectorate covering an area of 400 km<sup>2</sup>, protects varied coastal and mountain ecosystems unique of the Gulf of Aqaba. The area differs dramatically from the other Protectorates on the Gulf. The coastal area contains undisturbed coral reefs with high diversities of coral reef fish and associated flora and fauna.

14.3 Initial Environmental Examination (IEE)

14.3.1 Summary of Groundwater Development Plan

The main water resources of this development plan are two kinds of groundwater, which come from the Lower Cretaceous Aquifer in the south of Nakhl area and the Quaternary Aquifer in El Qaa Plan. Groundwater development potential of the Main Block in the Lower Cretaceous Aquifer is estimated as  $110 \times 10^9 \text{ m}^3$ , while available amount of groundwater is estimated as  $13 \times 10^9 \text{ m}^3$ .

Available amount of groundwater in El Qaa Plan is estimated as 12,500 m<sup>3</sup>/day ( $4.56 \times 10^6 \text{ m}^3/\text{year}$ ) from the result of a simulation model. This amount consists of present groundwater use 9,415 m<sup>3</sup>/day ( $3.43 \times 10^6 \text{ m}^3/\text{year}$ ) and additional groundwater abstraction of 3,085 m<sup>3</sup>/day ( $1.13 \times 10^6 \text{ m}^3/\text{year}$ ). Water demand in the target year 2017 on the other hand, is estimated as 260,000 m<sup>3</sup>/day or  $95 \times 10^6 \text{ m}^3/\text{year}$  (185,000 m<sup>3</sup>/day for domestic use and 75,000 m<sup>3</sup>/day for irrigation use). Therefore, the water capacity to be developed is determined considering both the available amount of groundwater and the water demands.

The main facilities of the groundwater development plan are well structures, pumping stations, conveyance pipelines and distribution water reservoirs, summarized below.

Summary of Groundwater Development Plan

Plan	Water Source	Development Capacity (m <sup>3</sup> /day)	Service Area	Main Purpose of Supply	Service Population & Area	Main Facilities
1	South of Sudr El Heitan	57,500	Ras Sudr, Abu Zenima, Abu Rudeis	Potable	235,845 (persons)	Well :N= 92 :D=1,000m Pipe :L= 64 km
2	South of Nakhl	56,000	Nuweiba, Dahab	Potable	204,112 (persons)	Well :N= 90 :D=1,000m Pipe :L= 189 km
3	North of El Tur	5,300	El Tur	Portable	110,023 (persons)	Well :N= 9 :D=155 m Pipe :L= 9 km
4A	Around Sudr El Heitan	11,700	Sudr El Heitan	Irrigation	714 ha	Well :N= 19 :D=1,000m
4B	South of Nakhl	13,700	Malha	Irrigation	840 ha	Well :N= 22 :D=1,000m
4C	Around Themed	11,700	Themed	Irrigation	714 ha	Well :N= 19 :D=1,000m
5	Bedouin Community	80	Typical case	Common	1,600 (persons)	Well :N= 4 :D=25m

Remark: "D=" of Main Facilities means well depth

#### 14.3.2 Initial Environmental Examination

The main objective of the IEE is to evaluate whether an EIA (Environmental Impact Assessment) is necessary for the further study and to examine, from an environmental viewpoint, the measures for alleviating the effects of the project which requires environmental consideration but not a full-scale EIA.

Table 14.3.2-1 summarizes the estimation of the environmental changes and assessment of the influence by these changes. These environmental items apply according to "Environmental Guidelines for Infrastructure Projects VIII Groundwater Development, JICA Environmental Guidelines, and September 1992". Environmental items for examined against the development plan are discussed below.

##### 1) Social Environment

Concerning "(2) Economic Activities" and "(7) Public Health Condition", the development plan will give benefits to inhabitants of the service areas. This will encourage economic development of service areas. Especially agricultural outputs will increase by the supply of irrigation water, and health condition of inhabitant will be improved by supply of drinking water.

The development plan will seldom affect other items of "(1) Resettlement", "(3) Traffic and Public Facilities", "(4) Split of Communities" and "(9) Hazard (Risk)". The reason is that most of the development plan is conducted in non-resident areas. Serious impacts

against items of other social environment are not observed.

## 2) Natural Environment

The main facilities of the development plan consist of intake facilities and transmission pipelines. Most of the intake facilities are proposed in non-inhabitant areas and pipelines are buried along roads. Therefore, the development plan will not directly affect item "(15) Fauna and Flora". Furthermore, the development plan does not require large-scale reclamation works. Therefore, environmental items "(10) Topography and Geology", "(11) Soil Erosion" and "(16) Meteorology" will not be affected by the development plan. However, each item of "(12) Groundwater", "(13) Hydrological Situation" and "(17) Landscape" should be paid attention to discussed below.

Development of wells for irrigation and common use is proposed in Bedouin communities. Locations of the new wells should be selected in points that are not causing effect such as lowering of groundwater table against existing wells.

Increase of wastewater related to the increase of water consumption is expected to have impact on the water quality of sea, if necessary measures against increase of wastewater are not taken. Aqaba Bay belongs to the protected area, and consequently necessary measures such as improvement of wastewater treatment facilities should be taken. Also, locations of pressure reducing tanks at the 7 sites in Wadi Watir should be decided considering the conservation of landscape because this section has superior landscape.

## 3) Pollution

Groundwater development in Bedouin communities is proposed. Drilling under the construction phase may cause water pollution on existing wells of the Bedouin communities. Therefore, item "(19) Water Pollution" should be paid attention to. Drilling machines generate noise and vibrations however since the period of construction is limited, item "(21) Noise and Vibration" will not be seriously affected by the development plan. Moreover, lift pumps during the operation also generate noise, however the sites for lift pumps are almost entirely located in non-resident areas. Concerning the noise of lift pumps in Bedouin communities, they will not seriously affect the environment due to the small-scale size. Serious impacts on items of other pollution are not observed.

### 14.3.3 Conclusion and Recommendation

#### 1) Conclusion of IEE

Based on the results of the study, the degree of the possible impact is assessed using the following three categories. A: Impact is deemed strong B: Some impact is expected C: Impact is very small. Table 14.3.2-1 summarizes the estimation of the environmental changes and assessment of the influence by those changes. The results of the IEE are as follows:

	A category	B category	C category
Plan-1	0	0	23
Plan-2	0	2	21
Plan-3	0	2	21
Plan-4	0	2	21
Plan-5	0	3	20

Thus, it is concluded that due to the reasons explained below, the environment will not be seriously affected by the implementation of the development plan. As a consequence, an EIA is not necessary. The reasons supporting the conclusions are as follows:

- (1) Most of South Sinai consists of scarce natural conditions under desert climate, and the habitats of plants and animals are limited. Plants grow in the mountainous area representing St. Catherine and wadis and gullies. Animals are also observed in only a part of the district. The development plan is not proposed in these areas. Therefore, the natural environment in the Study Area will not be directly affected by development plan.
- (2) Concerning the facility plan, the well fields of Plant, 2 and 3 require extensive areas, however these areas consist of non-resident areas. Furthermore the pipeline of Plan 2 has a length of 189 km, however pipes are buried along existing roads. Other facilities are small-scale in size and large-scale reclamations are not needed. Thus, the development plan does not seriously affect the environment.
- (3) The development plan will contribute to economic development and the improvement of public health condition. For instance, increase of water supply to service areas will develop tourism into a major industry in South Sinai. Also, agricultural outputs will increase by supply of irrigation water. At the same time, the development plan will give job opportunities through construction works.

However, concerning the "B" category, the necessary countermeasure should be taken. These measures and related subjects are shown in Table 14.3.2-2.

#### 2) Recommendation for Development Plan

Concerning the groundwater development plan, its characteristics and fundamental considerations against environmental viewpoints are summarized below.

(1) Water Resources

Scales of water resources are different according to the purpose of water supply. Water resources with the largest scale is for potable use; the area of each well field of Plan 1 and Plan 2 has the scale of 5,130 ha (9,500 m x 5,400 m). Plan 3 is 1,100 ha (5,500 m x 2,000 m). These areas are formed in desert lands and there are no inhabitants. Also, valuable species of wildlife and plants can not be found in these areas. Therefore, neither forced displacement of inhabitants by land acquisition nor special considerations against other environmental viewpoints are needed.

On the other hand, water resources for irrigation of Plan 4A, 4B and 4C and common use of Plan 5 consists of wells, and these wells will be established inside irrigation areas and residential areas. These plans will not seriously affect the environment due to the small-scale size. However, development of new wells in these areas should be carried out considering the effect on wells.

(2) Life of Aquifer

The increase of water demand by the growing population threatens to deplete the aquifer in the area. According to the water balance study life of the aquifer in the Study Area is estimated as 135 years if all the water demand in South Sinai depends on groundwater source. If alternative water sources are used, the life of the aquifer is estimated as 253 years

There is room for discussion of the life length of the aquifer since it is obvious that the storage capacity of groundwater is limited, regarding the groundwater in the Lower Cretaceous Aquifer, which is called Fossil Water because it is never recharged by present surface water, its use is not sustainable. Therefore, development of groundwater in the Lower Cretaceous Aquifer should be carefully carried out under strict management.

(3) Development Water Capacity

Total development water capacity in potable water sector is 118,880 m<sup>3</sup>/day; and about 550,000 persons the benefit from the development plan. Considering the total population 39,009 of South Sinai in 1996, the scale of the development plan can be realized. Also, the total development water capacity for irrigation water is proposed as 37,100 m<sup>3</sup>/day, resulting in that 2,268 ha of agricultural land can be irrigated. Agricultural land of South Sinai in 1994 was 1,400 feddans (588 ha).

On the other hand, increase of water consumption leads to increase of wastewater

generation. Ras Sudr, Nuweiba and El Tur are the largest benefit areas of the development plan. Especially, Nuweiba that faces Bay of Aquaba is included in the ABU Galum Managed Resource Protected Area. At present, wastewater in these cities is mostly treated by means of oxidation pond system. The amount of treated wastewater is reduced through evaporation and infiltration to the ground, and then part of the wastewater is reused for irrigation. However, the capacity of existing wastewater treatment facilities is not sufficient to treat the increased amount of wastewater. Therefore, countermeasures including the improvement of wastewater treatment facility should be considered.

(4) Conveyance Pipelines and Pressure Reduce Tanks

Conveyance pipelines of Plan 1, 2 and 3 have respective lengths of 64km, 189km and 9km.

Of these, the route of Wadi Watir in Plan 2 is following deep narrow valleys, and it is passing superior landscape. This area is also proposed as a new protected area, namely the Taba Protected Area.

Almost all pipelines are constructed along existing road and pipes are buried. Therefore, the construction of pipeline will not seriously affect the environment. However, the location of pressure reducing tanks of the 7 sites in Wadi Watir should be selected considering the conservation of landscape.

(5) Other Environmental Issues

“(8) Waste” and “(20) Soil Contamination” do not fall into the “B” category. The reasons are that these items are not “directly” affected by the development plan. However, development plan will lead to the following indirect effects on environment.

i) Solid Waste

The problems of solid waste management and disposal are reported in St. Catherine area. Despite the existence of an official dump and an incinerator in St. Catherine, solid waste, particularly plastic bags and paper is mostly disposed of haphazardly. The existence of such foreign articles in the environment disturbs wildlife, and represent a danger if they are ingested. Furthermore, the availability of excessive amounts of discarded food items leads to the unnatural increase in the population of certain scavengers. As an example, a dramatic increase of the Brown-necked Raven (a sort of crow) is recorded in the St. Catherine area. The increase of feral cats and dogs is also known, and they cause damage to populations of small mammals, small



birds and reptiles. These problems have been caused by the increased numbers of visitors and residents at St. Catherine.

A large number of immigrants will be received in development areas, particularly the areas in Plan 1, 2 and 3. At the same time, increase in domestic and other human wastes will also occur. Therefore, measures of solid waste disposal in development areas should be considered. Solid wastes should be collected, stored, and placed in municipally managed landfills.

#### ii) Soil Contamination

Agricultural lands of total 2,268 ha in Plan 4A, 4B and 4C are newly developed by supply of irrigation water. In these areas, agrochemicals will be used for the purpose of intensification of agriculture, introduction of high yielding varieties and new crops. However, utilization of agrochemical will cause soil contamination, especially in the case of continuous application of agrochemical with high residual toxicity or excessive use of agrochemical. Utilization of agrochemicals should be carried out with definition of criteria on agrochemicals with high residual toxicity and employment of strict regulation on use.

#### iii) Soil Salinization

Soil salinization is caused by improper management of irrigation water, particularly in arid zones. It is a phenomenon in which soluble salts accumulate in the surface layer of soil. Crop growth is consequently adversely affected resulting in decrease of land productivity and deterioration of land. These phenomena were observed in a part of the agricultural lands of the Study Area.

Therefore, the management of irrigation water in the development area should be carried out considering the problem of soil salinization. As mitigation measures, attention to the impact of irrigation and drainage on lower reaches in, the formulation of cropping pattern including time required for desalinization, introduction of salt tolerant crop and alteration of land use; etc.

Table 14.1.2.1 List of Flora of South Sinai (1/2)

No	Order	Family	Name	Distribution in South Sinai	Status
1	Gymnosperms	Ephedraceae	<i>E. foeminea</i>	W. side of J. Musa, c. 2000 m.	Endangered
2	"	"	<i>E. foliata</i>	Wadi El Sheikh, 17 Km E. of Feiran Oasis	Vulnerable
3	"	"	<i>E. pachyclada</i>	South Sinai	Endangered
4	Angiosperms	Anacardiaceae	<i>Pistacia Khurjuk</i>	Wadi Gebal	Vulnerable
5	"	"	<i>Rhus coriaria</i>	Wadi El Arbaeen garden	Extinct, Endemic
6	"	Asclepiadaceae	<i>R. tripartita</i>	South Sinai	Vulnerable
7	"	"	Sinaica	Mear, Sinai, W. Sigilla	Endangered
8	"	Caryophyllaceae	<i>Bufonia brachyphylla</i>	Catherine	Endemic, Endangered
9	"	"	<i>D. sinaicus</i>	J. Catherine, Wadi Rurg	Endangered
10	"	"	<i>S. leucophylla</i>	South Sinai	Endemic
11	"	"	<i>S. odontopetala</i>	South Sinai	Endemic
12	"	"	<i>S. schimperiana</i>	South Sinai	Endemic, Vulnerable
13	"	Chenopodiaceae	<i>Haloxylon persicum</i>	Gulf of Suez and Aqaba Gulf	Endangered
14	"	"	<i>Seidlitzia rosmarinus</i>	South Sinai	Vulnerable
15	"	Cistaceae	<i>Ph. sinaicum</i>	South Sinai	Endangered
16	"	"	<i>Tanacetum santolinoides</i>	Wadi El Raha, Wadi El Deir, Wadi El Arbaeen	Endemic
17	"	Convolvulaceae	<i>Ipomoea sinaica</i>	South Sinai	Endangered
18	"	Cruciferae	<i>Arabidospsis Kneuckeri</i>	Catherine	Endemic
19	"	"	<i>Matthiola arabica</i>	Wadi Feiran, Wadi Raha	Vulnerable
20	"	Dipsacaceae	<i>Torularia aculeolata</i>	Catherine	Endangered
21	"	"	<i>Ptercephalus arabicus</i>	South Sinai	Endemic
22	"	Euphorbiaceae	<i>E. obovate</i>	Gebel St. Catherine	Endemic, Endangered
23	"	Gentianaceae	<i>Centaurium malzacianum</i>	South Sinai	Endemic, Vulnerable
24	"	Hypericaceae	<i>Hypericum sinaicum</i>	Wadi Gebal	Endemic
25	"	Hyppochoeraceae	<i>Hypericum dimidiatum</i>	South Sinai	Endemic
26	"	Libiatae	<i>Ballota kaiseri</i>	South Sinai	Extinct
27	"	"	<i>Leucas inflata</i>	South Sinai	Endemic
28	"	"	<i>Nepeta septemcrenata</i>	Wadi Raha, Catherine	Endemic
29	"	"	<i>O. frutescens</i>	South Sinai	Endemic
30	"	"	<i>Phlomis aurea</i>	Catherine, Wadi El Dier, Wadi El Arbaeen	Endangered, Endemic
31	"	"	<i>Teucrium leucocladum</i>	Wadi Gebal, Wadi Isla	Vulnerable
32	"	"	<i>Thymus decussates</i>	Catherine	Endemic, Vulnerable
33	"	Loranthaceae	<i>Pistacea Atlantic's</i>	South Sinai	Endangered
34	"	Mimosaceae	<i>Acacia gerrardii</i>	South Sinai	Vulnerable
35	"	Moraceae	<i>Ficus carica</i>	South Sinai	Endangered
36	"	Moringaceae	<i>Moringa peregrine</i>	Wadi Tmara, Wadi Feiran, El Heswa	Endangered
37	"	Nyctaginaceae	<i>Commicarpus sinuatus</i>	South Sinai	Endangered

Table 14.1.2-1 List of Flora of South Sinai (2/2)

No	Order	Family	Name	Distribution in South Sinai	Status
38	Angiosperms	Papilionaceae	A. spinosus	Wadi El Sheikh, Wadi El Deir	Endemic
39	"	"	Colutea istria	Catherine	Endangered
40	"	Polygalaceae	Polygala sinaica	J. Mousa, Wadi Raha	Vulnerable
41	"	Polygonaceae	Atraphaxis spinosa	J. Catherine	Endangered
42	"	Primulaceae	Primula boveana	J. Catherine	Endemic
43	"	Rhamnaceae	Sageretia brandrethiana	South Sinai	Endangered
44	"	Rosaceae	Cotoneaster orbicularis	J. Catherine	Vulnerable
45	"	"	Crataegus azarolus	St. Catherine	Endemic, Extinct
46	"	"	Crataegus sinaica	J. Catherine, W. Gebal	Vulnerable
47	"	"	Rosa arabica	South Sinai	Endemic, Endangered
48	"	Scrophulariaceae	Anarrhinum pubescens	El Tor, Deir El Rahba, El Bustan, Wadi El Lega, Wadi Raha	Endangered, Endemic
49	"	"	K. macilenta	St. Catherine monastery	Endemic, Endangered
50	"	"	K. scariosopala	Wadi Feiran, Feiran Oasis	Endemic
51	"	"	V. islensis	Gabel Eldin, Wadi Esia	Endemic
52	"	"	V. kaiserii	Sheikh Umm Hussun	Endemic, Endangered
53	"	"	V. musa	South Sinai	Endemic, Endangered
54	"	Solanaceae	Withania obtusifolia	The Gulf of Aqabah, Gebel Musa	Vulnerable
55	"	Umbelliferae	Bupleurum falcatum	Wadi El Arbaeen	Endemic
56	"	Zygophyllaceae	F. boulosii	Wadi Dahab	Endemic
57	"	"	Z. dumosum	SW Taba near road of Nuweiba	Vulnerable
58	"	"	Z. propinquum	South Sinai	Vulnerable
59	Monocots	Liliaceae	Colchicum cornigerum	South Sinai	Endemic

Source: Environmental Studies towards Establishing Conservation Area (EEAA)

Table 14.1.2-2 List of Mammals of South Sinai

No	Order	Family	Name	Distribution in South Sinai	Status
1	Insectivora	Erinaceidae	<i>Paraechinus dorsalis</i>	Wadi El-Raha, Wadi Feiran, St. Catherine Monastery area	Rare and localized
2	"	Soricidae	<i>Crocidura suaveolens</i>	Wadi El-Arbaein	Rare
3	Chiroptera	Nycteridae	<i>Nycteris thebaica</i>	St. Catherine Monastery area	Widespread
4	"	"	<i>Rhinolophus clivosus</i>	Wadi Feiran, Wadi El-Arbaein	Rare
5	"	"	<i>Rhinolophus hipposideros</i>	Feiran Oasis	Rare
6	"	Hipposideridae	<i>Asellia tridens</i>	El-Tor	Widespread
7	"	Vesperilionidae	<i>Plecotus austriacus</i>	El-Tor, St. Catherine Monastery	Widespread
8	"	"	<i>Barbastella leucomelas</i>	St. Catherine Monastery area	Rare
9	"	"	<i>Pipistrellus bodenheimeri</i>	St. Catherine Monastery	Widespread
10	Lagomorpha	Leporidae	<i>Lepus capensis sinaiticus</i>	Wadi El-Raha, Wadi El-Sheikh, Wadi Feiran, Agramiya, St. Catherine Monastery	Rare and localized
11	Rodentia	Cricetidae	<i>Dipodillus dasyurus dasyurus</i>	Wadi El-Raha, Wadi El-Sheikh, St. Catherine Monastery area	Common
12	"	"	<i>Dipodillus henleyi mariae</i>	El-Tor, Wadi Feiran	Common
13	"	"	<i>Meriones crassus crassus</i>	Thal, Feiran Oasis, Wadi Feiran, Wadi El-Sheikh, St. Catherine Monastery area	Common
14	"	"	<i>Meriones libycus</i>	El-Tor, Other localities	Common
15	"	"	<i>Gerbillus gerbillus asyutensis</i>	Feiran Oasis, Ras Abu Rudeis	Common
16	"	"	<i>Sekeetamys calurus calurus</i>	Wadi El-Raha, Wadi El-Sheikh, St. Catherine Monastery area	Common
17	"	Muridae	<i>Acomys russatus russatus</i>	Wadi El-Sheikh, Wadi El-Arbaein, St. Catherine Monastery area, Feiran Oasis	Fairly common
18	"	"	<i>Acomys cahrinus dimidiatus</i>	Wadi El-Sheikh, Wadi El-Arbaein, Wadi Thal, St. Catherine Monastery area	Common
19	"	"	<i>Mus musculus praetextus</i>	Wadi El-Arbaein, Wadi El-Raha, Gebel Musa, El-Tor	Common
20	"	Muscardinidae	<i>Eliomys quercinus melanurus</i>	Ras Abu-Rudeis, Wadi El-Raha, Wadi Feiran	Common
21	"	Dipodidae	<i>Jaculus jaculus schlueteri</i>	Ras Abu-Rudeis	Uncommon
22	"	"	<i>Jaculus orientalis</i>	Wadi El-Sheikh	Vulnerable
23	Carnivora	Canidae	<i>Canis aureus lupaster</i>	Wadi Feiran, Abu-Sela	Rare
24	"	"	<i>Canis lupus arabs</i>	Wadi Feiran, Abu-Sela	Rare
25	"	"	<i>Vulpes vulpes aegyptiaca</i>	Wadi El-Sheikh, St. Catherine Monastery area, Wadi Abu-Sela	Uncommon
26	"	"	<i>Vulpes cana</i>	Ras Mohammed	Uncommon
27	"	"	<i>Vulpes rueppelli rueppelli</i>	Wadi El-Raha, Wadi El-Sheikh, Wadi Araba, St. Catherine Monastery area	Rare
28	"	Felidae	<i>Felis sylvestrus tristrami</i>	Wadi Feiran, St. Catherine Monastery area	Rare
29	"	"	<i>Caracal caracal schmitzi</i>	El-Tor	Rare
30	"	"	<i>Panthera pardus jarvisi</i>	No exact locality	Endangered
31	"	Hyaenidae	<i>Hyaena hyaena dubbah</i>	Wadi kid, Wadi Isia, Gebal Musa, Wadi Sidud, St. Catherine Monastery area	Endemic & endangered
32	Hyracoidae	Procaviidae	<i>Procavia capensis syriaca</i>	Wadi Zagra, Gebel Musa, Wadi El-Sheikh, St. Catherine Monastery area	Rare
33	Artiodactyla	Bovidae	<i>Capra ibex nubiana</i>	El-Raba, Gebel Umm Shomer, Wadi Feiran, Gebel Serbal, Wadi Isia	Vulnerable
34	"	"	<i>Gazella doscas</i>	Wadi El-Sheikh, Plain of El-Kaa	Endangered

Source: Environmental Studies towards Establishing Conservation Area (EEAA)

Table 14.1.2-3 List of Birds of South Sinai (1/2)

No	Order	Family	Name	Distribution in South Sinai	Status
1	Ciconiformes	Ardeidae	<i>Ardeola striata</i>	South Sinai to southern half of Aqaba coast	Common
2	"	"	<i>Egretta qularis</i>	Aqaba coast	Common
3	"	Threskiornithidae	<i>Platalea leucorodia</i>	Aqaba coast	Common
4	ccipitriforme	Accipitridae	<i>Gypaetus barbatus</i>	Gebel Sabbagh, Gebel Serbal and Umm Shomar	Rare and seldom seen
5	"	"	<i>Neophron percnopterus</i>	South Sinai	Rare and seldom seen
6	"	"	<i>Buteo rufinus</i>	South Sinai, Wadi Tinia, near St. Catherine	Common
7	"	"	<i>Aquila chrysaetos</i>	South Sinai	Rare breeder
8	"	"	<i>Aquila verreauxii</i>	South Sinai	Rare breeder
9	"	"	<i>Hieraetus fasciatus</i>	South Sinai, Ain Furtaga	Rare breeder
10	"	Pandionidae	<i>Pandion haliaetus</i>	Gulf of Ababa	Common
11	Falconiforme	Falconidae	<i>Falco tinnunculus</i>	South Sinai, St. Catherine, Sharm El Sheikh, Wadi Firan and other large Oasis	Common
12	"	"	<i>Falco concolor</i>	Through out South Sinai	Common
13	"	"	<i>Falco biarmicus</i>	South Sinai, Gulfs of Ababa and Suez	Common
14	"	"	<i>Falco pelegrinoides</i>	South Sinai, Gulfs of Ababa	Common
15	Galliformes	Phasianidae	<i>Alectoris chukar</i>	St. Catherine area and areas above 2000 m.a.m.s.l., Wadi El Sheikh, Wadi Feiran	Common
16	"	"	<i>Ammoperdix heyi</i>	South Sinai	Common
17	Gruiformes	Rallidae	<i>Gallinula chloropus</i>	El Tor's Waste Water	Common
18	"	"	<i>Burhinus oedienemus</i>	Land area of South Sinai	Rare and Local
19	"	"	<i>Cursorius cursor</i>	Low land areas of South Sinai, particularly along the Gulf of Suez	Rare
20	"	Glareolidae	<i>Charadrius alexandrinus</i>	South Sinai shores	Rare
21	teroclidiform	Pteroclididae	<i>Pterocles lichtensteinii</i>	Hilly and Mountain desert and Acacia scrub	Rare
22	"	"	<i>Pterocles coronatus</i>	Found in open stony or hilly desert	Rare
23	"	"	<i>Pterocles senegallus</i>	Found in more open sparsely vegetated sandy desert country	Rare
24	olumbiforme	Columidae	<i>Columba livia</i>	Inhabitant of hilly and mountainous country in South Sinai	Fairly Common
25	"	"	<i>Streptopelia decaocto</i>	Sharm El Sheikh, Dahab and probably Firan Oasis and El Tor	Common
26	"	"	<i>Streptopelia senegalensis</i>	South Sinai	Common
27	Strigiformes	Strigidae	<i>Bubo bubo</i>	Inhabitant of hilly and mountainous areas of South Sinai	Rare
28	"	"	<i>Athene noctua</i>	Inhabitant of hilly areas of South Sinai	Rare
29	"	"	<i>Strix butleri</i>	Oasis, Wadi Firan, St. Catherine, Ain Furtaga, North of Dahab	Rare
30	Coraciiforme	Upupidae	<i>Upupa epops</i>	Firan Oasis	Rare
31	Passeriformes	Alaudidae	<i>Ammomanes cincturus</i>	Known from lowland areas of South Sinai	Rare
32	"	"	<i>Ammomanes deserti</i>	St. Catherine area	Rare
33	"	"	<i>Alaemon alaudipes</i>	Known from lowland areas of South Sinai as well as high montance	Common
34	"	"	<i>Galerida cristata</i>	Mostly from lowland areas	Common
35	"	Hirundinidae	<i>Ptyonoprogne fuligula</i>	Through out most of South Sinai	Common

Table 14.1.2-3 List of Birds of South Sinai (2/2)

No	Order	Family	Name	Distribution in South Sinai	Status
36	"	Pycnonotidae	<i>Pycnonotus xanthopygos</i>	St. Catherine, Wadi Firan	Common
37	"	Turdidae	<i>Cercomela melanura</i>	In South Sinai occurs in area below 1500 m.a.m.s.l.	Common
38	"	"	<i>Oenanthe lugens</i>	In South Sinai occurs in area below 1500 m.a.m.s.l.	Common
39	"	"	<i>Oenanthe monacha</i>	In South Sinai occurs in area below 1500 m.a.m.s.l.	Rare
40	"	"	<i>Oenanthe leucopyga</i>	In South Sinai occurs in area above 2000 m.a.m.s.l.	Common
41	"	Sylviidae	<i>Scotoeceria inquieta</i>	St. Catherine	Common
42	"	Nectariniidae	<i>Nectarinia osea</i>	Mostly in Wadies	Common
43	"	Laniidae	<i>Lanius excubitor</i>	South Sinai	Rare
44	"	Corvidae	<i>Corvus splendens</i>	Dahab	Rare
45	"	"	<i>Corvus ruficollis</i>	South Sinai	Common
46	"	"	<i>Corvus rhipidurus</i>	St. Catherine Area	Rare
47	"	Sturnidae	<i>Onychognathus tristramii</i>	Wadi Feiran, St. Catherine area	Common
48	"	Fringillidae	<i>Bucanetes qithaqineus</i>	South Sinai	Common
49	"	"	<i>Carpodacus synoicus</i>	St. Catherine area	Common
50	"	Emberizidae	<i>Emberiza striolata</i>	Mostly in Wadies	Rare

Source: Environmental Studies towards Establishing Conservation Area (EEAA)

Table 14.1.2-4 List of Reptilia of South Sinai (1/2)

No	Order	Family	Name	Distribution in South Sinai	Status
1	Squamata	Gekkonidae	Cyrtopodion scaber	El Tor	Very common
2	"	"	Hemidactylus turcicus turcicus	Widely distributed in the south Sinai	Very common
3	"	"	Ptyodactylus hasselquistii hasselquistii	From Sharm el Sheikh, Wadi Esla, Wadi harq and shores of Gulfs and Aqaba	Very common
4	"	"	Ptyodactylus guttatus	St. Catherine Monastery area, Wadi el Arbaeen, Wadi Tlah	Rare
5	"	"	Stenodactylus stenodactylus	Wadi Akhdar, Wadi Harqs, near both the Gulfs, Suez and Aqaba	Rare
6	"	"	Tropicolotes nattereri	Nuweiba	Rare
7	"	"	Tropicolotes steudneri	Red sea islands from Tiran and Sinafir islands	Rare
8	"	Agamidae	Laudakia stellio brachydactyla	Feiran oasis, Wadi Feiran, St. Catherine Monastery area, Raba, Wadi el Arbaeen	Vulnerable
9	"	"	Pseudotrapelus sinaitus	St. Catherine Monastery area, Raba, Wadi Haroon, Wadi el Sheikh, Wadi Akhdar	Rare
10	"	"	Trapelus flavimaculatus	Wadi Akhdar, Elwa el Agramiya	Common
11	"	"	Trapelus pallidus pallidus	Wadi Feiran, Ain Sudr, Sudr el Haitan, Ain Musa, Wadi Garundel, Wadi Akhdar	Common
12	"	"	Uromastix aegyptius	Elwa el Agramiya Feiran oasis, Sharm el Sheikh, Dahab, Nuweiba	Vulnerable
13	"	"	Uromastix ocellatus ornatus	Wadi Feiran, Tor, Dahab, Sharm el Sheikh	Endangered
14	"	Lacertidae	Acanthodactylus boskianus asper	Feiran oasis, Wadi Feiran, Sarabit el Khadem, Wadi el Sheikh, Wadi el Arbaen	Very common
15	"	"	Acanthodactylus scutellatus scutellatus	St. Catherine Monastery area between Raba and Wadi Rada, Bir Thal, Wadi Hebron	Very common
16	"	"	Mesalina brevirostris	from Ras Mohammed, islands of Toran and Sinafir	Rare
17	"	"	Mesalina qummulata qummulata	St. Catherine Monastery area, Raba, between Rada and Wadi Rada, Wadi el Arbaen	Common
18	"	"	Mesalina rubropunctata	From Wadi el Bruk, 20 miles north of Nakhl	Rare
19	"	Scincidae	Ablepharus kitaibellii kitaibellii	Wadi el Arbaeen	Rare
20	"	"	Chalcides ocellatus ocellatus	Feiran oasis, Wadi Feiran, Wadi el Sheikh	Common
21	"	"	Eumeces schneideri	St. Catherine Monastery area, raba, Wadi el Sheikh, Wadi Harqs	Rare
22	"	"	Sphenops sepsoides	Bir Thal, Wadi Ghurundel, Wadi harqs	Rare
23	"	Typhlopidae	Typhlops vermicularis	St. Catherine	Rare
24	"	Leptotyphlopidae	Leptotyphlops macrohynchus	St. Catherine Monastery area	Rare
25	"	Colubridae	Coluber elegantissimus	Sinai almost Certain	Insufficiently known
26	"	"	Coluber nummifer	Wadi Feiran	Rare
27	"	"	Coluber rhodorhachis rhodorhachis	Wadi Feiran, Wadi el Sheikh and St. Catherine's Monastery area	Rare
28	"	"	Coluber rogersi	St. Catherine Monastery area, At Sudl el Haitan, Near ras el Jaifi	Rare
29	"	"	Coluber sinai	St. Catherine Monastery area, Wadi el Sheikh, Wadi Feiran	Rare
30	"	"	Eirenis coronella	El Raba, St. Catherine Monastery of St. Catherine	Rare
31	"	"	Eirenis coronelloides	St. Catherine Monastery area (1,600 m.alt.), Raba	Rare
32	"	"	Lytorhynchus diadema	St. Catherine Monastery area (5,000 ft.alt.), Raba	Rare
33	"	"	Psammophis schokari schokari	St. Catherine Monastery area, Between Raba and Wadi Rada, Wadi el Arbaeen	Common
34	"	"	Psammophis aegyptius	At Gulf of Aqaba	Common
35	"	"	Spalerosophis diadema cliffordi	St. Catherine Monastery area, Feiran oasis, Wadi Akhdar	Rare

Table 14.1.2.4 List of Reptilia of South Sinai (2/2)

No	Order	Family	Name	Distribution in South Sinai	Status
36	"	"	<i>Telescopus fallax hoogstraali</i>	St. Catherine Monastery area, Wadi el Sheikh	Rare and localized
37	"	Attractaspididae	<i>Attractaspis microlepidota engaddensis</i>	Feiran oasis, Wadi Feiran	Rare and localized
38	"	Elapidae	<i>Waltherinnesia acgyptia</i>	St. Catherine, Gebel Safsafa, Wadi Slaf, Wadi Feiran	Vulnerable
39	"	Viperidae	<i>Cerastes cerastes</i>	Wadi Feiran, Wadi Akhdar, Wadi Tiah, Wadi el Sheikh, Wadi Saal, Sharm el Sheikh	Common
40	"	"	<i>Echis coloratus</i>	St. Catherine Monastery area, El Raba, Wadi el Sheikh	Rare
41	"	"	<i>Pseudocerastes persicus fieldi</i>	South of Hassana, about 29 miles north of Nakhl, central Sinai	Very rare and localized
42	Testudinata	Testudinidae	<i>Caretta caretta</i>		Threatened
43	"	"	<i>Chelonia mydas</i>	Abu Rodeis, Tiran island	Threatened
44	"	"	<i>Eretmochelys imbricata</i>	Abu Rodeis, Tiran island	Very common
45	"	Deirochelyidae	<i>Deirochelys coriacea</i>	Abu Rodeis, Nuweiba, between Naama and Tiran Island	Endangered



Table 14.1.2-5 List of Fish Fauna in South Sinjal Protected Areas (1/4)

No	Family	No	Species	Seasons				Localities				
				S	A	W	S	RM.	N	AG		
1	Carchahinidae	1	Carcharhinus melanopterus		*	*	*	*		*		
		2	C. plumbeus			*	*					
		3	Trianenodon obesus			*	*					
2	Dasyatidae	4	Taeniura lymma		*		*	*				
3	Tropediniidae	5	Torpedo marmorata			*	*	*				
4	Phynchobatidae	6	Phynchobatus djiddensis				*	*	*	*		
5	Acanthuridae	7	Acanthurus nigricans				*	*	*	*	*	
		8	A. nigrofuscus	*	*	*	*	*	*	*	*	
		9	A. Sohal	*	*	*	*	*	*	*	*	
		10	Ctenochaetus striatus				*	*	*	*	*	
		11	Naso lituratus				*	*	*	*	*	
		12	N. unicomis			*	*	*	*	*	*	
		13	Zebrasoma veliferum	*	*	*	*	*	*	*	*	
		14	Z. xanthurum				*	*	*	*	*	
		6	Atherinidae	15	Atherinomorus lacunosus				*	*		*
		7	Balistidae	16	Pseudobalistes fuscus				*	*	*	*
				17	Rhinecanthus assasi	*		*	*	*	*	*
				18	Sufflamen albicaudatus				*	*	*	*
		8	Belonidae	19	Tylosurus choram	*	*	*	*	*	*	*
		9	Blenniidae	20	Istiblennius andamanensis				*	*	*	*
21	Salarias fasciatus						*	*	*	*		
10	Bothidae	22	Bothus pantherinus				*	*		*		
11	Caesionidae	23	Caesio Lunaris				*	*				
		24	Caesio striatus				*	*				
		25	Caesio suevicus				*	*				
		26	Carangoides bajad		*			*				
		27	C. chrysophrys			*		*		*		
13	Chaetodontidae	28	Chaetodon auriga			*	*	*		*		
		29	C. austriacus			*	*	*		*		
		30	C. fasciatus	*	*	*	*	*		*		
		31	C. lineolatus				*	*		*		
		32	C. melannotus	*			*	*		*		
		33	C. paucifasciatus				*	*		*		
		34	C. semilarvatus				*	*		*		
		35	heniochus diphreutes				*	*		*		
		36	H. intermedius				*	*		*		
		37	Megaprotodon trifascialis				*	*		*		
14	Cirrhitidae	38	Oxycirrhites typus			*	*	*		*		
		39	Paracirrhites fasteri	*			*	*		*		
15	Congridae	40	Conger cinereus			*	*	*	*	*		
16	Cyprinodontidae	41	Aphanius dispar				*	*	*	*		
17	Diodontidae	42	Diodon Hystric			*	*	*		*		
18	Echeneidae	43	Echeneis naucrates				*	*		*		
19	Ephippidae	44	Platax orbicularis		*		*	*		*		
20	Fistulariidae	45	Fistularia commersonii				*	*		*		
		46	Gerres acinaces	*			*	*		*		
21	Gerreidae	47	G. oyena		*		*	*	*	*		
		48	Gnatholepis anjerensis				*	*	*	*		
		49	Istigobius ornatus				*	*	*	*		
22	Gobiidae	50	cryptocentrus SP		*		*	*		*		
		51	Grammistes sexlineatus			*	*	*		*		
23	Grammistidae	51	Grammistes sexlineatus			*	*	*		*		
24	Haemulidae	52	Plectrohynchus gaterinus	*		*	*	*		*		
25	Hemiramphidae	53	Hemiramphus far	*		*	*	*		*		
		54	Hyporhamphus gamberur			*	*	*		*		
26	Holocentridae	55	Adioryx diadema				*	*		*		

Table 14.1.2-5 List of Fish Fauna in South Sinai Protected Areas (2/4)

No	Family	No	Species	Seasons			Localities			
				S	A	W	S	RM.	N	AG
		56	<i>Myripristis murdjan</i>	*		*	*	*		
		57	<i>Neoniphon sammara</i>	*	*	*	*	*		
		58	<i>Sargocentron rubrum</i>	*				*		
		59	<i>S. spiniferum</i>			*		*		
27	Kyphosidae	60	<i>Kyphosus cinerascens</i>			*	*	*		
		61	<i>K. vaigiensis</i>	*		*		*	*	
28	Labridae	62	<i>Anampsis caeruleopunctatus</i>	*			*	*		
		63	<i>Cheilinus lunulatus</i>			*	*	*		
		64	<i>Cheilinus digrammus</i>	*				*	*	
		65	<i>Coris aygula</i>	*				*		
		66	<i>Gomphosus coeruleus</i>			*		*		
		67	<i>halichoeres hartulanus</i>					*		
		68	<i>Hologunmus annulatus</i>	*				*		
		69	<i>Labroides Dimidiatus</i>				*	*		
		70	<i>Thalassoma klunzingeri</i>	*		*	*	*		
		71	<i>Thalassoma purpureum</i>			*	*	*	*	*
		72	<i>Bodianus axillaris</i>	*			*	*	*	*
		73	<i>B. anthioides</i>				*	*		
29	Lethrinidae	74	<i>Lithrinus croceus</i>					*		
		75	<i>L. lentjan</i>			*	*	*		*
		76	<i>L. mahsena</i>			*	*	*		*
		77	<i>L. mahsenoides</i>	*			*	*		
		78	<i>L. nebulosus</i>	*		*	*	*		
		79	<i>L. xanthochilus</i>				*	*		
		80	<i>L. elongatus</i>				*	*		*
		81	<i>Monotaxis grandoculis</i>	*		*	*	*		*
30	Lutjanidae	82	<i>Lutjanus bohar</i>				*	*		*
		83	<i>L. ehrenbergi</i>		*	*	*	*		
		84	<i>L. fulviflamnus</i>				*	*		
		85	<i>L. kasmira</i>				*	*		
31	Monodactylidae	86	<i>Monodactylus argenteus</i>	*		*			*	*
32	Mugilidae	87	<i>Crenimugil crenilabis</i>		*	*	*		*	
		88	<i>Mugil cephalus</i>	*	*			*		
33	Mullidae	89	<i>Mulloidis flavolineatus</i>		*			*		*
		90	<i>M. vanicolensis</i>	*	*		*	*		
		91	<i>Parupeneus cinabarinus</i>			*		*		*
		92	<i>P. cyclostomus</i>			*	*	*		*
		93	<i>P. forsskali</i>				*	*		
		94	<i>P. macronema</i>	*				*		
		95	<i>P. rubescens</i>		*			*		
34	Muraenidae	96	<i>Echidna nebulosa</i>			*		*		
		97	<i>Gymnothorax flavimarginatus</i>			*		*	*	
		98	<i>G. javanicus</i>				*	*		
		99	<i>Siderea griesea</i>			*		*	*	
		100	<i>S. picta</i>			*	*	*		
35	Ostraciidae	101	<i>Ostracion cubicus</i>		*			*		
36	Pempheridae	102	<i>Pempheris vanicolensis</i>				*	*		
37	Platycephalidae	103	<i>Papilloculiceps longiceps</i>				*	*		
38	Plesiopidae	104	<i>Callopleysiops altivelis</i>			*		*		
39	Pomacanthidae	105	<i>Genicanthus caudovittatus</i>				*	*		
		106	<i>Pomacanthus imperator</i>				*	*		
		107	<i>Pomacanthus maculosus</i>				*	*		
		108	<i>Pygoplites diacanthus</i>				*	*		
40	Pomacentridae	109	<i>Abudefduf saxatilis</i>	*	*		*	*		
		110	<i>A. sexfasciatus</i>				*	*		

Table 14.1.2-5 List of Fish Fauna in South Sinal Protected Areas (3/4)

No	Family	No	Species	Seasons				Localities		
				S	A	W	S	RM.	N	AG
		111	<i>A. sordidus</i>				*	*		
		112	<i>Amphiprion bicinctus</i>				*	*		
		113	<i>Amblyglyphidodon flavilatus</i>				*	*		
		114	<i>Chormis dimidiata</i>				*	*		
		115	<i>Dascyllus aruanus</i>				*	*		
		116	<i>D. trimaculatus</i>				*	*		
		117	<i>Paraglyphidodon melas</i>			*	*	*		
		118	<i>Plectroglyphidodon leucozona</i>	*			*	*		
		119	<i>Pomacentrus albicaudatus</i>				*	*		
		120	<i>P. aquilus</i>			*	*	*		
		121	<i>P. sulfureus</i>				*	*		
41	Priacanthidae	122	<i>Priacanthus hamrur</i>			*	*	*		
		123	<i>P. aereus</i>				*	*		
42	Psettodidae	124	<i>Psettodes erumei</i>				*	*		
43	Pseudochromidae	125	<i>Pseudochromis fridmani</i>				*	*	*	
		126	<i>Hipposcarus harid</i>	*	*		*	*		
		127	<i>Scarus cyanescens</i>				*	*	*	
		128	<i>S. frenatus</i>	*			*	*	*	*
		129	<i>S. ferrugineus</i>				*	*		
		130	<i>S. genazonatus</i>		*		*	*	*	*
		131	<i>S. ghoabban</i>	*		*	*	*	*	*
		132	<i>S. gibbus</i>				*	*	*	
		133	<i>S. psitacus</i>	*	*		*	*		
		134	<i>S. russelii</i>			*	*	*		
44	Scorpaenidae	135	<i>Dendrochirus brachypterus</i>			*	*	*		
		136	<i>Preroidis radiata</i>			*	*	*		
		137	<i>P. volitans</i>	*	*	*	*	*	*	
		138	<i>Scorpaenopsis diabolis</i>			*	*	*		
		139	<i>Synanceia verrucosa</i>			*	*	*		
45	Serranidae	140	<i>Anthias squamipinnis</i>			*	*	*	*	*
		141	<i>A. teaniatus</i>			*	*	*	*	*
		142	<i>Cephalopholis argus</i>	*	*	*	*	*	*	
		143	<i>C. haemistiktos</i>	*		*	*	*	*	
		144	<i>C. miniata</i>	*		*	*	*	*	*
		145	<i>C. oligosticta</i>	*		*	*	*	*	
		146	<i>C. rogae</i>	*		*	*	*	*	
		147	<i>C. sixmaculata</i>			*	*	*	*	
		148	<i>Epinephelus areolaatus</i>		*		*	*	*	
		149	<i>E. chlorostigma</i>			*	*	*	*	
		150	<i>E. fasciatus</i>	*		*	*	*	*	*
		151	<i>E. fuaacoguttatus</i>			*	*	*	*	
		152	<i>E. hexagonnatus</i>	*			*	*	*	
		153	<i>E. microdon</i>	*		*	*	*	*	*
		154	<i>E. summana</i>			*	*	*	*	
		155	<i>E. tauvina</i>	*	*	*	*	*	*	*
		156	<i>Plectropomus truncatus</i>			*	*	*	*	*
		157	<i>Variola louti</i>	*		*	*	*	*	*
47	Siganidae	158	<i>Siganus argenteus</i>	*			*	*	*	*
		159	<i>S. luridus</i>	*	*	*	*	*	*	*
		160	<i>S. rivulatus</i>			*	*	*	*	*
		161	<i>S. stellatus</i>			*	*	*	*	*
48	Soleidae	162	<i>Pardachirus marmoratus</i>			*	*	*	*	
49	Sparidae	163	<i>Acanthopagurus bifasciatus</i>	*	*	*	*	*	*	
		164	<i>Argyrops spinifer</i>			*	*	*	*	
		165	<i>Diplodus noct</i>				*	*	*	

Table 14.1.2-5 List of Fish Fauna in South Sinai Protected Areas (4/4)

No	Family	No	Species	Seasons				Localities		
				S	A	W	S	RM.	N	AG
		166	<i>D. sargus</i>			*		*		
		167	<i>pagellus affinis</i>		*			*		
		168	<i>Pterogymnus laniarins</i>	*				*		
		169	<i>Rhabdosargus haffara</i>		*			*	*	
		170	<i>R. sarba</i>	*		*		*		
50	Sphyraenidae	171	<i>Sphyraena barracuda</i>	*			*	*		
		172	<i>S. forsteri</i>		*			*		
51	Syngnathidae	173	<i>Trachyrhamphus bicoarctatus</i>				*	*	*	
52	Synodontidae	174	<i>Saurida undosquamis</i>				*	*		
		175	<i>Synodus varigatus</i>			*		*		
53	Teraponidae	176	<i>Terrapon jerbua</i>	*	*			*		
54	Tetraodontidae	177	<i>Arothron diadematus</i>		*		*	*		
		178	<i>A. hispidus</i>		*			*	*	
		179	<i>A. stellatus</i>				*	*		
55	batrachoididae	180	<i>Batrachus sp</i>				*	*		*

Source: Fish of AQABA Bay (Red Sea) Final Report July, 1995  
 Egyptian Environment Affairs Agency

Table 14.1.2-6 List of Corals of Gulf of AQABA

No	Class	Family	Name	R.M.	Nabq	Ab.G.
1	Hydrozoa	Milleporidae	Millepora dichotoma	*		
2	"	"	M. exaesa	*	*	*
3	Alcyonaria	Tubiporidae	Tubipora musica		*	
4	Zoantharia	Astrocoeniidae	Stylocoeniella armata		*	
5	"	"	S. guentheri Basset-Smith	*	*	
6	"	Pocilloporidae	Pocillopora damicornis		*	*
7	"	"	P. verrucosa		*	
8	"	"	S. hystrix Dana	*	*	*
9	"	"	Stylophora mammillata Scheer & Pillai	*		
10	"	"	S. pistillata	*	*	*
11	"	Acroporidae	Astreopora myriophthalma			*
12	"	"	A. explanata	*	*	
13	"	"	Acropora granulosa		*	
14	"	"	A. digitifera		*	
15	"	"	M. danae	*	*	*
16	"	"	M. informis Bernard			
17	"	"	M. monasteriata	*		
18	"	"	M. verrucosa			*
19	"	Agariciidae	P. decussata		*	*
20	"	"	P. varians	*	*	
21	"	"	L. yabei		*	*
22	"	"	Gardineroseris planulata	*		
23	"	"	Pachyseris speciosa	*		*
24	"	Siderastreidae	Coscinaraea monile	*		
25	"	Fungidae	Ctenactis echinata	*		
26	"	"	Podabacia crustacea	*		
27	"	Poritidae	Alveopora sp.			*
28	"	"	Goniopora sp.	*		
29	"	"	Porites compressa Dana		*	*
30	"	"	P. lobata Dana		*	
31	"	"	P. lutea Edward & Haime		*	
32	"	Faviidae	favia stelligera	*		
33	"	"	Favites abdita		*	*
34	"	"	F. flexuosa	*		*
35	"	"	F. halicora			*
36	"	"	F. peresi Faure & Pichon	*		
37	"	"	Goniastrea retiformis		*	
38	"	"	Platygyra sinensis		*	
39	"	"	Leptostrea purpurea			*
40	"	"	Cyphastrea microphthalma	*	*	*
41	"	"	Echinopora gemmacea	*	*	*
42	"	"	E. fruticulosa			*
43	"	Oculinidae	Galaxea fascicularis	*		*
44	"	Merulinidae	Hydnophora exesa	*		*
45	"	"	H. microconon	*		*
46	"	Mussidae	Acanthastrea echinata			*
47	"	"	Blastomussa merleti			*
48	"	"	Lobophyllia corymbosa	*		*
49	"	"	L. hemprichi	*	*	*
50	"	Pectiniidae	Echinophyllia aspera	*		*
51	"	"	Mycediuni elephantotus	*		*
52	"	"	Oxypora lacera	*		*
53	"	Caryophylliidae	Plerogyra sinuosa			*
54	"	"	Gyrosmilium interrupta			*
55	"	Dendrophylliidae	Tubastrea coccinea			*
56	"	"	Turbinaria mesenterina		*	*
Total				32	27	33

Source: Corals of Aqaba Bay (Red Sea) Final Report July, 1995  
Egyptian Environmental Affairs Agency

**Table 14.3.2-1 (1) Checklist of IEE (Groundwater Development) for (Plan --1)**

No	Environmental Item	Description	Evaluation	Reasons
<b>A. Social Environment</b>				
(1)	Resettlement	Resettlement by land occupation (transfer of rights of residence, land ownership)	C	Most of development plan is proposed in non-residential areas. Therefore, forced displacement of inhabitants by land acquisition is not needed.
(2)	Economic Activities	Loss of production base (land, etc.) and change of economic structure	C	Economic activities are prompted. Especially, agricultural outputs will increase by supply of irrigation water. Tourism will be also developed by increase of water supply.
(3)	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	C	No wells are proposed in public facilities. Pipelines are buried structure.
(4)	Split of Communities	Separation of regional communities by hindrance of regional traffic	C	Most of development plan is carried out in non-residential areas. Also, pipelines are buried structure.
(5)	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	C	No development plan is proposed in the area of cultural property.
(6)	Water Rights and Rights of Common	Obstruction of fishing rights, irrigation and water rights	C	No overdraft that causes lowering of groundwater is proposed. However, development of wells in Bedouin community should be carried out considering the location of existing wells.
(7)	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects	C	Public health condition will be improved by water supply. Especially, improvement of public health condition in Bedouin community is expected, because much of the well water, particularly shallow well water is unsuitable for human consumption.
(8)	Waste	Generation of construction waste, surplus soils, sludge, domestic waste, etc.	C	Generation of construction wastes is small. However, increase in domestic and other human wastes will occur due to population increase by development.
(9)	Hazard (Risk)	Increase in risk of cave-ins, ground failure and accidents	C	There is no facilities plan that causes hazard and risk.
<b>B. Natural Environment</b>				
(10)	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	C	Large-scale reclamation works are not needed; therefore, the changes of topography and geology are small.
(11)	Soil Erosion	Topsoil erosion by rainfall after land reclamation or deforestation	C	Large-scale reclamation works are not needed; therefore soil erosion do not occur.
(12)	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	C	Development aquifer bears a vast water volume.
(13)	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	C	There's no natural protected zone along the coastal line.
(14)	Coastal Zone	Coastal erosion and sedimentation due to change of littoral drift and reclamation	C	No development plan is proposed in coastal zone.
(15)	Fauna and Flora	Interruption of reproduction or extinction of species due to change of habit condition	C	No valuable species of fauna and flora inhabit in development areas.
(16)	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation and construction	C	Large-scale reclamation works are not needed, therefore meteorology in development areas is not affected.
(17)	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	C	Location of pressure reduce tanks in Wadi Watir should be selected considering the conservation of landscape because this section is blessed with superior landscape.
<b>C. Pollution</b>				
(18)	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. Also, there is not facilities plan that generates toxic gas.
(19)	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	C	Construction scale is relatively small against the project and there's no natural protected zone along coastal line.
(20)	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	C	Soil contamination against agricultural lands will occur by utilization of agrochemical, if continuous application of agrochemical with high residual toxicity or excessive use of agrochemical is conducted.
(21)	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	C	Most of drillings and operation of pumping machines are conducted in non-inhabitant area. Pumping machines in Bedouin community consist of small-scale size; and noise and vibration of machine is also small.
(22)	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	C	Exploitation of groundwater will be conducted under suitable management. Therefore, land subsidence by excessive exploitation of groundwater will not occur.
(23)	Offensive Odor	Generation of offensive odor and exhaust gases	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. There are not facilities that generate offensive odor.

Evaluation; A: Serious impact, B: Some impact, C: Very small impact

**Table 14.3.2-1 (2) Checklist of IEE (Groundwater Development) for (Plan 2)**

No	Environmental Item	Description	Evaluation	Reasons
<b>A. Social Environment</b>				
(1)	Resettlement	Resettlement by land occupation (transfer of rights of residence, land ownership)	C	Most of development plan is proposed in non-residential areas. Therefore, forced displacement of inhabitants by land acquisition is not needed.
(2)	Economic Activities	Loss of production base (land, etc.) and change of economic structure	C	Economic activities are prompted. Especially, agricultural outputs will increase by supply of irrigation water. Tourism will be also developed by increase of water supply.
(3)	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	C	No wells are proposed in public facilities. Pipelines are buried structure.
(4)	Split of Communities	Separation of regional communities by hindrance of regional traffic	C	Most of development plan is carried out in non-residential areas. Also, pipelines are buried structure.
(5)	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	C	No development plan is proposed in the area of cultural property.
(6)	Water Rights and Rights of Common	Obstruction of fishing rights, irrigation and water rights	C	No overdraft that causes lowering of groundwater is proposed. However, development of wells in Bedouin community should be carried out considering the location of existing wells.
(7)	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects	C	Public health condition will be improved by water supply. Especially, improvement of public health condition in Bedouin community is expected, because much of the well water, particularly shallow well water is unsuitable for human consumption.
(8)	Waste	Generation of construction waste, surplus soils, sludge, domestic waste, etc.	C	Generation of construction wastes is small. However, increase in domestic and other human wastes will occur due to population increase by development.
(9)	Hazard (Risk)	Increase in risk of cave-ins, ground failure and accidents	C	There is no facilities plan that causes hazard and risk.
<b>B. Natural Environment</b>				
(10)	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	C	Large-scale reclamation works are not needed; therefore, the changes of topography and geology are small.
(11)	Soil Erosion	Topsoil erosion by rainfall after land reclamation or deforestation	C	Large-scale reclamation works are not needed, therefore soil erosion do not occur.
(12)	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	C	Development aquifer bears a vast water volume.
(13)	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	B	Increase of water consumption leads to increase of wastewater. Increase of wastewater is expected to have impact against water quality of sea.
(14)	Coastal Zone	Coastal erosion and sedimentation due to change of littoral drift and reclamation	C	No development plan is proposed in coastal zone.
(15)	Fauna and Flora	Interruption of reproduction or extinction of species due to change of habit condition	C	No valuable species of fauna and flora inhabit in development areas.
(16)	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation and construction	C	Large-scale reclamation works are not needed, therefore meteorology in development areas is not affected.
(17)	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	B	Location of pressure reduce tanks in Wadi Watir should be selected considering the conservation of landscape because this section is blessed with superior landscape.
<b>C. Pollution</b>				
(18)	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. Also, there is not facilities plan that generates toxic gas.
(19)	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	C	Construction scale is relatively small against the project.
(20)	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	C	Soil contamination against agricultural lands will occur by utilization of agrochemical, if continuous application of agrochemical with high residual toxicity or excessive use of agrochemical is conducted.
(21)	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	C	Most of drillings and operation of pumping machines are conducted in non-inhabitant area. Pumping machines in Bedouin community consist of small-scale size; and noise and vibration of machine is also small.
(22)	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	C	Exploitation of groundwater will be conducted under suitable management. Therefore, land subsidence by excessive exploitation of groundwater will not occur.
(23)	Offensive Odor	Generation of offensive odor and exhaust gases	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. There are not facilities that generate offensive odor.

Evaluation; A: Serious impact, B: Some impact, C: Very small impact

**Table 14.3.2-1 (3) Checklist of IEE (Groundwater Development) for (Plan 3)**

No	Environmental Item	Description	Evaluation	Reasons
<b>A. Social Environment</b>				
(1)	Resettlement	Resettlement by land occupation (transfer of rights of residence, land ownership)	C	Most of development plan is proposed in non-residential areas. Therefore, forced displacement of inhabitants by land acquisition is not needed.
(2)	Economic Activities	Loss of production base (land, etc.) and change of economic structure	C	Economic activities are promoted. Especially, agricultural outputs will increase by supply of irrigation water. Tourism will be also developed by increase of water supply.
(3)	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	C	No wells are proposed in public facilities. Pipelines are buried structure.
(4)	Split of Communities	Separation of regional communities by hindrance of regional traffic	C	Most of development plan is carried out in non-residential areas. Also, pipelines are buried structure.
(5)	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	C	No development plan is proposed in the area of cultural property.
(6)	Water Rights and Rights of Common	Obstruction of fishing rights, irrigation and water rights	C	No overdraft that causes lowering of groundwater is proposed. However, development of wells in Bedouin community should be carried out considering the location of existing wells.
(7)	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects	C	Public health condition will be improved by water supply. Especially, improvement of public health condition in Bedouin community is expected, because much of the well water, particularly shallow well water is unsuitable for human consumption.
(8)	Waste	Generation of construction waste, surplus soils, sludge, domestic waste, etc.	C	Generation of construction wastes is small. However, increase in domestic and other human wastes will occur due to population increase by development.
(9)	Hazard (Risk)	Increase in risk of cave-ins, ground failure and accidents	C	There is no facilities plan that causes hazard and risk.
<b>B. Natural Environment</b>				
(10)	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	C	Large-scale reclamation works are not needed; therefore, the changes of topography and geology are small.
(11)	Soil Erosion	Topsoil erosion by rainfall after land reclamation or deforestation	C	Large-scale reclamation works are not needed; therefore soil erosion do not occur.
(12)	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	B	Development of wells in Bedouin community should be carried out considering the effects against existing wells such as lowering of groundwater table.
(13)	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	C	Construction scale is relatively small against the project and there's no natural protected zone along coastal line.
(14)	Coastal Zone	Coastal erosion and sedimentation due to change of littoral drift and reclamation	C	No development plan is proposed in coastal zone.
(15)	Fauna and Flora	Interruption of reproduction or extinction of species due to change of habit condition	C	No valuable species of fauna and flora inhabit in development areas.
(16)	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation and construction	C	Large-scale reclamation works are not needed, therefore meteorology in development areas is not affected.
(17)	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	B	Location of pressure reduce tanks in Wadi Watir should be selected considering the conservation of landscape because this section is blessed with superior landscape.
<b>C. Pollution</b>				
(18)	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. Also, there is not facilities plan that generates toxic gas.
(19)	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	C	
(20)	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	C	Soil contamination against agricultural lands will occur by utilization of agrochemical, if continuous application of agrochemical with high residual toxicity or excessive use of agrochemical is conducted.
(21)	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	C	Most of drillings and operation of pumping machines are conducted in non-inhabitant area. Pumping machines in Bedouin community consist of small-scale size; and noise and vibration of machine is also small.
(22)	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	C	Exploitation of groundwater will be conducted under suitable management. Therefore, land subsidence by excessive exploitation of groundwater will not occur.
(23)	Offensive Odor	Generation of offensive odor and exhaust gases	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. There are not facilities that generate offensive odor.

Evaluation; A: Serious impact, B: Some impact, C: Very small impact



**Table 14.3.2-1(4) Checklist of IEE (Groundwater Development) for (Plan 4)**

No	Environmental Item	Description	Evaluation	Reasons
<b>A. Social Environment</b>				
(1)	Resettlement	Resettlement by land occupation (transfer of rights of residence, land ownership)	C	Most of development plan is proposed in non-residential areas. Therefore, forced displacement of inhabitants by land acquisition is not needed.
(2)	Economic Activities	Loss of production base (land, etc.) and change of economic structure	C	Economic activities are prompted. Especially, agricultural outputs will increase by supply of irrigation water. Tourism will be also developed by increase of water supply.
(3)	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	C	No wells are proposed in public facilities. Pipelines are buried structure.
(4)	Split of Communities	Separation of regional communities by hindrance of regional traffic	C	Most of development plan is carried out in non-residential areas. Also, pipelines are buried structure.
(5)	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	C	No development plan is proposed in the area of cultural property.
(6)	Water Rights and Rights of Common	Obstruction of fishing rights, irrigation and water rights	C	No overdraft that causes lowering of groundwater is proposed. However, development of wells in Bedouin community should be carried out considering the location of existing wells.
(7)	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects	C	Public health condition will be improved by water supply. Especially, improvement of public health condition in Bedouin community is expected, because much of the well water, particularly shallow well water is unsuitable for human consumption.
(8)	Waste	Generation of construction waste, surplus soils, sludge, domestic waste, etc.	C	Generation of construction wastes is small. However, increase in domestic and other human wastes will occur due to population increase by development.
(9)	Hazard (Risk)	Increase in risk of cave-ins, ground failure and accidents	C	There is no facilities plan that causes hazard and risk.
<b>B. Natural Environment</b>				
(10)	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	C	Large-scale reclamation works are not needed; therefore, the changes of topography and geology are small.
(11)	Soil Erosion	Topsoil erosion by rainfall after land reclamation or deforestation	C	Large-scale reclamation works are not needed; therefore soil erosion do not occur.
(12)	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	C	Development aquifer bears a vast water volume.
(13)	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	B	Increase of water consumption leads to increase of wastewater. Increase of wastewater is expected to have impact against water quality of sea.
(14)	Coastal Zone	Coastal erosion and sedimentation due to change of littoral drift and reclamation	C	No development plan is proposed in coastal zone.
(15)	Fauna and Flora	Interruption of reproduction or extinction of species due to change of habit condition	C	No valuable species of fauna and flora inhabit in development areas.
(16)	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation and construction	C	Large-scale reclamation works are not needed, therefore meteorology in development areas is not affected.
(17)	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	B	Location of pressure reduce tanks in Wadi Watir should be selected considering the conservation of landscape because this section is blessed with superior landscape.
<b>C. Pollution</b>				
(18)	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. Also, there is not facilities plan that generates toxic gas.
(19)	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	B	Drillings have possibility that occur water pollution. Especially, drillings in Bedouin community should be conducted considering effect against existing wells.
(20)	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	C	Soil contamination against agricultural lands will occur by utilization of agrochemical, if continuous application of agrochemical with high residual toxicity or excessive use of agrochemical is conducted.
(21)	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	C	Most of drillings and operation of pumping machines are conducted in non-inhabitant area. Pumping machines in Bedouin community consist of small-scale size; and noise and vibration of machine is also small.
(22)	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	C	Exploitation of groundwater will be conducted under suitable management. Therefore, land subsidence by excessive exploitation of groundwater will not occur.
(23)	Offensive Odor	Generation of offensive odor and exhaust gases	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. There are not facilities that generate offensive odor.

Evaluation; A: Serious impact, B: Some impact, C: Very small impact

**Table 14.3.2-1(5) Checklist of IEE (Groundwater Development) for (Plan 5)**

No	Environmental Item	Description	Evaluation	Reasons
<b>A. Social Environment</b>				
(1)	Resettlement	Resettlement by land occupation (transfer of rights of residence, land ownership)	C	Most of development plan is proposed in non-residential areas. Therefore, forced displacement of inhabitants by land acquisition is not needed.
(2)	Economic Activities	Loss of production base (land, etc.) and change of economic structure	C	Economic activities are prompted. Especially, agricultural outputs will increase by supply of irrigation water. Tourism will be also developed by increase of water supply.
(3)	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	C	No wells are proposed in public facilities. Pipelines are buried structure.
(4)	Split of Communities	Separation of regional communities by hindrance of regional traffic	C	Most of development plan is carried out in non-residential areas. Also, pipelines are buried structure.
(5)	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	C	No development plan is proposed in the area of cultural property.
(6)	Water Rights and Rights of Common	Obstruction of fishing rights, irrigation and water rights	C	No overdraft that causes lowering of groundwater is proposed. However, development of wells in Bedouin community should be carried out considering the location of existing wells.
(7)	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects	C	Public health condition will be improved by water supply. Especially, improvement of public health condition in Bedouin community is expected, because much of the well water, particularly shallow well water is unsuitable for human consumption.
(8)	Waste	Generation of construction waste, surplus soils, sludge, domestic waste, etc.	C	Generation of construction wastes is small. However, increase in domestic and other human wastes will occur due to population increase by development.
(9)	Hazard (Risk)	Increase in risk of cave-ins, ground failure and accidents	C	There is no facilities plan that causes hazard and risk.
<b>B. Natural Environment</b>				
(10)	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	C	Large-scale reclamation works are not needed; therefore, the changes of topography and geology are small.
(11)	Soil Erosion	Topsoil erosion by rainfall after land reclamation or deforestation	C	Large-scale reclamation works are not needed; therefore soil erosion do not occur.
(12)	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	B	Development of wells in Bedouin community should be carried out considering the effects against existing wells such as lowering of groundwater table.
(13)	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	C	Development aquifer bears a vast water volume.
(14)	Coastal Zone	Coastal erosion and sedimentation due to change of littoral drift and reclamation	C	No development plan is proposed in coastal zone.
(15)	Fauna and Flora	Interruption of reproduction or extinction of species due to change of habit condition	C	No valuable species of fauna and flora inhabit in development areas.
(16)	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation and construction	C	Large-scale reclamation works are not needed, therefore meteorology in development areas is not affected.
(17)	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	B	Location of pressure reduce tanks in Wadi Watir should be selected considering the conservation of landscape because this section is blessed with superior landscape.
<b>C. Pollution</b>				
(18)	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. Also, there is not facilities plan that generates toxic gas.
(19)	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	B	Drillings have possibility that occur water pollution. Especially, drillings in Bedouin community should be conducted considering effect against existing wells.
(20)	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	C	Soil contamination against agricultural lands will occur by utilization of agrochemical, if continuous application of agrochemical with high residual toxicity or excessive use of agrochemical is conducted.
(21)	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	C	Most of drillings and operation of pumping machines are conducted in non-inhabitant area. Pumping machines in Bedouin community consist of small-scale size; and noise and vibration of machine is also small.
(22)	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	C	Exploitation of groundwater will be conducted under suitable management. Therefore, land subsidence by excessive exploitation of groundwater will not occur.
(23)	Offensive Odor	Generation of offensive odor and exhaust gases	C	Exhaust gas by drilling machines under construction will generate, however the period of construction is limited. There are not facilities that generate offensive odor.

Evaluation; A: Serious impact, B: Some impact, C: Very small impact

Table 14.3.2-2 Environmental Impact and the Countermeasures

Environmental Item	Causes of Impacts	Case in Study Area	Possible Environmental Impacts	Useful Factors for Evaluation	Countermeasures
(12) Groundwater	1. Overdraft in the operation	1. Wells for irrigation in Plan 4A, 4B and 4C 2. Wells in Bedouin community of Plan 5	1. Lowering of the groundwater table of existing wells 2. Exhaustion of wells which may affect the groundwater use in the area	1. Existence of existing wells 2. Shallow wells tend to receive serious impacts. 3. Lowering of the groundwater table of existing wells 4. Utilization of a large quantity of groundwater for irrigation	1. Restriction of irrigation water 2. Groundwater utilization plan (water for living use should be given priority) 3. Implementation of monitoring (periodic observation of groundwater table)
(13) Hydrological Situation	1. Increase of domestic wastewater by increase of water consumption	1. Wastewater in Ras Sudr, Abu Zenima and Abu Rudeis of Plan 1 2. Wastewater in Nuweiba and Dahab of Plan 2 3. Wastewater in El Tur of Plan 3	1. Deterioration of water quality caused by the increase of the domestic wastewater	1. Existing capacity of wastewater treatment facilities 2. Water quality in sea (Aqaba Bay, Suez Bay) has a recent tendency to lower.	1. Improvement of wastewater treatment facilities 2. Implementation of monitoring (periodic water quality survey)
(17) Landscape	1. Construction of facility in area with superior landscape 2. Implementation of reclamation works	1. The route of Wadi Watir in Plan 2	1. Deterioration of aesthetic harmony by structure 2. Topographic changes by reclamation	1. Existence of area with superior landscape	1. Review of location of facilities 2. Harmony between facilities and landscape (Design, Color, etc)
(19) Water Pollution	1. Disturbance of ground layer by drilling and the use of muddy water 2. Lowering of groundwater table caused by overdraft	1. Wells in Bedouin community of Plan 5	1. Groundwater pollution caused by the construction of wells (drilling) would affect the utilization of groundwater 2. Deterioration of water quality caused by the lowering of the groundwater table in operation	1. Shallow wells may be affected by water pollution. 2. Lowering of groundwater table is observed. 3. Utilization of a large quantity of groundwater for irrigation	1. Restriction of overdraft 2. Groundwater utilization plan 3. Improvement of sewage treatment facilities 4. Implementation of monitoring (periodic water quality survey)

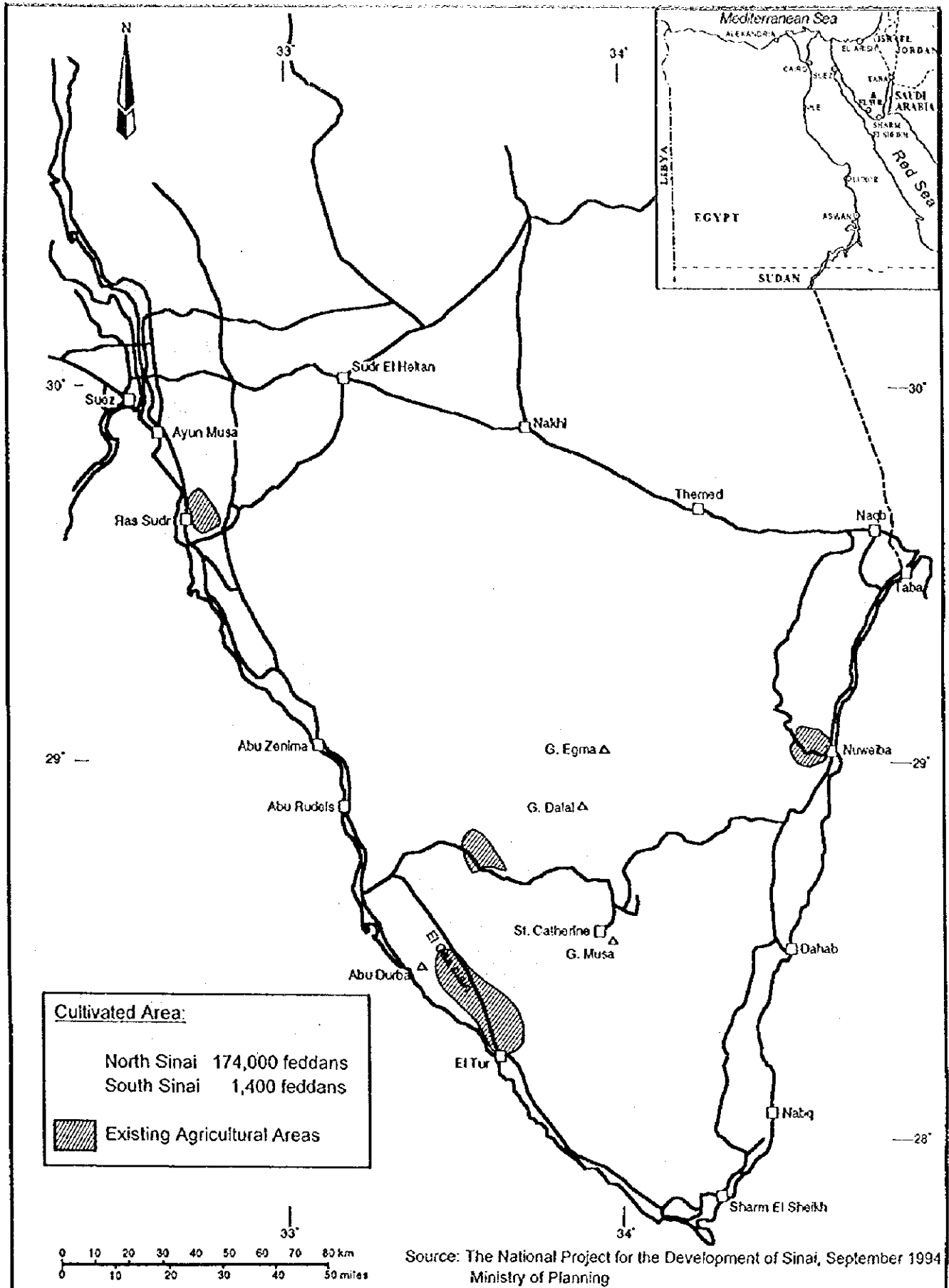


Fig. 14.1.1-1 Existing Agricultural Areas in South Sinai

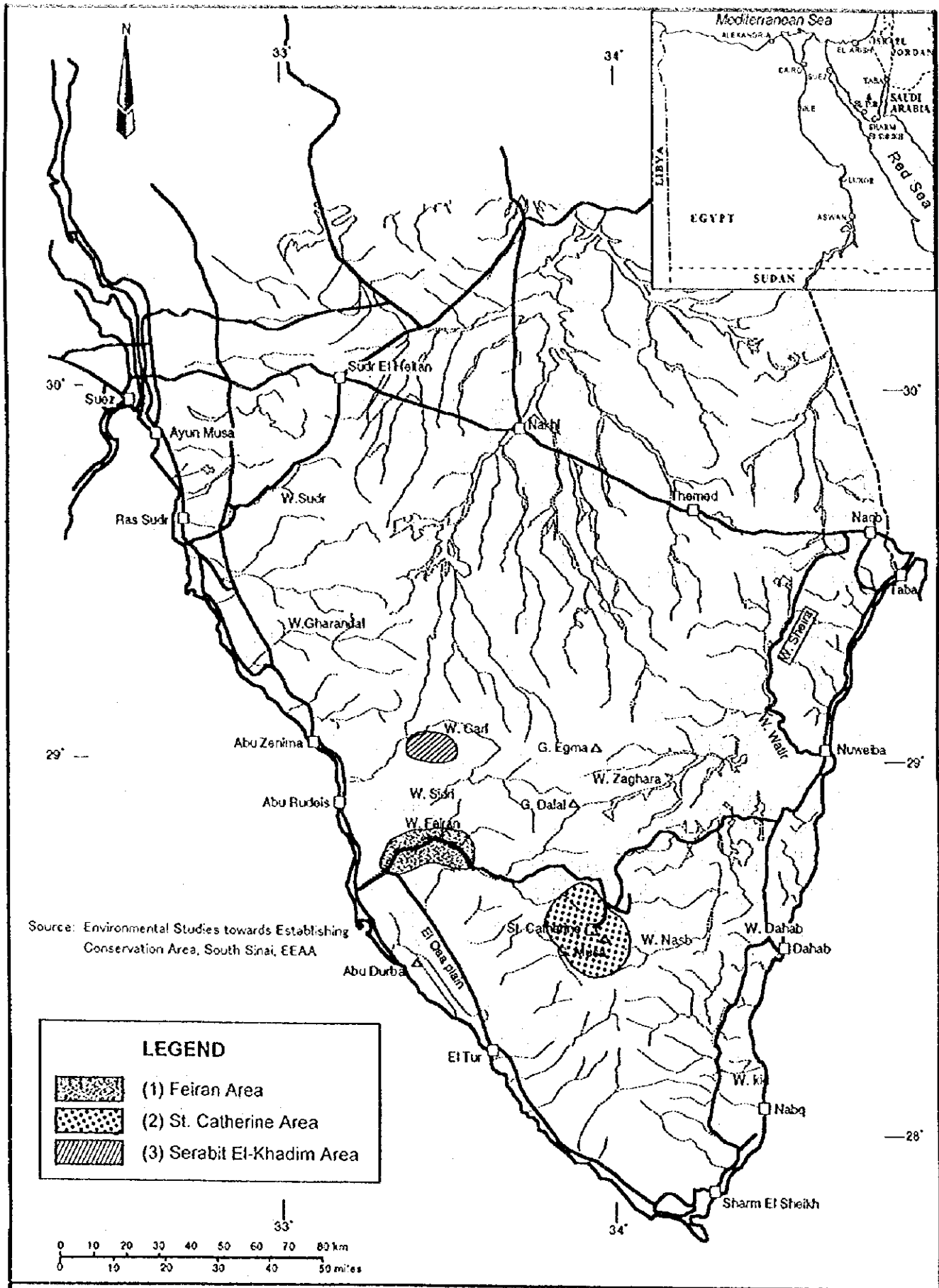
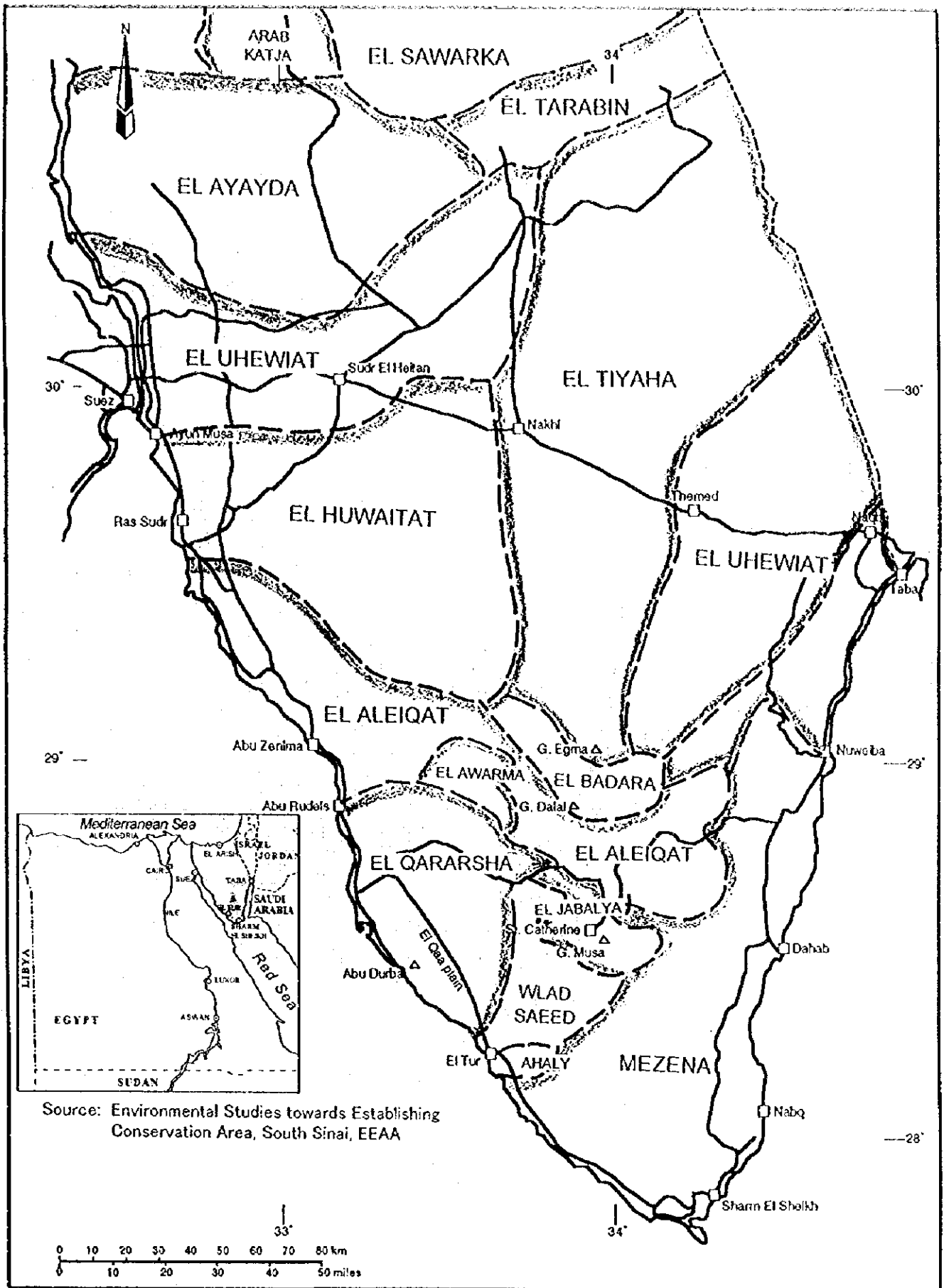


Fig. 14.1.1-2 Location of Cultural Properties and Ruins

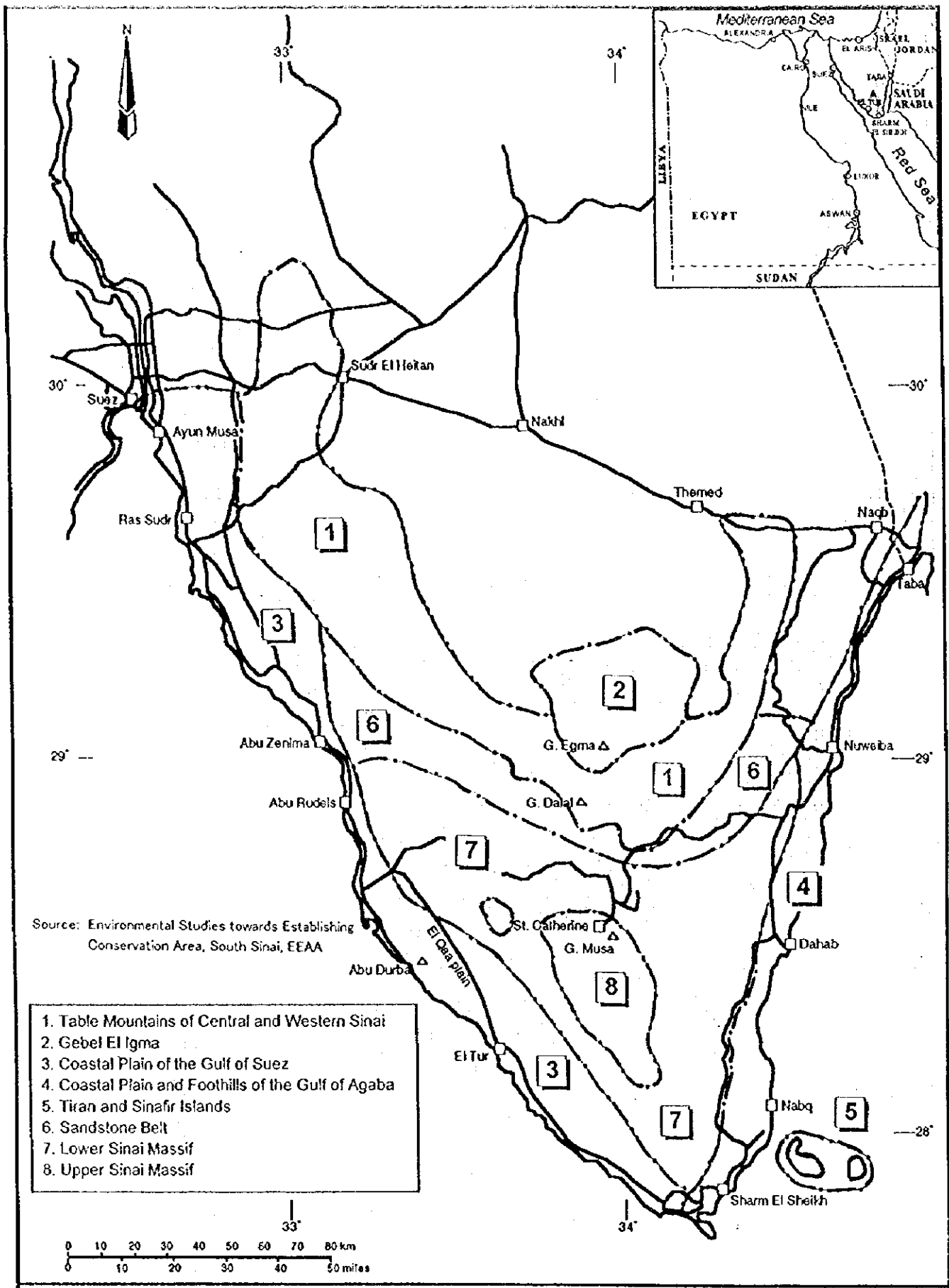


Source: Environmental Studies towards Establishing Conservation Area, South Sinai, EEA

Fig. 14.1.1-3 Distribution of Tribes in South Sinai

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT

JICA



Source: Environmental Studies towards Establishing Conservation Area, South Sinai, EEA

- 1. Table Mountains of Central and Western Sinai
- 2. Gebel El Igma
- 3. Coastal Plain of the Gulf of Suez
- 4. Coastal Plain and Foothills of the Gulf of Agaba
- 5. Tiran and Sinafir Islands
- 6. Sandstone Belt
- 7. Lower Sinai Massif
- 8. Upper Sinai Massif

Fig. 14.1.2-1 Geomorphological Districts in South Sinai

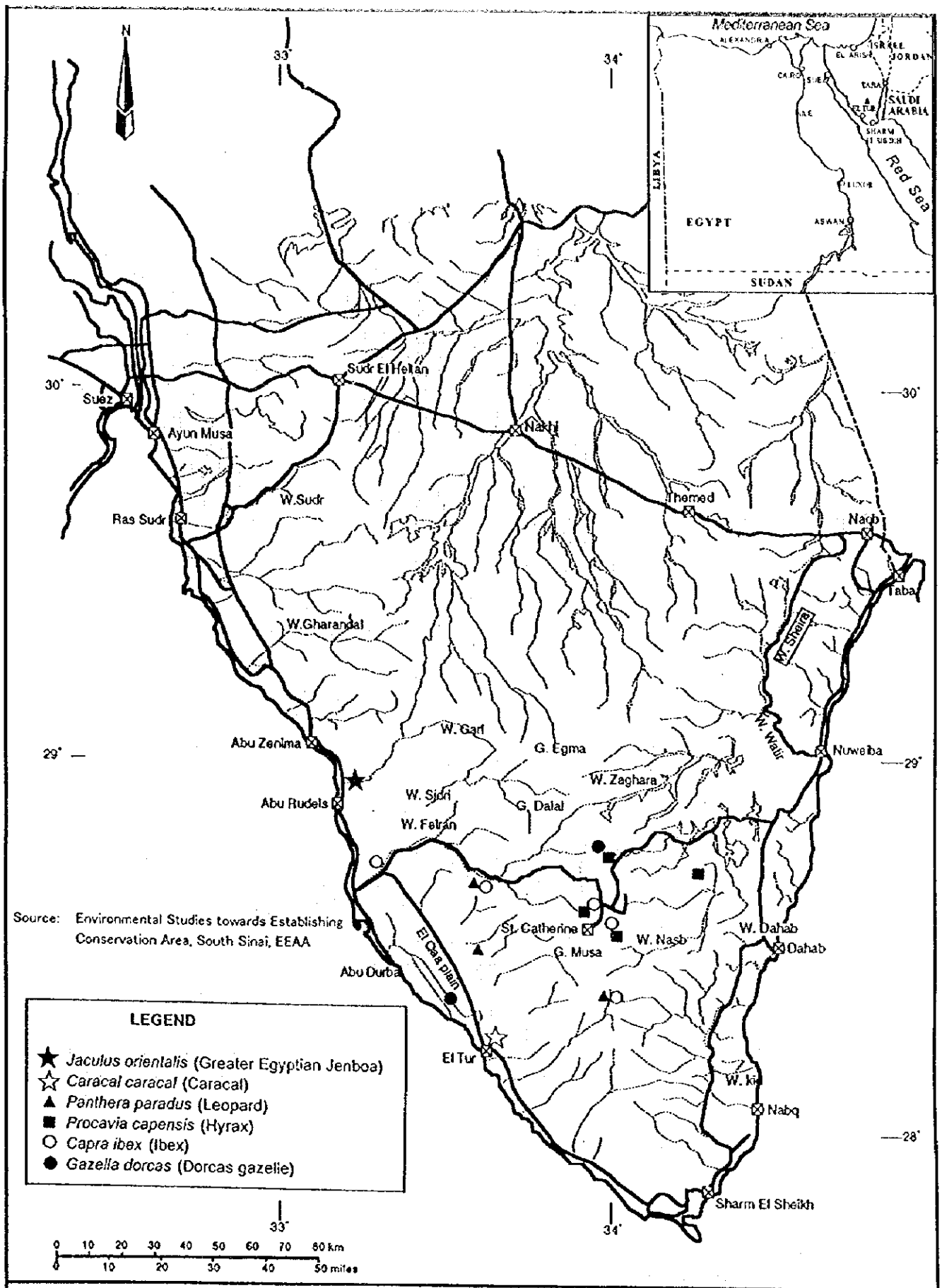


Fig. 14.1.2-2 Distribution of Vulnerable and Endangered Species of Mammals

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT

JICA



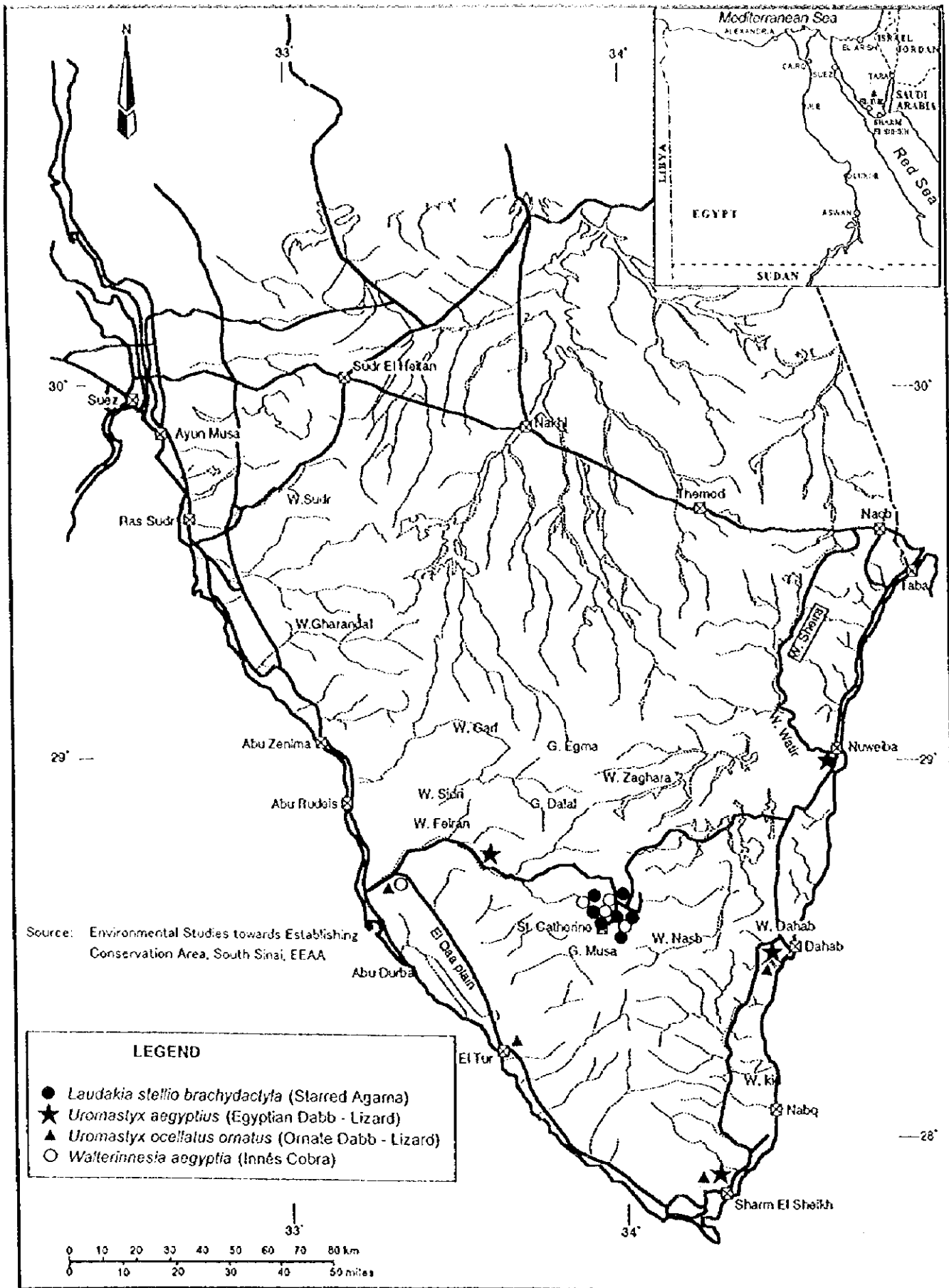


Fig. 14.1.2-3 Distribution of Vulnerable and Endangered Species of Reptilas

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT

JICA

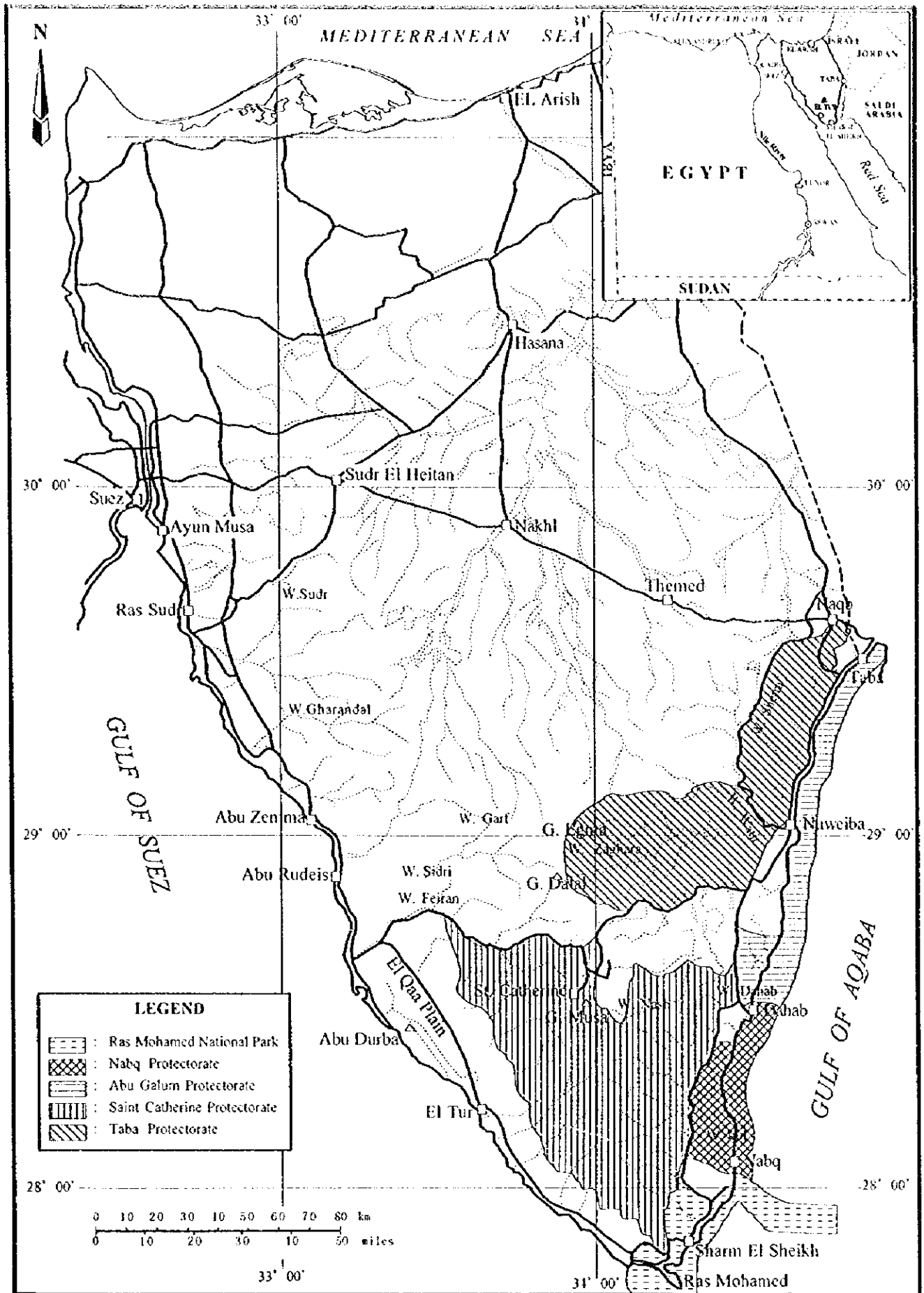
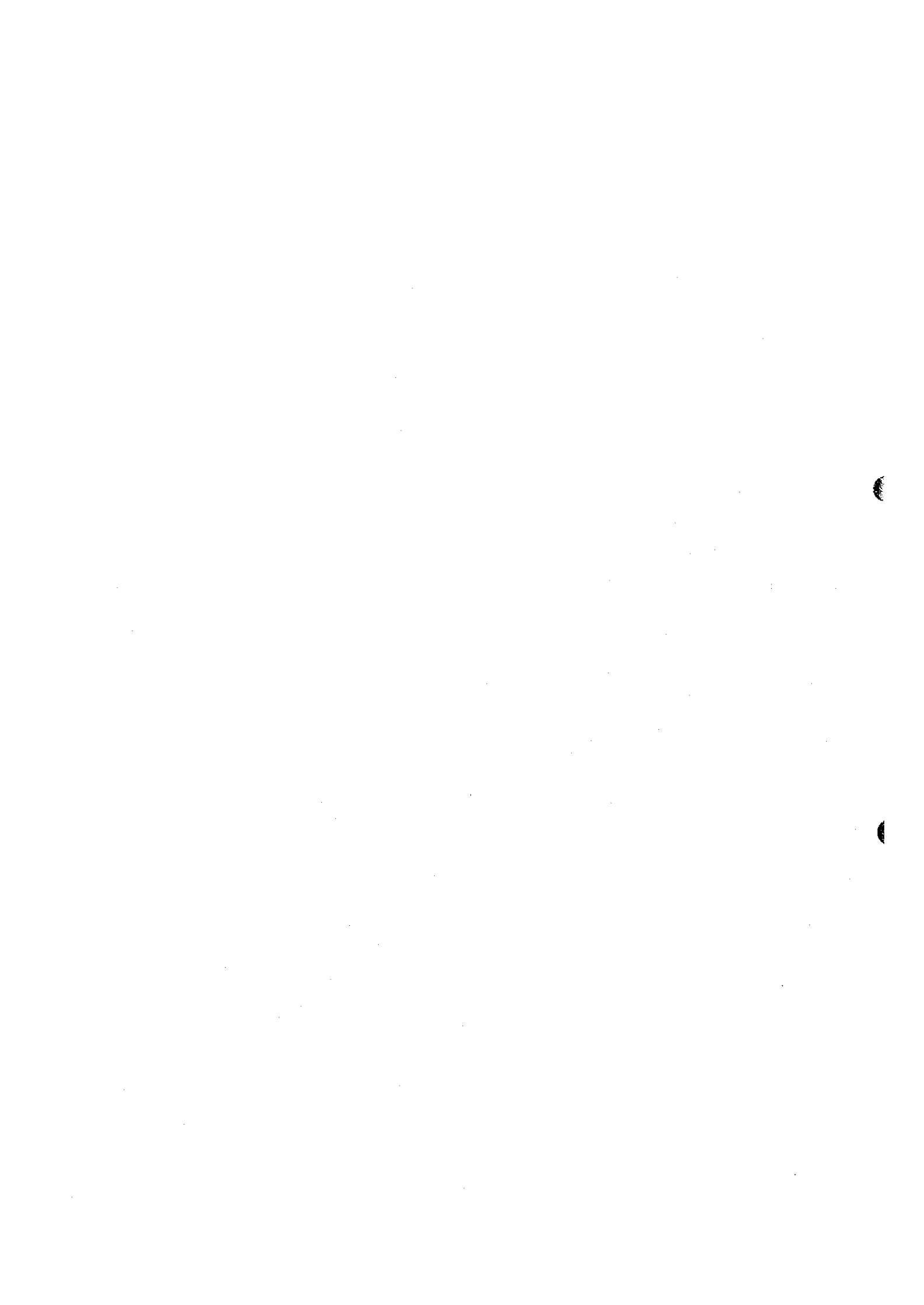


Fig. 14.2.3-1 The Protected Areas in South Sinai



## CHAPTER XV SOCIO-ECONOMIC ASPECTS

### 15.1 Administration

Egypt administratively consists of 26 Governorates, which are classified into four geographical parts, namely, four Urban Governorates, nine Lower Governorates, eight Upper Governorates and five Frontier Governorates. Cairo City, the capital city of Egypt, is located in Cairo Governorate in the Urban Governorates. South Sinai Governorate, the project area of the current study, is one of the Frontier Governorates.

According to the law of local government system (the Law No. 57 for 1975), there are three types of local government units (LGUs) in the country. They are: the governorate, the city (or called in the law as district, town or quarter), and the village in order of governmental power. These LGUs are established in the following way: a governorate is by a decree of the President of the Republic; a city is by a decree of the Prime Minister; and a village is by a decree of the governor. As of the 1986 census year, there were 26 governorates, 191 cities, and 4,310 villages in Egypt.

In South Sinai Governorate, there are eight cities, as shown in the below table. Among them, El Tur is the capital city of the Governorate. In the Governorate, however, there are no villages as legally called as LGUs. Instead of villages, there are several tens of Bedouin communities. The Bedouins are literally a nomadic desert people, so some of them are still moving around in and out of the Sinai Peninsula. Therefore, they do not always live in a settled community, although the government pushes on them to settle down in communities. The settled communities are under jurisdiction of the neighbouring cities. As of the 1986 census year, the number of communities is enumerated at 78, which are distributed as shown in the following table. The names of these communities are listed in Table 15.1-1.

No.	Name of City	Number of Communities
1	El Tur	11
2	Ras Sudr	9
3	Abu Zenima	11
4	Abu Rudeis	11
5	St. Catherine	15
6	Sharm El Sheikh	7
7	Dahab	5
8	Nuweiba	9
Total		78

## 15.2 Socio-Cultural Profiles

### 15.2.1 Population

According to the 1996 census by Central Agency for Public Mobilisation and Statistics (CAPMAS), Egypt had a population of 59.3 million. This population increased by 11.0 million as compared to the 1986 census. During this decade, the average growth rate was 2.1% per annum. Table 15.2.1-1 shows the population change between the two censuses in 1986 and 1996.

In South Sinai Governorate, a population in the 1996 census year was 54,495, as shown in Table 15.2.1-1. This population accounted for only 0.09% of the country. Since the population was 28,929 in the 1986 census, the average growth rate was 6.5% per annum between the two censuses. This growth rate was higher than that of the country, i.e., 2.1%.

The populations of the eight cities involved in South Sinai Governorate were listed in Table 15.2.1-1. Among eight cities, El Tur City was the largest in terms of population. Its population was 14,155 in the 1996 census. The growth rate between the two censuses was 8.1% per annum on average, which was larger than that of the governorate average. Among the eight cities, the population in Sharm El Sheikh has increased at the highest growth rate of 16.6% per annum.

More than fifty percent of Sinai's population is said to be Bedouin. While the majority of South Sinai's inhabitants are of Bedouin descent, their status has changed to urban dwellers of inhabitants with increasing urbanisation and settlement. An urban population of the governorate was counted at 29,323 in 1996, accounting for 54% of the total population (54,595), as shown in Table 15.2.1-1. The urban population grew at 9.9% per annum on average between the two censuses, which was higher than the total population (6.5%). In particular, Sharm El Sheikh recorded the highest growth rate of 18.6%. On the other hand, the governorate being predominantly rural had a rural population of 25,172, accounting for 46% of the total. The rural population grew at 3.7% per annum on average. Incidentally, the urban population is defined as inhabitants in the city cores, and the rural population, as inhabitants in the rural communities in the surrounding areas of the cities.

In the governorate, a male population was 33,666 or 62% of the total population in the 1996 census. Then, the sex ratio, i.e., the number of males per 100 females, was 162. This ratio was considerably large as compared with the national one of 105. Accordingly, the male migrants tended to concentrate into the governorate. This tendency was more serious in urban areas where the sex ratio was 198 in the same year. In rural areas, on the other hand, the sex ratio was 129.

An old age population (more than 60 years old and over) was 1,382 as shown in Table 15.2.1-2, accounting for 2.5% of the total population in the governorate in the 1996 census. In urban areas, the composition of the old age population was 1.9%, so younger people in urban areas increased more than those in rural areas. In the country, the old age population was estimated at 3.0 million, accounting for 5.1% of the national population. Thus, this composition is less than half of the country.

With a population of 54,495 on 28,438 km<sup>2</sup> of a land area in South Sinai Governorate, the governorate constitutes 2.9% of Egypt's total land area but contains only 0.09% of the national population. Then, a population density of the governorate was 1.9 persons per km<sup>2</sup> in the 1996 census, as shown in Table 15.2.1-3. The density of the country was 59.4 persons per km<sup>2</sup> in the same year, so the governorate was much scarcer than the country. An average density of the eight cities was 255.5 persons per km<sup>2</sup>, as shown in the table. The density of the respective cities ranged from the largest one of 2,701.2 persons per km<sup>2</sup> in Sharm El Sheikh to the smallest of 69.8 persons per km<sup>2</sup> in Dahab.

According to the 1996 population census, the number of households was 10,277 in the governorate, which was segregated as 5,402 in urban area and 4,875 in rural area. This number was counted for private residents, which was enumerated at 43,996 people in the governorate. The total population was segregated into 22,038 in the urban and 21,957 in the rural. Accordingly, the average family sizes were 4.3 in the governorate. That was also segregated into 4.1 in the urban and 4.5 in the rural. Those rates were smaller than the national average of 4.6.

### 15.2.2 Labour Force

According to the Annual Report of the Central Bank of Egypt (CBE), a labour force in the country reached 16.0 million in the fiscal year 1993/94, as shown in Table 15.2.2-1. Meanwhile, the number of employees rose to 14.4 million at the end of June 1994. Thus, an unemployment population was 1.6 million in the fiscal year. Then, the unemployment rate was calculated at 9.8% nation-wide.

In the census year 1986, the labour force in Egypt registered 13.4 million. This accounted for 49.4% of the total production age population (27.1 million), i.e., between 15 and 65 years old. Thus, the labour participation rate was 49.4% in 1986. Of this labour force, 11.9 million or 89% were male and the rest of 1.5 million or 11% was female. However, despite the fact that 25.6 million workers were out of labour force, some of them were engaged in production activities in 1986.

In the past, the agricultural sector, so called as the primary sector, used to absorb the

greatest portion of manpower resources in the country. As shown in Table 15.2.2-2, this sector accounted for only 4.8 million or 39.0% of the total labour force in the 1986 census, which recorded a drastic decrease from the 1976 census figure of 47.6% and the 1960 census figure of 57.0%. In spite of the fact that the number of workers in the sector increased from 7.7 million in 1960 and 10.3 million in 1976 to 12.2 million in 1986, the number of workers in the agricultural sector did not grow at higher pace of the total number of workers, i.e., from 4.4 million in 1960 and 4.9 million in 1976 to 4.8 million in 1986.

On the other hand, the industrial sector, or the secondary sector, employed the smallest share of the labour force among the three major economic sectors. In the 1986 census, its share was 2.5 million or 20.7% in the country, as shown in the table. However, the number of workers in this sector rapidly increased from 0.9 million in 1960 and 1.9 million in 1976 to 2.5 million in 1986. It grew at the annual rates of 4.5% on average between 1960 and 1976 and 3.0% between 1976 and 1986. Of these total workers of 2.5 million in the industrial sector, 1.8 million or 70.0% lived in urban areas in 1986.

The number of workers in the services sector, or the tertiary sector, expanded from 2.3 million in 1960 and 3.3 million 1976 to 4.4 million in 1986. It increased at annual rates of 2.4% on average between 1960 and 1976 and 3.0% between 1976 and 1986. Of this total workers of 4.4 million in the service sector, 3.0 million or 68.6% lived in urban areas in 1986. Among four sub-sectors in the tertiary sector, financial, real estate and business services grew at the inconceivably high rates of 32.3% per annum on average between 1960 and 1976 and 10.5% between 1976 and 1986.

Among the total population of 54,495 in South Sinai Governorate, the labour force was estimated at around 22,361 in the 1996 census. The Employment was recorded as 21,909 in the census, so the unemployment was calculated at 2.0% only.

### 15.2.3 Household Income and Expenditure

Living conditions may be derived sketchily from family income and expenditure. The annual average of family income was said as LE 1,000 to LE 1,500 for low-income class, LE 2,000 to LE 2,500 for middle income class, and LE 4,000 to LE 5,000 for high-income class. According to the annual report 1993/94 of CBE, the average salary per worker was about LE 3,245 per annum. Supposing that the number of income earners in a household is 1.25 against the average family size of 4.9, the average family income was estimated at LE 4,050 per annum.

According to "Average Annual Household Expenditure on Principal and Sub-expenditure

Groups, 1996" by CAPMAS, an annual household expenditure was LE 5,526 on average in 1991, as shown in Table 15.2.3-1. People expended LE 2,761 per annum for food and beverages, accounting for 50% of the total expenditure. This rate ranged from the largest one of 51% in a single family to the smallest of 47% in a large family having five and more members.

Housing expenses of the national average accounted for LE 488 per annum or 9% of the total family expenditure. Of this total, the expenses for fuel, light and water were LE 154 or 3% of the total. This rate ranged from 2% in large households having more than four members to 3% in small families having less than three members. Of this expenditure for fuel, light and water, about one-third (or 0.9% of the total expenditure) or a quarter (0.7%) was said to be used for water. In other words, 0.7% to 0.9% of the total expenditure might be used for water consumption. Thus, the total amount of LE 120 to LE 160 per annum or LE140 as a median might be used for water in 1991.

#### 15.2.4 Settlement Programme

The government perceives that the current rate of population growth is too high and that it hinders the development efforts. It organised the National Population Council to examine the population issues. Furthermore, it considers redistributing the population throughout the whole of Egypt through the creation of new cities. Sinai Development Plan is expected to work out this population problem, although the plan has many other objectives, needless to say. The plan deals with the following matters for the people to settle down in the project areas in the Sinai Peninsula.

- (1) Potable water is a main factor in settling population particularly in Sinai. Thus, the water problem is considered as one of the most important development issues. It includes not only water supply system but also sewage treatment system particularly in some environmentally protected areas.
- (2) Creation of job opportunities eventually motivates people to move into Sinai, and make them settle in newly inhabited areas. Thus, the project areas are considered aggressively to allow the development of major industries such as tourism, manufacturing, mining and agriculture as leading sectors.
- (3) Housing is one of the most fundamental issues for settlement. The Sinai Development Plan aims at installing the physical infrastructures in the peninsula in order to achieve links between industrial and urban developments. In addition, the housing circumstance should be supported by a system to guarantee the flow of social services.
- (4) Education is one of the most important means in population attraction and settlement. In new societies, fulfilment of education is especially important to ensure the supply



of all levels of specialised and educated people to the labour market. Education is one of the pillars of the social infrastructure.

- (5) Health services are also one of the main foundations for human development, and for attracting and settling population.
- (6) Social services in addition to educational and medical services are also attractive for settlers. They sometimes aims at creating job opportunities for newly settled populations as well as supporting the original inhabitants in the areas. They cover the following areas: religion, information, culture, sports, training, social welfare, security and judiciary.

#### 15.2.5 Ethnic Group Distribution

Sinai is a coastal region with a mountainous hinterland. Because of its history rather than its land capability, Bedouins principally settle it. However, the current "post-war" circumstances are such that the economy is in transition and that the population is gradually shifting within Sinai in accordance with the government policy. At present, namely, the principal population issue for the coming twenty years is immigration to the Sinai peninsula, i.e., how to attract the right immigrants at the right time to the right places in accordance with the Sinai Development Plan.

It is said that 70% of South Sinai's population is Bedouin. In dispersed population centres such as Dahab, Nuweiba, St. Catherine and Abu Zenima, Bedouins constitute between 80% and 90% of the population. While the majority of Sinai's inhabitants are of Bedouin descent, their status has changed to urban dwellers of inhabitants with increasing urbanisation and settlement. However, traditional ties to ethnic groups and their lands remain strong. Thus, urban "non-Bedouins", including new settlers, have to get along with these aborigines.

In the Sinai Peninsula, there are roughly ten tribes of Bedouins, according to "Guide to Exploration of the Sinai". Within South Sinai, there are around eight tribes: Haweitat, Tiyaha, Lahelwat, Aleiqat, Sawalha, Muzeina, Tarabin and Gebelieh.

- The Haweitat, a great tribe of Jordanian origins, lives in a triangular area of Suez, Nakhl and Gebel Raha.
- The Tiyaha, Palestinian origin, spreads for a large territory from the oasis of El Quseima in the North to the oasis of El Kuntilla in the South, along East Side of the Haweitat. The Badara, affiliated with the Tiyaha, lives in a small area at the foothill of Gebel Egma in the centre of South Sinai Governorate.
- The Lahelwat lives in an area to south of the Tiyaha's territory, spreading between El

Kuntilla in the North and Aqaba in the South.

- The Aleiqat lives in an area around Abu Zenima and along the seashore of the Gulf of Suez.
- The Sawalha lives in the outskirts of El Tur.
- The Muzaina lives along the seashore of the Gulf of Aqaba.
- The Tarabin lives in the north of Nuweiba, although many of them live in Jordan and Israel.
- The Gebelieh, originally from Bosnia so not true Bedouin, stands alone to serve in the monastery of St. Catherine.

#### 15.2.6 Social Forms and Culture

Social forms in South Sinai are mainly classified into the following three types in general.

##### 1) Conventional and nomadic form

Most of Bedouins come into this form. They support their lives on self-sufficiency, so they have to be dispersed in spread areas because of their primary occupation, which is livestock grazing. This ancient occupation necessitates low density of animals and population, since the sparse rainfall supports only a limited amount of vegetation to feed the animals. They put sheep, goats and camels to grazing in pasturelands in dispersed inland areas. They cultivate some traditional crops such as date palms and barley under rainfed agriculture under intermittent condition in scattered wadi beds.

##### 2) Modernised cultural form

This form is supported by modern industries such as oil exploitation and tourism, which are mainly managed by foreign-affiliated corporations. It includes other modern sectors such as infrastructure services and construction. Sharm El Sheikh and Abu Rudeis are typical areas of this form. People at Sharm El Sheikh are primarily engaged in the maintenance of large hotels and other tourist infrastructure. People working in Abu Rudeis are involved in the oil and gas industry.

##### 3) Intermediate form

This form is positioned between the above two forms. It is seen at irrigated farmlands at El Qaa plain and at intensive fishery along the seashores of the Gulf of Suez and the Gulf of Aqaba. These areas are found here and there on the coast of the both gulfs.