

دراسات تنمية سيناء-المرحلة الأولى

Sinai Development Study

Phase I

Final Report

VOLUME VI

SETTLEMENT AND SOCIAL DEVELOPMENT

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LIST OF VOLUMES

- Volume I A Strategy for the Settlement of Sinai
Volume II Managing Sinai's Development
Volume III An Economic Development and Investment Plan, 1983 to 2000
Volume IV The Land and the Environment of Sinai
Volume V Water Supplies and Costs
Volume VI Settlement and Social Development
Volume VII Sinai Data Book

VOLUME VI
SETTLEMENT AND SOCIAL DEVELOPMENT

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SETTLEMENT AND SOCIAL DEVELOPMENT

1.0 INTRODUCTION

Volume VI consists of three parts:

- Population - What kind of people will occupy Sinai? Where will they live? What will they do? And from where will they come?
- Infrastructure - What infrastructural services are called for in Sinai to serve the population and to support economic activities? What infrastructure is needed in Sinai to serve the nation? And where and when is that infrastructure needed?
- Settlement - How will the population and the infrastructure that serves it be organized upon the Sinai Peninsula landscape? How will sites be selected for large and small settlements?

Basic logic affirms that people need infrastructure and that infrastructure composes and connects settlements. In the case of Sinai (Figure 1.1), a different logic is perhaps more valid. Egypt has decided to have settlements in Sinai, and people will not move to Sinai unless there is infrastructure. These two logical approaches are discussed throughout this volume.

Volume VI presents data that serves as input to Volume I and that extends further concepts introduced in Volumes I, III, and IV. Volumes I and III define the possible population distribution and its economic activities. Chapter 2 of this volume begins to develop the program needed to find and attract the needed skills and aptitudes. Based on the description of the land and water capabilities of Sinai (Volumes IV and V), Volume VI proposes a method for using such information to locate and develop settlements efficiently. Volume I formulates a strategic path to achieve eight diverse goals; Volume VI also carries into more detail the construction and budgetary aspects of the strategic path formulated in Volume I. The investment cost estimates of this volume are inputs to Volumes I and III. Much of the data on which Volume VI is based can be found in Volume VII and more is in working papers and project files at the Ministry of Development, including field survey information.

The chapter on Population is not a population forecast. A population of one million is set as a target and this chapter explores how it might be achieved efficiently. The two major issues addressed are:

- Integrating the native population into both rural and urban development
- Competing successfully with Cairo and OPEC countries for immigrants.

There is no one overriding task to the accomplishment of Egypt's goals for Sinai. However, the attraction of skilled migrants and the acquisition of skills by migrants comes as close to being the key task as any other. The accomplishment of a ten percent per annum average growth in population, most of it through in-migration, is the highest priority.

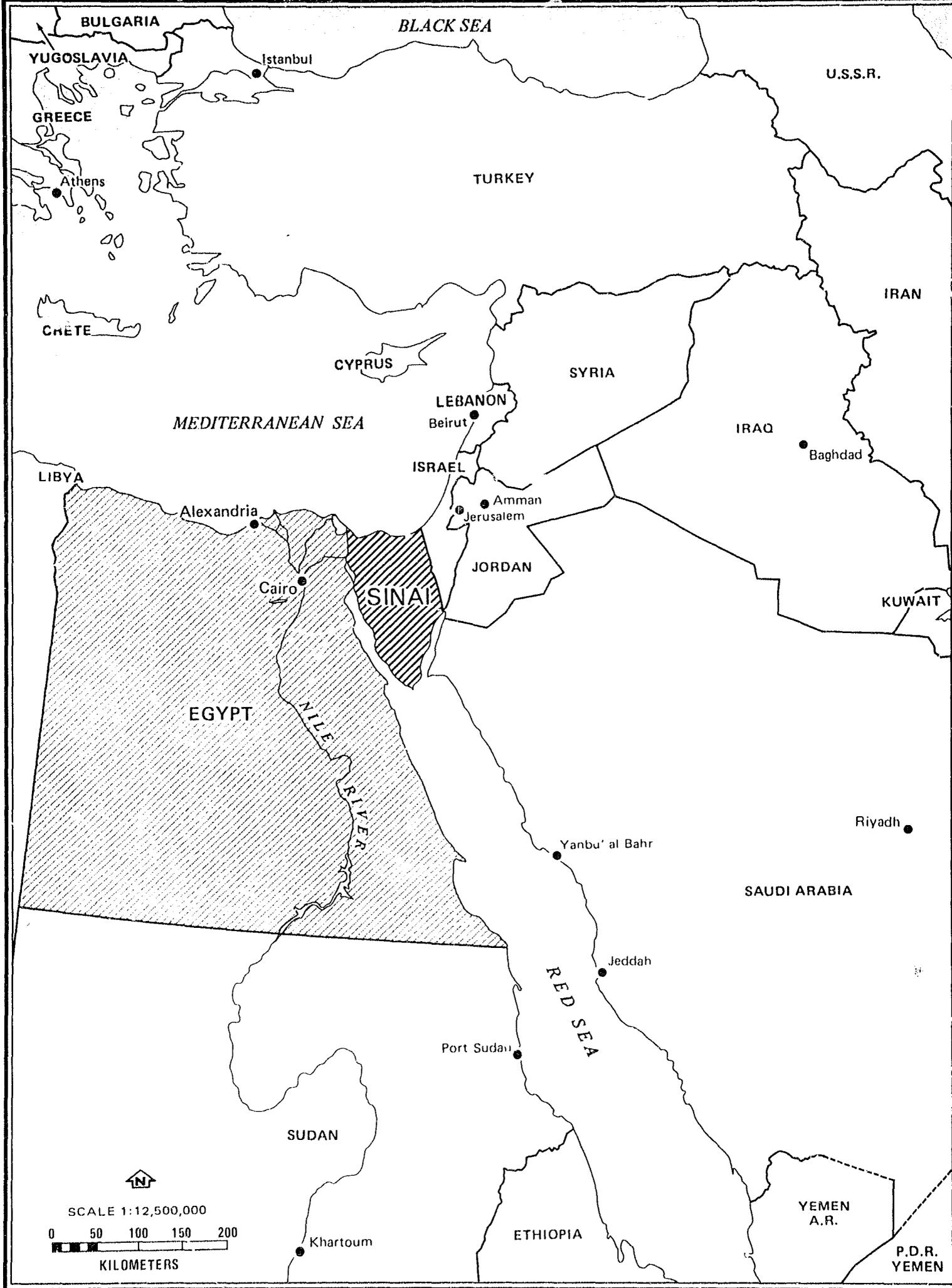


FIGURE 11

The infrastructure chapter finds that two-fifths of all infrastructure costs are likely to be for the delivery of Nile water. However, this estimate may be conservative (high). It also concludes that about 54 percent of the infrastructure costs will come in the last 7.5 years of the 17.5-year planning period, during which a slightly higher percentage (56 percent) of the population increase is achieved. This is true not only because some building programs expand as the momentum of development accelerates, but also because it is intended that Egypt's and Sinai's infrastructure and service standards will be considerably higher in the 1990s than in the 1980s.

The Settlements chapter describes the recommended "hierarchy" of settlements, which in turn reflects the Government's goal of having a pattern of permanent settlements distributed fairly evenly throughout the peninsula. Achievement of this goal is interpreted to require that almost as much importance be given to a small mountain settlement as to a large coastal city. The subjects of the interlocking system of settlements, the relationship of settlements to major economic activities, and the siting of settlements are presented with a broad brush.

The flow of work presented in the seven Volumes of this Report is multidirectional. Employment (jobs) has been related to Sinai's resources and overall population target in Volume III (with inputs from IV and V). Here in Volume VI, these jobs are again related to population by subregion and economic sector. The population, in all of its characteristics (not jobs alone), is related to infrastructure, with due concern for both urban and rural requirements. Population and jobs are also related to a settlement pattern. And prototypically, infrastructure is related to settlements. It is hoped that town and country planners, who build on this strategic regional plan, will find it helpful when designing individual settlements and rural development projects, to refer to the data, methods, and policies recommended in this Report.

In this Volume, as in others, the Consultant has attempted to be clear in presenting the methodology used to arrive at conclusions, so that the document can be used as a model when future planners, and those responsible for plan execution, adjust their strategy to accommodate new policy directives from government and changing economic or social circumstances.

2.0 POPULATION

2.1 INTRODUCTION AND SUMMARY

Returned almost entirely to Egypt by April 1982, the Sinai peninsula will undergo a rapid economic and population expansion as it becomes an integrated part of Egypt during the remaining years of this century. Sinai's current population of about 172,000 is projected to grow, through natural increase, to about 240,000 by 2000. An additional population of up to 600,000 will emigrate from elsewhere in Egypt, moving from the crowded Nile Valley to Sinai. The natural increase of these immigrant settlers is projected to add at least 130,000 more to the total Sinai population.

In order to attract migrants and create attractive, growing, dispersed communities, the services and infrastructure of existing towns will be improved, and new settlements will be established.

The current population, a mix of Bedouin and non-Bedouin peoples, is examined below by subregion. The Bedouin, who now live in a dispersed settlement pattern, must be provided with greater employment opportunities and improved facilities in order to reduce and hopefully prevent further out-migration. The non-Bedouin population lives in a less dispersed settlement pattern. Increased dispersion and permanence of settlements will provide a stronger foundation for a rapid population increase through in-migration.

The completion of the National Urban Policy Study and the CAPMAS censuses of North and South Sinai in the latter half of 1982 provided important new data sources. A review of migration-related data pertaining to Egypt supplemented the earlier work of Professor Saad Gadalla, and provided additional information. However, in view of the scope of the Sinai migration requirement, and the limited nature of Egyptian experience in this area, existing internal documentation was not considered sufficient.

It was therefore necessary to examine migration and settlement schemes in other countries, especially Indonesia and Brazil, where successful migration efforts provide important lessons. Demographic trends as well as migration-related issues in Northern Africa as well as other areas of the Middle East were so instructive.

Characteristics and conditions of Sinai's current population were closely examined, since this will be the building block on which future population can be added. The very large number of migrants called for in the Recommended Strategy necessitated a close examination of Egypt's labor characteristics. The very high demand for Egyptian laborers abroad provides a lucrative alternative to migrants who might consider moving to the Sinai. Foreign labor demand therefore affects the availability of possible migrants and was carefully examined, with future trends projected.

Population projections of current and migrant populations are based on surveys and documented demographic trends in Egypt. A basic migration theory relating distance to pay was postulated and demonstrated, and is used to select likely source governorates for Sinai migrants as well as in formulating a strategy to attract internal migration.

Information and reception centers combined with media resources can be used to inform and direct qualified migrants to Sinai settlement schemes. The provision of cheap, easy access to Sinai through transport and communication is vital. Agricultural cooperatives are shown to be one important feature of successful agricultural resettlement schemes. High quality educational facilities and curricula appropriate to Sinai are the essential means through which current and migrant populations will gain the knowledge and skills necessary to build the Sinai of the future.

2.2 SINAI'S CURRENT POPULATION

2.2.1 Introduction

With a population of 172,000 on 61,000 square kilometers, Sinai constitutes 6 percent of Egypt's land area but contains only one-third of one percent of her population. Half of Sinai's population is Bedouin, constituting three-quarters of all Bedouin in Egypt(1). Bedouin are relatively evenly dispersed throughout Sinai and constitute over two-thirds of the population in the three least densely populated subregions (the Southeast, Southwest and Uplands). The non-Bedouin population includes urban dwellers of Bedouin descent and 8,000 foreigners, primarily of Palestinian origin. About 80 percent of the non-Bedouin population is concentrated in the Northeast Subregion. Covering only one-tenth of Sinai, this subregion contains more than two-thirds of Sinai's estimated population. The southern and Uplands subregions, including over three-quarters of Sinai territory, contain less than a quarter of the population.

Under the Recommended Strategy it is projected that the population of Sinai will grow nearly sixfold to about a million by the year 2000. Nearly 70,000 of the increase will come from the natural rate of growth of current population. The rest of Sinai's population will come from in-migration of Egyptians supplemented with their natural increase after settling in Sinai.

2.2.2 Bedouin Population

Fifty percent of Sinai's population is Bedouin. While the majority of Sinai's inhabitants are of Bedouin descent, their status has changed to urban dwellers or inhabitants with increasing urbanization and settlement. In El Arish, with an urban population over 50,000, less

(1) Reference notes for this Section are found toward the end of this Volume on Pages A-1 to A-7.

than 10 percent of those interviewed in the September - November 1982 census of North Sinai identified him/herself as a Bedouin. Excluding El Arish, Sinai is 70 percent Bedouin. However, traditional ties to kin and the land remain strong. Urban "non-Bedouin" may continue to raise livestock or own livestock that is cared for by relatives in rural areas.

The subregional differences in the Bedouin percentage of the population reflect both proximity to the rest of Egypt and the urban build-up of the subregion. The Uplands, the subregion which is most remote and has the fewest non-agricultural investment opportunities, remains almost exclusively Bedouin. (See Table 2-1.)

In the Southwest and Southeast Subregions Bedouin constitute 70 percent of the population. Increasing non-grazing activity brings in outside, non-Bedouin workers and increases Bedouin population concentrations as traditional employment shifts from livestock to service and construction. In the Northwest and Northeast Subregions, access from non-Sinai Egypt is far easier, allowing a greater influx of investment, and both Bedouin and non-Bedouin urban workers.

Unlike non-Bedouin, who are concentrated in the Northeast, and to a lesser extent on the Southwest coast, the Bedouin population is spread relatively evenly over the whole of the Sinai.

In such dispersed population centers as El Hasana, Dahab, Nuweiba, St. Catherine, Nakhl and Abu Zenima, Bedouin constitute between 80 and 95 percent of the population. In the Uplands, including over a third of the area of Sinai, Bedouin comprise 97 percent of the population.

The dispersion of the Bedouin population is dictated by their primary occupation, which is livestock grazing. This ancient occupation necessitates low animal, and therefore low population, density since the sparse rainfall supports only a limited amount of vegetation to feed the animals. Historically, distinct areas of grazing rights became established for each of Sinai's Bedouin tribes. Though less important today than in the past, the 27 existing tribal land divisions still constitute the primary habitat and grazing areas for each respective tribe.

TABLE 2-1

BEDOUIN AND NON-BEDOUIN POPULATION, BY SUBREGION, 1982

	<u>Population</u>	<u>Percent</u>	
		<u>Bedouin</u>	<u>Non-Bedouin</u>
TOTAL	<u>172,000</u>	<u>50</u>	<u>50</u>
Northwest	14,429	35	65
Northeast	117,425	40	60
Uplands	19,238	97	3
Southwest	17,808	73	27
Southeast	3,100	70	30

SOURCE: Dames and Moore calculations based on the CAPMAS census of North and South Sinai, reported in February 1983.

In recent decades, overgrazing reduced the quality of vegetative cover and has made livestock a less certain, less profitable source of income. This, combined with construction and transportation employment opportunities in areas of economic expansion along the ocean coasts, appears to be drawing Bedouin males away from inland settlements. Thus, whereas the markaz of Nakh1 has 50 percent more females than males, Abu Zenima, El Tor and Sharm el Sheikh, areas of economic growth, have between 20 to 30 percent more Bedouin males than females(2). Although no present evidence demonstrates that male Bedouin out-migration to areas of greater employment opportunity has resulted in permanent emigration, it is clear that a very strong pattern of employment, leading to family or community out-migration, does exist as the norm for Egyptian migration. The absence of a high portion of young men also renders a community less productive and attractive, thereby reducing the incentive of the out-migrants' relatives to remain in the community. While Bedouin are by definition nomadic, the nomadism generally involves either groups of families or, more often, several of the children. Thus, the departure of the economically most productive segment of the population for long-term work elsewhere disrupts Bedouin communities in a new way.

If recent trends of accelerating desertification and geographically concentrated economic growth were to continue, the coming decades of rapid development would mean a further decrease in the attractiveness of livestock grazing in favor of alternative employment opportunities. The present pattern of Bedouin male out-migration would almost certainly accelerate, and Bedouin family and community departure from dispersed inland settlements to concentrated coastal towns would continue. In order to prevent further population drift from dispersed to less dispersed areas, it will be necessary both to strengthen the livestock economy and other rural activities as well as to add new employment opportunities in these predominantly Bedouin settlements.

The Bedouin in the Sinai have a literacy rate of about 20 percent. (See Table 2-2.) In the Southwest, Southeast and Uplands Subregions, where they are more scattered and nomadic, census reports show Bedouin population to be 16 percent literate. The Bedouin literacy rate in the Northwest and Northeast Subregions is 28 percent, just slightly lower than the average literacy (30 percent) of all rural Egypt. In view of the relative unimportance of formal education to the traditional Bedouin economy and the scarcity of educational facilities in many predominantly Bedouin areas, their literacy rates seem to indicate a strong desire for education. With the prospect of greater non-traditional employment and provision of greater access to schools, literacy rates among Bedouin are likely to rise rapidly.

Table 2-2

Levels of Literacy by Subregion and Zone - 1982

<u>Subregion</u>	<u>Zone</u> ^{1/}	<u>Illiterate</u>	<u>Read and Write</u>	<u>Below College Education</u>	<u>College Education</u>	<u>Total</u>
Northwest						
	N	50.9	24.8	20.7	3.6	100
	C	n.a.	n.a.	n.a.	n.a.	n.a.
	S	n.a.	n.a.	n.a.	n.a.	n.a.
Northeast						
	E	47.5	23.7	25.6	3.2	100
	W	62.9	22.8	12.2	2.1	100
Uplands		92.2	6.1	1.6	0.1	100
Southwest						
	N	65.1	19.8	11.1	4.0	100
	S	62.4	20.0	11.9	5.7	100
Southeast						
	N	81.2	9.3	5.2	4.3	100
	S	55.4	11.3	22.7	10.6	100
Total Bedouin		79.6	13.3	6.2	0.9	100
Total non-Bedouin		39.5	28.8	26.5	5.2	100

^{1/} Subregions have been divided into zones for some planning purposes.
 N = Northern; C = Central; S = Southern; E = Eastern; W = Western.
 n.a. = not available.

SOURCE: Dames & Moore calculations based on the CAPMAS census of North and South Sinai, reported in February 1983.

2.2.3 Egyptian Non-Bedouin Population

Unlike Bedouin, the non-Bedouin Egyptian population of Sinai is not dispersed. Over 98 percent of non-Bedouin in the Sinai live in the Northwest, Northeast and Southwest Subregions, areas that constitute only 42 percent of the Peninsula's land mass. The El Arish markaz alone accounts for 57 percent of the non-Bedouin population. According to CAPMAS, an undetermined but believed-to-be-large portion of non-Bedouin are first-, second- or third-generation townsfolk, who despite continued close ties to the land are no longer classified as Bedouin in the Census because they have settled in urban areas.

In the South Sinai governorate, the male to female ratio for non-Bedouin is 3.25 to 1 (3), a fact that underlines the lack of permanence of non-Bedouin in communities where the primary activities, such as petroleum at Abu Rudeis, administration and construction at El Tor, or the military at Sharm el Sheikh result in temporary employment for non-Sinai workers. Typically, these workers do not bring spouses or families and neither plan to nor are required to settle in the Sinai communities where they work. If highly imbalanced male/female ratios and the pattern of temporary non-Sinai employment continues in southern Sinai, economic expansion and construction will occur without the growth of integrated and balanced communities. Work preference should be given to those already living in Sinai. Workers coming to Sinai should be strongly encouraged to bring spouses, settle and invest instead of leaving with salaries earned from Sinai jobs. Adequate infrastructure, services and incentives must be provided to make communities attractive for settlement.

The literacy rate for non-Bedouin in Sinai is about 60 percent, well over the 44 percent literacy rate for Egypt as a whole(4). In the Northeast Subregion, 4 percent have college degrees while 30 percent have some sort of educational degree. In the southern subregions, 14 percent of non-Bedouin have college degrees, and almost half have some sort of educational degree. This compares very favorably with an average of 2 percent of Egyptians with college degrees and 19 percent with any sort of educational degree. Though this is partly accounted for by the male/female ratio (4 to 1), both males and females are, on average, at least twice as educated as Egyptians as a whole. The importance of this segment of the population to the future of Sinai depends largely on whether they settle permanently or remain temporary migrants.

2.2.4 Foreign Population

Non-Egyptian foreigners constitute over half the 7,640 non-Bedouin inhabitants of Rafah. A total of 7,852 "foreigners" live in North Sinai, of whom 6 percent are Bedouin (5). The large majority of these are of Palestinian origin. Despite their foreign status, they are ethnically and culturally similar to the inhabitants of Northeast Sinai, where they have settled. Most entered Sinai within the few years prior to the census-taking in 1982; a large percentage are unemployed. Nevertheless, this population is expected to become rapidly absorbed into and employed in the local economy.

In Southern Sinai, foreigners number 134, of whom two are Bedouin. All but five live in Abu Rudeis, Sharm el Sheikh or St. Catherine. The largely western foreign population working at Abu Rudeis is involved in the oil and gas industry. Foreigners at St. Catherine are there for religious purposes, while those at Sharm el Sheikh are primarily engaged in the maintenance of large hotels and other touristic infrastructure. With high education levels, those foreigners engaged in high paying industry jobs will help build infrastructure but are not likely to settle permanently in Sinai.

2.3 POPULATION BY SUBREGIONS

2.3.1 Northwest Subregion

The Northwest Subregion, with an estimated population of 14,429, is one of Sinai's two smallest subregions in terms of area. (Inclusion of Port Fouad, a neighborhood of Port Said, would quadruple the population.) Two-thirds of this subregion's population are concentrated in Qantara and Gilbana. Only 35 percent of the population is Bedouin, the lowest of any subregion. This reflects both the closeness of this subregion to the rest of Egypt, which is overwhelmingly non-Bedouin, and the high percentage of population in urban settlements.

As the Suez Canal Governorates expand, this region is likely to grow rapidly. Development and population growth in this region will, in part, reflect the expansion programs of the three Canal Governorates.

2.3.2 Northeast Subregion

The Northeast Subregion, with an estimated 117,425 people, or about two-thirds of the Sinai total, and the smallest area (barely 10 percent of the peninsular total), has by far the highest population density of Sinai's five subregions. Eighty percent of this subregion's population, over half of Sinai's inhabitants, are concentrated in the northeastern corner

from El Arish through Rafah. While the El Arish markaz is 90 percent non-Bedouin, the other three markazes that comprise this subregion (Bir El Abd, Rafah and Sheikh Zuwayid) are 80 percent Bedouin. Slightly over half of the Sinai's Bedouin and over 80 percent of the non-Bedouin population live in the subregion.

With a literacy rate of slightly over 50 percent for those aged 10 and above, the Northeast Subregion has the highest subregional education level in Sinai, and the only one to exceed the Egyptian average (6). This reflects the high number of schools and the density of population (more than quadruple that of Sinai as a whole), which results in greatly reduced average distance for children to travel to school. The educational level of Bedouin (over 30 percent literacy) is the highest in Sinai and is equal to the rural literacy rate of Egypt.

Both the El Arish and Sheikh Zuwayid markazes have high unemployment rates. Non-Bedouin unemployment in Rafah in 1982 was thirty percent. This may be explained in part by the recent influx of Palestinian migrants. The unemployment rate should drop as the new population is absorbed into the agriculturally rich, economically expanding area. The 25 percent unemployment rate for both Bedouin and non-Bedouin in Bir El Abd markaz is the highest in Sinai. Seasonal employment in fishing and very limited activity in agriculture, transport and construction need to be supplemented by additional employment opportunities. Completion of the Qantara-Bir El Abd pipeline during 1983 will make the area more attractive for other investment.

The Northeast Subregion contains 8,300 "foreigners" largely of Palestinian origin, primarily in Rafah and El Arish. Thus, a part of the high population density (nearly 18 people per square kilometer) in the Northeast Subregion can be attributed to political forces outside the country.

2.3.3 Uplands Subregion

The Uplands Subregion includes the El Hasana and Nakh1 markazes. It is the largest subregion, covering nearly 42 percent of Sinai, but it contains only 11 percent of the population. All but 650 of the 19,238 inhabitants are Bedouin. The largest population centers in the subregion are Gifgafa, with 2,350 inhabitants, and Nakh1, with about 1,200. Most of the population is dispersed into small subtribal units that practice livestock husbandry as their primary occupation.

The subregion is characterized by high male out-migration to seek employment. The ratio of females to males of all ages is 1.13 to 1,

indicating substantial out-migration of males; other data suggest this occurs in the late teens through the late 20s. Seven percent of the subregion's population is 65 or over, more than double the average for Sinai as a whole. One out of seven women is widowed or divorced (8). Average family size is under 4.5, the lowest subregional figure, reflecting out-migration by young males and delayed marriage, leading to reduced family size. In short, this subregion is characterized by:

- sparse settlement,
- small family size,
- a high ratio of aged dependents, and
- high out-migration rate of the most productive segment of its population.

Bedouin of the Uplands Subregion have the highest illiteracy rate in Sinai. Establishment of schools in towns and also in wadis where Bedouin gather during summer months would give many Bedouin access to education for the first time.

Without the Bedouin population, this area - over two-fifths of the land area of Sinai - would be almost uninhabited. Since one objective of the Recommended Strategy is to establish a dispersed pattern of permanent settlements throughout the peninsula, it is important that employment opportunities be created and services improved in this subregion, in order to halt out-migration.

2.3.4 Southwest Subregion

The Southwest Subregion contains about ten percent of Sinai's population, of whom 73 percent are Bedouin. Over a quarter of the population (including 90 percent of non-Bedouin) is concentrated in the three settlements of El Tor, Abu Rudeis and Ras Sudr, all on the Gulf of Suez. Except for El Tor, where Bedouin males exceed females by 30 percent, these settlements and the subregion as a whole have a balanced ratio of males to females among Bedouin. In contrast the ratio of males to females for non-Bedouin is greater than 3, the result of temporary immigration of single males for jobs related to petroleum at Abu Rudeis and Ras Sudr, and to administration and construction at El Tor. Reflecting investment activity, the unemployment rate is low, at least for the time being. However, income and employment in this subregion have not so far attracted many permanent settlers or established permanent communities. From Belayim Bay through Abu Zenima, Egyptian and foreign workers are housed in temporary trailers strung out along the coastal road. There appears to be an opportunity to develop an

attractive new population center here with government assistance. It seems likely that workers could be encouraged to bring spouses and to make permanent communities in Sinai, building an important new city in the area.

The literacy rate of over 45 percent for the region is misleading, since it includes temporary workers. The literacy rate for non-Bedouin is 71 percent; for Bedouin it is only 17 percent. Forty-four percent of non-Bedouin have some sort of educational degree, including 13.5 percent with college degrees.(9). Only one of every 35 Bedouin has an educational degree. The great division in educational status in this subregion reflects the lack of integration between the local Bedouin population and the temporary workers involved in a largely self-sufficient and self-contained activity - the production and export of petroleum.

This fundamental division is distinctly less sharp in El Tor, where economic expansion and employment opportunities, primarily in construction-related activities, have resulted in the recent influx of both Bedouin and non-Bedouin populations. Relatively greater integration of the Bedouin into the expanding economy is reflected in a less sharp split in education levels. The literacy rate for all urban dwellers is slightly less than 60 percent, while the Bedouin literacy rate in towns is over 30 percent.

The relatively high concentration of educational facilities in El Tor reflects the integration and permanence of the settlement. Establishment of educational facilities elsewhere would allow overall literacy and employability levels of the largely Bedouin population to rise. Establishment of additional schools and other basic facilities will also help in the building of dispersed, integrated settlements.

2.3.5 Southeast Subregion

The Southeast Subregion, covering 16 percent of the Sinai and containing only 3,100 people, is the least populated of Sinai's subregions. About 70 percent of the population is Bedouin. Except for Sharm El Sheikh, where Bedouin males outnumber Bedouin females by 30 percent, the Bedouin population is balanced, with little other indication of Bedouin male in-migration or out-migration. In contrast, the non-Bedouin population has ratio of over five males to one female, indicating the highly temporary nature of non-Sinaiian population. At the Southwest, the extreme male-female imbalance in demographic distribution will not only inhibit natural population growth, but will continue to inhibit the establishment of self-sustaining and expanding communities. Temporary in-migration by male workers can be ameliorated through incentives for laborers to come with their families and to settle permanently; such incentives are discussed further in Sections 2.5.8 to 2.6 below.

Since these population figures do not include the military personnel at Sharm El Sheikh, the male-female imbalance is in fact even greater.

Of the 300 non-Bedouin, only eight percent are illiterate. Of the 2,500 Bedouin, less than 10 percent are literate. Even more than the Southwest Subregion, this region exhibits two almost completely distinct and separate populations. Non-Bedouin are overwhelmingly educated, male, and temporary. Bedouin are uneducated, with a balanced male/female ratio, and are permanent inhabitants. Overall population is very sparse. The population can serve as a good base to establish integrated, attractive and permanent communities only if the two populations and economic sectors are better integrated, with emphasis made on establishing schools for Bedouin and other means for them to join the modern economy should they wish to do so.

2.4 FUTURE POPULATION GROWTH IN SINAI

2.4.1 Introduction

Sinai's population is projected to grow from 172,000 to one million by the year 2000. Migration is required to provide about 600,000 people to Sinai. The natural increase of current and immigrant population is estimated to provide an additional 200,000 population.

2.4.2 Future Population Growth of Current Sinai Population

The factor of family size in Sinai is substantially a policy one. The net reproductive rate, or population growth rate, in Egypt in 1981 was 2.9 percent per annum (10). In view of the economic and social burden of a rapid population expansion, the Government of Egypt has instituted a vigorous family planning campaign to bring the rate of population growth down to one percent by the year 2000. Sinai is an area where rapid population growth is called for; in other words it is a region selected to absorb population. The transfer of people from Nilotic Egypt will help relieve the population pressure there. Large families are not particularly desirable in Sinai because they imply a high dependency rate or low labor-force participation rate. The net reproductive rate of existing population, calculated to be an average 2.2 percent per year, is projected to drop to 2.0 percent for the period 1987-1992 and 1.7 percent for 1992-2000.* By the year 2000 the rate of population growth for the established population (current and immigrants of 10 years standing) is projected to be 1.5 percent. This figure represents a significant drop in reproduction rates but is higher than the national target goal, reflecting the special population circumstances of the Sinai.

The estimated current reproductive rate of 2.2 percent in Sinai is 25 percent lower than for Egypt as a whole. The non-native population, especially in the Southwest and Southeast Subregions is overwhelmingly male and single and contributes very little to population increase in Sinai. The Uplands Subregion has twice the national average of people 65 or over and a significant level of out-migration of young males, both of which contribute to a reduced level of population growth. (See subregional descriptions). The average family size of between 4.0 and 4.5 for these three subregions (11) also indicates relatively low reproductive rates. The family size for the Northwest is 5.2.(12) Family size in the most populous, Northeast Subregion, is 6.0. These figures are generally slightly lower for Bedouin inhabitants in the north and slightly higher in the south. Overall family size of 6.0, if assumed to imply a family of two adults with

* The birthrate is projected to drop from 3.5 to 3.1 and 2.7. Death rates are projected to drop during the same periods from 1.3 to 1.1 and 0.9 in 2000.

four children, would equate to a net reproductive rate of 2.2, according to studies done by RAPID for USAID. (13)

As single males are joined by spouses in the Southwest and Southeast Subregions (or replaced with married migrants), and as economic opportunities in the Uplands slow out-migration, the overall reproductive rate might be expected to rise. In rural areas such as the New Valley, the average family has over four children; over two-thirds of parents aged 40-50 had five or more children(14). The reduction of reproductive rates of current population in the Sinai from the 2.2 in the period to 1987 down to 2.0 in 1988-92 and 1.7 in 1992-2000 will require a vigorous and effective family planning campaign.

2.4.3 Role of Migration to Sinai

Migration to Sinai is necessary to expand current population and provide the labor skills and range of human talents necessary to develop the peninsula.

During the first two phases of projected growth, the 1980s through the early 1990s, large-scale construction activities will help to expand the work force. The normal Egyptian pattern of hiring a temporary labor force should be reconsidered, however, since the introduction of large numbers of single males does little to promote the establishment and expansion of permanent settlements. (See 2.3.4 and 2.3.5). A larger share of wages paid for labor in Sinai will remain within the Sinai economy if the workers live there permanently, establishing families and permanent communities. Temporary workers will prefer to transfer wages to their home villages instead of using earnings to build homes and invest in Sinai.

Clearly, the goal and role of migration should be changed if Sinai is to grow from a population of 172,000 to nearly six times this in the next few decades. Migration will have to serve as the primary means for obtaining a large, permanent population that can continue to be expanded and upgraded by training and additional migration. In order to establish balanced, permanent communities, it is suggested that married couples be given preference when allocating agricultural land, employment and housing opportunities in Sinai. Youthful couples, as opposed to single males, or even middle-aged couples, would provide better prospects for the establishment and expansion of vigorous and growing communities.

2.4.4 Composition of Migrant Groups

The majority of Sinai's population by the year 2000 will be married migrants, most of whom are young, and their families. Their rate of reproduction will therefore be significantly higher than the Egyptian or Sinaian population as a whole, and is therefore calculated separately. Migrant populations are divided into agricultural and non-agricultural employment. Agricultural workers will have different characteristics from non-agricultural workers. Their rates of reproduction are therefore calculated separately.

For purposes of projection most migrants settling on agricultural plots are assumed to be married; however, it is also assumed that 10 percent of all migrants moving to agricultural schemes will be unmarried adult kin of migrant families. Consistent with age ratios of internal Egyptian migrants (see Table 2-3), it is projected that 70 percent of the pool of agricultural migrants would be couples aged 20-30, 20 percent would be couples aged 30-40, and 10 percent would be kin. Movement of kin to Sinai settler households, though likely to be less than at the Ibis settlement Scheme (15) because of the greater distance, is expected to be significant. Adult kin migration would increase the agricultural work force and improve productivity, while allowing the maintenance of strong family bonds.

As discussed above, it is recommended that the present pattern of temporary male migration be reversed. In the relatively complex urban non-agricultural sector it is more difficult to ensure that married couples get priority over single males. Employment opportunities in such sectors as manufacturing and construction have traditionally drawn single male migrants from rural to more urban areas. Employment opportunities in the non-agricultural urban areas of Sinai are therefore more likely to attract single migrants from areas of Egypt outside of Sinai, but it is recommended that strong priority be given to couples whenever it is possible to do so -- for instance, in government-related jobs.

Private sector employment opportunities, such as construction or transportation, will continue to employ unmarried migrants and are not easily subject to regulation. Many of these migrants, who may be kin of recent Sinian migrants, should be encouraged to marry and to bring a spouse from Nilotic Egypt. The same housing and employment benefits provided to other married migrants or present Sinaian population would then be available to these newlyweds.

With the establishment of housing and employment priority to married migrants, it is projected that two-thirds of migrants employed in non-agricultural areas would be married. Half of this migrant group would be couples aged 20-30, 15 percent aged 30-40, with 35 percent single male and female migrants, aged 15 through 50. (See Table 2-4.)

Table 2-3

Cairo Age Structure: Recent Migrants Compared with
Total Population in 1976

<u>Age</u>	<u>Recent Migrants %</u>	<u>Total Population %</u>
0- 4	12.0	11.7
5- 9	6.2	11.0
10-14	7.8	12.8
15-19	20.0	11.9
20-24	20.1	10.4
25-29	12.5	8.3
30-34	6.4	6.5
35-39	4.4	6.0
40-44	2.9	5.5
45-49	2.3	4.3
50-54	1.6	3.9
55-59	1.4	2.4
60-64	1.0	2.3
65+	1.5	3.1
TOTAL	239,218	5,074,017

SOURCE: PADCO, Egypt: Urban Growth and Urban Data Report, National Urban Policy Study, July, 1982, Page 78.

Table 2-4

Projected Reproductive Rate of Migrants in Sinai
(First Decade of Residence)

<u>Age Group</u>	<u>Percent</u>	<u>Marital Status</u>	<u>Children per Family at Arrival</u>	<u>First 10 Years</u>		
				<u>Number of Children Born in Sinai</u>	<u>Annual Reproductive Rate (percent)</u>	<u>Annual Average Reproductive Rate (percent)</u>
<u>A. Migrants to Agricultural Settlements:</u>						
20-30	70	M	1.5	2.5	7.1	
30-40	20	M	2.0	1.5	3.8	6.6
15-60	10	S	0	0.7	7.0	
<u>B. Migrants to Other than Agricultural:</u>						
20-30	50	M	1.5	2.0	5.7	
30-40	15	M	1.5	1.5	4.3	5.6
15-60	35	S	0	0.6	6.0	

NOTE: Migrant families are projected to assume reproductive rates of current population after 10 years in Sinai.

SOURCE: Calculations by Consultant.

2.4.5 Migrant Family Size and Rates of Natural Increase

Of a million people in Sinai in the year 2000, about 730,000 will be immigrants and their children. Migrants to Sinai will be primarily young married couples with the beginnings of families. They will therefore have a reproductive rate that exceeds the averages for Sinai or Egypt. Two separate pools of migrants to Sinai, with differing reproductive rates, can be distinguished. Agricultural migrants, settled in the more rural areas are likely to have somewhat larger families than settlers in more urban areas, consistent with the national fertility trend in Egypt. (16)

As indicated in Table 2-4, it is projected that a high portion of single migrants to agricultural settlements will settle in Sinai and marry. The cumulative reproduction rates for agricultural migrants is 6.6 percent per annum for their first ten years. After an initial decade of high birth rates, this population is assumed to reproduce at the same rate as existing population.*

Partly as a result of recommended housing and employment priorities for married migrants, it is projected that two-thirds of migrants employed in non-agricultural areas would be married. Many of the unmarried migrants were assumed to settle in Sinai, marry and have children. Under the above assumptions, migrants not employed in agriculture have a reproductive rate of 5.6 for ten years, and then are assumed to drop to the reproductive rates of the existing population. The relatively small family size projected reflects the additional recommendation that an effective family planning campaign be established in Sinai; if such a campaign is not instituted, reproductive rates might be substantially higher. This would result in a larger population, a lower labor participation rate and a higher dependency ratio.

Under the above assumptions, the residents of Sinai in the year 2000 will include up to 600,000 immigrants and another 130,000 persons, roughly, who are the offspring of immigrants. Table 2-5 shows the number of migrants projected by phase.

* After the year 2000 it is likely that the large influx of young parents in the periods of 1987-92, 1992-2000 would have had children who in turn would marry and reproduce at a higher rate than the current population. However, this "baby boom" effect will occur after 2000 and is not considered here.

Table 2-5

Estimated Number of Migrants Needed for Settlement in
Sinai, by Phase, 1982/83 - 2000
(in thousands)

	<u>Migrants from Nilotic Egypt</u>				<u>Children of Migrants</u>
	<u>1982/83- 1986/87</u>	<u>1987/88- 1991/92</u>	<u>1991/92- 2000</u>	<u>Cumulative</u>	
TOTAL	<u>22</u>	<u>265</u>	<u>313</u>	<u>600</u>	<u>130</u>
Agricultural	11	107	109	227	55
Non-Agricultural	11	158	204	373	75

SOURCE: Calculations by Consultant. Note that all such estimates are rough orders of magnitude and subject to wide variation as underlying assumptions are changed. For instance, if more migration occurs in the early years and consists mainly of young couples, more children will be born in Sinai and the total number of migrants needed could be substantially less than 600,000, while the number of children requiring school and other facilities would be greater than 130,000 noted here.

2.4.6 Future Population by Phase and Subregion

Sinai's population is projected to increase from 172,000 to nearly one million by 2000 (Figure 2.1). Consistent with the recommended pattern of permanent settlements, the population's rate of increase will be greatest in subregions that are currently least populated. The Northeast Subregion will nearly quadruple in population by 2000, growing at a slower rate than any other subregion. The Uplands will increase more than twice as fast and contain a population in the year 2000 roughly as large as the total peninsular population today. The Northwest and Southeast Subregions, now the least populated, will increase tenfold by 2000. (Table 2-6.) The Southeast Subregion, with mainly mountainous terrain and limited employment opportunities, will remain Sinai's least populated subregion.

Population growth by phase varies for each subregion. (See Figure 2.1). The Northwest Subregion shows the most rapid rate of population increase, through migration, in the first phase. The populations of the Uplands and Southeast Subregions grow very slowly during that phase, reflecting the natural increase of current inhabitants with very little in-migration. Between 1987 and 1992, population growth rates are quite balanced for all subregions. In the third phase, after 1992, the Uplands, Southwest, and Southeast all experience rapid in-migration, reflecting rapid economic and social expansion, responding to infrastructure investment and the creation of new, well-paid employment opportunities.

Table 2-6

Recommended Strategy: Projected Population, by Phase and Subregion

<u>Subregion</u>	<u>Projected Population</u>			
	<u>Current</u>	<u>1987</u>	<u>1992</u>	<u>2000</u>
TOTAL	<u>172,000</u>	<u>213,668</u>	<u>521,163</u>	<u>973,074</u>
Northwest	14,429	32,407	88,543	167,065
Northeast	117,425	135,762	311,067	453,822
Uplands	19,238	19,694	53,244	170,004
Southwest	17,808	22,404	52,014	137,486
Southeast	3,100	3,401	16,295	44,699

SOURCE: Calculations by Consultant.

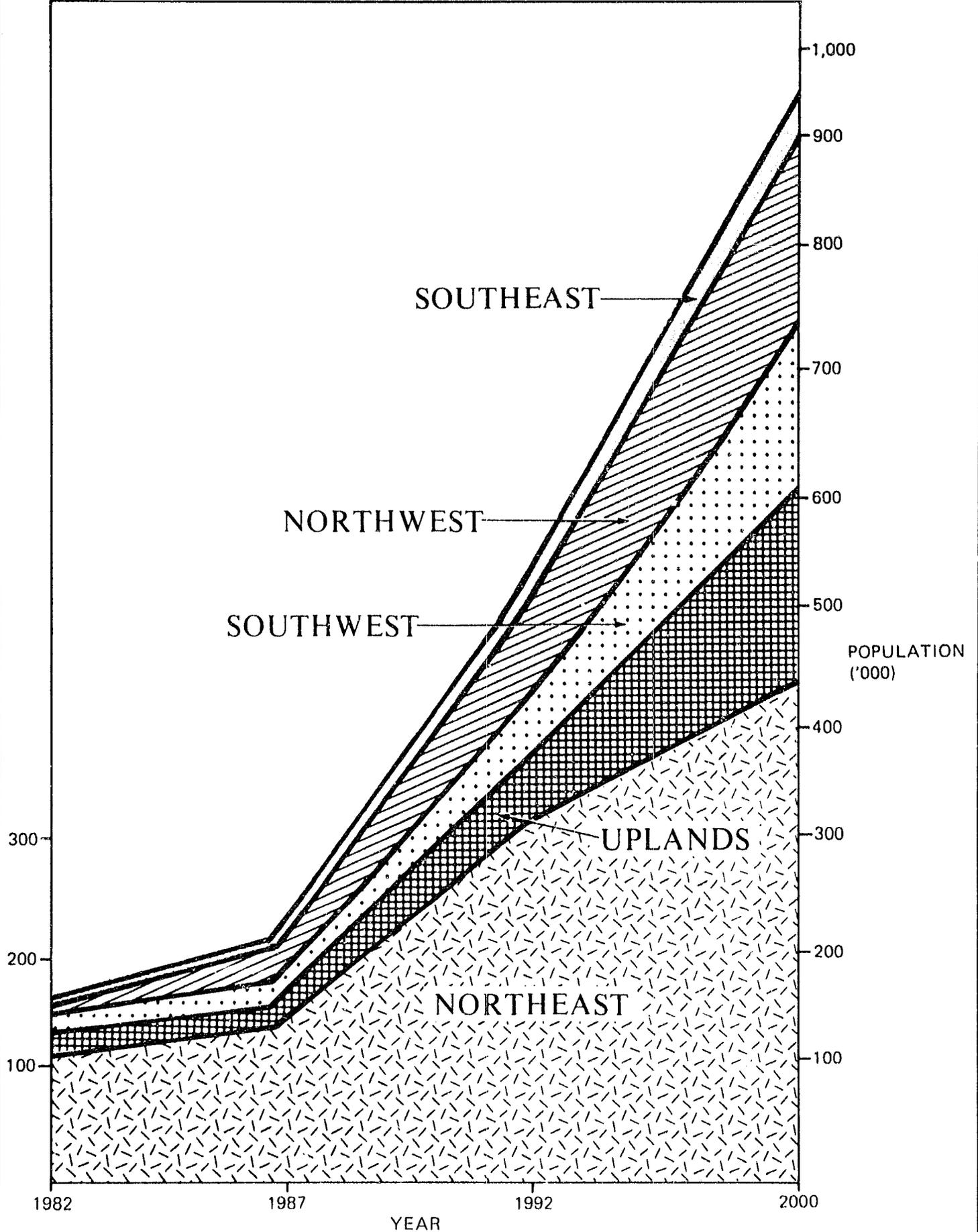


FIGURE 2.1
 RECOMMENDED STRATEGY:
 PROJECTED POPULATION BY PHASE AND SUBREGION

2.5 MIGRATION PROBLEMS AND POTENTIALS

2.5.1 Introduction

The Recommended Strategy requires that 600,000 Nilotic Egyptians settle in Sinai by the year 2000. This represents Egypt's largest migration effort. While this effort is unique in its size, it is likely to be very similar in its characteristics and problems to previous migration efforts in Egypt and abroad.

An essential need shared by all migration programs is the identification of a suitable population base from which qualified migrants can be drawn. For Sinai this entails the examination of the Egyptian labor market, migration patterns and education/skill levels. Once an adequate base or migrant "pool" is identified, inducements needed to motivate migrants can be specified.

All new settlers are faced with new difficulties and challenges that must be coped with. In the paragraphs that follow recurrent problems in settlement schemes are identified and positive solutions presented. Since three-quarters of Sinai's population will be first generation or recent in-migrants, it is essential that suitable infrastructure be created to make Sinai an attractive, permanent home.

2.5.2 Characteristics of Egyptian Labor

The development of Sinai calls for not just migrants but settlers with a broad range of job skills. In order to draw expert farmers, skilled workers, technicians, and professionals, Sinai will have to compete successfully in a labor market that is subject to particular problems and constraints.

As a whole, Egyptian labor is characterized by a very high degree of immobility between labor sectors, especially at the skilled level (1)*. While it is relatively easy for farm workers to move to urban regions and find employment in unskilled labor, including construction, more skilled workers, especially technicians, are generally fixed into their skill or occupational levels. It is found that the unskilled occupational levels are characterized by a surplus of labor, while there are major labor shortages in the technically skilled or professional occupational levels.

Reflecting both the structure of the educational system and a general dislike of manual work, Egypt's schools and universities produce an overabundance of non-technical graduates in such areas as literature and history (2), many of whom subsequently cannot find employment matching their area of study. (3)

* Numbered references for this Section are found in the Appendix at the end of this volume, beginning on page A-2.

The number of students enrolled in technical or skilled fields is growing; however, even in this area education tends to be theoretical, with very little actual contact with machinery, equipment or other on-the-job experience. (4) As a result, technical graduates often lack basic skills or "know how". This limits their effectiveness in the field of their training and may also impede their ability to switch into other occupations where opportunities exist. The present system relies heavily on examinations and is inflexible; it also provides little opportunity for adult education or the vocational re-training necessary for adults to acquire new skills. A critical result of limited occupational mobility at the skilled level is that little internal occupational re-adjustment has occurred within the Egyptian labor market to make up for labor shortages resulting from migration abroad in recent years of certain skilled types of manpower.

The public sector employs 75 percent of the Egyptian non-agricultural labor force, not including the armed forces. (5) Labor immobility is exacerbated by this policy. While government pay is low, it provides a secure income, status, and guaranteed salary increases, and usually allows time for a second and even third job. Once workers have secured a government job they are generally unwilling to give it up and are therefore very unlikely to move or migrate permanently to another area of the country. Thus, government employment is said to be a very major constraint on the possible migration to the Sinai.

The three million non-agricultural wage earners, not employed by the public sector include a high portion of unemployed, with low education and employment experience. The best qualified portion, those who do have a high occupational mobility, constitute the primary source of overseas employment.(6) Sinai, in seeking immigrants, will therefore be competing for a relatively small pool of qualified workers who also have attractive employment opportunities outside Egypt.

2.5.3 The Stouffer Migration Model

A large number of theories exist that attempt to explain or help predict migration patterns. Perhaps the most useful in planning the settlement of Sinai is one that relates mobility to distance. It was first put forward in 1940 by S.A. Stouffer. His model postulates that:

"The number of migrants going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities" (7).

In other words, the greater the effort involved in travelling from one point to another, the more selective the migrant group which makes the journey. Less well-educated or less skilled workers are likely to be stopped by the first intervening opportunity, while better educated workers are more likely to take more risks.

This model can be used to explain why one-quarter of Egypt's population has moved from their place of birth and now resides in a different governorate. The other 75 percent have not moved; the incentive to move has not been sufficient to compensate for the distance traveled. The 25 percent have moved, largely to the urban centers of Cairo and Alexandria, because the increased income, educational opportunities, and other incentives were perceived, at the time of moving, to more than compensate for the difficulties involved.

The "distance" from Aswan to Sharm El Sheikh should not be measured by the intervening physical distance, but by how far and with how much difficulty, time and expense an individual must move from one place to another. Thus, the "distance" from southern governorates, such as Qena and Sohag, to Southern Sinai would be greatly decreased if a regular, inexpensive ferry service were installed, running from Safaga to El Tor and/or Sharm El Sheikh. Similarly, a regular ferry service from Zafarana to Ras Sudr and/or Abu Rudeis would greatly reduce the distance between Middle Egypt and the Southwest Subregion.

The accuracy and relevance of this theory is confirmed by an examination of migrants from governorates close to Alexandria and Cairo. If the model is correct, then the most popular destination of migrants from governorates near Alexandria will be Alexandria. The primary destination of migrants from governorates south of Cairo should be Cairo, not Alexandria.

Indeed, according to the NUPS 1982 Urban Growth and Urban Data Report, 34 percent of those migrating from Kafr el Sheikh chose to go to nearby Alexandria, while only 19 percent went to Cairo(8). From Behira Governorate, 65 percent went to Alexandria, with only 19 percent going to Cairo(9). In governorates south of Cairo, migrants overwhelmingly chose Cairo over Alexandria as a destination. From Minia, 56 percent of migrants moved to Cairo, while only 5 percent went to Alexandria (10). Fayoum Governorate sent 59 percent of all migrants to Cairo, with only 3 percent going to Alexandria (11). Thus, the Stouffer migration model seems an accurate predictor of general migration patterns in Egypt and is a useful model for planning and directing future migration patterns from Nilotic Egypt to the Sinai Peninsula.

It is important to note that as distance and cost from alternative destinations decrease, the correlation in preference tends to drop.

Thus, although Assiut and Sohag are clearly closer to Cairo than to Alexandria, the ratio of migrants to the city is not as pronounced as it is for Fayoum or Beni-Suef. Three-fifths of migrants from Assiut traveled to Cairo while one-sixth went to Alexandria (12). From Sohag, 30 percent traveled to Cairo while 12 percent went to Alexandria (13). Thus, the importance of proximity for potential migrants to the Sinai will diminish as the distance from the governorate of origin increases. This suggests that the importance of the proximity of the governorate of origin will be of much greater significance in the western Sinai subregions than in the eastern subregions. In 1983, because of the quality of the North Sinai road, the Northeastern Subregion can be considered as less distant than the Uplands subregion or the Southeast Subregion. With the reconstruction of the Hadj highway and the connection to Taba, this subregional advantage will be reduced.

The Stouffer model is also applicable to overseas workers. Egyptian workers go to oil-rich Gulf countries because the economic incentive is adequate to compensate for the difficulty and distance of the move. On the average, Egyptian workers receive about ten times higher salary in Gulf State countries than in Egypt (14), although increases as low as 500% and as high as 3000% (15) have been reported.

Egyptian governmental restrictions on migration in the late 1960s were subsequently relaxed to encourage and facilitate labor migration abroad. In 1975, the Egyptian Parliament ratified a treaty for manpower between Egypt and Arab countries (16). Egypt opened labor offices attached to its embassies in Iraq, Libya, Saudi Arabia, and other Gulf States to help improve Egyptian working conditions and make labor immigration easier.

Under labor secondment policies, the Egyptian government has encouraged, made quicker, cheaper and surer the process of securing foreign jobs, thereby reducing the "distance" or difficulties of emigrating. Government assistance, combined with a steadily rising foreign demand for labor, resulted in a very rapid increase of Egyptians employed in other Arab States.

Financial incentives required to induce migrants to move to another location correlate to distance. Thus, while Egyptian migrants moving from Cairo to Gulf States receive a thousand percent increase in salary, construction workers moving to the New Valley receive an increase in pay of 50 to 100 percent. Similarly, regular government employees working in the New Valley receive a 60 percent salary increase as a "hardship allowance" (18). Far greater incentives are needed to move migrants to a new environment outside Egypt than within Egypt. The greater the distance and difficulty involved in the move, the greater the economic and social incentives needed to motivate migration.

As a possible destination for migrants, Sinai is more similar to the New Valley than to the Gulf States in terms of the difficulty and costs involved in moving there. Incentives, especially economic incentives, needed to attract migrants to Sinai will be much less than to the Gulf States, especially if migrants have a sense of permanent ownership in Sinai rather than a temporary "exile" to accumulate cash savings before returning to other homes in Egypt.

2.5.4 Temporary Migration of Egyptian Workers Abroad

As a potential destination for migrants, Sinai will be competing not only with other locations in Egypt (especially urban centers) but also with foreign countries. The relative immobility of Egyptian workers both occupationally and locationally, makes the very large foreign demand for skilled Egyptian labor particularly important. For example, a continued rise in foreign demand for selective Egyptian labor would severely reduce the potential migrant source or "pool" that might otherwise consider moving to the Sinai. However, a drop in foreign labor demand would effectively increase the potential Sinai migrant pool. It is therefore important to examine recent trends in external Egyptian labor emigration.

Emigration of Egyptian workers is in response to external demand for labor, largely from oil-rich Arab States. The great increase in temporary migration out of Egypt can be attributed to the programs of rapid economic expansion initiated in these countries after the sharp increase of oil prices in 1973/74. The number of Egyptians working in oil-rich states rose from 80,000 in 1972 to about 500,000 in 1976, 1 million in 1980 and approximately 1.75 million in 1983 (Figure 2.2). A higher proportion of these workers had, and continue to have,

* 1970-80 data from Employment Opportunities and Poverty in a Changing Economy: Egypt in the 1980's, Report of the ILO/UNDP employment strategy mission, June-October 1980, Page 75. The 1983 estimate is from The Middle East Economic Digest, March 25, 1983, Page 25, corroborated by a report in The Middle East Weekly, February 4, 1983, Page 4. Other references have somewhat higher figures for the 1970's.

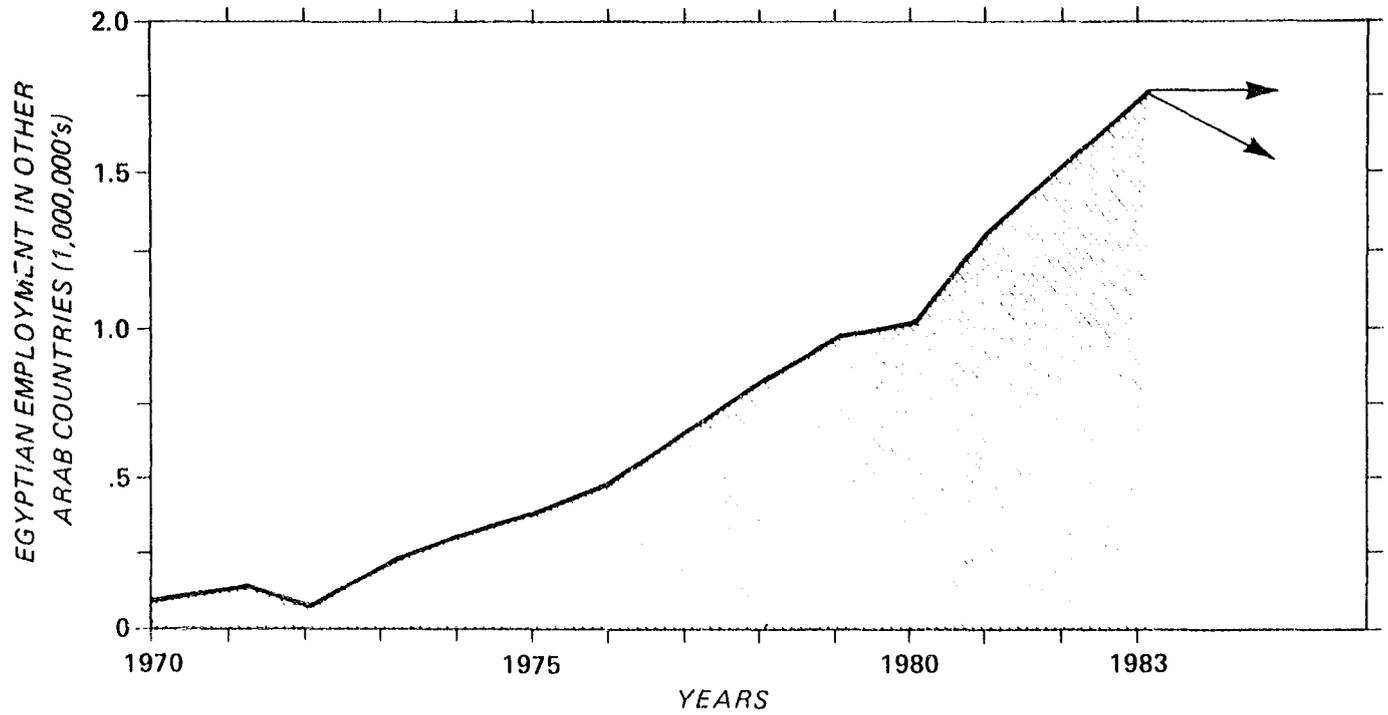


FIGURE 2.2
GROWTH OF EGYPTIAN EMPLOYMENT
IN OTHER ARAB COUNTRIES, 1970 TO 1983

more technical, scientific or advanced educational skills than the Egyptian labor force as a whole. In 1973 36 percent of Egyptian workers in these countries were in scientific or technical occupations, while the same category constituted only 5.5 percent of the national labor force in 1976. (19). While about 10 percent of all Egyptian school teachers were working abroad in 1978, this included 22 percent of all math teachers and 49 percent of special instructors (20). There is in Egypt today a shortage of non-agricultural workers with technical skills needed for Sinai's development. Therefore, the out-migration of many workers not in government employment (and therefore geographically immobile), greatly reduces the availability of suitable non-governmental migrants for Sinai.

The effect of the large foreign job market on the potential emigrant pool has changed with the stages of economic development within the oil-rich countries. The first stage involved an emphasis on building infrastructure and providing services and training. In 1975, 28 percent of the non-agricultural Saudi work force was employed in construction, compared to 5 percent in the United States (21). About one-third of the approximately 300,000 Egyptians in Saudi Arabia were employed in construction (22). The initial stage of infrastructure building is mostly completed. The mid- and late-1980s will be a period of consolidation, with a reduced need for workers in the areas of construction, transport, communication and services. Between 1981 and 1982, the value of contracts documented by Middle East Directory and Analysis (MEDCO) dropped by almost 40 percent (23). A steep increase of oil prices might initiate a new spurt of construction. However, it is more likely that oil-rich countries will seek to complete and maintain existing infrastructure, emphasizing completion of works in the productive sector.

Recent research by 150 British banks with branches in the Middle East predicts a deceleration of construction activity in the main labor-importing states, because "basic infrastructure is now well in place"(24). Current demand for less skilled labor and services in areas involving construction or infrastructure building is likely to drop. Some decline in labor demand in sectors such as utilities, mining, trade and finances is also likely through the 1980s, with increased installation of labor-saving devices. Highly educated professional, managerial and financial jobs, presently held by foreigners, are likely to be replaced gradually by growing numbers of well educated nationals.

The clear trend in the oil-rich Gulf States is a swing away from imported Middle Eastern labor. In 1979 all new construction contracts in Saudi Arabia were won by Korean firms (25). The World Bank, in the most detailed studies of manpower and international labor in the Middle East yet published, predicted that Asian labor would expand from 22.9 percent to 35.0 percent of foreign labor in the oil-rich Middle Eastern nations between 1975 and 1985 (26). Labor from non-national Arabs, including Egyptians, is projected to drop from 65 percent to about 52 percent by 1985, as Asian labor continues to replace non-national Arab workers through the 1980s (27).

The drop in oil prices, sustained since 1981, will have a fairly immediate effect on the number of foreign workers. Increased government expenditure until the early 1980s fostered a rapid increase in non-national laborers. If the decline in oil prices, revenue, and expenditure, sustained since late 1981, continues a long-term decline in demand for foreign labor is very likely. Although projections of future oil price trends are hazardous, the consensus seems to be that oil prices are likely to rise only relatively slowly in the future. With much reduced oil incomes beginning in 1982, OPEC Nations are most likely to drop or postpone large construction projects. By March 1983, the oil revenue slump in Saudi Arabia had already resulted in delays in major infrastructural schemes amounting to several billions of dollars (28).

As projects are postponed, the foreign labor component will decrease even more rapidly (29). In fact a new Saudi government decree forbids foreign firms from bidding on jobs involving catering, transport, banking, and other services (30). Thus, it can be expected that demand for foreign labor in OPEC countries is likely to be reduced, while the percentage of non-national Middle Eastern labor in this market is also anticipated to decrease.

A third major factor pointing to a likely drop in external demand for Egyptian workers is the enormous but uncertain labor market in Iraq. In 1975, Iraq employed only 8,000 of about 375,000 Egyptian migrant laborers in foreign Arab countries (31). Since the beginning of the Iran-Iraq war, demand for foreign labor has risen very rapidly. In 1982, Iraqi Airways resumed flights to Egypt and Egyptians were allowed to enter Iraq without visas (32). Growing numbers of Egyptians working in Iraq performed services and jobs vacated by Iraqi men serving in the army. In 1983, there were at least 1.25 million Egyptians in Iraq, 450,000 more than in Saudi Arabia and 950,000 more than in Libya, the two next largest employers of the Egyptian labor (33). Of this one and a quarter million, at least three-quarters of a million were working, constituting over 40 percent of all Egyptian temporary laborers abroad.

The future course of the war between Iraq and Iran is uncertain. When the state of war ends, the Iraqi demand for foreign workers, primarily Egyptian, may well drop rapidly.

Demand for Egyptian skills in the OPEC countries is probably therefore at or close to a peak. (Increased Egyptian labor emigration to Europe or the United States is unlikely, both because of high rates of unemployment in those areas and because of immigration restrictions). How soon and at what rate external Egyptian labor employment is reduced appears to depend on:

- the future of the Iran-Iraq war,
- a decreasing percentage of Egyptians as non-national hirings in the face of increased competition by Asians in Saudi and other labor markets, and
- the price of oil, which in turn will depend somewhat on the state of the world economic recovery and the war.

The foreign labor market competes with migration options within Egypt for Egyptians who are willing to move and have a relatively high educational and skill level. A reduced demand for Egyptian labor abroad, by reducing employment opportunities for mobile Egyptians, would enhance migrant recruitment opportunities within Egypt. Reduced foreign labor demand will therefore increase the likelihood that Egyptian migrants would select Sinai as a destination.

2.5.5 Identification of Migrant Pool and Key Migration Source Governorates:

Emigration generally occurs from areas of low income and quality of life to areas of higher income and quality of life. Forces at the point of departure are "push" factors, while attractive aspects of the destination are "pull" factors. Economic factors alone correlate closely to the decision to leave, while non-economic amenities, presence of fellow regionals, proximity and employment opportunities all help to determine the destination (34).

The less well-educated are particularly likely to make the decision to migrate because of "push" factors - usually declining economic and employment opportunities. A town is usually chosen as a destination, because it is perceived as a place of greater social and economic opportunity.

Table 2-7 also illustrates that the largest internal migration from rural governorates occurs from urban areas within these governorates. On the average, migrants from these governorates are seven times more likely to originate from urban than from rural areas. As this brief analysis, as well as a number of Egyptian demographic studies, indicates (35), migration generally occurs in more than one step from rural to more and more urbanized areas. The final dwelling place for migrants, prior to leaving a governorate for metropolitan governorates like Cairo, Alexandria, Port Said and Suez, is likely to be the largest town or city, generally the governorate capital. The likelihood that migration out of a rural governorate will occur from an urban place is seven times as great as from a village.

Table 2-7

Internal Migration from Selected Governorates,
Percentage Urban, Number of Cities - 1976

<u>Governorate</u>	<u>Population (millions)</u>	<u>Percent Urban</u>	<u>Percent of Total Migration from Urban Places</u>	<u>Number of Migrants from Urban Places (000)</u>	<u>Number of Cities Larger than 50,000</u>
Delta					
Dakhalia	2.7	24	66	92	4
Damietta	0.8	26	72	43	1
Sharkia	1.6	20	72	89	3
Ismailia	0.4	50	77	3	1
Gharbia	2.3	33	72	52	3
Qalyubia	1.7	40	64	35	3
Menoufia	1.7	20	53	29	2
Southern Egypt					
Sohag	1.9	21	73	54	3
Qena	1.7	23	52	19	1
Assiut	1.7	28	61	18	1
Minia	2.1	21	74	15	2
TOTAL	18.6	25	68	449	24

SOURCE: Calculations by the Consultant from data reported in Egypt: Urban Growth and Urban Data Report, National Urban Policy Study, July, 1982, pp. 304-358.

Nearby urban centers are chosen because they are easier to travel to and are more likely to contain kin or village members who could help find jobs and provide a temporary place to live. If adequate employment, educational or social opportunities are not available in this city, migrants move on to a larger urban agglomeration - usually Cairo. Greater Cairo had received over half of all Egyptian internal migrants in this century (36) .

Migrants leaving the urban centers of rural governorates are unlikely to have firm job offers in the major cities. They (correctly) believe that potential economic opportunities are greater in Cairo, Alexandria, Port Said or Suez than in the urban centers of their rural governorates.

Cairo and Alexandria, because of their size and potential as migrant sources have to be included as possible source governorates for Sinai. Moreover, the more each individual has migrated, the more likely he or she is to do so again (37). During the five years prior to 1976, 239,000 people moved from Cairo to Alexandria, Suez, Port Said and Ismailia, equal to almost 30 percent of recent migrants to Cairo (38). Migrants from Cairo and Alexandria, with the strongest migration history, are therefore the least likely to settle permanently. The majority of migrants originating from urban areas interviewed on small farms in the Tahaddi development scheme were generally less happy and had more problems than migrants from rural areas, possibly because they were used to the conveniences and pace of life in a city (39). Migrants from Cairo or Alexandria, with a generally higher previous income and higher expectations will expect greater incentives to move to Sinai and be more demanding about infrastructure and services at their destination.

In 1976, 1.7 million migrants aged 15 and above were living in Cairo and Alexandria. Four-fifths of a million employed migrants had occupations and skills very similar to the occupational structure of Egypt's two primate cities (see Table 2-8). Fourteen percent of migrants are working in technical and scientific professions, somewhat higher than the total population. With educational levels higher than the Egyptian average and a broad range of professional and technical skills, the large pool of migrants already in primate cities or contemplating a move there, represents a large source of qualified migrants for Sinai.

Of 7,500 migrants of rural origin interviewed by CAPMAS in 1978-1979, 45.5 percent had moved to rural areas. This rural-to-rural migration constitutes one-quarter of all migration movement. While two-thirds of all females originally from a rural area settled in a rural region, more than four-fifths of males of rural origin go to urban areas.

Table 2-8

Three Major Reasons for Changing Residence to Cairo,
Given by Various Occupation Groups, Male and Female, 1976 ^{a/}

<u>Occupation of Migrant</u>	<u>Reason for Changing Residence to Cairo</u>				<u>Total Migrants (000)</u>
	<u>M/ F</u>	<u>Work</u>	<u>Education</u>	<u>Accompany Other Migrant</u>	
		(percent giving reason)			
<u>Occupied, Subtotal</u>	M	71.9	3.1	13.3	548.6
	F	22.0	4.0	50.0	61.5
Technical & Scientific Professions	M	56.8	12.4	16.7	67.5
	F	10.0	7.7	52.7	18.9
Administrative & Business Directors	M	63.5	11.3	8.6	16.6
	F	13.3	5.7	50.2	1.6
Clerks	M	70.1	3.8	12.7	76.2
	F	9.4	3.6	59.2	12.4
Sales Occupations	M	77.5	1.0	10.5	64.5
	F	22.0	0.9	45.7	3.4
Service Occupations	M	82.6	1.0	7.3	99.3
	F	60.2	0.6	24.4	14.1
Agriculture & Fishing	M	63.0	1.7	12.0	6.4
	F	6.7	0.6	87.3	0.7
Production & Transport	M	74.7	0.6	14.2	199.3
	F	12.3	0.8	62.2	3.6
Unspecified	M	39.6	5.8	41.4	18.8
	F	8.3	4.6	70.2	6.8
<u>Unoccupied</u>	M	35.5	16.9	36.1	118.3
	F	3.1	1.6	65.2	541.1
TOTAL, all Recent Migrants	M	65.5	5.6	17.4	666.9
	F	5.1	1.9	63.6	602.6
TOTAL, both Male and Female		36.8	3.8	39.3	269.6

^{a/} Survey covered population 15 years and older.

SOURCE: Egypt: Urban Growth and Urban Data Report, National Urban Policy Study, July, 1982, Table II-12, Page 78;
original table based on NUPS analysis of 1976 census.

This demographic phenomenon is attributable both to high male emigration to foreign countries and also to the difficulty and expense of finding suitable family accommodation for married migrants moving to large cities. Spouses are unlikely to join workers who take temporary foreign jobs; wives generally return to their in-laws. Similarly, wives of workers in large cities, where apartments are expensive, may choose to move in with their in-laws until their husband returns or makes enough money to settle his family in the city. The phenomenon of husbands working in cities while spouses stay in rural areas is common in many countries (40). The fact that in this study 96 percent of females moving to rural areas did so for "social" reason (versus 87 percent moving to urban areas) tends to confirm the hypothesis that the bulk of rural-rural migration is not for job purposes, but for temporary social reasons.

The total male urban-rural and rural-rural migration rates are 8 and 18 percent respectively (see Table 2-9). By excluding all female migration - which is overwhelmingly for social reasons - we obtain a more accurate representation of the actual level of permanent work-motivated rural migration.

Agricultural employment in Sinai through the year 2000 will constitute nearly 40 percent of all employment in Sinai. Since only about one-eighth of current "non-social" migration is to rural areas, it would appear that inducing migration to agricultural projects in Sinai will be more difficult than moving migrants to urban areas. However, this difficulty may be mitigated by the fact that quite capital-intensive, sophisticated irrigation techniques are contemplated with many of the characteristics of industrial activities. Migration to work in the "new generation, high tech" irrigated agriculture of Sinai may prove to be easier to organize than migration from one traditional rural setting to another rural community, with similarly limited, low-paying employment prospects.*

Increased education has consistently been correlated with a greater tendency to migrate, both within and outside of Egypt. Migrants to urban areas tend to be somewhat better educated than Egyptians as a whole and are about equal in education and occupation levels to Egypt's two primate cities, Cairo and Alexandria. Migrants to rural areas are much less well-educated. Almost two-thirds of male migrants to rural areas are illiterate, double the rate for migrants to urban areas. (See Table 2-10.) About one-quarter of Egyptian migrants to urban areas are relatively well-educated, having attended secondary school or beyond, a higher percentage than Egypt's two largest cities. Migrants in the highest adult migration bracket (ages 15-25) also have the highest education level. For migrants aged 20 to 25, the literacy rate was 80 percent with 68 percent having received formal education. Female migrants in this age bracket also had literacy levels significantly higher than the national average.

*The lack of migration to rural areas also reflects the lack of opportunities in rural areas. Interviews are needed to measure the "propensity to migrate" to Sinai, and that "propensity" can be increased by successful "job creation" programs in Sinai and a high standard of social amenities.

Table 2-9

Internal Migration from Urban/Rural
to Urban/Rural Places, by Sex - 1979

	<u>To Urban</u>	<u>To Rural</u>
<u>Male</u>		
from Urban	92	8
from Rural	82	18
<u>Female</u>		
from Urban	69	31
from Rural	37	63
<u>TOTAL</u>		
from Urban	84	16
from Rural	55	45

SOURCE: Dames & Moore calculations from CAPMAS report on migration, 1979.

Table 2-10

Education Level of Migrants,
Urban and Rural Destinations, 1979

<u>Destination</u>	<u>Educational Level (percent)</u>			
	<u>Illiterate</u>	<u>Read and Write</u>	<u>Less than College</u>	<u>College Degree</u>
Urban	46	24	22	9
Rural	86	10	4	1
Total	60	19	16	6

SOURCE: Calculations by the Consultant based on the Internal Migration Study, CAPMAS, 1979. Rows may not add due to rounding.

People who have chosen to migrate recently are far more likely to move to opportunities in the Sinai than people who have never migrated. Since many of the migrants in urban centers of rural governorates have left their agriculturally related jobs much more recently than migrants in Egypt's larger cities, they are somewhat more likely to have agricultural skills relevant to settling in the Sinai, even though the type of agriculture proposed for Sinai is quite different from most current and traditional agricultural practice in Nilotic Egypt. Urban centers in rural governorates serve as a midway point or channel through which the majority of internal migration in Egypt occurs.

Continued low investment in agricultural areas (41), increasing rural density and continued growth of employment opportunities in urban areas has hastened the outmigration of agricultural laborers, leading to cyclical agricultural labor shortages.* Migrants from Qena and Sohag constituted 40 percent of the net migrants to the Suez Canal Region up to 1976 and were engaged primarily in construction work (42). A substantial but undetermined portion of people migrating to urban areas is likely to have a high level of agricultural skills but has chosen to pursue urban employment opportunities, using construction and other related manual skills as a means of initial entry into urban labor markets. Migrants from small cities, therefore, offer a mixture of agricultural and non-agricultural skills. Thus, this migrant pool is characterized by fairly high skill and education levels, recent agricultural employment and a demonstrated high propensity to migrate; this general group would appear to be a very promising source of migrants for both agricultural and non-agricultural settlements in Sinai.

Proximity has been shown to be a very strong indicator of preference of destination for Egyptian migrants. The most likely source for Sinai will therefore be the governorates closest to Sinai - specifically Suez, Ismailia, Port Said, Sharkia, Damietta, and Dakhalia. When reliable bus-ferry connections are established from Safaga to El Tor/Sharm El Sheikh and from Zafarana to Ras Sudr/Abu Rudeis, then the list of governorates likely to supply population to Sinai might also include the governorates of Minia, Beni Suef, Assiut, Sohag and Qena; these have a climate not unlike the southern Sinai lowlands and also a high ratio of migrants to population.

Over 80 percent of the migrants moving from the three rural governorates of Dakhalia, Damietta and Sharkia in the five years prior to 1976 went to the three rapidly growing Suez Canal governorates, and not to Cairo or Alexandria. These three rural governorates, with high outmigration rates, and a tradition of sending migrants eastward, are close to Sinai and appear to be the most likely sources of migrants to Sinai.

* Labor shortages occur during brief periods, with underemployment normal through the rest of the year.

Migration recruitment efforts should concentrate on rural governorates. As discussed earlier, migrants from urban areas of rural governorates would be easier to attract, have greater agricultural and other skills applicable to settling Sinai, and are more likely to be permanent settlers (44). Suez and Port Said, although bordering on Sinai, are probably not very good sources for migrants to Sinai, since they are urban. They are therefore not considered "key source governorates". However, Ismailia, which is 50 percent rural and shares a more extensive border with Sinai, appears to be a good source for migrants.

Gharbia, Qalyubia and Menoufia, though further west, still had a high migration rate to the Canal governorates (66 percent [45], 60 percent [46], and 40 percent [47], respectively) and a high population density. High population densities in rural areas indicate a low ratio of agricultural land to farmers, and have been correlated with increased desire to migrate in Egypt and also in other countries such as Indonesia (48). In Nubia the lack of agricultural land has been found to be a factor causing migration (49). Sohag, with Egypt's highest rural density, has traditionally had one of Egypt's highest rates of outmigration (50). These rural governorates also have a relatively high rural population density and should therefore be considered as possible, though less likely, sources of migrants for the Sinai.

The governorates that have had the greatest number of migrants moving to three of the four so called frontier governorates (the New Valley, Matruh and Red Sea) are Qena, Sohag and Cairo (51). Many of the administrative-level migrants in the New Valley are from Cairo (52). Since most national administrative and political employees come from Cairo, it seems likely that much of the migration from Cairo to the frontier governorates are migrants on a temporary assignment. Qena and Sohag, among the most densely populated rural governorates, and with high overall and frontier out-migration, are also likely sources of population for Sinai. To this we should add Assiut and Minia because they are very rural governorates with a history of outmigration.

In summary for a wide variety of reasons, the following governorates seem to be the most probable sources of migrants to Sinai:

- Assiut
- Beni Suef
- Dakhalia
- Damietta
- Ismailia
- Minia
- Port Said
- Qena
- Sharkia
- Sohag
- Suez.

Somewhat less likely sources but still to be kept in mind would be

- Cairo
- Gharbia
- Menoufia
- Qalyubia.

2.5.6 Facilitators in Migration: The Need for Information and Reception Centers

Less well-educated migrants in Egypt tend to move in family groups. Generally, a single young male, often the brightest and most successful (53), will move to a city and seek a job. If he finds a job, other family members, including cousins, may join. If all goes well, the whole family, then other village members, follow. The process of kin or friend assistance as facilitating both the finding out about employment opportunities and the providing a place to stay while a kin member is looking for a job, establishes the basic pattern of migration worldwide -- for instance, in Indonesia or Brazil (54) as well as in Egypt. In this way, families or village

members tend to remain together, often working in the same office or factory and sharing an apartment. Families or villages with strong migration histories are much more likely to continue having outmigrants than areas without such histories (55).

The importance of informal communication about employment results both from the strength of familial and village ties, and the absence of formal information about jobs. It is reported that the majority of laborers in Kuwait come from less than 15 villages in Upper Egypt. One Egyptian study found that in 72 percent of cases studied, relatives were facilitators, while 24 percent were friends. For only 30 percent of those migrating internally did firm employment commitments exist beforehand. About one-sixth of migration cases came because of direct persuasion from relatives or friends, while 64 percent resulted from emulating other successful migrants. Only 13 percent of migration cases in this study came as a result of a firm job offer (56).

Mass media are important sources of information helping to determine the destinations of migrants. Indonesia and Brazil, both with successful large-scale migration programs, have used mass media to inform and encourage potential migrants. One study in Indonesia found that 52 percent of those interviewed had learned about internal migration possibilities from the radio, while only a quarter of the population had learned about the migration opportunities from a friend, from school, the local government or a newspaper (57). Since there is clearly a correlation between awareness of distant employment opportunities and interest in or willingness to migrate, mass media can be effective as an information tool.

In Brazil, the radio has been an important secondary source of information for migrants. Newspapers and journals have been effective for the urban dwellers, less so for those in rural areas (58). Since reading requires literacy, the radio and television would appear to be the most effective form of mass communication about the opportunities of migration. Provision of employment information in rural or urban areas can help guide migrants to areas where there are the greatest opportunities (59). In Egypt, public information -- both in the form of pamphlets and radio broadcasts -- was useful in answering questions and helping to inform the Nubian tribes displaced by the Aswan High Dam before they were resettled in the Sudan (60).

An information/promotion campaign using radio and written messages should play a role in telling people about employment and living opportunities in Sinai. These information campaigns should be established in the governorate capitals and the other major cities of the 11 governorates identified as most likely to supply migrants. This would

entail the establishment of a central information office about the Sinai in each of the selected governorate capitals with smaller offices in other major towns. Media messages should discuss opportunities in Sinai and provide the phone number and address of the Sinai information offices in source governorates and towns. These offices would serve as a source of information, guidance, and advice, playing the role of facilitator.

To allow for the establishment of links from source governorates to areas of Sinai, it is important that in-migrant reception centers be established in each of Sinai's subregions. Employees in both information and reception offices should be local people, and every effort should be made to ensure a high level of communication and cooperation with local labor, governmental and private organizations. The greater the distance and expense involved in moving to a destination, the less likely it is that a prospective migrant is able to visit before deciding to make a serious commitment to move. Since first-hand experience tends to increase the likelihood of migration, visitations by prospective migrants to the Sinai should be encouraged and facilitated through subsidized or free transportation and short-term lodging.

For those who decide to migrate, reception centers should provide information, a place to stay and access to employment opportunities, as well as connections to other migrants from the same governorate or village. Well-established information and reception centers, connected by strong links, including free transportation, would greatly reduce the uncertainty, apprehension and cost normally involved in migration, thereby decreasing the "distance" between point of departure and destination. Reception centers should probably be located in the largest, most central and accessible town in each subregion, probably including El Arish, El Qantara, El Tor, Bir El Thamada and Sharm El Sheikh. Large land reclamation schemes in areas such as Gifgafa or the Wadi Feiran Delta would necessitate the establishment of reception centers specifically equipped to assist farmers.

Information and reception centers and the provision of free or subsidized transportation would be particularly valuable and effective for "have-nots", those who are forced to migrate because of a family disaster (61). Access to employment possibilities and the provision of temporary shelter will enable those with little money to migrate to Sinai, so long as they are otherwise qualified and want to move.

2.5.7 Managing Migration

The issue of how to promote and manage migration is a difficult one. The logistical difficulties of moving and settling people and the uncertainty and fear of settlers about their new destination are two sets of negative factors which any migration program must deal with. At the same time some of the specific problems that arose in previous Egyptian internal migration programs can be avoided in Sinai by learning from earlier mistakes (62, 63).

In the Ibis settlement scheme (64), for instance, private land ownership provided security and resulted in efforts to improve and develop the property, confirming the hypothesis that private ownership is a more effective land distribution pattern than tenancy. However, in both the Ibis and Nubian settlement schemes, inadequate or slow land distribution resulted in increased dependence on government funding. Moreover, a lack of non-agricultural employment opportunities in both areas, led to dissatisfaction and a pattern of outmigration of young males, seeking jobs away from the settlement.

An appropriate variety of skilled people should be given priority as settlers in Sinai, and some effort should be made to include a balance of requisite skills in each community.

2.5.8 Access to Sinai: Communication and Transportation

In the Nubian settlement near Kom Ombo, facilities and public services were well established when the Nubians arrived, and were the aspect of the settlement scheme most pleasing to its new residents (68). Particularly important are infrastructural elements related to internal and external access: good roads, transportation, post and telecommunications services. These communication and access components will be particularly vital to the success of settlement schemes in Sinai. Provision of good transportation, telephone, telegraph and mail services will greatly reduce the "distance" between settlers and home governorates.

Providing good communication and transportation services and increasing communication and visits between settlers and home communities does two very important things. First, this relatively low investment greatly decreases the psychological and time distances, thereby making settlers feel happier, less distant and less remote (70). Second, the high interchange serves to publicize settlement possibilities, thereby providing the most effective possible form of promotion of the Sinai - contact with relatives and friends from home communities. Visitation to and from settlements should be facilitated by cheap, regular bus service to allow for firsthand experience by potential settlers and to allow more frequent home visits by settlers. Because of the Sinai's distance and image of remoteness, this kind of interchange and contact is particularly vital (71).

2.5.9 Agricultural Cooperatives

Agricultural cooperatives were first established by the British in 1908, and have become a very common feature of rural communities. Since independence, agricultural cooperatives have the legal authority to grant loans, deliver agricultural supplies, market crops, organize land use and cultivation patterns, and provide social services (80). Starting in 1955, the role of cooperatives was greatly expanded by the government. During the same period, the Principal Bank for Development and Agricultural Credit (PBDAC) grew rapidly. By 1980, the PBDAC, the primary source of credit for farmers and cooperatives, had 130 branches, 740 village banks, and 4,200 agencies throughout Egypt (81). As the basic channel through which loans, agricultural inputs, services and some marketing occurs, cooperatives have become an essential feature of Egyptian agriculture.

Despite their importance, however, cooperatives have met with varying degrees of success in Egyptian resettlement projects. Cooperatives at the Tahaddi settlement scheme, for example, worked well and were judged by the settlers to be by far the best infrastructural or service element of that particular settlement scheme. Probably based on the success of the agricultural cooperatives, almost all settlers said they would also like to see consumer cooperatives established, primarily to provide cheaper consumer goods. It is apparent that an essential reason for the success of these cooperatives is that settlers had a very high degree of control over them. By contrast settlers at Ibis were less satisfied with their cooperative system and reported a lack of financing, a scarcity of agricultural inputs, high prices charged by cooperative stores and delivery delays. Officials assigned to manage Ibis cooperatives were described as generally lacking in experience and tending to take decisions without the benefit of local input. The difference in success of the two cooperatives seems to stem mainly from the lack of local control in one, and the relative independence and degree of local authority in the other. Reinforcing this view is a report that the lack of popularity for agricultural cooperatives in the New Valley can be attributed in large measure to the lack of local authority (82-4).

The success of agricultural cooperatives in Sinai settlement schemes may well depend not only on the provision of adequate infrastructure and financing but also on the placing of a high degree of responsibility with cooperative members.

The role of cooperatives in agriculture reclamation increases with the isolation of the area. Inhabitants from settlement schemes that are distant from towns or markets often have little choice other than to buy goods and sell produce to cooperatives. For instance, in the isolated northwestern desert settlements of the Matruh Governorate, Bedouin cooperatives have responsibility for credit, marketing, irrigation system operation, and the management of local community facilities and services. The Consultant concludes that if settlement is to occur in Sinai on the scale called for in the Recommended Strategy, cooperatives, well-run by properly trained local participants, are likely to be particularly important.

Ideally, small farmers, by combining into cooperatives can achieve greater leverage, secure supplies at lower prices, and obtain higher prices for produce through improved market access. In agricultural settlements in the "new lands," the produce of most small farmers moves through two or more wholesalers before reaching the retailer. This excessive handling results in greater damage to produce, higher prices to the consumer, and lower return to farmers. Moreover, the fertilizer quota supplied to "new lands" farmers was quite inadequate, since it was calculated for Delta soils. A further problem experienced with cooperatives in the "new lands" settlement schemes is that bank outlets were up to 30 km distant from farmers.

Newly-established land reclamation schemes in the Sinai should avoid similar problems by assuring that banking facilities are mobile or are located at places convenient to farmers. Alternatively, the cooperative may be sufficiently funded to provide short and long-term loans, as in the northwestern settlements. Well-funded and supplied cooperatives that have a high degree of local decision-making responsibility and support are most likely to respond in a timely manner to special local conditions and are better able to fulfill an essential role in successful agricultural settlements.

2.5.10 The Role of Education

The rapid development and population expansion of Sinai in the coming decades will require the establishing and upgrading of a large number of schools. Provision of good educational facilities is a significant "pull" factor, that is very attractive to potential immigrants and contributes importantly to their quality of life.

The rapid economic expansion and great variety of employment opportunities, including many high-skill jobs, will require educational facilities capable of training the population in the wide variety of skills needed to their work. The existing educational infrastructure is not adequate, especially at levels beyond primary school. No preparatory or secondary school exists in the Southeast or the Uplands Subregions. The Northwest Subregion has one six room preparatory school but no secondary school (86). In 1981 68 percent of primary school-aged children in Sinai were enrolled, but only 22 and 10 percent respectively of preparatory and secondary school-aged children were attending schools. (See Table 2-11). The fundamental problems are the lack of schools and the distance to facilities. A child growing up in Nuweiba will find that the nearest secondary school is 210 km away in Ras Sudr. Sinai's higher educational facilities totaled four in 1981, of which three are in El Arish and one is in El Qantara (87).

Table 2-11

Summary of Public School Data, in 1981 ^{1/}

	<u>North Sinai</u>	<u>South Sinai</u>	<u>Total</u>
Number of primary, preparatory, and secondary schools	39	20	59
Number of students	<u>16,087</u>	<u>1,089</u>	<u>17,176</u>
Boys	8,938	814	9,752
Girls	7,149	275	7,424
Percentage of enrollment in level of school			
Primary (Grades 1-6)	66	86	68
Preparatory (Grades 7-9)	23	8	22
Secondary (Grades 10-12)	11	6	10
Total number of teachers	569	127	696
Student-teacher ratio	28:1	9:1	25:1

1/ Does not include Sinai east of El Arish, Nakhl and St. Catherine.

SOURCE: Calculations by Consultant, based on data from North and South Sinai Governorates and a 1981 survey of major settlements.

The provision of educational facilities enhances the quality of life and provides needed skills. At the same time educational achievement has been strongly correlated with increased migration out of rural areas, both in Egypt (88) and in other countries, including Indonesia and Brazil (89). The establishment of educational facilities in rural areas of Sinai may have the undesired effect of hastening migration from rural areas to Sinai's or Egypt's urban centers, resulting in the loss of settlers and manpower. Nevertheless, education is so important to the pattern of development of Sinai that provision of ample facilities in both rural and urban communities will be essential; improved education can be expected to increase mobility both into and out of all subregions and areas of Sinai.

Accelerating migration from rural areas has caused a large number of Latin American and African countries to revise their programs of rural education. Recent studies of these educational reforms have demonstrated that by orienting rural education to include skills and knowledge applicable to rural job opportunities, rural employment has increased and out-migration can be reduced (90). The basic problem addressed in these educational reforms is that formal education in rural areas usually teaches skills not applicable to rural areas, and education is perceived solely as a preparation for urban life (91).

In recent years, the Egyptian government has begun to modify education away from theory towards skills in an effort to make education more responsive to existing employment opportunities. Although technical and skill-related education has been increased in Egypt (92), the number and quality of students with needed skills is still judged deficient. A fundamental flaw is the lack of work or "hands on" experience in technical education.

In 1976, 18 percent (or 160,000) of migrants in Cairo and Alexandria gave education as their primary reason for migrating. The large majority of these are students - many at universities or teacher training schools. Of those employed, migrants in technical and scientific professions or who were in administrative or business positions most frequently gave education as the primary reason for moving to Egypt's two major cities. About 15,000 migrants, including 6,000 females in these highly educated professions, gave education as their primary reason for migrating. It seems most likely that these people came to attend higher educational institutions, attained their degrees, and then settled in Cairo and Alexandria. Education is clearly the original, primary cause of migration for at least 20,000 well-educated, technically skilled migrants in these two cities.

Establishment of a university in Sinai, by attracting bright young students, may provide an additional source of migrants to Sinai. The more closely skills taught correlate to employment opportunities in the Sinai, the more likely it is that these temporary students might decide to settle in the Sinai and contribute their skills to its development.

It will be important to ensure that the education and training provided in Sinai are responsive to particular employment needs as they emerge. Because of Sinai's relatively small population and projected varied employment opportunities (e.g., tourism, agriculture, mining, fishing, both light and heavy manufacturing, etc.), technical education here could more easily integrate actual "hands on" work experience with theoretical studies. The establishment of local agricultural secondary schools would provide the skills and training appropriate to the special agricultural needs and technologies of Sinai. Education both in general agricultural skills and in more advanced fields such as range management, erosion and desertification control, drip and sprinkler irrigation technology, sand-dune control, groundwater management, agronomy, soil analysis and fertilization, desalinization and similar skills will be one key to successful rural development in Sinai.

2.6 CONCLUDING SUMMARY

Fully returned to Egypt in 1982, Sinai is slated to undergo rapid economic and social expansion in the coming decades. An essential part of this development will be the rapid expansion of population in a dispersed settlement pattern.

Presently all areas in Sinai away from the coasts are inhabited primarily by Bedouin. Evidence of out-migration from these areas signals the need to expand existing employment opportunities, including improvements in range management, the establishment of independent range co-operatives, small-scale industry, mining and tourism. The early upgrading of services, especially education, will make many inland settlements more attractive as permanent bases for future population growth.

The Recommended Strategy calls for the establishment of schools with academic programs providing high quality education oriented toward the technical and agricultural skills needed in Sinai. These educational institutions, by providing a constant upgrading of migrant and resident skills, can contribute to a flexible workforce with the range of skills and training required for Sinai's development.

Current population is projected to grow through natural increase to almost a quarter of a million by 2000. During this same period, according to the Recommended Strategy, Sinai is to receive perhaps as many as 600,000 migrants. The very high rate of natural increase of the migrants--most of whom are projected to be young and married-- will contribute at least another 130,000 to Sinai's population by 2000.

On examination, the potential migrant pool for Sinai seems adequate. Cities in selected rural governorates of Nilotic Egypt can provide the needed number of workers with the necessary range of agricultural and non-agricultural skills. If demand for Egyptian labor abroad decreases, as anticipated, then employment and settlement opportunities in Sinai will be relatively more attractive. However, many potential Sinai settlers are locationally immobile because of their employment in the public sector. Whereas government employees can easily obtain temporary job leaves in order to work abroad, no such policy exists for permanent migrants to frontier settlement schemes. The Egyptian government can assist in encouraging internal migration by selecting government employees for Sinai that are married and providing them with incentives adequate to ensure that they settle there with their families. Army service in Egypt has been a way in which migrants have learned about urban destinations (93). Soldiers posted in Sinai should be exposed to the economic and settlement opportunities available, and encouraged to return and settle in Sinai once their period of military service is completed. The push of overcrowding in Nilotic villages and cities is both a motivation for government to settle Sinai and a cause for hope that Nilotic Egyptians will migrate there.

Sinai's population is projected to increase almost sixfold by 2000, an average annual increase of 10 percent. Though the rate of population growth is very ambitious, it is not unprecedented for Egypt. Construction of the Aswan High Dam and associated employment opportunities resulted in the population of the city growing from 63,000 in 1960 to 168,000 in 1966, representing an annual average growth of 13 percent. In that same period the population of Suez also grew at or close to 10 percent a year.

Employment opportunities in Aswan and in virtually every other area of settlement are by far the most important single "pull" factor causing in-migration. The economic expansion of Sinai through 2000 will provide a broad range of employment opportunities, including the upgrading or replacement of all current jobs. (See Volume III).

It has been shown that incentives needed to induce migration increase with distance. Job pay and facilities required to attract migration to Sinai are therefore greater than that required within the Nile Valley and Delta and less than at locations outside Egypt. The establishment of reliable, quick ferry services across the Gulf of Suez as well as the Canal would reduce the distance and difficulty of traveling. Improved transport and the establishment of reliable mail and phone services would make Sinai a less distant, better-integrated part of Egypt, reducing the level of economic and quality-of-life incentives required to motivate in-migration.

3.0 INFRASTRUCTURE

3.1 INTRODUCTION

3.1.1 Purpose

Four key purposes have been identified for infrastructure in Sinai:

- To provide better access to resources
- To facilitate communications, both electronic and transport (within Sinai, with Egypt and with the Middle East)
- To improve the quality of life of the residents
- To make Sinai an acceptable place for in-migrants.

Each of these purposes is essential and substantially reinforces the others; accomplishing one purpose helps to accomplish the others. The planning questions concern: phasing, emphasis, and cash-flow. The natural resources necessary for development, as reported in Volume IV and several Working Papers, are concentrated on or near the coasts but with significant reservoirs of rich soils, minerals and touristic sites in the hinterland. In order to optimize the development of these resources infrastructure must service them with fresh water, reliable telecommunications, efficient highways, convenient ports, electricity, and a suitable living environment for the labor force. The infrastructure system proposed is largely oriented towards Sinai's major resource sites: water to good soils on level or gently sloping land, highways to tourist sites, electricity to mineral deposits, and so forth.

The mountainous arid Sinai Peninsula has been relatively isolated from Egypt and the Middle East. The modernization of communications sweeping the rest of the Middle East during the past thirty-five years is just beginning to reach Sinai. The northern, southern, eastern and western portions of Sinai have been isolated from each other due to the high mountains and the lack of an electronic communications network or good highways. The goals set by the Government for Sinai (see Volume I) require a strong communications system well connected to Nilotic Egypt and the Middle East, in order to increase Egypt's international trade and to integrate Sinai completely with the rest of Egypt, so that its current 'remote' status will become history.

Residents of Sinai today do not receive as good a level of infrastructure services as the rest of Egypt. The closing of this gap is well under way through the programs of the Sinai Development Authority. More is needed. Such improvements are needed not only for social justice, but also because the modernization of Sinai will require different capabilities of its residents.

Egyptian migrants are drawn to places that offer a better quality of life as well as to higher wages (see this Volume, Section 2). Many potential migrants will not move their families to places without good education, health care and communication services.

Having identified these four purposes as being important, the Consultant then considered each infrastructural proposal of the Alternative Strategies to determine its primary and secondary purposes. Any infrastructure element that served only one or even two purposes was repeatedly challenged to determine if it was essential. Thus, when formulating the Recommended strategy, the Consultant gave a higher rating to a highway which provided access to resources, access to Nilotic Egypt, access between subregions of Sinai and access for local residents to a hospital than to one which only connected two subregions and provided access to a resource. Similar evaluation of new infrastructure proposals against these purposes will be essential to future planning and decisionmaking.

This section is organized as follows:

- First, the current situation is summarized.
- Second, targets are suggested, phase by phase, to improve the level of service for each major infrastructure component.
- Third, costs of each system or facility are estimated, phase by phase.

Conclusions of the third section are picked up in Volumes I and III.

3.1.2 Methodology

The process of preparing infrastructure proposals to be included in the Recommended Strategy was initiated in 1981, then reviewed and revised in 1983; it involved many members of the SDS-I team. Steps in this process are reported in several Working Papers and Memoranda on file with the Advisory Committee for Reconstruction; they are illustrated in Figure 3.1 and included:

- Surveys of infrastructure and settlements in mid-1981, which reported on regional level infrastructure
- Review of infrastructure trends in Egypt, other remote areas in Egypt, and other development regions
- Review of relevant legislation as well as national and governorate budgets

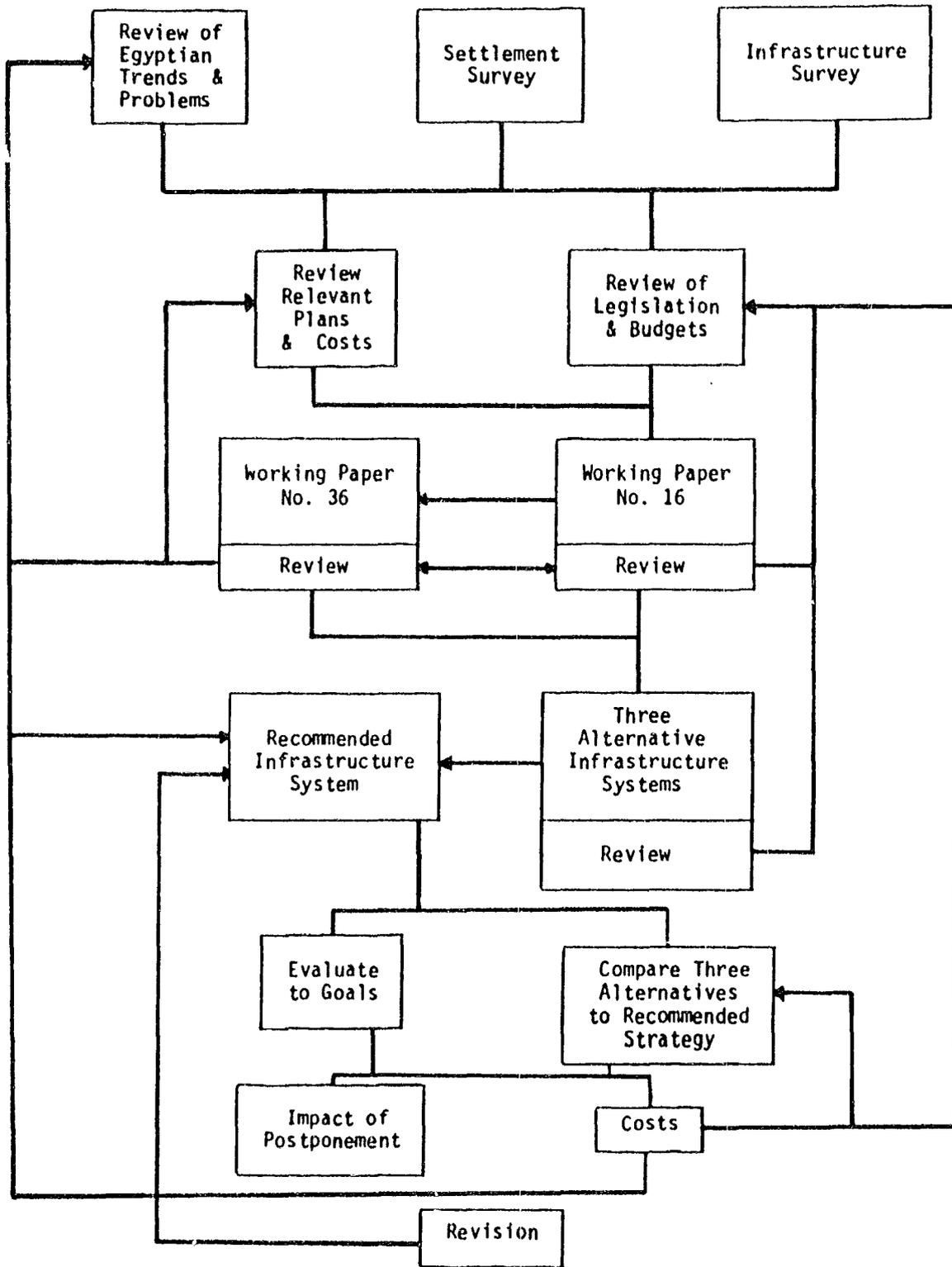


FIGURE 3.1
 INFRASTRUCTURE STRATEGY METHODOLOGY
 FLOW DIAGRAM

- Review of the work of other regional and town planning studies, and the concerned ministries and authorities
- Evaluation of infrastructure systems in terms of Sinai development goals as defined in consultation with the Steering Committee (Table 3-1)
- Comparison of the infrastructure requirements of the Recommended Strategy relative to those proposed for alternative strategies
- Analysis of the impact of postponing provision of an element of infrastructure
- Analysis of costs, considering high and low estimates
- Modification of infrastructure proposals and modification of the Recommended Strategy in other aspects.

Egypt has established a remarkable record since independence in the infrastructure areas of health, education, and electricity. Since 1974 it has been rapidly improving its level of service in water, sanitation and electricity. These trends have been studied. The concerned ministries, Cairo University and several consulting firms have prepared infrastructure plans. Each has a different level of relevance to Sinai but all those studied were helpful.

The Planning Law of 1981, the Law on Public Roads of 1968 and others have a bearing on infrastructure provision. The National five-year plans and the budget of the SDA include figures that assist in plotting trend lines. These tasks combined with interviews of knowledgeable officials provided the basis for the review and recommendations presented in earlier Working Papers and in this Report.

In 1983 three alternative strategies were prepared for consideration by the Steering Committee. The infrastructure systems were distinct. Basically it was clear that confining settlement to the north and west coasts, as has been the trend, would contribute to infrastructural efficiency. Discussions with the Steering Committee at the time seemed to indicate that the GOE was prepared to use infrastructure as a means to both stimulate and guide development; the Recommended Strategy also suggests that some infrastructure be installed prior to demand.

The Recommended Strategy's infrastructure was evaluated in four different ways:

- It was compared to the infrastructure of each of the three alternatives and to the strategy presented in Working Papers 32 and 47.

Table 3-1

Evaluation of Infrastructure Elements
in Terms of National Goals for Sinai

	Recommended Infrastructure Element						
	<u>High-ways</u>	<u>Energy</u>	<u>Telecom-munica-tions</u>	<u>Bulk Water</u>	<u>Higher Edu-cation</u>	<u>Hospi-tals</u>	<u>Parks/Beaches</u>
National Integration	+	0	++	++	+	0	+
Population Absorption	+	+	++	++	++	+	0
Resource Development	++	+	++	++	+	0	+
Manpower Mobilization	0	0	+	0	++	0	0
Economic Viability	+	++	++	++	+	0	0
Dispersed Settlement System	++	0	++	++	+	+	0
Improved Communications	++	0	++	0	+	0	0
Enhanced Environment	0	0	+	+	+	0	++

KEY: 0 = Little impact

+ = Positive impact

++ = Direct strong positive impact

- It was analyzed in terms of contributing to the achievement of the goals.
- The possible impact of postponing infrastructure provision was analyzed. This was done logically on two arguments:
 - that postponement could accelerate cost-recovery as a larger population would be available to pay more readily for the service
 - that any infrastructure element that could be postponed was probably not as important to the achievement of the Strategy as those elements that could not be postponed.

Thus, it was concluded that hospitals could be postponed (given good primary health care) but secondary education could not (even with good primary schools).

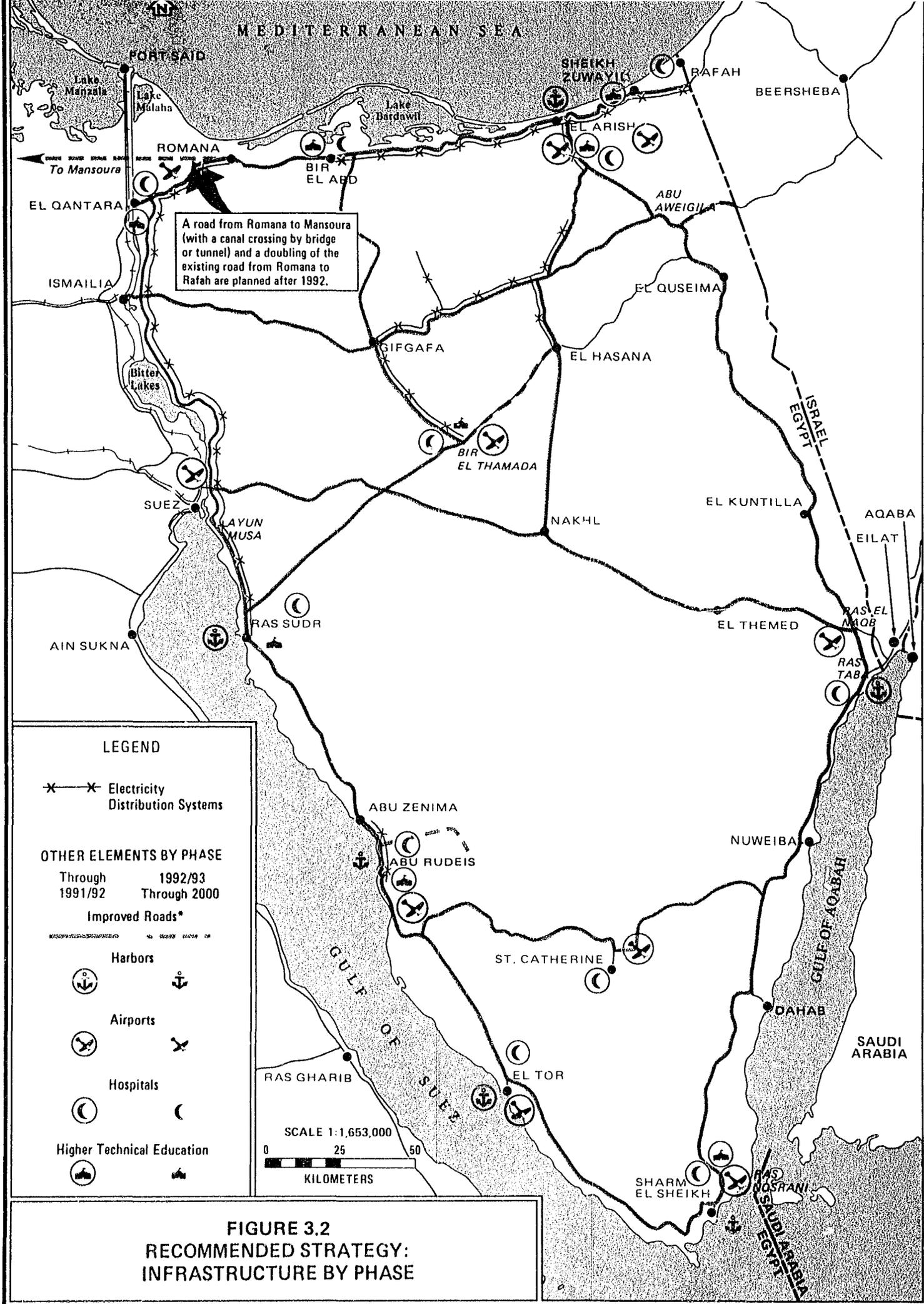
At this stage the cost analysis was recast. Earlier, costs defined in the 1981-82 Working Papers had been used. The revised cost estimates built on the earlier ones but also incorporated more recent data on all-Egypt costs, based on the final NUPS reports and follow-up interviews. The bulk water cost, which is by far the largest, was estimated in a detailed procedure as reported in Volumes V and III. In most other cases the costs are close to actual expenditures modified by inflation and local factors.

The review of cost estimates provided an opportunity to reconsider the Recommended Strategy; information in background working papers was used to check each proposal and its implications. It will be advisable to repeat that same process from time to time in future as part of the Strategic Monitoring process (Volume I, Section 6.6).

3.1.3 Products

Figure 3.2 illustrates major elements of the much revised inter-urban infrastructure of the Recommended Strategy. Elements of the community infrastructure within the proposed settlement system are described in Chapter 4 of this Volume.

For each of the key elements of regional infrastructure as well as for the several categories of community infrastructure this Report recommends levels of service by phase. These recommendations are presented by subregion and by class of settlement, where relevant. These recommendations are presented in narrative and tabular form, and costs are projected in terms of 1981 LE. The projected costs are further broken down into costs that might be the responsibility of the Nation or of the Region, including some which are unique to Sinai. These costs are summarized in the relevant chapters of Volumes I and III.



3.1.4 Seven Key Issues

3.1.4.1 The basic issue of whether or not to postpone infrastructure investments has been subject to several analyses and should be reconsidered from time to time. The Consultant recommends the pattern presented here, subject to periodic review every five or ten years.

3.1.4.2 In the highway sector, the most controversial segment has been the Ras Taba-El Arish leg of the 'Sinai National Peripheral Highway'. This link is essential to connect northern and southern Sinai and to give the dynamic Mediterranean coast improved access to Middle East markets. It also provides access to undeveloped resources near El Quseima and El Kuntilla. Lastly, it is essential to achieve a dispersed pattern of permanent settlements. The cost overall and per kilometer will be high, because the terrain is quite mountainous. The issue is not 'if' but 'when'.

3.1.4.3 Telecommunications have lagged behind some other infrastructure components in Egypt. The Consultant concluded that telecommunications should precede other systems in Sinai, because:

- It is less densely settled.
- Development must move very quickly and cannot afford communications delays and breakdowns.
- The dispersed industries and hotels will require reliable telecommunications as one of their top priorities.

3.1.4.4 A university in Sinai may encounter certain inefficiencies and difficulties. Nevertheless, the necessary research and manpower for development can best be achieved by having a local university. No single decision by the Cabinet may so clearly signal its intent to integrate Sinai fully as the decision whether or not to place a university in the southern part of the peninsula. The institution could begin as an outpost of the Suez Canal University, specializing in petroleum engineering, marine sciences, desert ecology and other faculties of particular importance to Sinai.

3.1.4.5 Hospitals are nowadays costing Egypt LE 60,000 per bed to build. Sinai's population will be relatively low density, and for many families hospitals will be distant. The Consultant recommends that Sinai receive the National standard of hospital service, but also urges that alternatives be studied (e.g., airborne and other mobile medical services, or home care).

3.1.4.6 Waterborne sewage is patently inappropriate to arid climates. The Consultant has recommended its use only in cities of over 50,000. Alternative waste management should be studied urgently. Recycling of wastewater should also have priority.

3.1.4.7 The upgrading of existing settlements is a special issue in Sinai. The Bedouin half of the population have a long tradition of low expenditure on shelter. Public and private corporations have invested in both permanent and temporary housing, creating "neighborhoods" that are poorly suited to becoming part of an attractive permanent settlement. Urgent and imaginative studies and programs are needed.

3.2 THE CURRENT SITUATION

3.2.1 Introduction

The current situation was reported as of the winter of 1982/83, but included some data from 1981. This section describes conditions somewhat earlier than the preceding section on 'Population'.

3.2.2 Transportation

The road network is extensive and supports some dispersal of settlements. Many more roads have been asphalted than would normally be expected in so sparsely populated an area. However, the physical conditions of many links in the road network are poor. The road network in Sinai is subject to occasional washouts and substantial duning; many sections require continuous maintenance to be kept in first-class condition.

The most important road now and throughout Phase I (1982-1987) is the perimeter road from Rafah via Qantara, Ras Sudr and Sharm El Sheikh to Ras Taba. Many sections of this road have been upgraded by the SDA in the past few years. The road parallel to, and on the east bank of, the Canal was being reconstructed in 1983. This will serve the land now under reclamation near New Mit Abul Kom and additional land to be reclaimed in Phase II. A few short stretches of the rest of this road were still in poor condition in 1983 but were scheduled for early rehabilitation: to the north of Abu Zenima, between Abu Zenima and Abu Rudeis and, most serious of all, from the Ras Mohammad junction to Sharm El Sheikh.

Certain key links will soon need upgrading. Accessibility to the Southeast Subregion will be better once the Hadj highway has been improved (Phases I and II), particularly between Nakh1 and Ras Taba. Land reclamation is recommended to proceed near Gifgafa so the Ismailia-Gifgafa link will have to be upgraded. Southeast-southwest access is being improved by constructing a hardtop road between St. Catherine and the Nuweiba junction; this used to be only a dirt road requiring four-wheel drive to pass certain sections. El Arish's access to the Wadi El Arish is hampered by some very poor road conditions immediately to the south of the town. The Bir El Abd-Gifgafa road has been overwhelmed by sand dunes.

Traffic volumes are not high on any stretches of the road network; very low on most. August 1981 numbers of vehicles per day are reported in the Memorandum on Community and Regional Infrastructure Conditions, which can be found in the files of SDS-I. The northern coastal road had 350 vehicles per day, while the busiest portion of the western coastal road carried only 150 vehicles per day. Team member records of 1983 visits to Sinai indicate only slight increases in these figures. East of the interim withdrawal line, only the Nuweiba-Dahab and El Arish-Rafah links approached or exceeded 100 vehicles per day.

Many stretches of road suffer from sand intrusion. This takes two forms: sand dunes themselves gradually advancing onto the road (as along the northern coastal road and some of the Uplands roads) and sand blowing across the road, particularly during the khamsin (for instance, in February 1983 the El Hasana to Gifgafa sections were almost entirely covered with a layer of sand from a few centimeters to impassably deep). The northern third of Sinai suffers most from these conditions.

The canal crossings are key links in the transport system. The opening of the Hamdi tunnel has improved access to the southern peninsula. Although the other main crossings, ferries at El Qantara and Ismailia, now operate for longer hours, long queues can still be observed. Dames & Moore staff conducted a two-week survey at the Canal crossings in September, 1981. There are eight crossing locations: Port Said, El Qantara, Ismailia, Deversoir, Sarafiam, Gamal Nasim, Hamdi, and El Shatt. The survey of five of these crossings found an average of 1,900 tons/day of freight crossing the Canal, almost all eastbound; most were petroleum products and building materials. It was estimated that between 2,200 and 2,400 people in 130 to 140 vehicles crossed the Canal (each way) each day. Observations by team members in 1983 indicate a significant increase in these volumes. Much of the increase is going via the Hamdi tunnel, through which passed from 20 to 50 vehicles each hour.

Sinai is very well endowed with airfields. Nineteen are shown in Working Paper 45, Preliminary Map Portfolio, April 1982. Many can accommodate Boeing 737 types of aircraft; some even Boeing 747s (El Arish, Ras El Naqb, Sharm El Sheikh). Passenger facilities have been improved at El Arish and Sharm El Sheikh. Air Sinai operates frequent services to the tourist resorts in the Gulf of Aqabah.

In the past there have been few port facilities in Sinai. The access from land to sea and sea to land has been from the beaches or from small piers. There is now a protected harbor facility under construction at El Arish. The facility will have docking accommodation

for two coastal ships of 5,000 ton dead-weight size and for some 60 fishing boats, with ancillary facilities on shore. Similar facilities are being planned for El Tor to serve the fishermen in that area. There are also piers and/or quays at Abu Zenima, Abu Rudeis and Sharm El Sheikh.

One significant change since the Consultant's surveys in 1981 is in the variety of transportation services. There are now petrol stations at more settlements along the perimeter road; bus services have improved greatly between Cairo and major Sinai destinations (for example, El Arish, Rafah and Sharm El Sheikh); and border crossings have been eased somewhat.

3.2.2.1 Highway Construction Guidelines

The movement of goods and people in the Sinai and to and from other parts of Egypt is highly dependent on the road network. The goals and objectives of the Government for the development of Sinai cannot be achieved without maintaining and improving these roads.

The factors which must be taken into account in the design of roads include: traffic volumes, future traffic volumes, desired travel speeds, axle loads of trucks using the roadways, the conditions of the subgrade, the terrain, and the local materials available for construction.*

Representatives of the Egyptian Authority for Roads and Bridges of the Ministry of Transport have indicated that when traffic approaches 6,000 vehicles per day they consider that it is necessary to increase the width of the roadway to four lanes. It is recommended that this standard be used in Sinai in making decisions on when to increase the width of any Sinai roadway beyond two lanes. Illustrative design criteria are shown in Table 3-2.

There are two severe operational problems in connection with roadways in Sinai: washouts of portions of roadways when rains occur and blowing sand which forms dunes on roadways and blocks traffic.

Although the Sinai Peninsula is mostly desert with very little annual precipitation, there are times when heavy rainfall occurs and causes flash floods. Roadways which cross wadis or are constructed parallel to and within wadis may be subjected to severe damage when such flash floods occur. In several cases where roadways cross wadis in Sinai, box culverts have been installed in the wadi beds beneath the roadways. These culverts have not performed satisfactorily. They become plugged with debris or sand, gravel and boulders; and the culverts wash away together with the roadway.

* See Con, F.W., A Review of Highways Design Practices in Developing Countries (May 1975).

Cooper, L., Reports on Roads and Transport Planning in Tropical and Subtropical Countries (United Kingdom: Transport and Road Research Laboratory, 1929).

"Low Volume Roads," Transportation Research Record, No. 702 (Washington D.C.: Transportation Research Board, National Academy of Sciences, 1979).

In one location a Dames & Moore engineer observed three box culverts each about one meter square in cross section, which had been installed under the roadway where the road crossed a wadi; concrete wing walls had been installed on both sides of the culverts. The box culverts were either not large enough to carry the volume of water flowing down the wadi, or they had become plugged. The water had washed out a ten meter section of the road immediately adjacent to the area where the box culverts had been installed, flowing around the culverts and wing walls and washing out an unprotected area of the roadway.

Where roadways cross wadis alternatives to box culverts should be considered. The alternatives are:

- to build a bridge across the wadi, leaving the entire wadi area open, so that any water and debris which comes from flash floods can pass under the bridge without affecting the roadway
- to depress the roadway so that it runs through the base of the wadi, letting debris and water pass over the roadways during flash flood conditions.*

The latter suggestion of depressed roadways is far more economical than building bridges and seems most appropriate where floods occur less than once in five years on average. However, the water from a flash flood will probably deposit sand, gravel, boulders, and debris on the depressed roadways; these would have to be removed before the roadways can be used again for normal vehicular traffic. The removal of sand, gravel, boulders and debris from depressed roadway sections requires mechanized equipment such as front end loaders, bulldozers, scrapers, and possibly trucks. It is suggested that the depressed portion of the roadway going through the wadi be a reinforced concrete slab, some 30 to 50 centimeters in thickness, with reinforced concrete footings tied into the slab and extending into the soils beneath the surface of the wadi beds.

Blowing sand which is deposited in drifts or dunes on and adjacent to roadways is a continual problem in many parts of Sinai. Where there has been no continuing clearing of windblown sand, the roadways have been completely covered with sand and are closed to vehicular traffic. In some locations the sand may be five, ten, or even more meters in thickness over a roadway. Although a permanent solution to the problem is not easy, there are ways to mitigate the problem, such as:

- Placing bituminous products on the sand on the windward side of a roadway to stabilize the sand and keep it from blowing

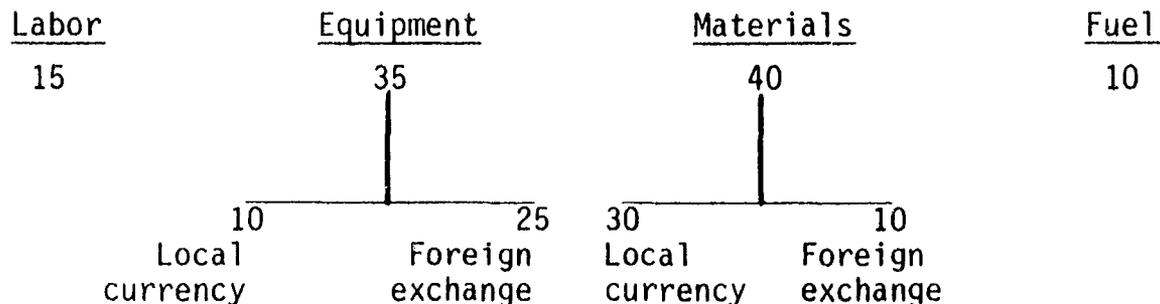
* Referred to by Egyptian engineers as an "Irish Bridge."

- Placing picket fences on the windward side of a roadway some five or ten meters from the edge of the roadway; these fences will break the velocity of the wind and cause the sand to be deposited between the fence and the roadway. Periodically the sand will build up and bury the fence, which then needs replacement
- Grow a windbreak of trees on the windward side of a roadway using plant varieties requiring little moisture and few nutrients
- Have sand removal equipment, bulldozers, front end loaders, scrapers, trucks and personnel available on short notice to clear areas of roadways which have been made impassable by drifting sand.

A research study is required to develop permanent, economic solutions to the problem of protecting roadways from drifting sand. Some combination of the above seems likely to produce a satisfactory solution.

The cost of building new roads, maintaining existing roads, and paving streets in Sinai will be a major factor in the development budget. Expenditures budgeted for the Sinai Development Authority for roads and streets in the current Five-Year Plan (1982/83 to 1986/87) total some LE 85 million, which is about one-half of the total Plan budget for the Authority.

Most roads in Egypt are constructed by capital-intensive methods. A Ministry of Transport breakdown is given below:



Labor is only 15% of the total cost. In Sinai it would be desirable to increase the labor percentage of the total cost, since one of the goals of the Government is to attract more people to Sinai. On some of the roads which are currently under construction in Sinai, the side slopes of filled sections of the roadbed are being protected by quarried stone blocks which are placed by hand on the surfaces of the slopes. This activity is useful from an engineering point of view and also increases the labor portion of the total cost of a roadway.

Many new roadways are contemplated between new agricultural areas and nearby towns or between existing roadways and nearby towns. Such roads can be built initially unpaved, but with the same sub-base and base course characteristics as primary roads. Instead of putting an asphaltic surface on such roads, consideration could be given to topping with pit run sand and gravel, sprayed with light oil and rolled, which could save up to 50 percent of the initial construction cost. The roads in Sinai seem to break down more rapidly than they should. Enquiries about this problem have brought responses that the asphalt obtained from Egyptian refineries has too high a wax content and that it tends to dry out and lose its resilience in a relatively short period of time.

Engineers in the Ministry of Transport indicate that they generally follow the design concepts established by the American Association of State Highway Officials (AASHTO). Based on observations of some newly constructed roadways in the Sinai, it is possible that the roadways are not always constructed in ways that are fully consistent with their designs. There may be a need for more inspection and quality control in the construction phase than has been the case to date. The organization responsible for the design could provide field monitoring services to see that the materials being used meet the specifications and that materials are being used as they were conceived to be used in the design.

3.2.2.2 Highway Maintenance Guidelines

Programs would also be desirable to reduce unnecessary road wear (for instance, by enforcing limits on axle weights), maintain the roads, and encourage the development of freight services. Much of Sinai road traffic is two- or three-axle trucks carrying grain, vegetables, cement, and other bulk materials. They are frequently overloaded. Road wear is partly a function of axle loadings. It is found that a high proportion of road wear is attributable to overloaded vehicles of this type, rather than more common car, taxi, or bus trips or the larger multi-axled, articulated vehicles. The Canal crossings and the military checkpoints provide convenient opportunities to check on overloading.

A clearly observable problem with many, if not most, roads is a lack of adequate maintenance. A precise cost/benefit study has not been carried out for Sinai, but it has been demonstrated in many studies that regular maintenance is more cost-effective than periodic major upgrading. For example, a USAID study in West Africa compared no-maintenance to maintenance cases for roads with average daily vehicle trips (ADTs) of about 100 rising to about 250 over a 15-year period.

In the first case, for an improved 12.25-mile road costing U.S. \$377,618 (1980 dollars), the internal rate of return (IRR) without maintenance was 7.9 percent, and with maintenance (\$20,000 to \$40,000 per annum), the IRR was 23 percent. The second case involved a new road, 33.2 miles long, costing U.S.\$1,134,126 to construct. Without maintenance, but with periodic upgrading (as in the first case), the IRR was 10.2 percent; with maintenance, 15.7 percent.*

Massachusetts Institute of Technology and Cairo and Assuit Universities recently collaborated on studies of optimal road maintenance policies.** Their economic analysis demonstrated that the best policy would be to have

"--a heavy initial (asphalt) overlay followed by frequent, light overlays on the secondary and tertiary systems (where additional structural strength is needed to meet future traffic demands)."

A higher maintenance-to-basic-construction ratio will reduce the capital intensity of road construction, especially on the minor, gravel roads. Highway departments seek to pave low-density roads because maintenance funding might not be available, paved roads will give several maintenance-free years of service, and the initial cost of paving might come from an overseas aid agency, whereas maintenance will more likely come out of the Government's local budget.

There is a danger of a cash flow problem with labor-intensive road projects, because laborers have to be paid every two to four weeks. In the equipment-intensive project the contractor provides the operating capital, whereas the implementing authority would be required to make arrangements for regular payment in labor-intensive projects. International lending agencies as well as central governments tend not to have a system of financing to facilitate frequent payments to laborers.

The labor-intensive construction of low volume roads under the control of local government is in the spirit of the current Government policy of decentralization. In community-based projects, local laborers learn construction and gain the knowledge they need to maintain roads effectively. The "line man" system of maintenance gives explicit responsibility for maintaining a road to the people and communities living alongside each particular stretch of road.

* Impact of Rural Roads in Liberia, USAID Project Impact Evaluation Report No. 6 (June 1980).

** Brademayer, B., F. Moavenzadeh, and M. J. Markow, "Road Network Analysis for Transportation Investment in Egypt," Transportation Research Record No. 702 (Washington, D.C.: Transportation Research Board, National Academy of Sciences, 1979).

3.2.3 Telecommunications

The infrastructure survey conducted in mid-1981 indicated that many settlements either had no telephone service or that the telephone service was not working. It was estimated that Sinai had only 923 telephones, 700 of them in El Arish. Although the situation has improved in the past 18 months, the current service is not adequate for modern business and administrative requirements. Telegraph facilities are also inadequate.

Egyptian as well as Israeli, Lebanese and Syrian television programs can now be received in Sinai. Egyptian programs arrive via transmitters at El Arish and El Tor. The reception radius from these transmitters is about 100 km. The 1981 Survey indicated that there were 17,336 radios and 8,810 TV sets in Sinai. Local radio reception is good.

Each community in Sinai is being linked to the national telephone and telegraph networks, which are themselves being upgraded. Prior to April 1982, ARETO planned telephone exchanges in 28 settlements in Sinai. Connection to Southeastern settlements have now been added to that plan. There are to be automatic exchanges in El Arish and El Qantara. All others are to be manual. El Qantara's exchange is to have a capacity of 1,000 lines, El Arish's 2,000, Abu Rudeis and Ras Sudr 3,000 each. Microwave links are to carry telephone channels as well as other telecommunication requirements.

The Recommended Strategy proposes larger population and economic activity buildups than projected in the interim program announced by ARETO in 1981. In general, more capacity will be required by the early 1990s. An objective recommended for establishing service standards would be to use telecommunications links to overcome remoteness and isolation; this would imply sufficiently high performance in telephone, telegraph and telex service that officials, businessmen and private citizens feel confidence in prompt, clear contact with any other part of Egypt and with export markets, despite the travel time-distance between themselves and Cairo. Exceptionally good telecommunications services would thus serve as a partial compensation for geographic distance.

3.2.4 Electricity and Natural Gas

3.2.4.1 Natural Gas

Sinai's oil, gas, and coal reserves represent one of the peninsula's most significant economic assets. The most immediate unused asset is the flared associated gas in the southern Gulf of Suez, which could be gathered and piped to the northern end of the Gulf of Suez and the Delta. The increased exploration and development east of the Suez Canal, especially on-shore and off-shore in northern Sinai, present the likely prospect of major new discoveries in the next few years. This resource could be used as the main feedstock for electrical power generation in Sinai and still leave a sufficient surplus available to permit exports from the region.

Some of the industries recommended for development in Sinai will make use of gas as a direct fuel input or feedstock:

Table 3-3
Proposed Sinai Industries That Could Use Natural Gas

<u>Location</u>	<u>Activity</u>	<u>Projected Gas Requirement</u> mmcf ^d *
<u>Northeast Subregion</u>		
	Clay brick	0.6
	Salt	3.0
<u>Southwest Subregion</u>		
	Fertilizer complex, subtotal	<u>75.1</u>
	. gas feedstock	39.0
	. fuel	32.0
	. electric power	4.1
	Caustic/chlorine, subtotal	<u>16.0</u>
	. fuel	1.0
	. electric power	15.0
	Soda ash, subtotal	<u>5.5</u>
	. fuel	4.7
	. electric power	0.8
	Cement, subtotal	<u>31.7</u>
	. fuel	28.0
	. electric power	3.7
	Clay brick, fuel	0.5
	Refractories	0.6
	Flat glass	4.5
	Ferromanganese smelter	3.5
	Calcined gypsum, subtotal	<u>3.6</u>
	. fuel	2.2
	. electric power	<u>1.4</u>
		144.6 mmcf ^d

*million cubic feet per day.

SOURCE: Volume III, Chapter 5 and Working Paper No. 36, Industry, in SDS-I project files.

Gas requirements to generate electrical power for other economic and household activities are much smaller. Desalinization is a natural ancillary process to electrical power generation with natural gas. As a rough approximation between 20,000 and 60,000 cubic feet are required per day per capita. On this basis, gas requirements for three subregions, separate from industrial uses listed above, might be as follows:

<u>Subregion</u>	<u>Zone</u>	<u>Gas Required for Electric Power Generation in 2000 (mmcf)</u>
Northwest	Northern	2.2
	Central	5.7
	Southern	1.6
Northeast	Eastern	16.2
	Western	4.4
Southwest	Northern	5.5
	Southern	1.7
TOTAL		37.3

These small requirements contrast with the projected demand at the proposed petrochemical complex for about 100 million cubic feet per day by the year 2000. The combined demand is less than the quantity of gas now flared in the Gulf of Suez.

The Recommended Strategy projects pipelines running from El Belayim to El Shatt and Qantara and Rafah.

(a) Link between El Belayim and El Shatt/Hamdi:

- 16-inch diameter line transporting 120 mmcf
- 20-inch diameter line transporting 200 mmcf

The smaller line would almost be sufficient for the needs of Ras Sudr and Abu Rudeis urban areas. The larger line could carry a surplus for export from the Southwest Subregion to the Suez Canal Zone.

(b) Link between Qantara and Rafah:

- 16-inch diameter line transporting 100 mmcf
- 20-inch diameter line, initially transporting 100 mmcf, but expanded to 200 mmcf by addition of compressors at a later stage, when demand increases.

Link (a) or (b) could be constructed first, the latter based initially on Delta non-associated gas. Link (b) would have a flow from west to east in the early years, to be reversed when the northern coastal fields come onstream, with a connection to the emerging national grid.

3.2.4.2 Electricity

Development and operation of electric power generation, transmission and operation in Sinai are the responsibility of CEDCO. CEDCO has established small generating and distribution facilities in the main population centers.* No electricity is transmitted from the national grid into Sinai; however, four 11-Kv, 3-phase submarine cables have been laid under the Canal parallel to the six Nile water syphons at Deversoir, and two 66-Kv cables were installed in 1981. There is space in the Hamdi tunnel's utility section for two 220-Kv cables. Table 3-4 describes Sinai's 1981 electricity generation and consumption pattern, 80 percent of which was in El Arish.

In accordance with the first phase of a plan prepared by CEDCO prior to the Israeli withdrawal from east Sinai, diesel and gas turbine generators are being installed in principal settlements. Large gas turbine generators using natural gas will be installed in a second phase, to be tied into a 66-Kv network. In the third phase, Sinai will be linked to the national grid by establishing a 220-Kv network and matching transformer stations in the region. The CEDCO plan assumed that a thermal power station will be constructed at Gebel El Maghara. CEDCO's third phase developments are to be completed by 1990, by which time the Company projected a load of about 109 mw in North Sinai, and 30 mw each for land reclamation in North and South Sinai.

An early action proposal (both CEDCO and Dames & Moore) concerns the damaged power plant at Abu Zenima. The plant has three gas turbine generators of 7-megawatt size that were installed just prior to 1967. During the occupation, the plant was badly damaged, control systems were completely destroyed, and the associated desalinization plant was removed; however, the turbine generators themselves were evidently never operated and appear to have sustained little damage. The plant was to be run on natural gas piped from the El Belayim field. The pipeline built for this purpose was largely converted to scrap in the intervening years.

The Sinai Manganese Company is planning to rebuild and activate the ferromanganese smelter. The power plant was originally built to supply electricity for the smelter. If the power plant cannot be restored to operability, some alternate source of electricity will be needed. In a recent study of the ferromanganese project, the consulting engineers concluded that the most economic solution would be to discard the old equipment and purchase new units, since efficiency and reliability have been greatly improved in the last 15 years. Other engineers express confidence that restoration can be done reliably for much less than the cost of a new plant. This matter needs additional, more comprehensive study.

* For the distribution of turbine generators in North Sinai, see Table 4.1 in Working Paper 47, Community and Regional Infrastructure, April 1982.

Table 3-4

Electric Power Generation - 1981

<u>Community</u>	<u>No. of Generators</u>	<u>Rated Capacity (kW)</u>	<u>No. of Houses or Buildings Served</u>	<u>Average Daily Consumption (kWh)</u>
<u>North Sinai, Subtotal</u>	<u>19</u>	<u>9,807</u>	<u>11,588</u>	<u>39,475</u>
El Arish	7	8,305	10,280	35,000
Bir El Abd	1	145	250	85
Negila	1	58	250	180
Rabaa	1	90	35	200
Romana	3	210	150	690
Baloza ^{a/}	2	149	281	390
Gilbana ^{a/}	--	--	--	--
El Qantara ^{a/}	2	750	316	2,480
Gifgafa ^{a/}	--	--	--	--
El Hasana	1	50	10 ^{b/}	150
Bir El Thamada ^{a/}	--	--	-- ^{b/}	--
Nakhl	1	50	16 ^{b/}	300
El Shatt ^{a/}	--	--	--	--
<u>South Sinai, Subtotal</u>	<u>17</u>	<u>22,825</u>	<u>981</u>	<u>3,250</u>
Ayun Musa ^{a/}	--	--	--	--
Ras Sudr	4	1,000	531	1,180
Abu Zenima ^{c/}	3	21,000	--	--
Abu Rudeis ^{d/}	--	--	--	--
Feiran Oasis	1	30	110	180
St. Catherine	4	300	200	1,440
El Tor ^{e/}	5	495	140 ^{f/}	450
<u>TOTAL</u>	<u>36</u>	<u>32,632</u>	<u>12,569</u>	<u>42,725</u>
	==	=====	=====	=====

^{a/} No public electrical service provided to community.

^{b/} Government guesthouses.

^{c/} Three 7-megawatt gas turbine generators, inoperative.

^{d/} Approximately 25 percent of the community is provided with electricity by private companies.

^{e/} El Tor has two additional generators (rated capacity, 515 kilowatts) that are not used.

^{f/} Includes 120 guesthouses.

SOURCE: Canal Electricity Distribution Company (CEDCO).

A theoretical alternative, that has interested the Dames & Moore team and others, is a joint venture or cooperative arrangement with oil company operators in the Abu Rudeis area. The operators of Petrobel and SUCO are well into the development/production stage with substantial power requirements. In establishing self-sufficiency, as is customary in oilfield operations, the companies have provided for excess capacity backup to assure their on-stream reliability. It was not possible in this study to obtain complete information as to exact capacities; however, it has been speculated that as much as 20 to 40 megawatts of standby power is a reasonable possibility. If this power could be made available without jeopardizing the safety of oil operations, it might satisfy requirements of the smelter and other demands likely to develop in the area over the next five to ten years.

This possibility was discussed with officials in the Ministry of Petroleum, the Egyptian General Petroleum Company, and the EEA. It appears that, while all parties have a strong desire to aid in the development of Sinai and to sponsor improved efficiency in the respective sectors, the sale of oil company power to outsiders involves financial risks for foreign partners, who may not welcome an involvement which complicates their operating problems and adds to risks of power outages.

The other options exist:

- The oil operators could sell natural gas to the EEA, which would generate electricity for CEDCO to distribute to the public and to industry.
- The oil operators could supply gas directly to large consumers, such as the Sinai Manganese Company, as was planned prior to 1967.

Further study of the gas supply and alternatives for its use seems necessary before a solution is found that is in the best interests of all.

3.2.4.3 Renewable Sources of Energy

Noncommercial energy--primarily in the form of biomass and animal wastes burned for cooking and, to a much lesser extent, for space heating--represents a significant portion of energy consumption in Egypt. No accurate determinations have been made of the quantities of noncommercial fuel used in Sinai. Based on limited information available for Egypt as a whole, and considering figures for petroleum-product consumption in Sinai, some general observations are possible. Most noncommercial energy is in the form of vegetation, agricultural residues, and dried animal dung. Some observers feel the use of shrubs and trees for fuel has contributed significantly to desertification trends in Sinai in recent decades.

Probably 50 to 75 percent of the rural households in Sinai use non-commercial fuels for at least some of their cooking requirements. Due to the increasing availability of kerosene and butagas in Sinai, and because of the value of biomass and dung for a variety of other uses, the total quantity of noncommercial fuels in Sinai is not expected to increase significantly in the future, and per-capita levels will decline as more areas are settled.

Solar and wind energy potential is high in Sinai. Both resources are more promising in southern portions, where wind levels are double those on the northern coast and there is less cloud cover. Windmills have been used in Egypt for many centuries, and will have application in remote places in Sinai. Solar water-heating is not unusual today near El Arish and can be introduced more rapidly in Sinai than in other parts of Egypt. Small-scale renewable energy sources have a greater relevance in Sinai than in Nilotic Egypt, because the delivered cost of kerosene and butagas will be much higher and to some degree less reliable. The consultant recommends a prefeasibility study to define these opportunities and relevant action programs more clearly.

3.2.5 Water

The current provision of fresh water is described in some detail in Chapter 3 of Volume V. More than half the water now consumed in Sinai is imported by pipeline and ship and distributed by truck and pipeline. The lesser half, in quantity and quality, is drawn from wells. (Table 3-5.)

Table 3-5
Local Water Supply for Sinai Cities - 1981

	Wells		Daily Use m ³ /day	Storage m ³
	Sweet	Brackish		
El Arish ^{a/}	12	2	7,000	500
Nakh1 ^{b/}	2	2	4	32
Ras Sudr ^{c/}	----	46 ----	(d)	(d)
El Tor	3	13	700	500

^{a/} El Arish exports water.

^{b/} Nakh1 also receives water by truck.

^{c/} Ras Sudr draws on wells at Ras Misalla and has installed desalinization facilities.

^{d/} Not determined.

SOURCE: Dames & Moore Survey, June 1981.

About half of the wells in use deliver brackish water, indicating a considerable demand for desalinization.

Water consumption rates in Sinai are dangerously low. Whereas the World Health Organization recommends a 'basic needs' standard of 10 liters a day for drinking, cooking and washing, there is evidence that many individuals in Sinai have less than five liters a day available on a year-round basis. Health surveys indicate that the population is less healthy than Egypt as a whole. This finding is likely to be related to the poor provision of water. Most Egyptians have 100 or more liters a day available to them.

Standpipes are in as common use in urban Sinai as wells in rural Sinai. Often these standpipes are more than a quarter of a kilometer from family homes. Such distances discourage cleanliness.

Projects which are already well advanced in current investment programs will carry piped Nile water to El Arish, Abu Rudeis and Gifgafa and/or Bir El Thamada. When these aqueducts are operational more than two-thirds of the peninsula's population will be within ten kilometers of a Nile water supply.

The largest water use in Sinai is irrigation. This use is concentrated east of El Arish and east of the Bitter Lakes. The former area relies on wells, and there are reports of overpumping. The latter area relies on siphons under the Suez Canal, and their capacity is considerably in excess of current use, since reclamation activities are still in their initial stages.

3.2.6 Higher Education

There are fewer secondary schools than hospitals in Sinai. South Sinai Governorate, an area three times the size of Lebanon, was reported to have only one secondary school with three rooms. At the top of the educational pyramid in Sinai are three commercial schools and a teachers' college in El Arish and El Qantara with a total of 850 students, accounting for one-half of all secondary school enrollments in 1981. (Table 3-6.)

Girls' participation in secondary education is about one half the level of boys' in Sinai and only one-quarter in South Sinai. There is a greater balance in college and technical school attendance; these institutions seem to be focused on the needs of the local economy. The secondary schools are more general. Enrollments as a share of population are a fraction of the participation rates in Nilotic Egypt. As discussed in Chapter 2, illiteracy and under-education are problems in Sinai and tend to hold back the participation of local people in the overall development process. Continued lack of good educational facilities would also discourage in-migration.

Table 3-6

Higher Education Facilities and Enrollments - 1981

	Secondary Schools				College/Technical Schools					
	Units	Rooms	Enrolled		Total	Units	Rooms	Enrolled		Total
			M	F				M	F	
El Arish	3	46	900	499	1399	3	20	449	301	750
Rabaa	1	14	240	54	294	-	-	-	-	-
Ras Sudr	1	3	48	12	60	-	-	-	-	-
El Qantara	-	-	-	-	-	1	3	45	57	102
	<u>5</u>	<u>63</u>	<u>1188</u>	<u>565</u>	<u>1753</u>	<u>4</u>	<u>23</u>	<u>494</u>	<u>358</u>	<u>852</u>
	===	===	=====	===	=====	==	==	===	===	===

- Notes:
- Secondary school enrollments equal 1 percent of population.
 - College enrollments equal one-half of 1 percent of population.
 - Technical education facilities are in construction at El Tor.
 - Suez Canal University is opening a research facility at Sharm El Sheikh.

SOURCE: Surveys by the Consultant.

3.2.7 Hospitals

Hospitals are expected to provide a full range of medical services concentrating on the more unusual cases of ill health; the more common diseases and minor accidents are normally cared for at primary health centers within neighborhoods. Sinai has a rather large number of facilities called hospitals, but does not currently offer a full range of health services to most of its population. This is because: (a) some of the hospitals are small and not multi-purpose, and (b) the hospitals are concentrated on the coasts.¹⁸

Private health care services, theoretically an alternative to public services, are little developed in Sinai and do not seem probable, since the peninsula has a low population density and low levels of income. Overall health care and health are poor in Sinai. Rapid development will include a requirement for major upscaling of medical care with convenient multi-purpose hospitals and clinics.

* Table 3-7 lists hospitals and beds as reported in 1981.

Table 3-7

Hospitals and Hospital Beds in Sinai - 1981

	<u>Hospitals</u>	<u>Beds</u>
El Arish	2	64
El Qantara	1	16
Ras Sudr	1	12
Abu Rudeis	1	4
El Tor*	1	6
St. Catherine	<u>1</u>	<u>11</u>
TOTAL	7	113
	==	===

NOTE: Population 172,000 = 1,522 persons per hospital bed or 0.66 beds per thousand persons. Egypt average = 2 hospital beds per thousand persons. Figures updated in 1983 indicated 0.75 beds per thousand in Sinai and 2.2 per thousand for all Egypt.

* 60-bed hospital in construction in 1983.

SOURCE: Surveys by the Consultant.

3.2.8 Recreation and Conservation

The two most used recreation facilities in Sinai are the palm beach at El Arish and Marsa El Att north of Sharm El Sheikh. The Ras Mohammad headlands and coral reefs are now a National Park, as yet unimproved. A magnificent "corniche" is in construction at El Tor. St. Catherine is being considered for National Park status. Most of the other recreation facilities can be labelled as local in scope. Many places with excellent regional recreation potentials are nowadays used informally. It is predictable that with improved access by ferry and tunnel that this will soon create problems.

3.2.9 Intra-Community Infrastructure

The 1981 Dames & Moore survey identified primary schools, clinics, parks, playgrounds, streets, courts, prisons and other local facilities and service centers in many Sinai communities. The SDA is carrying out a truly massive program to provide schools, clinics and other facilities to all parts of the peninsula.

The current picture is one of very uneven service indeed and a great rush to achieve equity. The pattern at this writing is that of the Mediterranean coast being much better provided for than the remainder of Sinai; also, El Tor has better facilities per capita than other places south of the Mediterranean coast. Thought might well be given to negotiating with large scale developers and employers to share in the cost of local community infrastructure as a way they could contribute to Sinai catching up with the rest of Egypt.

3.2.10 Summary

This section has reviewed the status of regional infrastructure, using a broad definition to include telephones and secondary schools because of the SDS-I focus on the overall process of development. The picture is not a balanced one. Highways are at quite a high standard, thanks partly to recent construction. Telephone service is very poor indeed, but significant improvements are being implemented and more are planned. Hospitals are better distributed than secondary schools. Water services are quite uneven despite very substantial recent improvements.

The impacts of inadequate regional infrastructure are documented elsewhere: high illiteracy, high infant mortality, low levels of hotel occupation, poor communications, and so forth. The next section presents some ideas for an economical path to catching up on these deficiencies during the next few years, while at the same time providing for a six-fold growth in the population of Sinai.

3.3 LEVEL OF SERVICE

3.3.1 Introduction

This section recommends target levels of service for each of several elements of regional infrastructure. Section 3.4 estimates regional infrastructure costs and phasing. Some types of intra-community infrastructure are considered in Chapter 4, Settlements, including community land budgets in Section 4.9. By and large, the objectives proposed would enable Sinai to catch up quickly to levels of service already achieved in Nilotic Egypt and then to move ahead according to its particular needs. It would not be efficient for Sinai to replicate exactly the mix and level of infrastructure in the rest of Egypt, since the peninsula has some different needs. Rather the intent is to match some services and excel in others.

3.3.2 Transportation

The Recommended Strategy suggests 100-kilometers-per-hour highways east-west and north-south and all around Sinai. The area of Sinai is about 61,000 square kilometers, which is more than the entire Nile Valley within Egypt. Good road transport will be central to rapid development. Proposed national highways will serve as major arteries; they will connect with hundreds of dirt farm-to-market roads and urban streets.

Farmers and manufacturers in Sinai should have the option to export by land, sea or air. Therefore, the level of service guidelines for transport include: a harbor on each coast--El Arish, Port Said, Port Tewfik, Ras Sudr, El Tor and Taba; 747 airports in the north and south--El Jura, Ras El Naqb and Sharm El Sheikh, and 737 airports in each subregion--El Qantara, Bir El Thamada, Abu Rudeis, and St. Catherine.

The level of service for interregional buses and flights is already good. Ferry service continues to require improvement as does intra-regional bus service.

3.3.3 Telecommunications

The current level of service in Sinai is one telephone for 200 persons whereas for Nilotic Egypt it is about seven phones for each 200 persons. It seems reasonable to set a target to achieve service as good as all of Egypt by 1987 and to move ahead of the rest of the country from then onward. This strategically higher level of service is suggested to overcome the twin handicaps of distance and relatively low density in Sinai.

Suggested Levels of Service Telephones per 100 Persons in Sinai

1981	0.5
1987	3.5
1992	7.0
2000	14.0

It may be expected that one-half the phones will be residential and one-half for all other uses. This implies one telephone for each three families in the year 2000. A rational allocation system should make them available to all income groups and land uses. Thus, for telephones it is suggested that the all-Egypt level of service be achieved by 1987 and exceeded after that; whereas for electricity, catching up to Lower Egypt is suggested only in 1992. Since the Sinai system will be all new equipment, the same number of telephones per 100 should give a better standard of service.

3.3.4 Electricity and Natural Gas

At present Sinai uses a variety of fuels for manufacturing and domestic purposes. Considering the local resources of natural gas, it is suggested that natural gas be piped to the Mediterranean and northern Gulf of Suez coastal plains. The rest of Sinai may be served by local coal, solar or wind energy, and butagas, with diesel for electrical generation. It is intended that natural gas be distributed along the full 700-kilometer length of the coastal plains, which will be intensely developed; this service would be provided on a basis that recovers all costs within the life of the equipment. The target level of service for the year 2000 will be better than service in Nilotic Egypt in 1980.

At present 40 percent of Sinaians have electrical service, whereas 60 percent of Nilotic Egyptians do. It is suggested that the level of service targets be as follows:

- 1987 - similar to New Valley
- 1992 - similar to Lower Egypt
- 2000 - similar to Suez Canal Zone.

Table 3-8

Suggested Per-Capita Electric Generation Capacity^{a/}

	<u>1981</u>	<u>1987</u>	<u>1992</u>	<u>2000</u>
Kilowatt hours per capita per annum	77 ^{b/}	150	185	220
Percent of population served by system	40 ^{c/}	55 ^{d/}	65 ^{e/}	75 ^{f/}
Generation (installed watts per capita) ^{g/}	58	267	329	392

^{a/}The "generation capacity per capita" is intended to cover all uses except heavy industry, which are calculated as part of the cost of specific heavy industry project.

^{b/}Based on CEDCO data.

^{c/}Table 3-3.

^{d/}Equal to Red Sea and New Valley in 1979.

^{e/}Equal to Lower Egypt in 1978.

^{f/}Equal to Suez Canal Zone in 1978.

^{g/}Calculated as follows: kWh/year divided by 365, adjusted for a load factor of 68 percent.

SOURCE: Calculations by Consultant based on the EEA 1981 Annual Report as cited in NUPS Urban Growth and Urban Data Report.

User Projection for Egypt, 1983 (Gwh/year)

	<u>Gwh^{a/}</u>	<u>Percent</u>
General industry	5208	38
Residence & commerce	6322	47
Irrigation & related	835	6
Other	<u>1193</u>	<u>9</u>
	13558	100

Load factor - 66 percent/peak demand 3000 mw^{b/}

a/ Gigawatt hours

b/ Megawatts

SOURCE: EEA Projections, 1980.

In Sinai heavy industry is expected to provide its own electricity. Therefore, general industry may account for a smaller proportion of general requirements analyzed here. It is expected that agriculture will demand a larger share of all electricity because more pumping will be required than in Nilotic Egypt, even though some pumping will be done by other energy sources.

Projected Percentage Distribution
of Sinai Demand

Industry	33.5
Residential/Commercial	50.0
Agriculture	10.0
Other	6.5

Extension of electrical service to populations near coastal towns and cities is actively under way. It seems likely that 55 percent can be served by 1987 at a similar wattage per capita as the natural average in 1981. Reliable electricity should be available to incoming industry; therefore, it is recommended that capacity be built just ahead of these levels-of-service guidelines.

3.3.5 Water

The all-Egypt average urban consumption of potable water is 167 liters per day, 100 of which is discarded as sewage. Studies of leakage indicate that half of this water is not put to good use. In Sinai the 1981 survey indicates that the mean consumption is about 5 liters a day, whereas the World Health Organization recommends 10 as a safe minimum. The following table is suggested as a guideline:

Suggested Level of Service
Liters per Day per Capita (LDC)

<u>Population Size of Settlement</u>	<u>1981</u>	<u>1987</u>	<u>1992</u>	<u>2000</u>
Over 50,000	20	40	100*	150*
25,000 - 50,000	NA	25	50	100
5,000 - 25,000	NA	17.5	30	50
Under 5,000	NA	10	20	30

* Includes sanitary sewerage after 1992.

The level of service includes both domestic and commercial use but not heavy industry or agriculture, which are calculated separately for each major project. Recycling systems are assumed in all but the smallest settlements. Achievement of the 1992 level with efficient engineering and management can provide a high amenity level of potable water service. The year 2000 levels can be very comfortable, provided recycling for some commercial uses is handled efficiently; ample maintenance of street trees is allowed for.

3.3.6 Higher Education

At present, participation in secondary school education is about one percent of the Sinai population, or about 25 percent of eligible males and 12 percent of eligible females. For all Egypt, various sources of information suggest that the 1983 participation rate is over 40 percent for males and over 25 percent for females; these proportions have been climbing. For Sinai the Recommended Strategy advocates higher levels of education than for Egypt as a whole with special emphasis on the skills needed to build Sinai. Therefore, the following levels of service are suggested.

Secondary School Attendance Targets
(percent of age group)

	<u>1981</u>	<u>1987</u>	<u>1992</u>	<u>2000</u>
Male	25	35	60	90
Female	<u>12</u>	<u>25</u>	<u>50</u>	<u>90</u>
Average:	19	30	55	90

Secondary schools should be located in each subregion by 1987, in each zone by 1992, and in each settlement of over 5,000 population by the year 2000. The distribution of secondary school enrollments should be a mirror of the proposed Sinai economy. Thus, the emphasis will be:

Agriculture	40 percent
Industry	20 percent
Trade and Commerce	25 percent
General	15 percent

3.3.7 Hospitals

Updated 1983 figures indicate there are 0.75 hospital beds per thousand Sinaians whereas Nilotic Egyptians have 2.2 beds per thousand; a few Sinaians also have access to Suez Canal region hospitals. The Ministry of Health has set a national target of 4.5 beds per thousand. The level of service recommended is at least one full-service hospital in each of the five subregions. The target number of beds per thousand in hospitals or poly-clinics would be as follows:

1981	0.75
1987	1.00
1992	2.25
2000	4.50

These twin standards of service, based on subregions and the total population level, are recommended to help improve the health of current residents and also to provide the infrastructure needed to attract immigrants.

First priority in health care should go to clinics, both small and large; second priority to hospitals. Clinics are included in Intra-Community Infrastructure (Section 3.3.9 below).

3.3.8 Recreation and Conservation

The Sinai peninsular landscape and environment, described in Volume IV, is unique in Egypt and in the world. It provides Sinai with a special economic base and Egypt with a natural and cultural heritage. The Recommended Strategy suggests that about 1 percent of Sinai's land may be needed for urban uses, and the other uses will need only 25 percent more by the year 2,000. As a level-of-service recommendation, it is suggested that 15 percent of Sinai, including unique mountain, coastal and historic areas, be declared "out of bounds" and not available for industry, settlements, intensive agriculture or mining. It is also recommended that one-third of the beaches and coral coastline be similarly protected.

These areas would be recognized as serving 75 million Egyptians in the 21st century and attracting hundreds of thousands of tourists, from Egypt and from abroad, year after year.

3.3.9 Intra-Community Infrastructure

By the year 2000 the following services are to be provided in all Sinai settlements with a population of 5,000 or more. Programs to provide these services to all unserved settlements are under way; education above the first six grades and improved health care take priority. However, all services should be provided by the end of the 1980's.

- Grades 1-12 education
- Primary health care
- Potable water
- Religious facilities
- Electricity
- Post and telephone
- Streets
- Recreational open space
- Public safety

At the 25,000-50,000 population (large town) class it is recommended to add secondary health care, telegraph and telex, and both solid and liquid waste services. Water-borne sewage services would be added at the "city" level (population over 50,000), where the intra-community infrastructure would also include college or university education, a sports stadium, and all the governmental services of a provincial capital.

The levels of service for streets and open space are considered in Chapter 4 under "Community Land Use Budgets." The criteria for electricity, water, telephone and secondary education are described in previous subsections of this Chapter.

3.3.10 Summary of Level of Service Recommendations

This section has briefly set out the Consultant's recommendations concerning the appropriate mix of infrastructure services in Sinai; the intention is to serve the twin purposes of social justice and rapid settlement during the next two decades of development. Priority has been recommended for transportation and communications and secondary educational facilities, as these seem to be the elements that can contribute most effectively to the metamorphosis of Sinai. Within each category the level of service has been tripled or quadrupled over the current average. This has been suggested to be spread over the entire 17.5 years of the planning period at appropriate rates of improvement, service by service.

3.4 COSTS AND PHASING OF REGIONAL INFRASTRUCTURE

3.4.1 Introduction

The purpose of this section is to present an efficient way to achieve the level of service recommendations of the previous section. Costs are presented in 1982 Egyptian pounds, which are estimated in most cases by adding a 15 percent-per-year inflation factor to 1979 and 1980 data from sources already cited. Phasing is fitted to the population projection of the Recommended Strategy (Section 2.4); however, this is varied more often than not by factors for upgrading of existing levels of service and providing services to presently unserved areas. Thus, each infrastructural element responds in cost and time to strategic as well as social justice requirements. The outputs of this section are summarized in Table 3-14 and incorporated in Volumes I and III, where the Recommended Strategy and associated investment plans are described comprehensively.

3.4.2 Transportation

The costs of transportation have been prepared for major links and nodes in the system. The "order of magnitude" cost estimates for first class roads are based on observation and interviews with engineers who have recent road-building experience in Sinai and elsewhere in Egypt (2-lane paved roads: through level terrain LE 100,000 per kilometer; rolling terrain LE 150,000 per kilometer; hilly LE 200,000; escarpment LE 400,000). The costs for harbors are based on 1981 Government estimates for El Arish and El Tor (Table 3-9). Railroads were not found necessary to the Strategy proposal.

In addition to major projects listed here, a great deal of highway construction is already well advanced or has been completed recently; and, as reported earlier, a harbor is under construction at El Arish. Thus, the investment costs estimated here cover only major projects still to be started on the basis of the Recommended Strategy.

3.4.3 Telecommunications

The cost of telephones in Egypt, considering all national, regional and local equipment, is estimated by ARETO to be LE 3,000 per instrument.* It may be estimated that in the early years Sinai costs will be somewhat higher than this to establish the "main lines." Later the cost may go down. In Egypt over 90 percent of what little cost-recovery there is for telecommunications services is from non-residential users. Four main lines are envisaged:

- Qantara-Rafah
- Ismailia-El Quseima
- Suez-Ras Taba
- Suez-Sharm El Sheikh.

The first and third of these are expected to provide international connections.

Recommended Phasing

- 1981 - El Arish, Qantara, Ras Sudr only
- 1987 - Add 5,000 to current 1,000 phones in Sharm El Sheikh, St. Catherine, Abu Rudeis, El Quseima, Rafah, Gifgafa areas and some intermediate points
- 1992 - Exchanges in all settlements listed in Chapter 4
- 2000 - Diversification of systems and increase number of instruments by three times.

Estimated Costs (order of magnitude)**

Phase I	LE 15 Million
Phase II	LE 78 Million
Phase III	<u>LE 315 Million</u>
TOTAL:	LE 408 Million

* ARETO Sector Study, 1978, Volume III, as cited in NUPS, Volume I, Chapter IV.

**A policy is recommended whereby one-half of capital costs for telecommunications is assigned to the National system.

Table 3-9

Cost of Major Transportation Investments, by Phase

	<u>Subregion</u>	<u>Investment Cost (LE Million)</u>		<u>Total</u>
		<u>National</u>	<u>Regional</u>	
PHASES I & II (through 1991/92), Subtotal	--	<u>125</u>	<u>60</u>	<u>185</u>
Roads, Subtotal	--	<u>90</u>	<u>35</u>	<u>125</u>
El Qantara - El Shatt**	NW	11	--	
Hadj Highway	UP	27	--	
Ras Taba - Ras El Naqb	SE	8	--	
Ras El Naqb - El Quseima	UP	21	--	
Bir El Abd-Gifgafa	NE	--	6	
El Tor - Sharm El Sheikh	SW	4	--	
Abu Rudeis - Umm Bugma	SW	--	7	
Rural roads*	ALL	--	10	
Others to be identified	ALL	19	12	
Harbors, Subtotal	--	<u>35</u>	<u>25</u>	<u>60</u>
Ras Taba	SE	15	--	
El Tor	SW	--	15	
Ras Sudr	SW	15	--	
Others to be identified		5	10	
PHASE III (1992/93-2000), Subtotal	--	<u>60</u>	<u>50</u>	<u>110</u>
Roads, Subtotal	--	<u>48</u>	<u>27</u>	<u>75</u>
El Tina - Rafah**	NE	18	--	
Bir El Thamada - El Hasana	UP	--	4	
El Quseima - Border	UP	--	1	
Rural roads	ALL	--	10	
Others to be identified	ALL	30	12	
El Qantara Airport	NW	--	15	15
Ports and other Transportation	ALL	<u>12</u>	<u>8</u>	<u>20</u>
TOTAL		<u>185</u>	<u>110</u>	<u>295</u>

*All or partially in current Five-Year Plan.

**Dualing of coastal highway and Canal crossing.

SOURCE: Estimates by Consultant, based on review of Plan and Budget documents and discussion with Governors and other officials.

3.4.4 Electricity and Natural Gas

Electricity, like telecommunications, will cost more per unit of service in early phases than late phases and more in some subregions and zones than others. This cost estimate, for the level of service recommended, is to provide an order of magnitude figure comparable to other regional strategies and plans. Costs are therefore presented as though they are the same for all parts of Sinai and for all phases. Costs for electrical generation are particularly sensitive to mode and scale of generation. Transmission and distribution costs are more readily estimated for a special system. The following phased proposal presents a set of sub-systems for costs which can be estimated more accurately only at the prefeasibility stage. It is presented with the judgement that the savings in transmission costs will justify the higher generation costs implied in smaller plants. As in the case of telecommunications, electricity costs include distribution to the ultimate user; therefore, electricity is not included in intra-community infrastructure costs in Section 3.4.9 below.

Egypt EEA Projections of Electricity Costs 1980-1987 (LE 000 per megawatt)

Generation	762
Transmission	92
Distribution	<u>194</u>

TOTAL LE 1,048 per MW

SOURCE: EEA Investment Paper, April 1980.

EEA expects that retail electricity capacity will cost about one million pounds per megawatt. In Sinai electricity will be generated with local natural gas, coal and renewable resources. Therefore, there will be a savings in energy source. However, generation facilities will be smaller and therefore more expensive per unit than in Nilotic Egypt. Transmission will be somewhat more expensive per settlement. Distribution may be somewhat more efficient because most communities will be better planned. Considering these factors and inflation since the EEA forecast, the Consultant recommends LE 1.5 million per megawatt of capacity be used as an order-of-magnitude cost estimate.

The electrification program included in the current Five-Year Plan is introducing electricity to all parts of Sinai. Therefore, the Strategy presented here is basically one of improving services.

Cost by Phase (using the levels of service from Section 3.3.4)

<u>Phase I</u> - New population 40,000 x 267 wpcd = 10.6 MW	
10.6 MW x 55% served	= 5.8 MW
Old population added 20,000 x 267 wpcd	= 5.2 MW
Additional capacity to 1987/88	= <u>11.0 MW</u>

11 x 1.5 = LE 16.5 Million (rounded to LE 16 million)

Phase II - New population 308,000 X 329 wpcd = 101 MW
 101 MW X 65% service = 65.8 MW
 Old population 25,000 X 329 = 8.2 MW
 Additional Capacity to 1992/93 = 74.0 MW
 74 X 1.5 = LE 111 Million

Phase III- New population 402,000 X 392 wpcd = 177 MW
 177 MW X 75% served = 133.0 MW
 Old population added 40,000 X 392 = 13.0 MW
 Additional capacity to 2000 = 146.0 MW
 146 X 1.5 = LE 219 Million

Grand Total = LE 346 Million

wpcd - watts per capita per day

Commenting on a 1983 draft of this Report, the Ministry of Electricity and Energy reported its plans to build a 1,200 megawatt steam generating station between El Shatt and Ras Sudr. This plant, for which financial assistance has been offered by Japan and the United Kingdom, is expected to burn a combination of imported and local (e.g., Maghara) coal. Although sited in Sinai, much of its output would serve the national grid; investment costs can be shared between national and regional systems. The Ministry also proposes an extensive transmission network in Sinai, which would offer an alternative to at least some of the proposed smaller systems listed in Table 3-10. The optimum combination of independent and interconnected systems can best be determined on the basis of detailed feasibility and engineering studies, which will be necessary before full implementation of the Ministry's plans. Therefore, a tentative order-of-magnitude allocation of costs is proposed along the following lines.

Summary of Projected Power Systems Lists, By Phase
 (LE Million)

	<u>I</u>	<u>II</u>	<u>III</u>	<u>TOTAL</u>
1200 MW generating plant-National	500	500	-	1,000
Transmission, distribution and smaller generating systems - Regional*	16	111	219	346

* The Ministry of Electricity foresees investment of LE 271.4 on these items, through 1992. The Consultant foresees less expenditure before 1992 but a larger overall total because of the longer time period covered by the Recommended Strategy, a population target of one million, and a somewhat dispersed pattern of settlements.

Table 3-10

Proposed Electrical Systems for the 1990s*

<u>Subregions</u>	<u>Zones</u>	<u>Generation</u>	<u>Grid</u>
Northwest (3 systems)	Northern	Gas at Baloza	To Romana and Qantara
	Central	Gas at Abu Sultan	
	Southern	Ayun Musa gas or coal	Ras Sudr to Hamdi
Northeast (2 systems)	Western	Gas at Bir El Abd	Bir El Abd to El Mazar Rafah to El Arish
	Eastern	Gas at Sheikh Zuwayid	
Uplands (2 systems)	Western	El Maghara coal	El Maghara, Gifgafa, Bir El Thamada, El Hasana, El Sirr
	Eastern	Diesel, solar, wind	None
Southwest (2 systems)	Southern	Gas on coast, diesel, solar, wind in the mountains	Abu Zenima and Abu Rudeis only
	Northern	Gas and/or imported fuel	Ayun Musa and Hamdi
Southeast		Diesel, solar and wind	None

* Basically, the Consultant recommended that a Sinai grid for the entire peninsula be postponed until after 2000.

Natural gas lines are recommended from Abu Rudeis to Suez and from El Qantara to Rafah (see Figure 4.4, Working Paper 38). These lines will parallel highways and bulk water conveyances. Therefore, installation costs may be relatively low. For costing purposes it is assumed that the gas line west of the Suez Canal can serve the area east of the Canal as well. Costs for natural gas lines have been estimated as a fraction of the bulk water conveyance costs (which are discussed in detail in Volume V). Both lines should be built during Phase II. Their estimated cost is LE 162 million (Abu Rudeis-Suez LE 85 million and El Qantara-Rafah LE 77 million). These costs do not include the connection to the west of the Suez Canal natural gas grid, but do include all appurtenances.

3.4.5 Water

The costs of providing fresh water for irrigation overshadow other water costs. Water for industry and settlements may be transmitted in the same conveyances and purified on site. Costs for potable water are included in the intra-community costs in the next subsection. Heavy industrial users are expected to provide their own water from wells, recycling or desalinization. Investments are already committed for potable Nile water delivery to El Arish and Abu Rudeis and are not reflected here. Costs for wells are included either as productive sector investments or as intra-community infrastructure costs. Bulk water conveyance costs listed in Table 3-11 are considered part of the National system.

Table 3-11

Bulk Water Conveyance System (including Pumps) Costs,
by Phase and Subregion

<u>Conveyance (number*)</u>	<u>Subregion</u>	<u>Investment Cost (LE million)</u>
Phases I and II (1982/83-91/92), Subtotal	--	<u>585</u>
Ismailia-El Shatt** (1)	NW	62
Suez Canal-Baloza (2a)	NW	17
Suez Canal-El Mazar (3)	NE	141
Suez Canal-Rafah (4)	NE	208
Ismailia-Gifgafa (9a)	UP	105
Suez Canal-El Tina (11a)	NW	35
Ismailia-Ras Sudr*** (12a)	SW	17
Phase III (1992/3-2000), Subtotal	--	<u>1,650</u>
Suez Canal-Baloza (2b)	NW	28
Suez Canal-El Arish (5)	NE	282
Suez Canal-El Sirr (6)	UP	193
Ismailia-Abu Rudeis** (7)	SW	198
Ismailia-Wadi Feiran** (8)	SW	273
Ismailia-Gifgafa (9b)	UP	105
Ismailia-Bir El Thamada (10)	UP	477
Suez Canal-El Tina (11b)	NW	35
Ismailia-Ras Sudr*** (12b)	SW	<u>59</u>
Total cost, primary conveyances LE:		<u>2,235</u>

* Numbers in parentheses refer to pipeline systems discussed and illustrated in Volumes III and V.

** May be lower cost with another take-off point.

***Mainly to serve the proposed petrochemical and heavy industry complex north of Ras Sudr.

3.4.6 Higher Education

Rapid development requires education levels higher than the nation as a whole. The Recommended Strategy includes levels of service above national norms with an emphasis on technical education. Both these factors increase costs per student.

Replacement Cost per Student for Secondary Schools in 1980

Fayoum	LE	83
Beni Suef		113
Assiut		116
Alexandria		121
Suez		155
Tanta		<u>170</u>
Average LE		<u><u>126</u></u>

SOURCE: National Urban Policy Study, Volume Two, Table V-A.11. Table based on local planning department data.

In order to establish high-quality technical education at the secondary school level, the Consultant has raised this figure by 15 percent per year for inflation and doubled it. The same figure is applied for colleges and technical schools. The university is estimated at LE 10,000 per student, spread over the latter two phases and covering the costs of technical laboratories and both faculty and student housing.

Investment Costs of Higher Education, by Phase

	<u>Phase I</u>		<u>Phase II</u>		<u>Phase III</u>		<u>Total Cost**</u>
	<u>Students*</u>	<u>Cost**</u>	<u>Students*</u>	<u>Cost**</u>	<u>Students*</u>	<u>Cost**</u>	
Secondary Schools	1,750	0.8	8,875	4.0	31,600	14.4	19.2
Colleges	450	0.2	2,200	1.0	8,000	3.6	4.8
University	--	--	4,000	40.0	4,000	40.0	80.0
TOTAL	<u>2,200</u>	<u>1.0</u>	<u>15,075</u>	<u>45.0</u>	<u>43,600</u>	<u>58.0</u>	<u>104.0</u>

*Cumulative.

**LE Million.

Due to the relatively young age of the in-migrants during Phases II and III a bulge in secondary school enrollments may be predicted between 1990 and 2010. The Consultant does not recommend building facilities to accommodate this bulge and suggests planned "overcrowding" for a few years. Higher technical education institutions would be in the cities and larger towns but would reach out to the rural community.

3.4.7 Hospitals

The achievement of the Ministry of Health target level of service can be postponed in Sinai on three conditions:

- Primary health care is improved as a higher priority.
- Hospitals are built in key locations.
- Existing hospitals are improved.

Existing and Proposed Hospital Locations by Phase

<u>Existing(1981)</u>	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>
El Arish	Improvement only	Sharm El Sheikh*	Abu Rudeis
Qantara		Ras Taba*	Bir El Abd
Ras Sudr		Bir El Thamada	
St. Catherine		Sheikh Zuwayid	
El Tor			
Abu Rudeis			

*Convenient to the airport.

The Ministry of Health has found that well-equipped hospitals are costing about LE 60,000 per bed (NUPS Volume 1, Table V-A 13). This unit cost and the level of service recommended in the previous section suggest:

	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>TOTAL</u>
Number of beds	100	1,000	3,750	4,850
Cost (LE million)	6	60	225	291

3.4.8 Recreation and Conservation

Locations of simple facilities should be within the areas designated (see Figure 4.1 in Volume IV). Some permanent boundaries will need to be established and border fences installed for monitoring and limiting tourist use.

	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>TOTAL</u>
Cost (LE Million)	--	4	8	12

3.4.9 Intra-Community Infrastructure

Settlement infrastructure in Sinai should be at least as good as in Nilotic Egypt. This does not mean that it has to cost as much. Better urban design can reduce costs. Better civil engineering can reduce costs. The two functions where savings seem particularly possible are streets and potable water. In these categories the Consultant has recommended reduced levels of consumption. On the other hand, services have an enhanced expenditure compared to the national average, partly because Sinai, particularly for the next generation, will have a younger population.

Per-Capita Community Infrastructure Costs* for Egyptian Towns - 1979

Tanta	470
Ismailia	440
Beni Suef	320
Mersa Matruh	310
Zagazig	270
Sohag	270
Kafr El Sheikh	217
Bilbeis	175
Abu Kebir	170
Average	294

* Includes all utility and social services except telecommunications.

SOURCE: PADCO, National Urban Policy Study, Volume Two, Table V-A, Page 33.

Community infrastructure costs summarized below in Table 3-12 will appear relatively low, because electricity, telecommunications and secondary education are included under separate functional headings. Based on these considerations and the level of service discussed in the previous section, the Consultant offers the following order-of-magnitude guide to settlement infrastructure costs:

Table 3-12

Projected Intra-Community Per Capita Infrastructure Cost (LE)

	<u>Settlement Size (Population in Thousands)</u>				
	<u>Over 50</u>	<u>25-50</u>	<u>5-25</u>	<u>Under 5</u>	<u>Rural</u>
Potable Water (wells, treatment and distribution)	40	60	30	25	25
Sanitation	65	10	5	--	--
Circulation (mainly streets)	100	100	80	50	--
Others*	35	25	20	20	15
<u>TOTAL</u>	240	195	135	95	40

*Includes primary education, primary health, police, fire, post, telegraph, religious facilities, and recreation.

Infrastructure for smaller settlements is projected to be about half that of the larger settlements (LE 115 for settlements under 25,000 population compared to LE 217 for those over 25,000). The largest difference is in the cost of sanitation services. (Table 3-13.)

Table 3-13

Costs For New and Upgraded Intra-Community Infrastructure,*
By Community Size, Year 2000

	<u>New Population</u>		<u>1981 Existing Population</u>		<u>TOTAL</u> <u>(LE Million)</u>
	<u>Population</u> <u>(000)</u>	<u>New Infrastruc-</u> <u>ture Costs</u> <u>(LE Million)</u>	<u>Population</u> <u>(000)</u>	<u>Upgrading**</u> <u>Infrastructure</u> <u>Costs</u> <u>(LE Million)</u>	
Total	<u>801</u>	<u>125.1</u>	<u>172.0</u>	<u>8.9</u>	<u>134.0</u>
Rural, subtotal	<u>197</u>	<u>13.5</u>	<u>58.5</u>	<u>0.9</u>	<u>14.4</u>
Urban, subtotal	<u>604</u>	<u>111.6</u>	<u>113.5</u>	<u>8.0</u>	<u>119.6</u>
Over 50,000	<u>230</u>	<u>55.2</u>	<u>40.0</u>	<u>3.8</u>	<u>59.0</u>
25-50,000	<u>144</u>	<u>28.1</u>	<u>16.0</u>	<u>1.3</u>	<u>29.4</u>
5-25,000	<u>160</u>	<u>21.6</u>	<u>40.0</u>	<u>2.2</u>	<u>23.8</u>
Under 5,000	<u>70</u>	<u>6.7</u>	<u>17.5</u>	<u>0.7</u>	<u>7.4</u>

* Telecommunications and electricity are costed separately in sector programs.

** Costs for upgrading are estimated at two-fifths those for new facilities.

SOURCE: Calculations by Consultant.

As the table indicates miscellaneous community infrastructure, including the upgrading of existing settlements and providing accommodations for new population, will cost a total of about LE 134 million, or LE 138 per capita, by the year 2000.

Community Infrastructure Costs by Phase
(LE Million)

<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>Total</u>
12	50	72	134

The allocation of costs per phase is more or less in response to population growth. This may reflect the completion rather than the initiation of community-building projects. Actual expenditures may be bunched close to the beginning of each of the later phases.

3.4.10 Summary of Infrastructure Costs and Phasing

Two-thirds of Sinai's infrastructure costs, aside from bulk water, are for communications (including transport) and energy systems. The investment in these systems is likely to cost as much as all social systems plus housing. The regional infrastructure figure stated here includes only the later investments of the current Five-Year Plan. The investment is about LE 1,000 per capita for the year 2000 population; 60 percent of the cost would fall in the last 40 percent of the planning period (1992/93 and later).

Bulk water, predominantly Nile water conveyances, is expected to cost twice as much as other utilities and transport combined (over LE 2,000 per capita); 74 percent of that is expected to be committed in the last 40 percent of the strategy period.

From a budgetary point of view, 1990 is the target date for a major update of the Sinai Development Strategy. Particularly in the categories of telecommunications, hospitals and bulk water, the large expenditures come after that date (Phase III investments for telecommunications, hospitals and bulk water are, respectively, 77, 77 and 74 percent of recommended totals). Much of the increase in the cost of utilities and services in Phase III will be due to improved levels of service, which are based on government targets for Egypt nationally. These targets could be modified if development of the National economy requires that; and Sinai in the 1990s will be expected to follow the national pattern to a large degree.

3.4.11 Cost Recovery

Each infrastructure element considered in this Chapter has a different procedural and temporal relationship to cost recovery. The procedures of cost recovery in Egypt are quite special to the country. Egypt has free health care service, and no charges are made for higher education or for irrigation water. Thus, the majority of the infrastructure costs itemized are not subject to cost recovery within the region, but are a national concern.

During the 17-year Strategy period the population of Sinai will not pay back the full costs of infrastructure facilities but in the longer term they will pay their share of all National costs; moreover, to a substantial degree, the proposed facilities will serve all of Egypt (for example, the telephone line to Taba will help connect Cairo to Amman and Baghdad). Electricity is heavily subsidized in Egypt, that is to say, most of its cost is recovered indirectly. Natural gas is being sold on a fee basis in only a few places in Egypt, and insufficient data exist to comprehend the relevance of the fee structure at this time.

In telecommunications, electricity and gas, the Consultant favors a fee structure that covers the distribution, operations and renewal costs. Demand for reliable service in these functions is very high in Sinai and little price resistance is foreseen. Community infrastructure and services are properly the responsibility of local government.

The more local government can raise revenue directly from the users of these services, the better able it will be to respond to needs. This category would include distribution of potable water, which is already generally paid for in Sinai today. Table 3-14 summarizes the costs estimated in this chapter. From 1983 to 1992 investment in "all other" infrastructure will cost twice as much as investment in bulk water supply. From 1992 to 2000 "all other" is only four-fifths as great as proposed for bulk water.

Table 3-14
Summary of Infrastructure Costs, by Phase
(LE Millions)

	PHASE			TOTAL	
	<u>I</u>	<u>II</u>	<u>III</u>	<u>Amount</u>	<u>Percent</u>
Systems, subtotal	--567--		644	1,211	22.0
Transport	--185--		110	295	5.4
Telecommunications	15	78	315	408	7.4
Electricity and Gas Distribution	16	273	219	508	9.2
Facilities, subtotal	--178--		363	541	9.8
Higher Education	1	45	58	104	1.9
Nature Conservation	2	2	8	12	0.2
Hospitals	6	60	225	291	5.3
Intra-Community Infrastructure	12	50	72	134	2.4
Housing, subtotal	--236--		283	519	9.4
Bulk, subtotal	--1,585--		1,650	3,235	58.8
Water (largely imported)	--585--		1,650	2,235	40.6
Power (largely exported)	491	509	--	1,000	18.2
GRAND TOTAL:	--2,566--		2,940	5,506	100.0

The costliest infrastructure system after water is regional electricity and gas despite considerable planning efforts to hold down costs. Telecommunications are projected to cost more than hospitals and education combined. These high costs are indicative of high level-of-service targets established for all Egypt and also reflect the rapid population growth projected for Sinai.

The categories of bulk water transport (other than local needs), higher education (including secondary schools), secondary health care, and national parks do not seem to be appropriate for cost-recovery procedures within Sinai, except to the extent that any national fee structure is applied for special services and facilities. Well over two-thirds* of the infrastructure recommended for Sinai is logically part of national systems; therefore, the costs concerned are chargeable to national programs rather than regional accounts.

*Sixty percent of the Ayun Musa electric generating plant is excluded from the calculation.

SOURCE: Estimates by the Consultant; details earlier in this chapter.

4.0 SETTLEMENT SYSTEM

4.1 INTRODUCTION

The goals of the SDS-I that are particularly relevant to the settlement system are:

- A dispersed pattern of permanent settlements
- Absorption of population from over-crowded parts of Egypt
- Integration of Sinai with the rest of Egypt.

Each of these goals contradicts the other two to a significant degree: a dispersed pattern of settlements is not likely to be the most efficient or economical way to absorb population, particularly if that dispersed pattern requires agriculture in an area that must import water; a dispersed pattern is also not likely to be the most integrative pattern; the integration goal is a constraint on forging ahead with the most modern industry and agriculture possible; and so forth. Thus, the recommended settlement pattern will be a series of compromises.

This Chapter does six things:

- Briefly defines the term 'settlement pattern'
- Describes the settlement pattern of the Recommended Strategy
- Describes the settlement pattern of alternative strategies that were considered as an early part of the process leading to formulation of the Recommended Strategy
- Relates the settlement pattern to population, infrastructure and other elements of the Recommended Strategy
- Defines principles and guidelines for relating settlements to economic activities
- Suggests a process for selecting the sites for new settlements.

The Consultant describes the process which has been used by SDS-I to provide the basis for "fine tuning" during later studies. The settlement pattern for Sinai requires particularly close attention, because the harsh and diverse environment makes it critical that the right settlement function be provided, in the right place, on time. An objective is to have no 'isolated places' in Sinai before the turn of the century; therefore, services (especially services provided by towns) have to be efficiently distributed.

This concern about settlements, both old and new, can be expressed under four headings:

- Location (resources, access, environment)
- Functions (economic activities and services)
- Linkages (isolated or dependent)
- Size (population and space)

We are least concerned with the last heading (Size), since it is largely an output of the other three. Thus, although we find it convenient to define a hierarchy of settlements by size, this parameter should not be understood as representing the settlement's significance. A small settlement in the Uplands may be more significant in terms of its functions and linkages than a medium-sized settlement near the coast.

The locations of the settlements included in the basic alternative systems were selected primarily on the basis of (i) nearby resources and (ii) transportation opportunities, and to a lesser degree land capability factors, including (iii) an existing settlement investment and (iv) the probable availability of a suitable site. Existing investments were more important in the relatively densely settled Northeast subregion and siting considerations are more important in the mountainous Southeast.

The allocation of functions to the various settlements was made primarily on the basis of local resources; secondary consideration was given to potentials due to location and to the settlement's role within a hierarchical system.

Because the Peninsula is vast, the resources diverse and the population relatively small, linkages need careful, early and continuous attention. The objective is to establish a set of subregional economies closely linked through the functions of towns. The dominance of Cairo, Suez and El Arish should diminish during the next two 5-Year Plans.

The planning process has not been biased in favor of large or small towns, nor does it favor either existing or new towns. Opportunities have been eschewed to proliferate settlements merely in order to achieve dispersal. The objective has been the minimum necessary number of settlements to achieve the set of overall goals assigned to Sinai by the Government.

The strategic planning process subsumes within a larger nearby settlement those small settlements that have but a single resource-related activity, such as mining, fishing, grazing or a small holiday resort.

4.2 THE RECOMMENDED SETTLEMENT PATTERN

4.2.1 Introduction

The Strategy includes 18 settlements along the Mediterranean, Gulf of Suez and Aqabah coasts, and 19 settlements inland or along the Suez Canal. The highest density of settlements is along the northern coast and the lowest density is in the southern mountains, reflecting land capacity in each case.

The thrust of the Strategy, in the settlement pattern, is away from the concentration on the north coast which is a characteristic of the early 1980s. Thus, the Strategy includes proposals for early start-up of new towns south of Suez and in the northern Uplands. The first objective is settlement distribution change; of secondary importance is a change in the distribution of population. Each five-year phase will deliver a more evenly distributed system of settlements to Sinai. This is illustrated in Figure 4.1.

The basic hierarchy of settlements proposed for Sinai is one of a few large multipurpose cities and many limited-function small towns and villages, as listed in Table 4-1.

4.2.2 Hierarchy of Settlements (National to Subregional)

The settlement pattern has been designed to work at three scales:

- National--fitting into the metropolitan system of the Suez Canal region and the Aqaba/Eilat and Gaza border economies.
- Peninsular--forming a hierarchy that spreads from El Arish in the north and from Abu Rudeis in the south (these two having but little overlap in their service areas).
- Subregional--comprising the following: Northwest--eight towns arrayed under Port Said, Ismailia and Suez; Northeast--eight towns under El Arish; Uplands--eight towns under Bir El Thamada; Southwest--five towns under Abu Rudeis; Southeast--four towns under Sharm El Sheikh (total 37 in Sinai; 3 Suez Canal cities are also referenced).

Within each of the subregions the relationship of the settlements to relatively flat land is neither even nor similar. In the Uplands area, there are vast "empty" plains between settlements. At the opposite extreme there is the Southeast, where the population is relatively crowded on the few square kilometers available as the mountains plunge into the sea. Only at Nuweiba and Sharm El Sheikh is there a small coastal plain for development. In the Uplands settlement locations are most equidistant and relate to the fertile soils. Along the Suez Gulf coast, settlements are located not solely according to soil fertility but also taking into account mineral resources and extra-regional trade. Thus, the power station and petrochemical plant between Ras Sudr and Ayun Musa are to serve the mainland of Egypt as well as world markets for oil and other minerals. The purpose at St. Catherine is to serve visitors from outside the country.

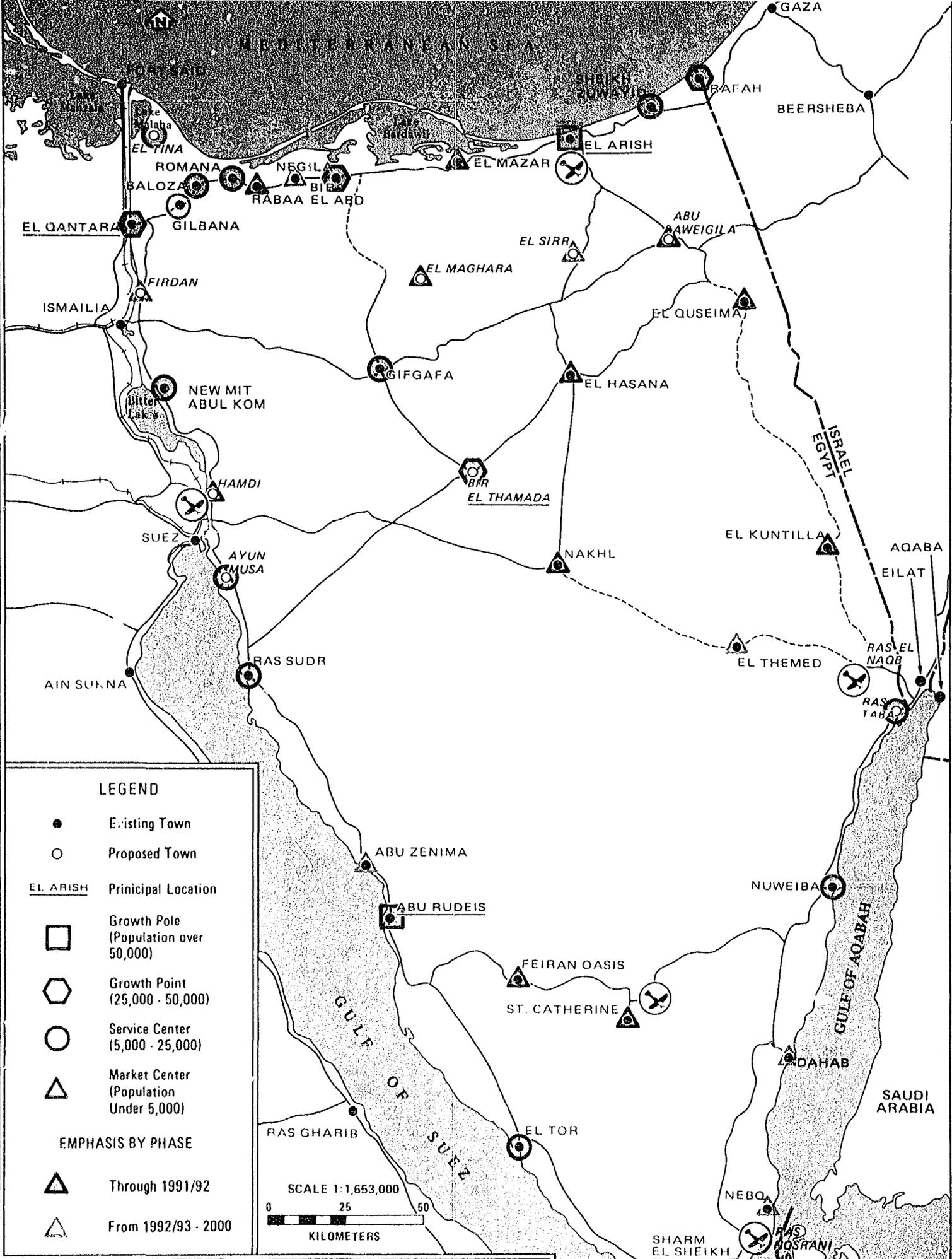


FIGURE 4.1
RECOMMENDED STRATEGY:
SETTLEMENT HIERARCHY

Table 4-1

Recommended Strategy: Sinai Settlements in the Year 2000

<u>Location</u>	<u>Primary Function</u>	<u>Subregion</u>
<u>Cities/Growth Pole</u> (over 50,000)	<u>(Two)^{d/}</u>	<u>Subregion</u>
El Arish	Industry/Tourism/Agriculture/ Administration	Northeast
Abu Rudeis (New site)	Industry/Agriculture/University	Southwest
Suez	Industry/Administration	Across west border
Ismailia	Administration/Agriculture	Across west border
Port Said	Commerce/Industry	Across west border
<u>Large Towns</u> (25,000-50,000)	<u>(Five)</u>	
El Qantara	Industry/Transport	Northwest
Rafah	Agriculture/Transport	Northeast
Bir El Abd	Agriculture/Industry	Northeast
Bir El Thamada (New)	Agriculture/Industry	Uplands
Sharm El Sheikh	Tourism/Administration/Industry	Southeast
<u>Small Towns/Service Center</u> (5,000-25,000)	<u>(Twelve)</u>	
Baloza	Agriculture	Northwest
Gilbana	Agriculture	Northwest
El Tina (New)	Agriculture/Fishing	Northwest
New Mit Abul Kom	Agriculture/Tourism	Northwest
Ayun Musa (New)	Industry/Tourism/Agriculture	Northwest
Sheikh Zuwayid	Agriculture/Industry	Northeast
Romana	Agriculture/Tourism	Northeast
Gifgafa	Agriculture	Uplands
Ras Sudr	Industry/Transport	Southwest
El Tor	Agriculture/Fishing/Tourism	Southwest
Ras Taba (New)	Tourism/Transport/Industry	Southeast
Nuweiba	Tourism/Administration	Southeast
<u>Settlements/Market Center</u> (Under 5,000)	<u>(Eighteen)</u>	
Firdan-East (New)	Agriculture/Transport	Northwest
Hamdi-East (New)	Transport	Northwest
El Mazar	Agriculture	Northeast
Negila	Agriculture	Northeast
Rabaa	Agriculture	Northeast
Abu Aweigila (New)	Agriculture	Northeast
El Quseima	Agriculture/Tourism/Transport	Uplands
El Kuntilla	Agriculture	Uplands
El Themed	Agriculture	Uplands
Nakhl	Agriculture/Transport	Uplands
El Hasana (New site)	Agriculture/Administration	Uplands
El Sirr (New)	Agriculture	Uplands
El Maghara (New)	Mining/Tourism/Agriculture	Uplands
Abu Zenima	Tourism/Industry	Southwest
Feiran Oasis	Agriculture	Southwest
St. Catherine	Tourism	Southwest
Dahab	Tourism	Southeast
Nebq	Tourism	Southeast

^{d/} Three cities west of the Suez Canal, just outside Sinai, also serve as Growth Poles for the peninsular economy.

In contrast to the south, where the settlement pattern is oriented to outside demands, and to the Uplands, where the spatial pattern responds directly to soil capacity, the pattern of development in the Northwest Subregion along the Suez Canal results from overspill of the Canal Zone and the eastern Delta. Here Suez industry expands into the Ayun Musa area: Ismailia and Qantara provide central place functions; and places like Firdan-east, El Tina, and New Mit Abul Kom function much like Delta villages, once removed. The holiday villages at Ras Misalla south of Ayun Musa and on the Bitter Lakes are tied to Cairo, like the Alexandria and Damietta resort settlements. In the Northwest there is no shortage of town sites as the flat plain extends for 20 to 30 kilometers to the foothills. The proposed sequence of settlements is similar to the current settlement pattern on the West Bank. The Northeast settlement pattern is already well established and requires selectivity as to what should occur at which place, rather than decisions of where settlements should be. The selection of Bir El Abd and Rafah or Sheikh Zuwayid as the second rank settlements after El Arish is consistent with the overall objective of decentralization.

Each of the four coasts can be understood as a development axis. The northeast coast is a classic example; with the Suez Canal Zone at one end and the Gaza Strip at the other, it is surely a development axis. The southwest coast is a similar case. The axis is strongest between Suez and Abu Rudeis. Between Abu Rudeis and Sharm El Sheikh it is weaker. The northwest axis is from Port Said to Suez and the east bank shares in it, particularly at Ismailia. The southeast axis from Taba (near Aqaba) to Sharm El Sheikh is so dominated by a single economic function that it is not particularly constructive to label it a development axis. However, both Taba and Sharm El Sheikh are proposed links to other subregions. The system is diagrammed in Figure 4.2.

From a peninsular point of view the Recommended Strategy includes a wide range of spatial rationales in its different geographic parts. The resultant smoothness of settlement distribution should not be interpreted as reflecting a smooth implementation program, since each of the five subregions will follow quite a different path to development.

The settlement system includes 37 significant places. Each of these places is expected to have a secondary school for the youngsters living there (and nearby) and a polyclinic to serve the settlement and surrounding villages. The early provision of a secondary school and a polyclinic is essential to provide current residents with the necessary health and skills and to instill confidence in potential immigrants that Sinai will be a good place to raise their families.

Education and health services could appropriately have two higher levels of service. Eleven hospitals will be located throughout Sinai in order that each one serve a population of about 100,000; and some college or technical school will be in each of the five subregions (in addition to the university proposed at Abu Rudeis).

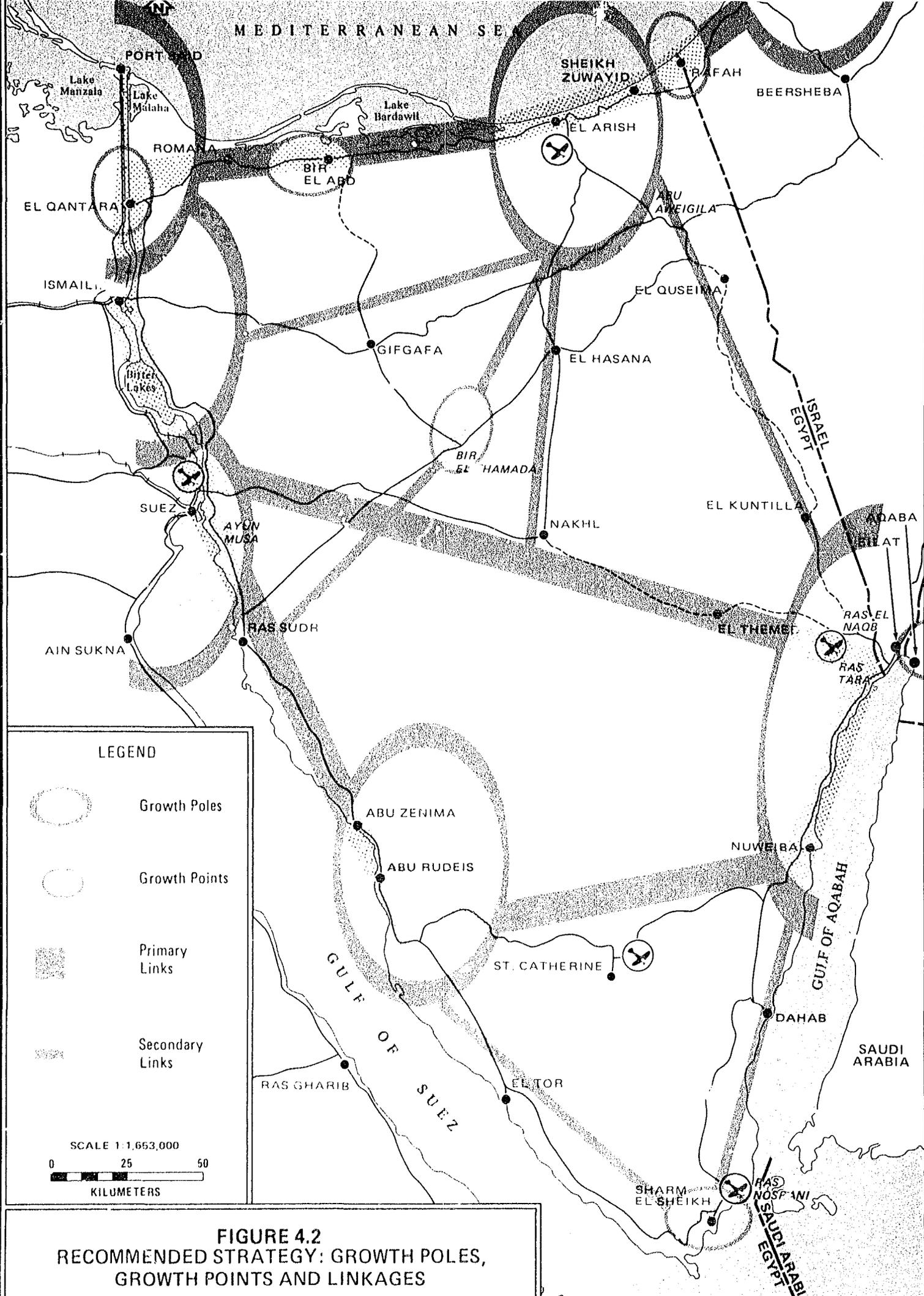


FIGURE 4.2
RECOMMENDED STRATEGY: GROWTH POLES,
GROWTH POINTS AND LINKAGES

4.2.3 Four Alternative Settlement Patterns

The design of alternatives was a significant part of the process resulting in the Recommended Strategy. The alternatives were all conceived as possible paths to development, depending on the Government's choice of objectives and strategy. The resulting settlement patterns, shown in Figure 4.3, were late outputs of the analysis of those alternatives, each of which contributed to the Recommended Strategy.

The All Coasts alternative foresaw a relatively "undeveloped middle." This alternative is both self-reliant and metropolitan, being essentially three coastal urban strips with small hinterlands. El Arish is the dominant city. Abu Rudeis, one rank lower, serves the south. Other coastal settlements are treated more or less equally.

The Dispersed Strategy has a large city in the center as well as one in the north and one in the south. Its agricultural and tourism towns are more spread out than the more industrially-focused towns of All Coasts.

The Frontier settlement pattern is of the same family as the Dispersed and the Recommended Strategy. Among the largest settlements are El Arish and Bir El-Thamada. For this strategy settlements in Sinai are more related to abutting regions and countries than in the other sets. Frontier differs from Dispersed in having more integrated (as contrasted with single purpose) settlements, and a smaller population in the south.

An essential lesson of the study of alternative settlement patterns was that there are but few real alternatives in Sinai. Land capability, more than in most regions, draws the new map. Nevertheless, the settlement options illustrated in Figure 4.3 include quite a wide range of possible choices for Sinai, from dispersed to concentrated, as well as from single function to multiple function.

The Dispersed alternative had a wide range of settlement sizes; these settlements were widely scattered and were frequently selective in function, concentrating mainly on agriculture, tourism or mining. Another alternative considered much earlier in the study and presented for discussion in the 1982 Working Papers had but few settlements; that proposal focused primarily on El Arish as a dominant metropolis, and its other settlements were typically small and specialized.

All Coasts not only doubled the population projected in the 1982 Working Papers, but also proposed more settlements with multiple functions. The Frontier alternative was far more dispersed than All Coasts but also recommended multi-purpose towns combining tourism with mining, industry or agriculture.

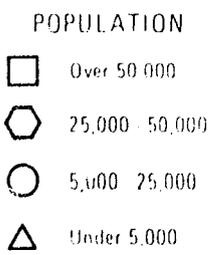
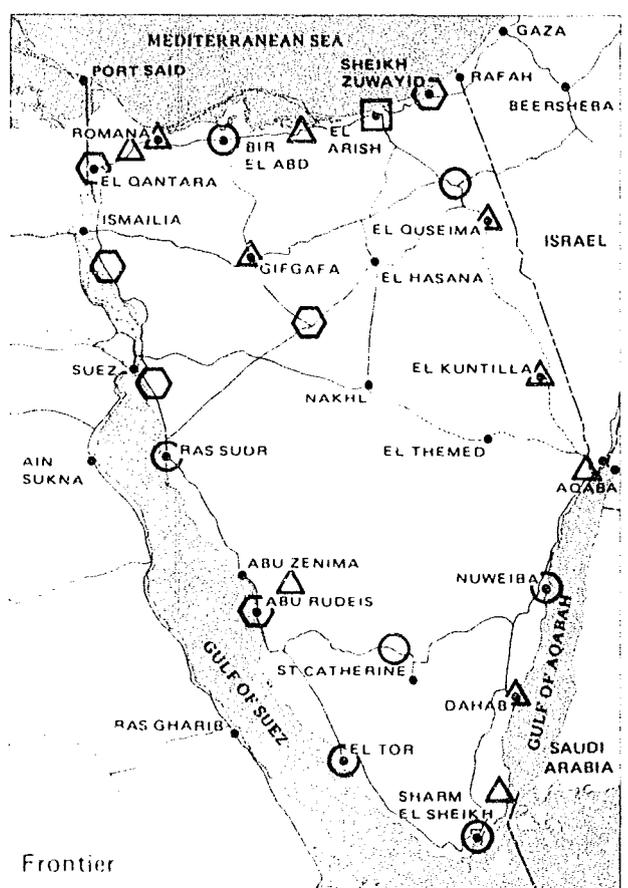
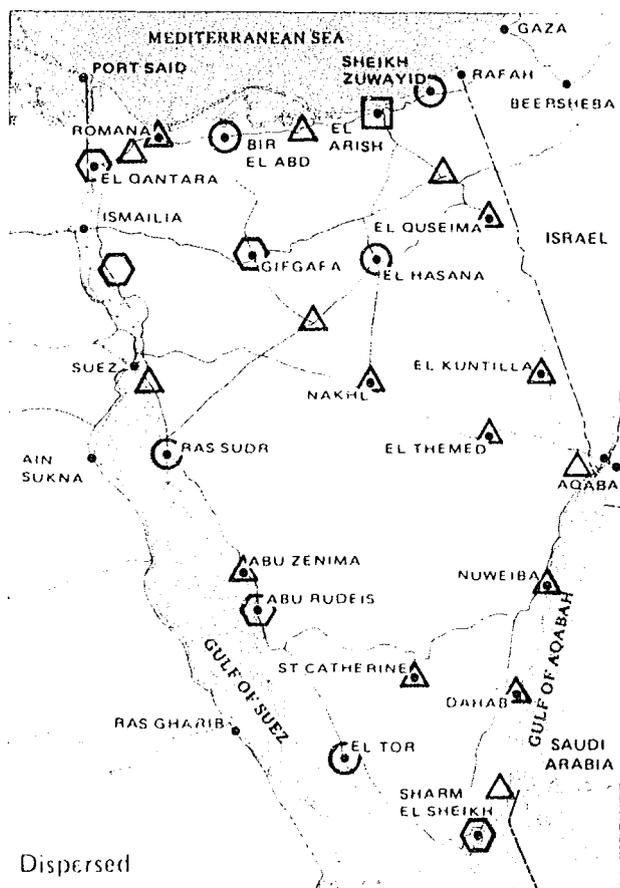
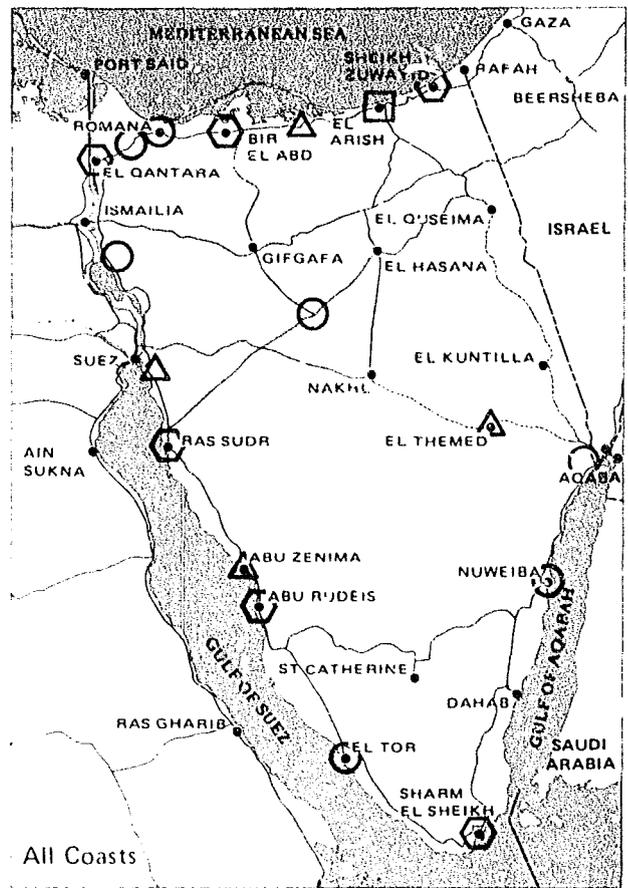
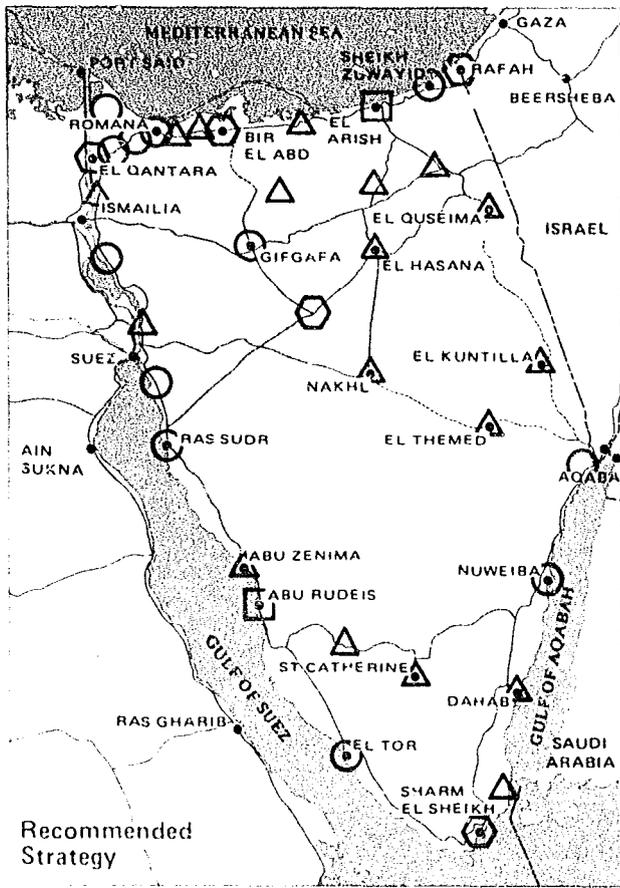


FIGURE 4.3
RECOMMENDED STRATEGY AND THREE
ALTERNATIVE SETTLEMENT PATTERNS

One objective of settlement in Sinai is understood to be to establish a dispersed pattern of cities, towns and villages. Once such a pattern is confirmed as a national policy, it is recommended that a good portion of those settlements be planned to carry multiple (integrated) functions. That is to say, the number of mono-function tourist or agriculture settlements is soon limited by land capability factors in each subregion--the constraint usually being very little flat land or very little water. Thus, the Recommended Strategy emphasizes multi-purpose towns in all subregions, and typically there are two or three; nevertheless, Southeast and Uplands have fewer integrated towns than Northwest or Northeast.

4.3 THE SETTLEMENT PATTERN AND OTHER SYSTEMS

The settlement pattern of Sinai, as in most regions, reflects several forces. On one side are land capability considerations; on the other, economic activities. (Both sides can be influenced significantly by the provision of infrastructure.) Economic activities (and infrastructure) establish land-use patterns. (Figure 4.4.)

A settlement pattern emerges historically, or in the planner's studio, as a response to land capability and the employment opportunities that can be created from it. More often than not, the location of a settlement is determined by the infrastructure constructed to provide access to the resources (capabilities) of the land. Settlements are shaped by land use--externally, by extensive land uses like agriculture and tourism; internally, by intensive uses like industry and residence. These factors are influenced in turn by the administrative regime governing (and facilitating) the utilization of resources and economic activities.

Each of the determining factors itself is shaped by the settlement pattern once it is established. The land capacity for groundwater and construction materials changes according to proximity to a settlement; land use near a large settlement is in a constant state of flux; regional infrastructure tends to become a framework intermeshed with settlements; settlements become the nerve centers of the economic system.

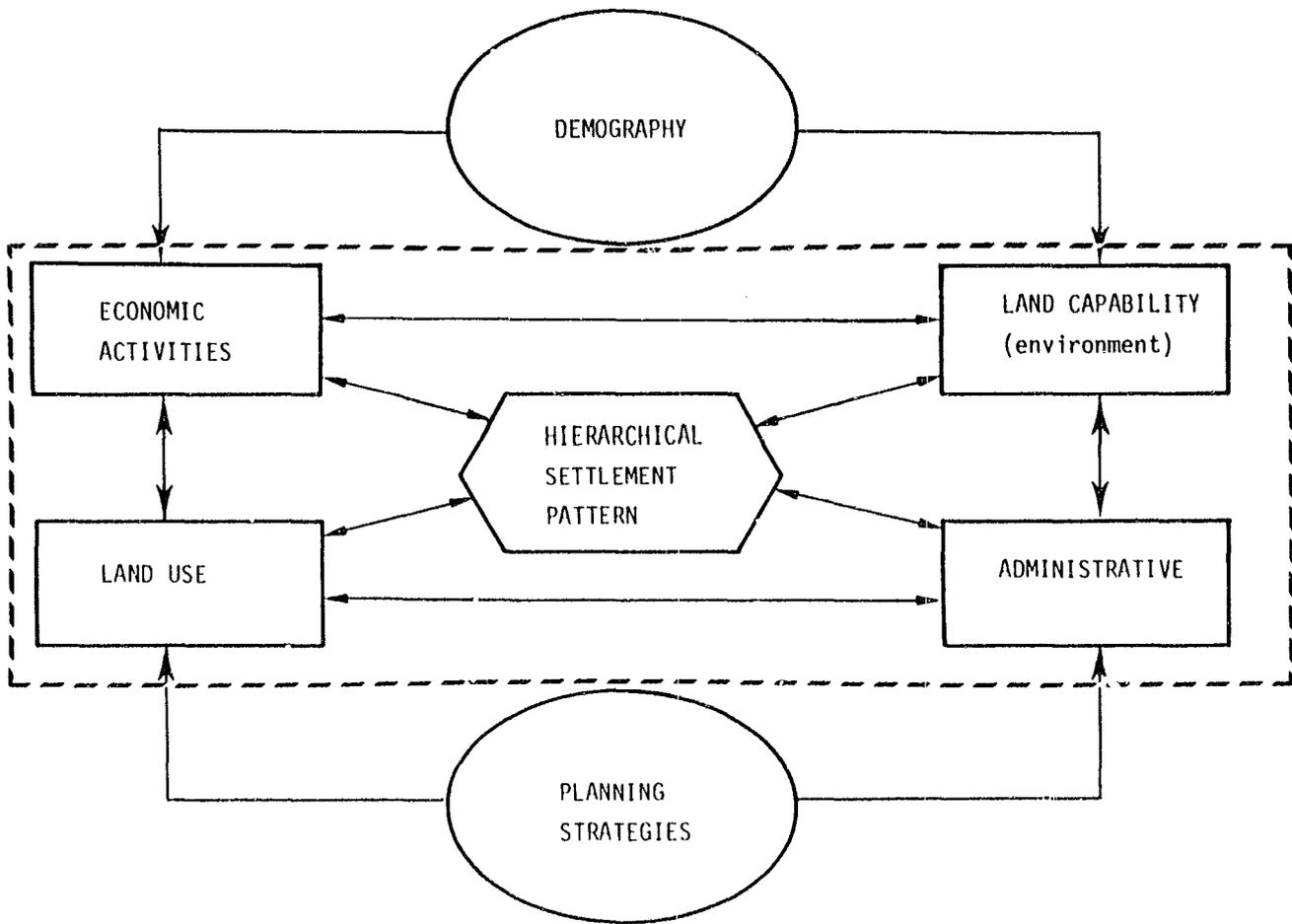


FIGURE 4.4
FACTORS DETERMINING SETTLEMENT PATTERNS

4.4 EXISTING SETTLEMENT SYSTEM

In Sinai the SDS-I team found four distinct settlement systems, their differences reflecting variations in land capability, infrastructure and economic activities. In the Northeast subregion, along the Mediterranean, the settlement pattern depends upon cultivable land watered by rain and shallow aquifers. The pattern is ordered in part by a coastal highway of ancient origin that was paralleled for two or three generations by a railroad. The settlements here are by-and-large logical in location, size and function. However, now that the area is reunited with Nilotic Egypt, functions and hierarchical relationships can change and expand.

In the Southwest subregion, on the Gulf of Suez, there is a settlement pattern based on the extraction of hydrocarbons and minerals. There seems no logical hierarchical order but rather a disarray, and therefore, a need for a rather new system entirely.

In the Uplands subregion there is an ancient settlement system, based on soil and groundwater capability, somewhat modified by a half-modern highway system, so that ancient settlements near a highway intersection are becoming more important. After studying the land capacity, land use and infrastructure systems, the Consultant recommends relying on the wisdom of history and, insofar as possible, building on the existing system.

In the Southeast, along the Aqabah Coast, the settlement system is quite new. Only a few traces remain to indicate this area's inclusion in ancient Palestine. The new system, however, was established during the recent occupation and is therefore being modified to conform to Egypt's objectives for Sinai. The changes to come will be limited by land capacity, and the physical location of settlements is unlikely to change dramatically.

4.5 HIERACHICAL RELATIONSHIPS

Settlement systems were designed for each of the five subregions. The integration of such subregional systems into a peninsular system and integration of the peninsular system with the Suez Canal Regional settlement system are more complex problems. The integration of the five peninsula systems, after several iterations, became possible by assigning certain settlements "hinge" or "link" functions between two subregions: Taba between Southeast and Uplands, El Arish between Northeast and Uplands, El Qantara between Northeast and Northwest, and Ras Sudr between Southwest and Uplands.

The most critical "hinge," and that having the least current capacity, is Ras Taba; its land capability is discussed in Volume IV. El Arish is already serving the Uplands Subregion as well as the coast. El Qantara has been affected by the widening of the Suez Canal and is still recovering from the 1967 war; it will link not only Northeast

and Northwest but will also be a connection to Port Said and to the Delta. Ras Sudr, at the foot of Wadi Sudr, can be a gateway to the interior from South Sinai. Such North/South interaction will become important when the Uplands shifts from a subsistence to a market economy and the Southwest becomes a market for its products. The Uplands economy might well focus for many years on Bir El Thamada near the junction of the Wadi Sudr and Wadi El Bruk. These hinge communities (Ras Taba, El Arish, El Qantara, and Ras Sudr) should have functions assigned to them ahead of subregional population demand in order to stimulate inter-subregional transactions.

The interrelation of the Sinai and Suez settlement systems is resolved in the Recommended Strategy by the allocation of prompt expansion of Suez and Ismailia across the Suez Canal and the reconstruction and expansion of Qantara as mentioned above. Suez might transfer and expand selected commercial functions to Hamdi new town and industrial and leisure functions to Ayun Musa. Suez thereby will become a modern multi-nucleated metropolis, arching from Ayun Sukhna to Ras Misalla via Hamdi. Ismailia, quite differently, can extend directly eastwards north of Lake Timsah and establish a second central business district to serve all of the Northwest Subregion. Ismailia will serve as the major gateway to and from Cairo as Qantara will to the Delta. It seems likely that Ismailia will be more of a cultural and leisure center and Qantara will be more characterized by commerce and industry, as Ismailia has a greater cultural heritage and the amenity of the Lake.

4.6 DEMOGRAPHY

The iterative formulation of a settlement pattern within a development strategy (described in Volume I) was done with an intention to absorb a six-fold increase in population during 18 years, in such a way that the ultimate population be well integrated with the current population and the population of the Suez Region and the Delta. In order to do this it was found necessary to alter the land capacity of the region by adding imported fresh water and to assign some major industries to Sinai, which might equally well be located elsewhere in Egypt. The populations of the settlements are therefore based: first, on land capacity, second, on existing and new infrastructure, third, on importation of Nile water, and fourth, on the transfer of industrial activities which could be located elsewhere. The population hierarchy of the settlement pattern is, therefore, both volatile and less important than the functional assignments of the settlements.

The population growth in Sinai will reflect national policy and Egyptian demographic trends more than any internal peninsular dynamics. Therefore, monitoring of the settlement system/population interface will extend beyond Sinai, and in the case of "manpower," beyond Egypt.

A slower population growth will by and large act to reduce the size of the larger settlements more than the smaller ones. This is so because the smaller settlements are more firmly based upon local land capability. A more rapid rate of population growth might well be directed as much to the middle-sized settlements as the larger ones to encourage places like Bir El Thamada, Sharm El Sheikh, and Ras Sudr to be the successors of Suez and El Arish.

4.7 SETTLEMENTS AND ECONOMIC ACTIVITIES

4.7.1 Introduction

This section of the Chapter on "Settlements" is concerned with the relationship of land use and economic activities to settlements. The principles, guidelines and standards that relate a settlement to its utilities and services (infrastructure) are addressed in Chapter 3. It said, "Settlement, therefore infrastructure." Here the settlement is set within a context, and later planners are counseled concerning key factors to be considered in guiding the further development of Sinai's hierarchy of settlements. Specific studies relating settlement to land capability are discussed in Volume IV, Chapter 4.

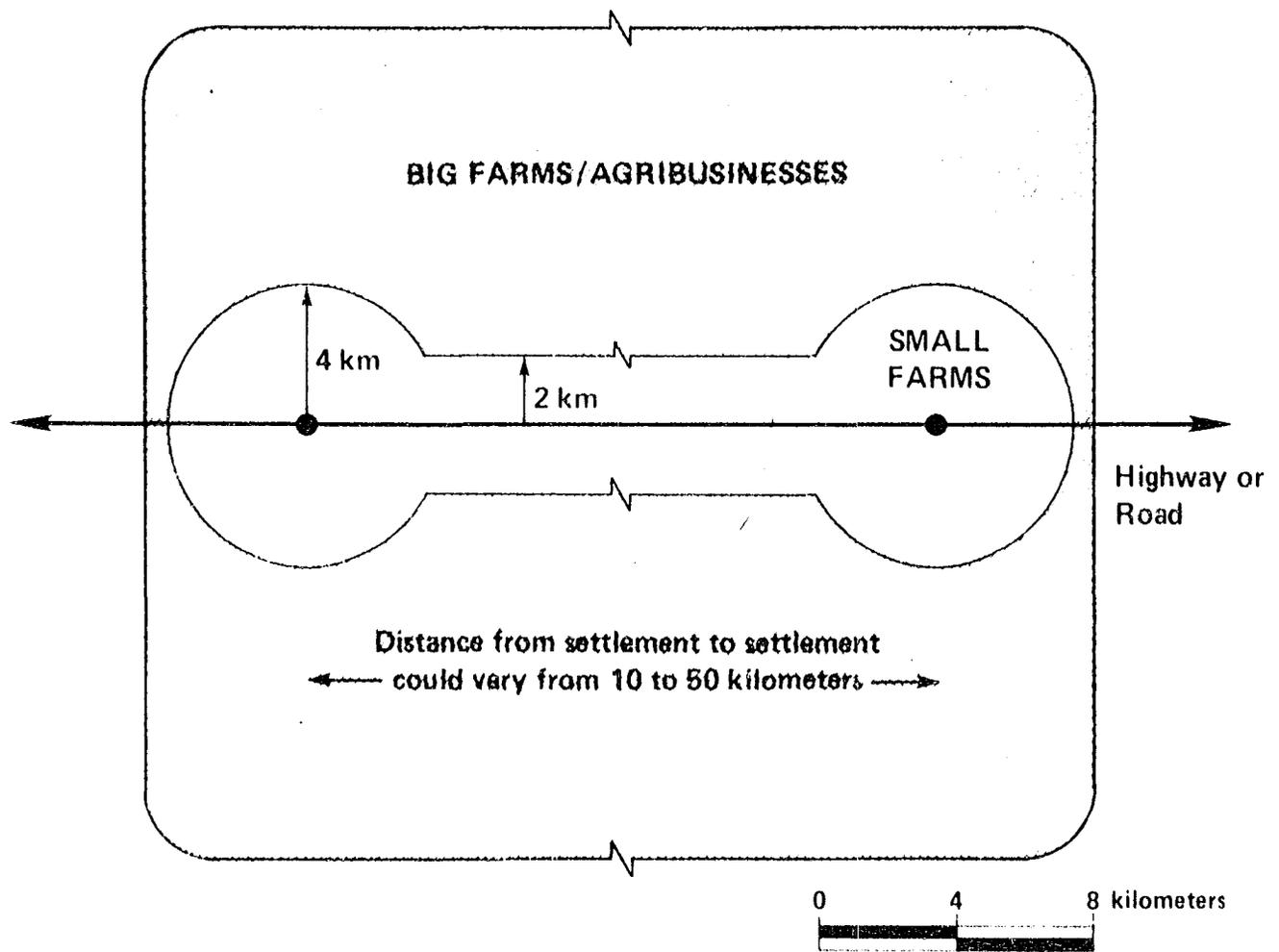
Four land uses are important to the establishment of a Sinai settlement pattern:

- Agriculture
- Mining
- Tourism
- Industry

4.7.2 Agricultural Settlements

Settlements based on both grazing and crop agriculture are included. The basic land use/settlement relationship (principle or guideline) in the grazing areas is to establish diverse irrigated (oasis) crop agriculture (including tree crops) near the settlement. This will provide employment for family members, fresh food, the amenity of shade (micro-climate) and encourage semi-nomadic peoples to settle permanently. Models for this type of settlement are available in Syria, Saudi Arabia, and other countries with "grazing deserts."

In the areas of irrigated crop agriculture, two types of allotment have been considered: (i) allocation of 5-feddan (plus or minus) plots to families and (ii) allocation of 5,000 feddan (or more) plots to corporations. A wider range than this should not have significantly different implications for settlements. The basic guideline or principle recommended is a priority allocation to small-holders near existing or proposed settlements and infrastructure and the allocation of large plots away from settlements and existing infrastructure. As a primary objective of a pattern of permanent settlements, the principle of labor intensive agriculture close to settlements is logical. The principle of allocating small-holdings closer to highways and other infrastructure is justified by arguments of infrastructural efficiency and social integration. Figure 4.5 illustrates these concepts.



LEGEND

- TOWN OR SETTLEMENT
- AREA GENERALLY ALLOCATED IN LARGE TRACTS TO BIG AGRIBUSINESS OPERATIONS
- AREA GENERALLY ALLOCATED IN SMALL PLOTS (5-10 feddans each) TO INDIVIDUAL FAMILIES

NOTES

Big farms, agribusinesses in tracts up to 5,000 feddans allocated to corporations and other large investors. These tracts would be located more than two kilometers from a highway and more than four kilometers from the center of a town or settlement.

Small farms in plots of five to ten feddans each to be allocated to individual farmers. These plots would be within two kilometers of a highway or within four kilometers of the center of a town or settlement.

Distances between settlements would vary from 10 to 50 kilometers according to resource availability and other conditions.

FIG 4.5
DIAGRAMMATIC SKETCH OF
GUIDELINES FOR LOCATING FARMS

A case in point is the Gifgafa/Bir El Thamada Plain. The Recommended Strategy proposes the irrigation of 41,000 feddans in two more-or-less rectangular areas, each about 40 kilometers in length. It projects a population of 75,000 for these areas, with the predominant economic activity being irrigated agriculture. Guidelines for further study would suggest small holdings within eight kilometers of Gifgafa and Bir El Thamada and four kilometers from the main highway between them. This represents a half-hour bicycle ride to school for secondary students near the two main towns and a half-hour walk to the bus for students in between. Journey-to-work and farm-to-market considerations apply equally. It may be assumed that the larger (corporate) holdings will have their own schools and school buses.

Preliminary SDS-I studies suggest that within the small-holding areas that the villages be similar to the "central services villages" in the South Tahrir and Ibis land reclamation projects. Although the journey to work in the fields will be longer, the propensity for a higher level of off-farm enterprise and the desire for higher levels of participation in education recommend the larger village units.

4.7.3 Mining Settlements

The Study considered two types of mining: hydrocarbons and metals. These resources occur in relatively isolated places and are in relatively small deposits compared to other world regions. Considering the location and size of deposits and Government goals for Sinai (including permanent settlements), the Consultant recommends that wherever possible, workers in mining and related activities should be settled in multi-purpose communities near to, but not at, the mine. As a case in point, a small integrated community at Gebel El Maghara is suggested to serve miners, irrigated-agriculture farmers, livestock grazers, and mountain tourists. At Abu Rudeis a large integrated community is recommended, with miners, oil workers, a university, agriculture, industry, tourism and local administration.

4.7.4 Industry and Settlements

Eleven of the recommended 37 settlements (nearly 30 percent) include an important industrial component, half of those being primarily industrial:

<u>Subregion</u>	<u>Settlement</u>
Northwest	El Qantara and Ayun Musa
Northeast	El Arish, Bir El Abd and Sheikh Zuwayid
Uplands	Bir El Thamada
Southwest	Abu Rudeis, Ras Sudr and Abu Zenima
Southeast	Ras Taba (option) and Sharm El Sheikh

The industry of the Northwest is primarily agro-industry and footloose light industry that "spills over" from Port Said and Suez. The agro-industry serves outside markets, while other factories begin with Sinai markets. Northeast industries also begin with agricultural processing and the Sinai market, but by 1990 become export-oriented. Industry is started in El Arish and is forecast to branch out to Bir El Abd and Sheikh Zuwayid.

Industry in the Southwest has two foundations--minerals and proximity to international shipping lanes. Sinai's heavy industry is planned to be north of Ras Sudr and south of Ras Misalla. It is based on processing petroleum, metals and non-metallic minerals for international markets. One large relocated settlement is to be based primarily on industry, Abu Rudeis.

In the Southeast light industry is put forward at Sharm El Sheikh and as an option to be studied near the 747-sized airport (Ras El Naqb) above Ras Taba. Here, Egypt is closest to the Middle East markets via land and has large underutilized airport capacity for export of lightweight products.

Industrial development is discussed in Volume III in more depth. Industry is indicated on the five subregional maps in both Volumes I and III. Industrial siting is considered in Chapter 4 of Volume IV.

4.7.5 Touristic Communities

The two major touristic resources are beaches and coral. The important secondary resources are mountains and historic/religious places. The SDS team has considered tourism within the context of goals to develop resources, and to establish permanent settlements. It seems reasonable, on the average, in Sinai to plan for relatively large tourist resorts/complexes in preference to the isolated hotel or settlements; other land uses and economic activities near tourist developments will help assure permanence and bring a higher return to both the regional economy and the national economy.*

* When planning development of coastal areas, it would be useful to keep in mind the following findings regarding mangrove plantations, particularly in desert areas and using highly saline waters.

H. J. Teas in "The Biolsaline Concept" (Plenum Press, New York, 1970, especially pages 117-136) suggests that life on the desert coastal plains of Sinai could be considerably enhanced by the re-establishment of mangrove forests and grasses with other trees and shrubs that thrive in salty water (up to 25,000 mg/l). Mangroves can provide windbreaks, shade, construction materials, and fodder grasses for livestock, poultry and fish. Together mangrove forests and marsh grasses can change the microclimate. Experiments in the Middle East have successfully established such mangrove plantations in coastal desert areas. With seawater or brackish groundwater irrigation for the first couple of years, mangrove windbreaks (possibly mixed with other trees) can be established in a way that enhances the environment, along otherwise barren shores, making these areas more suitable for human habitation and many other lifeforms beneficial to mankind including fish and fowl.

The existing borders of Sinai, formed by Suez Canal to the west and the international line between Rafah and Taba do not portray Sinai's natural geographical orientation. The geo-region naturally and organically faces outwards. From both the geomorphological point of view and the demographical/economical/social point of view it can be noticed that:

- (a) The Northeast Subregion, and a bit of the Northwest, are a natural ecological extension of Sharq El Delta Desert Region (Belbeis, Sharkia, Salhia desert area) which is now one of the most rapidly growing regions in Egypt. The Northeast Subregion also extends organically to the northeast of the El Quseima plateau through the northern part of El Naqb along the wide coastal region of Palestine, which is one of the most densely populated regions of Israel.
- (b) Gulf of Aqabah, due to its position on the so-called African Rift, extends naturally north to the Dead Sea Depression (Jordan Valley). The coastal strips on Aqabah's shores are vitally related to the South of El Naqb (Negev) and the rest of Israel. This is reflected by the dense tourism in this subregion.

This linkage of the Sinai Region with the surrounding regions is worthy of careful analysis in the process of Sinai's development.

Two time scales are to be considered: first, the intermediate, extending to the year 2000 and dealing with new towns, upgrading of existing settlements, introducing adequate and feasible job opportunities, creating better housing facilities, services, and infrastructures; second, a long-range strategy to the year 2020, concerned with the optimum size of population which could maximize the productivity of Sinai without destroying the ecological balance of the region. Factors limiting growth in the current local and world economic environment could prove to be the facilitating factors for future generations. It is important to have a flexible strategy, able to incorporate future achievements and opportunities without distorting its main features and overall relationships.

The vulnerable environmental conditions of the Sinai Peninsula dictate a need to manage and control its development programs in a way that differs from that now common for the Arab Republic of Egypt. Site selection and size of settlement projections will have to consider the growth poles already established along the Suez Canal and the Gulf of Aqabah, as well as the large population concentrated in the Gaza Strip. Both Suez and Aqaba cities have been growing at close to 10 percent a year for the past few years.

Most Egyptian planners and politicians have looked upon Sinai as the eastern border of Egypt, its "Eastern Gate," the end of the Egyptian land. This point of view is of relatively recent origin.

During the periods of Islamic khilafat, Sinai was a communication hinge linking Egypt and North Africa with the eastern Middle East Islamic countries. Hopefully, in future Israel may no longer be a barrier between Egypt and the Arab world, and the active communciations role of Sinai will be restored.

4.8.2 Objectives, Criteria, and Process

Within the framework of the Recommended Strategy the following eight objectives for site selection were defined:

- To maintain the most rational, harmonious use of existing resources, natural, human and technological, within the geographical region, without disturbing the sensitive ecological balance.
- To be flexible in time to cope with the gradual transition of the existing economic profile of the region's settlement pattern (mainly nomads) to the proposed profile mainly agro-industrial, industrial and touristic with its associated settlement pattern.
- To optimize use of water resources: rain water runoff, ground-water, or imported Nile water as a generative core around which primary services (mosque, health care, education, etc.) can be sited.
- To plan for the differences amongst the several ecological subregions within the peninsula, allowing for a different settlement pattern for each.
- To conserve for future generations of Egyptians, and the world, the unique flora and fauna of Sinai's deserts, mountain, lakes, coasts and off-shore areas.
- To create new settlements of such high aesthetic quality and efficiency that long-settled Nile Valley inhabitants are attracted to the "new lands" of Sinai.
- To accommodate for the extreme sensitivity of the climatic conditions (stability of boundary layers, wind direction and speeds, water currents and types of waves, heat inversions, possible patterns of pollution, etc.).
- To deal with each ecological region as a multi-nucleated system with a unique combination of functions, and with services (for example, health care facilities, industrial zone, or shopping center distributed over the region at appropriate distances.

Table 4-2 lists 48 factors which should be considered in selecting new or relocated settlement sites. Not all of them will apply to every site, but the majority will. Most of the regional data are site-specific, and analysis would normally be carried out for two or more alternative sites.

Table 4-2

Criteria for Site Selection of New Settlements in Sinai

A. Ecology

Physiography

- Height from sea level
- Distance from shoreline
- Degree of slope - under 5 degrees
- 5 - 15 degrees
- over 15 degrees
- Orientation of slope
- Relief of the site

- Runoff and dry valleys
- Site profile
- Location (relation to major landscape features)
- Sand driftforms and sand motion

Pedology

- Geological profile
- Seismic stability of carrying layers*
- Compressive strength
- Chemical analysis
- Subsoil water table level
- Erosion (wind, rain, and sea)

Climate

- Bioclimatic profile
- Degree of sensitivity
- Wind regime, speed profile, percent of prevailing directions (diurnal and seasonal)
- Bio-climatic stress index

- Rain-moisture/evaporation index
- Radiation regime, intensity relative weight of direct/diffuse/reflected
- Dew and mist
- Heat inversions and calm conditions

B. Infrastructure Potentialities

- Water supply accessibility
- Accessibility to main roads, ports, waterways, and airports
- Accessibility to energy
- Waste water disposal possibility
- Communications

* The epicenter of an eight-minute, 5.1 Richter scale earthquake was off the Sinai coast in the Gulf of Suez on June 12, 1983.

Table 4-2 (continued)

B. Infrastructure Potentialities (continued)

- Marine continental rift, sea currents, wave action, tidal inundation, forms of lagoons, sabkha meshash
- Fresh water bodies
- Aquifers, aquifer recharge zones

C. Compatibility of Land Uses

- Agricultural suitability
- Grazing suitability
- Mining suitability
- Recreation suitability
- Industrial suitability
- Institutional suitability
- Urban suitability

D. Scenic & Historic Factors

- Visual features and symbols
- Natural panoramas
- Environmental quality
- Cultural/Religious sites

E. Social & Demographical Patterns

- Existing nearby settlements
- Social profile and tribe relationship
- Expected size and future potentialities

F. Flora and Fauna

- Indigenous vegetative growth symbiotic with settlements
- Sensitive and rare land and water animals
- Sensitive and rare land and water plants

The Recommended Strategy presents a hierarchical array of principal settlements for Sinai. Eleven of these will be new towns or, like Abu Rudeis and El Hasana, old settlements relocated to new sites.

Within the settlement pattern defined in the Recommended Strategy, the site for each settlement must be selected while keeping in mind its proposed size and economic profile. Aerial photos and topographical maps at a scale of 1:5,000 to 1:10,000 may be useful, but most of the analysis must perforce be based on extended and intensive field study of the factors listed in Table 4-2.

In the instance of all but the smallest future settlements (under 5,000 population) it is recommended that the proposed areas of alternative sites be divided according to square grid varying from 10 hectares to one square kilometer. Each cell would then be evaluated against the relevant criteria and the relative weight of each criterion valued in percentage comparison with other criteria. The cells having the maximum value will define the best site selection for a given settlement according to its proposed size.

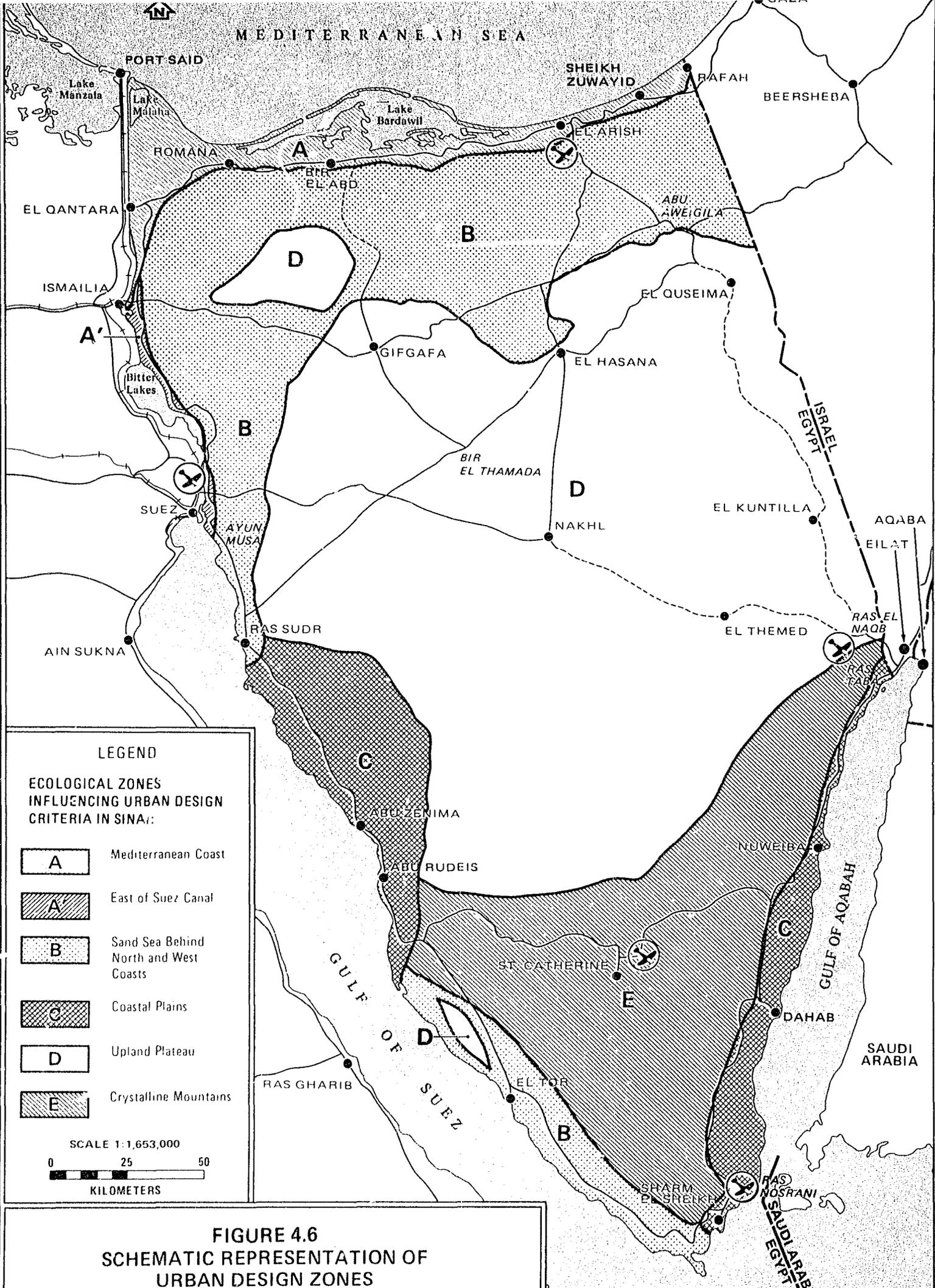
This process of site evaluation requires a multidisciplinary field and office team, including civil engineer, ecologist, anthropologist, economist, geologist, agronomist, and last but not least, a physical planner or urban designer. In some cases a marine engineer, or climatologist, or botanist may be required. Individual team members may spend greater or lesser time on the assignment but all are vital to the process.

4.8.3 Sinai Urban Design Zones (UDZs) and Siting Guidelines

Site selection will depend in every particular case on the given procedure. A framework for types of sites appropriate to several homogeneous areas of Sinai has been defined according to socio-bio-geo-ecological studies, in order to establish limited preliminary guidelines. Study of the existing bioclimatic profile of different locations, together with the geomorphological characteristics of Sinai subregions defines five distinct Urban Design Zones, as indicated on Figure 4.6.

4.8.3.1 Urban Design Zones A and A' (Mediterranean Coast and East of Suez Canal): These zones extend along the Mediterranean coast south toward the El Qantara-Rafah road; they include lands located east of the Suez Canal along the eastern shores of Bitter Lakes to a point 35 kilometers north of El Shatt and extending inland to a distance of 5 to 10 kilometers.

Zone A is a coastal strip of low land, sometimes below sea level, with salty ponds and water bodies separated from the sea, having a high water table, and experiencing occasional sea storms, tidal inundation and salt spray. The main northern road is close. A fresh water pipe is along the road.



LEGEND

**ECOLOGICAL ZONES
INFLUENCING URBAN DESIGN
CRITERIA IN SINAI:**

- A** Mediterranean Coast
- A'** East of Suez Canal
- B** Sand Sea Behind North and West Coasts
- C** Coastal Plains
- D** Upland Plateau
- E** Crystalline Mountains

SCALE 1:1,653,000



**FIGURE 4.6
SCHEMATIC REPRESENTATION OF
URBAN DESIGN ZONES**

Zone A' is a "sand sea" forming an arch, starting north of Ras Misalla and following along the northern valleys with depth from shoreline about 30 kilometers. Plains with sand formations of mainly sief dunes on a west-east axis change to north-south near the Suez Canal and Bitter Lakes. Potable water is very limited and under the dunes. Vegetation is scattered.

Bioclimatic zone A & B frequency is 40 percent. Air moisture content is high. Bio-Zone 'D' prevails in summer. High solar radiations are mainly reflected. There is no possible runoff (except in Wadi Glari). The soil on foundation level, is mainly sand and shale.

Recommended locations for site investigations:

- North of the main coastal road
- Away from shoreline, not closer than 5 kilometers
- On level land not less than 2 meters above sea level
- On northwest directed slopes
- Near existing oases or palm orchards
- Sheltered from eastern and southwest sand motion
- Away from good agricultural land, which should be located to the south of the chosen site
- Drainage inward to the lowest point
- On the west coast, sites along the Ayun Musa, Suez Canal and Bitter Lakes are preferred away from nearby sand dunes.

4.8.3.2 Urban Design Zone B (Sand Sea behind North and West Coasts): Zone B is a "sand sheet" extending from Ras Sudr to Rafah inland to the 200-meter contour line in northern Sinai behind Zone "A," together with the El Qaa Valley and other areas north and south of El Tor.

Main features include intensive sand motion (mainly "dune motion,") dune oases, and water (either through natural "well" points or water "posters" along water pipelines). It is an arid region with dry, hot conditions. The main trans-Sinai highway from Ismailia to El Arish and Rafah is along the northern edge of this region.

Recommended locations for site investigations:

- Away from threat of mobile dunes
- Near oases or reliable water source
- Near touristic attractions
- Near coast preferably facing northwest not less than 2 meters above sea level
- Protected from Khamsien winds
- Outside of wadi beds and flood danger
- Away from areas of exposed bedrock
- Near potential sources of wind energy but avoiding tunnel or venturi high wind sites.

4.8.3.3 Urban Design Zone C (Coastal Plains): Zone C includes the coastal plains extending between bays, from waterline to contour 200 meters within quite limited areas on the northern Gulf of Suez and along the Gulf of Aqabah. Areas are sometimes isolated from each other by mountains and high plateaus (Aqabah plains). Accordingly, these plains have their own geomorphological profile, which creates its own climatic, hydrologic and ecological character.

- High values of air temperature with moderately high moisture content. Bioclimatic profile shows 40 percent frequency for conditions A & B, mainly F (25 percent)
- Solar radiation is very high. Nevertheless, comfortable conditions extend for most of the year--especially in shaded areas
- Wind system: (i) from northern directions with high speed due to tunnelling effect of parallel mountains lining the shores, especially Aqabah Bay, reaching 10 m/sec, (ii) together with local catabatic cool winds, especially in summer calm nights, with low speed not more than 1.5 m/sec.
- There is no marine coastal erosion but tidal effect is significant; difference in water level could reach more than 2 meters, especially in the Gulf of Suez
- Hydrologically this zone is subjected to strong land erosion from the large number of short runoffs starting from the nearby mountains
- Soils here are wadi alluvium and playa from the quaternary and miocene periods, with raised beaches and corals of the Red Sea coast covered with gravel and rock eroded fragments due to the sea effect
- Some dispersed shrubs and limited vegetative life is limited to the coastal strip, 5-10 kilometers wide.

Some settlements are located near the seashore, mainly mono-societies located on poor sites (for example, Abu Zenima, Ras Sudr, El Tor). Some informal housing is located along the main road. Wind could be utilized economically for generation of electricity.

Recommended locations for site investigations:

- Areas elevated not less than 2 meters above the high-tide level along the shoreline between the waterline and the regional road

- Northwest bays are preferable; sites facing south oriented bays should be avoided
- Away from paths of long runoff and gaps between big mountains
- Some protection from strong winds and dust is available
- Potential shade trees are important
- Shadow from west or south mountains is desirable
- Sites near mountain edges are not recommended
- Sites near points from which roads and tracks start to the plateau and mountains are recommended
- Near natural resources, including water and tourist attractions.

4.8.3.4 Urban Design Zone D (Upland Plateau): Zone D includes the upland plateau with altitude from 200 to 1000 meters above sea level. The overall inclination is mostly from southeast to northwest.

The surface is divided by a number of deep valleys. The climate is continental with big frequencies of bioclimatic zones A & B and E & F. Conditions are very dry, but condensation by night within valleys forms dew in the bottom of valleys, giving some potential for very low density grass cover. High solar radiation is both direct and reflected. Every valley has its own microclimatic condition; mainly continental dry type, with an underheated period more than 55 percent of the time of the year. The main prevalence is for bioclimatic design conditions A & B and E & F.

It has low wind velocities, with directions following aerodynamic characteristics of natural features. Large sand dunes are mobile within the gaps between hills and mountains in the northern zone (north of El Hasana). Runoff from the surrounding mountains and plateau causes water erosion together with wind erosion on sharp edges. Surface soil on the plateau is mainly lime and sandstone. In the valley basins soils are wadi alluvium (clayey) and sandy gravel.

Water resources are limited in the bottom of valleys where there are nomad settlements around a number of local wells.

Communication is limited by the harsh topography. The existing road alignment follows the pattern of the main wadis, from east to west and north to south.

Recommended locations for site investigations:

- Small-size settlements on slopes facing southeast, preferably elevated from a valley bottom overlooking vast valley sections
- Near a reliable water source
- Facing gaps between hills but avoiding runoff patterns
- On the top of a plain plateau
- Away from erosion zones
- Away from threat of sand dunes
- Avoid locations in the shadow of a southern mountain
- Avoid wind tunnel (venturi) effect
- Away from exposed bedrock
- Should have potential for shade trees.

4.8.3.5 Urban Design Zone E (Crystalline Mountains): Zone E consists of the mountains of crystallized igneous rocks on the southern end of the Sinai Peninsula, strategically controlling the whole eastern coast of the Red Sea and Upper Egypt on the Sea. This region has an altitude of not less than 1,500 meters, and some mountains crest at a height of over 2,500 meters. Between the mountains is a group of high valleys with steep slopes running east and west. Higher values of rain and moisture content contribute to moderately dense vegetation which sometimes results in a very rich oasis, such as Feiran Oasis.

Due to the altitude, very cold and cold conditions (bioclimatic zone A & B) prevail more than 60 percent of the year, with minimum temperature reaching zero and minus values. Comfortable conditions dominate most of the year due to the high value of solar radiations, both direct and defused. Low wind velocities create an ideal condition for a very unique and diversely rich inventory of natural plant and animal species.

Recommended locations for site investigations:

- Places where there is an oasis or there is the potential for the creation of a valley oasis through good water management
- Places near major tourist attractions.

The oases, with the exception of Feiran, may be quite small agricultural/grazing villages. Other sites may be only tourist and research/residential areas rather than complete settlements.

4.9 SETTLEMENT LAND USE BUDGETS

Analysis of the Recommended Strategy indicates that less than one percent of Sinai's land will be needed for all urban land uses. It proposes that the urban population be distributed in 37 cities, towns and settlements. Several of these will be completely new communities and others will be wholly or partially resited. Therefore, the careful budgeting of land to the various categories of urban land use may be worth a considerable amount of study and planning. On the fiscal side, over a billion pounds is proposed to be invested in urbanization, and careful land use planning can be an important first step in the budgeting of such an investment and in monitoring its efficiency.

Each of the cities and towns of Sinai should be planned by a multidisciplinary team. Model neighborhoods, residential and other, should be built as pilots to define an Egyptian/Sinaiian type of design. Competitions should be held, with Sinaiians as judges, to search out the most suitable and efficient designs for the several ecological zones of the peninsula. The scale of the proposal to settle one million Egyptians in Sinai is large enough to justify all of these actions and more. However, as a beginning point it may be useful to postulate ideal land use budgets for each major class of settlement.

Land use budgets for four classes of settlements have been prepared from several sources including Working Paper 16; Working Paper 47; NUPS Urban Data Report Three, VI (Table VI-I and others); Helwan New Community unpublished data; the settlement survey and interviews. Consideration has been given to current conditions in Sinai and in the Nile Valley, to the work of other planners, and to the GOPP's current planning standards.

The Consultant presents these land use budgets with the intent that they will be useful in evaluating town and neighborhood plans, as a tool to redirect design. They are not intended as fixed parameters or limits, but guideposts. Each settlement should be unique. The principal findings from the studies that back up Volume IV and Section 4.8 in this Volume suggest relatively high density and high amenity communities. The suburban openness of garden cities does not seem suited either to the desert or a situation where infrastructure is already expensive in relation to family incomes.

Table 4-3 presents land use budgets for four sizes of settlements. The land per capita varies less than twenty percent overall but within categories the allocation of land per capita varies by as much as four times.

High residential area net densities are recommended on the principle that narrow lots on narrow streets are appropriate to hot and dry places. These densities are higher than for places of a similar size in Nilotic Egypt but similar to the densities in the next larger class of settlement there. Thus, a Sinai city of 100,000 may have net residential density design standards similar to current densities in a

Table 4-3

Proposed per Capita Core Land-Use Budgets, by
Population Size of Settlement

<u>Land Use</u>	<u>Recommended Standard by Population of Settlement</u>				<u>GOPP Comparison Standard^{a/}</u>
	<u>Over 50,000</u>	<u>25,000- 50,000</u>	<u>5,000- 25,000</u>	<u>Under 5,000</u>	
A. <u>Square Meters of Land per Capita</u>					
Total, core land use	<u>36.0</u>	<u>40.0</u>	<u>36.0</u>	<u>33.0</u>	<u>41.9</u>
Residential	12.5 ^{b/}	14.0 ^{c/}	16.0 ^{b/}	21.0	17.5
Industrial and related	5.0 ^{b/}	10.0 ^{c/}	5.0 ^{b/}	1.0	^{a/}
Recreation and open spaces	3.5	2.0	2.0	1.0	3.0
Circulation (streets)	7.5	8.0	9.0	7.5	13.9
Education and health facilities	3.5	3.0	2.0	1.5	3.6
Other	4.0	3.0	2.0	1.0	3.9
B. <u>Percent Distribution</u>					
Total, core land use	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Residential	35.0	35.0	45.0	63.0	41.7
Industrial and related	15.0	25.0	14.0	3.0	^{a/}
Recreation and open spaces	9.5	5.0	5.0	3.0	7.2
Circulation (streets)	21.0	20.0	25.0	23.0	33.2
Education and health facilities	9.5	7.5	5.5	5.0	8.6
Other	11.0	7.5	5.5	3.0	9.3

^{a/} This unofficial interpretation of GOPP standards is not strictly comparable for reasons explained in the text. Moreover, industrial and related uses are not included in GOPP "core land-use" budgets but are added separately in accordance with industrial plans for particular towns and settlements.

^{b/} Anywhere from 2.5 to 7.5 square meters per capita, depending on the importance and type of industry in the settlement.

^{c/} Anywhere from 5 to 15 square meters per capita, depending on the importance and type of industry in the settlement.

SOURCE: Calculations by Consultant based on Working Papers 16, 32, 47 in SDS-I project files; NUPS, Urban Growth and Data Report, Part III, Section VI, Pages 363-365; Helwan New Community, unpublished file data and personal interviews.

city twice that size in the Delta. This proposed density standard is for a final buildout, or 100 percent completed stage, of a neighborhood and is not expected to be achieved in the majority of Sinai neighborhoods by 2000. Densities may be between 50 and 75 percent of this in 2000. Settlement densities are not analyzed further in this section, because density analysis can best be carried out after allowing for non-core land use as discussed below. However, these recommendations can be compared with other plans and comparably-sized communities on a land use-by-land use basis.

The land-use budgets postulated do not include such functionally and site-specific land uses as tourism, large-scale industry, transportation and tree belts. The sample of 37 communities did not permit useful generalizations about such less common uses. Therefore, planned and actual community land use may be considerably higher than the totals shown in the table.

The residential category is without streets or such normal residentially related uses as small parks and primary education. The industrial use represents general industry and warehousing/wholesaling. Open space is recreational only and does not include tree belts, beaches, groundwater recharge areas, flood plains or other urban open spaces. The circulation category includes local streets only and not highways or airports within urban areas. Education and health include colleges and hospitals but not universities or special research facilities. "Other" uses include high-density uses, such as retailing and government offices.

The General Organization for Physical Planning (GOPP) and the Ministry of Development have recommended action guidelines for planning settlements in Egypt. An unofficial interpretation of its standards is included as the righthand column of Table 4-3. The only major difference is in the category of circulation, where the GOPP recommends 33 percent and SDS-I recommends 22 percent of the land uses included in each set. This difference is exaggerated, because GOPP does not include industry.

4.10 HOUSING

4.10.1 Introduction

Working Papers 16 (August, 1981) and 47 (December, 1982) present the status of housing at the time of the Consultant's Settlement Survey of June, 1981. Annex A of Working Paper 16 summarizes 1981 housing data west of the Interim Withdrawal Line, including El Arish, reporting approximately 20,000 urban dwelling units, of which about 4,000 were south of the Hadj highway. Table 3-6 of Working Paper 47 presents the characteristics of current public housing projects. The mean of those projects is approximately 150 square meters of floor space per family at a cost of LE 8,500 for "standard residential."

Overall housing conditions in Sinai are worse than in Nilotic Egypt. This may be due in large part to the Bedouin tradition of low expenditure on shelter. Contributing to the poor housing status are

the current high cost of certain building materials and the shortage of housing-related utilities such as electricity and piped water.

Analysis of surveys amongst Egyptian internal migrants suggests that good quality housing will be an important prerequisite to migration to Sinai. Housing programs therefore will be critical to the success of the Sinai Development Strategy. Three elements in such programs may be vital:

- Readily available, long-term moderate interest loans or mortgages for all income groups
- Readily available access to land and building tenure (fee simple or long-term lease) through hire-purchase or other schemes
- Readily available building materials at costs that do not exceed those of the rest of Egypt.

Thus, credit, tenure, and building materials are three separate housing programs that require early attention. These should be parallel with the public sector improvement of land by the installation of basic infrastructure and vegetative shelter belts.

4.10.2 Government Housing Policies and Sinai

The Government's housing policy, as articulated by the Ministry of Planning in November 1982 (part 2, Sector Picture, Detailed General Plan 1982/83 - 1986/87), seems to be very well suited to Sinai:

"The main aim of the forthcoming stage is to provide the family with its own house by Year 2000. This house must satisfy basic needs and be within the range of the various income levels. This involves improving outstanding housing conditions, dealing with current shortcomings, and reducing overcrowding. Moreover, housing must be considered a means of redistributing population so as to reduce population in some areas, where crowding is a serious condition...."

The MOP suggests the following reorientation for the public sector's activities in housing during the next five years, which seems particularly appropriate for Sinai:

"Marshalling the public sector's potentialities so that it may play a major role in providing the materials needed to solve the housing problem and encouraging the private sector to engage in housing construction, by helping to remove obstacles through the following means:

- Providing building lands equipped with utilities at suitable prices, and requiring the relevant authorities to play an effective role in this field. Provision of suitable land represents the first and basic factor for building a house, without which it is impossible to build,

- Providing necessary financing for housing units at the popular level, through easy-term loans which will thus enable the private sector, together with its own savings, to fulfill the major requirements of the Plan. Thus, as far as popular housing is concerned, financing by the State will be limited to the amounts required for covering the difference between the interest rate prevailing in the banks and the rate to be adopted for lending to citizens.
- Providing the necessary building materials and expanding the level of production so as to dispense with imports.
- Providing the manpower required by this sector through the creation of training centers that can supplement the apprentice training programs provided by contracting companies on the job sites.
- Extending the Governorates' activities to all cities and towns instead of limiting them to the capitals or chief towns."

4.10.3 Projected Investment Requirements for Housing

Chapter 2 of this Volume has projected a population growth of 800,000 during the next 17 years. This population might be divided into about 150,000 households. An appraisal of the existing housing stock suggests that the equivalent of 60 percent may be completely reconstructed during the same time period. The need to provide high quality housing for senior Government servants may represent about one household in ten--approximately 15,000.

A survey of recent literature on housing in Egypt*, site visits and several interviews lead to the conclusion that Sinai housing costs--not considering infrastructure and finance charges--can be reasonably stated:

- In-Migrants--10 percent, senior government servants @ LE 8,500 per dwelling unit, or LE 1,500 per capita
- In-Migrants--90 percent, private families @ LE 2,700 per dwelling unit, or about LE 460 per capita
- Natives--Upgrading existing 20,000 DUs @ LE 1,500 per dwelling unit, or LE 300 per capita.

The housing requirement of about 160,000 dwelling units is needed at the conclusion of the plan period. Construction will proceed at a relatively smooth pace as an average of 10,000 families set up housekeeping in Sinai each year. Following the population projection of Chapter 2, the "order of magnitude," capital requirements are as indicated in Table 4-4.

During Phases I and II housing seems likely to be the largest single capital budget item in the services column after the transmission of imported water. The investment in housing is a useful indicator in monitoring development. It should have a positive relationship to investments in the productive sector as earnings become savings. Housing investment should neither run very far ahead nor very far behind investment in social and

* See National Urban Policy Study, Volume II, Appendix V, III A, Table V-A.4.

community infrastructure. The cost estimates in Table 3-14 and 4-4 suggest that the investment in housing will be more or less equal to the investment in social and community "facilities" (without electricity and telephones) during the period covered by this Report, with housing having the largest share early on and "facilities" catching up in the 1990s. It seems reasonable to expect that a dwelling unit will represent about one-half the local investment needed to provide basic amenities, not considering land, communications or energy costs.

Table 4-4

Projected Capital Investment in Housing by Phase

	<u>Phase I</u>		<u>Phase II</u>		<u>Phase III</u>		<u>Total</u>	
	<u>DUs(K)</u>	<u>LEs(M)</u>	<u>DUs(K)</u>	<u>LEs(M)</u>	<u>DUs(K)</u>	<u>LEs(M)</u>	<u>DUs(K)</u>	<u>LEs(M)</u>
Senior Government Servants (LE 8,500)	0.8	6.8	5.8	49.3	8.1	68.8	14.7	124.9
Private New DUs (LE 2,700)	7.2	19.8	52.2	143.5	72.9	200.5	132.3	363.8
Private Upgrading (LE 1,500)	3.5	5.2	7.5	11.2	9.0	13.5	20.0	29.9
Total	11.5	31.8	65.5	204.0	90.0	282.8	167.0*	518.6

K = thousands
M = millions -- 1982 pounds
DU= dwelling unit

* The inclusion of 20,000 upgraded units in this total implies that all of the existing units will be upgraded to some extent.

SOURCE: Calculations by the Consultant.

5.0 ALTERNATIVE STRATEGIES

The Recommended Strategy of Chapter 5 is an output of a fifth major iteration in a process that began during the early months of 1981. Working Papers 8, 10, 20, and 32, and other memoranda in the project files* describe the systems and procedures that were followed and are summarized here.

The Consultant used two approaches to generate alternative futures. One estimated the development potential of the peninsula and planned its maximum development by 2000 with a minimum of inputs from the outside--a self-reliant approach. This process led to 70 percent of the year 2000 population being settled near the Mediterranean and much of the remainder near the Suez Canal. Another approach was to prepare idealized subregional plans for five subregions with the intention of settling at least one million persons overall.

This target translates to about 16 persons per square kilometer, which is equal to the theoretical potential for arid zones and thus, as intended by the Government's policy of developing remote regions, will stretch the capacity of mountainous Sinai enough to assure that all development potentials are identified. Under this approach, a scenario description of the year 2000 outcome was drafted for each alternative strategy; Section 5.4 below includes a description of the scenario expected to result from the Recommended Strategy.

5.1 PROCESS

To consider a full range of technically feasible and potentially realistic development alternatives for Sinai, a process was organized to consider the following:

- A spectrum of possibilities ranging from a settlement pattern that is widely dispersed across the face of Sinai using even quite small resource opportunities, to a pattern that is concentrated in a few large settlements with dependent settlements in their hinterlands
- A range of development options that will give more or less priority to Egypt's strategic "civilizational" objectives and also to other considerations such as economic viability, efficiency, and productivity
- A wide range in the sequence and location of key investments and projects, particularly as such activities relate to land resources still under study; that is, to their capacity and to international markets which have not been tested.

* Particular reference is recommended to a paper prepared in February, 1983, and the accompanying transparent overlays.

The range of choices that the Consultant presented to officials of the Ministry of Development for consideration included a number of settlement options according to the relative regional concentration or dispersal of population and to the relative integration or specialization of the settlements.

In the case of Sinai, these characteristics could be quickly measured from phase to phase because data had been assembled into subregional and zonal files. As an example, comparing the Dispersed and the Frontier Strategies, one finds that the "maps" are not very different (Figures 5.1 and 5.3). However, an analysis of the data and narrative descriptions shows Frontier to be much more concentrated in the North and to have a higher percentage of multipurpose towns (combining industry, tourism, higher education, and fishing) and Dispersed to have both a population more evenly distributed among the several zones and a higher frequency of single-purpose settlements (predominantly agriculture, industry, or tourism). Having developed several alternatives, of which two had significant options, the Consultant is confident that an adequate range of possible futures has been considered using all available information.

Each Alternative was constructed in four basic dimensions for extrapolating and hypothesizing the future of Sinai:

- Space
- Time
- Potentials
- Policy

Space is represented in the process by subregional profiles which maximized development based on conceptual projects. Time was divided into the 1980s, the 1990s, and beyond 2000 (adjusted later to fit the government's Five-Year Plans). Potentials were drawn from the land capability study, the water resources study, the study of minerals, and other aspects of SDS-I. Policy was a combination of goals, as defined by the RFP and the Steering Committee, and a set of guidelines derived from them and presented in the second Status Report.

The essential character of the three initial alternatives is that they combined space, time, physical potentials and policy considerations, based on:

- Imaginative scenarios or subregional "utopias," expressed as projects
- Substantial regard for
 - possible costs and,
 - the capability of the land
- Strict procedures
- Specialists' forecasts, used
 - to set a scale early on and, later,
 - as an evaluative measure.

These elements and procedures are described in several 1982 and 1983 memoranda.

The three strategies were presented to the Steering Committee on March 9, 1983, using transparent overlays. At this time the process of evaluating the strategies was underway: field trips were made to check subregions and sites (some of which had not been visited previously because eastern Sinai was closed at the time of original SDS-I field work in 1980 and 1981), and interviews were held with each of the five Governors or their representatives and with various interested persons and agencies, including GOPP and Cairo University. Issues that were turned up by this process were brought to the Steering Committee and, based on their advice, a Recommended Strategy was submitted on March 30, 1983, and accepted by the Committee as the basis for completion of this Report. The Recommended Strategy is summarized in Volume I.

5.2 THE THREE ALTERNATIVE STRATEGIES

The three alternatives are outlined here in Figures 5.1, 5.2, and 5.3, Tables 5-1, 5-2, and 5-6, and in the following 12 short paragraphs. They are also discussed in Volumes III and V, as well as in other documents in project files.

5.2.1 Dispersed

The path to full development of the Sinai Peninsula can begin with agricultural development in the wadis along all of its sea coasts, and on reclaimed land along the Suez Canal, while aqueducts for Nile water are being designed and built. Agricultural development attracts families who become permanent settlers.

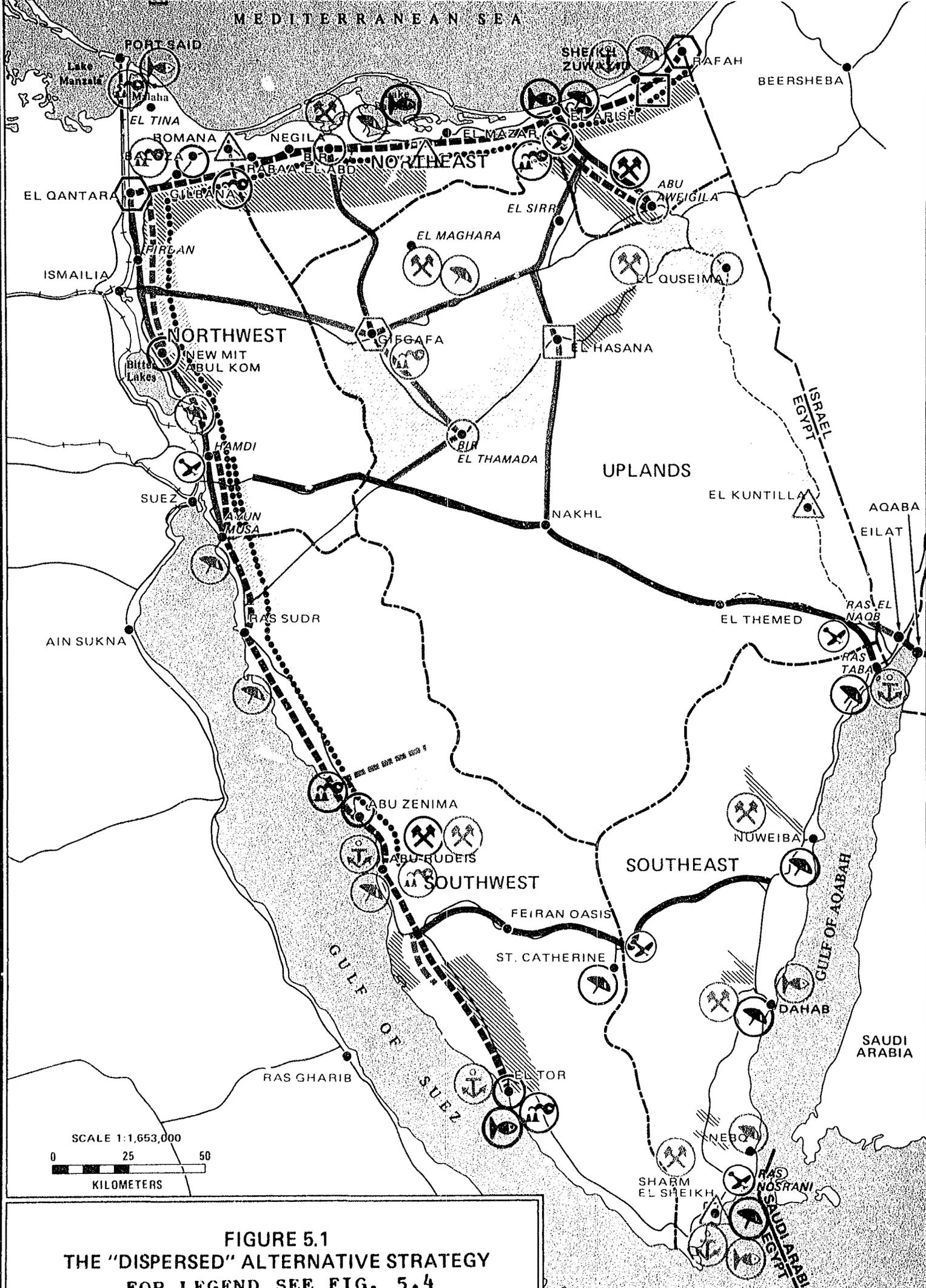
This alternative is led by infrastructure, with an emphasis on pipelines for Nile water and natural gas. Other early investments are more concentrated in secondary roads and pumping groundwater.

The second phase of development is dominated by the introduction of irrigated agriculture and the processing of its products for sale to Nilotic Egypt, Europe, and the Middle East. About 305,000 feddans are planned for development by 2000. Second priority is given to mineral and touristic land capability exploitation, with emphasis in the South, wherever resources are found.

The spatial pattern of development that will result from this path of development is one of scattered, agriculture-based settlements with a few service towns. The settlements in the highlands are expected to reach full size during the 1990s and further growth beyond the year 2000 will be principally on the coastal plains.

5.2.2 All Coasts

This strategy concentrates development along the four coasts below the 100-meter contour, with the intention of laying a solid base for settlement of the interior after 2000; 90 percent of the turn-of-the-century population may be on the coastal plains. All Coasts begins development with spillover from the Suez Canal Governorates, the expansion of El Arish as a "growth pole", and continued growth of the petroleum sector and touristic activities in the south.



SCALE 1:1,653,000
 0 25 50
 KILOMETERS

FIGURE 5.1
THE "DISPERSED" ALTERNATIVE STRATEGY
FOR LEGEND SEE FIG. 5.4

Table 5-1

Irrigated Feddans Under Alternative Strategies, by Subregion
(Year 2000)

<u>Subregion</u>	<u>Recommended Strategy</u>	<u>Alternative Strategies</u>		
		<u>All Coasts</u>	<u>Frontier</u>	<u>Dispersed</u>
Northwest	71,000	30,000	62,000	47,000
Northeast*	109,900**	45,000	119,800	195,000
Southwest	17,300	12,000	1,000	55,000
Southeast	<u>1,700</u>	<u>750</u>	<u>4,500</u>	<u>8,000</u>
TOTAL	199,900	87,750	187,300	305,000

* Includes Uplands.

**Of which Uplands accounts for 51,900 feddans (excluding 2,000 feddans of managed runoff).

Table 5-2

Leading Sector Employment Under Alternative Strategies, by Subregion
(Year 2000)

<u>Subregion</u>	<u>Recommended Strategy</u>	<u>Alternative Strategies</u>		
		<u>All Coasts</u>	<u>Frontier</u>	<u>Dispersed</u>
Northwest	36,945	41,400	40,941	66,186
Northeast*	107,950**	73,000	86,524	72,072
Southwest	26,620	37,100	7,100	30,938
Southeast	<u>8,210</u>	<u>13,500</u>	<u>12,150</u>	<u>18,097</u>
TOTAL	179,725	165,000	146,715	187,293

* Includes Uplands.

**Of which Uplands accounts for 33,550 jobs, mainly in agriculture.

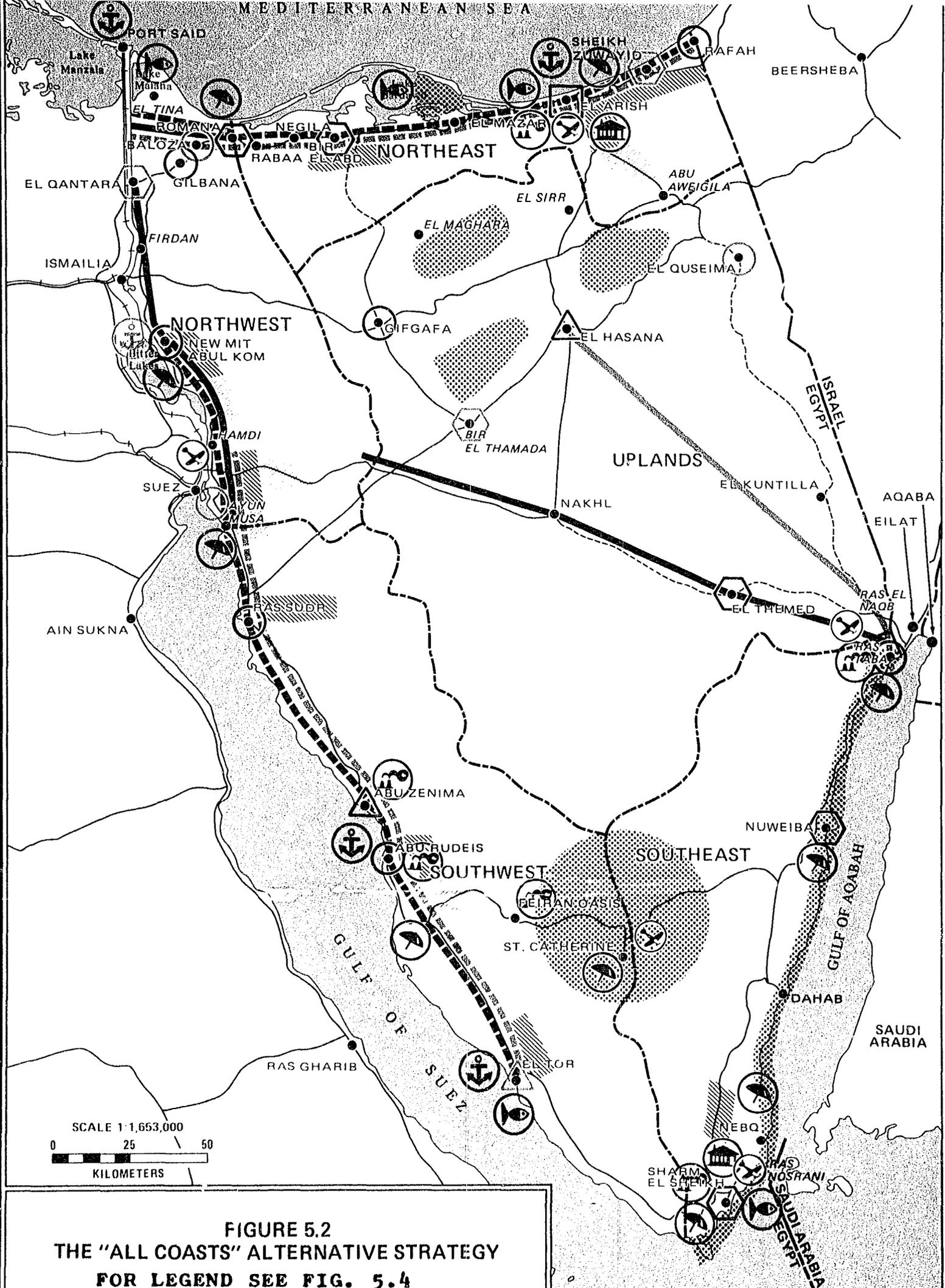


FIGURE 5.2
THE "ALL COASTS" ALTERNATIVE STRATEGY
FOR LEGEND SEE FIG. 5.4

Development is based throughout on two primary necessities: Sinai's access to Nile water and to national and international markets.

In 2000 Sinai could be a somewhat urbanized part of Egypt. The urban population (at least two-thirds of the total in towns of more than 20,000) would be divided between expanded existing towns and new towns. El Arish and two or three other places would be given priority during the 1980s, and another four or five settlements in the 1990s.

Agriculture is essential to permanent settlement of Sinai but requires only a portion of its population. Agriculture is export-oriented and is principally nontraditional, including aquaculture, horticulture, and controlled environment. Vertically integrated agribusiness operations and intensive drip-irrigated truck farms are more typical than the traditional farming of the felaheen.

5.2.3 Frontier

The Frontier Strategy begins development at the Suez Canal, at Rafah and at Ras Taba, in each case as an extension of robust development across the border. Simultaneously, it supports development on the other "frontier" in the Uplands through small-scale water, industrial, and agricultural projects designed to enrich and to enlarge local settlements.

Phase Two of the Frontier path to development delivers Nile water through the passes to the Wadi El Bruk and upper Wadi El Arish, and builds small ports on all four coasts with the largest being east of Little Bitter Lake near the Hamdi Tunnel.

Frontier emphasizes a self-reliant, balanced economy providing its own food, fuel, tools, and education. By striving for self-reliance, Sinai will more quickly become a truly settled place and will, in the long run, return greater benefits to Egypt. At the same time, the economy is closely linked to the economies of neighboring countries to the east.

At the turn of the century Sinai will be a balanced agricultural and urban region with large and small towns and many villages. Life will be focused on universities in north and south, in El Arish and at a new town near Abu Zenima/Abu Rudeis, and on seacoastal and mountain landscapes, which are very different from the Nile Valley.

5.3 EVALUATION OF ALTERNATIVES AND THE RECOMMENDED STRATEGY

The entire SDS-I team participated in the evaluation of alternative strategies against goals which were defined and weighted by the Steering Committee. Individual specialists evaluated separate sectors, usually by subregion. These are reported on in Working Papers and memoranda, and summarized here. The specialists rated Dispersed and All Coasts--the two extremes of a concentration continuum--as about equal, and gave Frontier--the strategy in the middle--a somewhat better score. This result is reflected in the Recommended Strategy, which is more similar to Frontier than to either of the others.

1983 - 1990

1990 - 2000

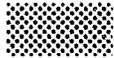
Irrigated Agriculture		
Nature Conservation		
Settlements		
over 50,000		
25,000 - 50,000		
5,000 - 25,000		
under 5,000		
Research Centers		
Tourism		
Industry		
Fishing		
Harbors		
Mining		
Major Roads (new & improved)		
Water Conveyances		
Natural Gas		

FIGURE 5.4
LEGEND FOR MAPS OF THE 3 ALTERNATIVE
STRATEGIES

Table 5-3 summarizes the results of the sector specialists' analysis. It is interesting to note that All Coasts scores best in more cases than either Frontier or Dispersed, and that Frontier scores least well only half as often as its two competitors. The similarity in the scores provides a level of confidence that the three alternative strategies were relatively equal in the balance of their elements. When the Recommended Strategy is added, it naturally outscores all three alternatives, since it builds on them and aims to combine the strengths of each into a stronger synthesis.

After the preparation of a Recommended Strategy, it was again compared with the three alternative strategies of the previous iteration. This was done on the basis of various criteria, including the eight regional goals as defined and weighted by the Steering Committee. The results presented in Tables 5-4 and 5-5 are the mean of the individual evaluations carried out by the Project Director, the Senior Economist, and the Regional Planner. Each of the evaluators had been previously associated more closely with one or another of the three alternatives and biases should have been cancelled.

The overall rank order of the four strategies is shown below:

- Recommended 15.3
- Frontier 12.5
- All Coasts 11.7
- Dispersed 10.2

The Recommended Strategy achieved the highest overall score, which, as noted earlier, is not surprising, since it was a later iteration and benefited from inputs from all the previous strategies. All Coasts ranked higher than Recommended in the Northeast Subregion, apparently because All Coasts invested more on the Mediterranean coast and had a larger population with more economic activities. All Coasts may offer a later stage (post-2000) or an accelerated option for the Recommended Strategy in the Northeast Subregion.

The Frontier Strategy ranked higher than the Recommended Strategy in the Uplands Subregion. This would seem to be due mainly to a further extension of Nile water-based irrigation into the Uplands than is included in the Recommended Strategy. This further infrastructural development is described in part in Volume V. It may offer development executives in Sinai a further stage in the development of the Uplands for implementation after the year 2000.

The most useful portion of the evaluation task has been to study the relative achievements by individual goals (Table 5-5). The Recommended Strategy is in first place on five of the eight goals. However, it comes in second (albeit, generally a close second) in terms of manpower, economic viability, and dispersed settlement system. Discussion with the evaluators indicates that the Recommended Strategy scored less well on economic viability because of a heavy dependence on capital-intensive, "high tech" agriculture in a relatively unknown environment. Keeping development concentrated on the coasts would be preferred if economic considerations outweighed all others.

Summary of Specialists' Evaluation of the
Three Alternative Strategies

<u>Criteria (unweighted)</u>	<u>Recommended Strategy</u>	<u>Alternative Strategies</u>		
		<u>Dispersed</u>	<u>All Coasts</u>	<u>Frontier</u>
Efficiency of water use	3	1	2	4
Infrastructural efficiency	3	1	4	2
Economic viability	3	2	4	1
Effective use of soil	4	3	1	2
Touristic development	3	2	1	4
Attractiveness to in-migrants	4	1	3	2
Internal flexibility	2	4	1	3
External flexibility	4	3	2	1
Nature conservation	4	1	3	2
Potential beyond 2000	4	2	1	3
TOTAL	34	20	22	24

NOTE: A high sector indicates a higher achievement.
SOURCE: Sector specialists' evaluations.

Table 5-4

Evaluation in Terms of Goals Achievement,
Recommended Strategy Compared to Three Alternatives, by Subregion

<u>Subregion</u>	<u>Recommended Strategy</u>		<u>Alternative Strategies</u>					
			<u>All Coasts</u>		<u>Dispersed</u>		<u>Frontier</u>	
	<u>WA</u>	<u>OR</u>	<u>WA</u>	<u>OR</u>	<u>WA</u>	<u>OR</u>	<u>WA</u>	<u>OR</u>
Northwest	3.8	1	2.1	3	1.2	4	2.9	2
Northeast	2.4	2	3.4	1	2.3	3	1.9	4
Uplands	3.0	2	1.3	4	2.2	3	3.6	1
Southwest	3.1	1	2.8	2	2.4	3	2.1	4
Southeast	2.9	1	2.1	4	2.1	4	2.2	2

Table 5-5

Evaluation in Terms of Goals Achievement,
Recommended Strategy Compared to Three Alternatives, by Goal

<u>Regional Goals</u>	<u>Recommended Strategy</u>		<u>Alternative Strategies</u>					
			<u>All Coasts</u>		<u>Dispersed</u>		<u>Frontier</u>	
	<u>AT</u>	<u>OR</u>	<u>AT</u>	<u>OR</u>	<u>AT</u>	<u>OR</u>	<u>AT</u>	<u>OR</u>
National integration	11.0	1	11.0	1	4.0	3	9.6	2
Population absorption	8.0	1	6.7	2	4.6	4	6.0	3
Resource development	13.0	1	6.0	4	8.0	3	9.6	2
Develop/attract manpower	3.0	2	4.0	1	1.3	4	2.0	3
Economic viability	4.7	2	8.6	1	2.0	3	4.7	2
Dispersed settlement system	12.0	2	7.0	3	13.0	1	7.0	3
Improved communications	9.3	1	5.3	4	8.0	2	6.7	3
Enhanced environment	3.7	1	3.7	1	2.3	3	3.3	2

NOTE: AT = Average of total weighted scores; OR - ordinary rank.

SOURCE: Steering Committee weights and senior staff evaluation.

It is not surprising that the Dispersed Strategy scored best in terms of the dispersed settlement goal, but the Recommended Strategy also scored well against this goal. All Coasts was ranked better able to attract manpower, because attracting agricultural settlers was judged more difficult than attracting urban workers. First place on the goal of enhanced environment was shared by the Recommended Strategy with All Coasts (which did not place many economic activities in the Uplands). The Consultant concludes that highest priority in terms of program and staff should be concentrated on economic viability and manpower, since these two goals may be the most difficult to achieve.

Summarized in Table 5-6 are some of the basic economic parameters of the three Alternative Strategies, prepared as a step toward designing a Recommended Strategy. They have common elements:

- Substantial increases in agricultural employment based on importation of Nile Water
- More absolute growth taking place in the Northeast Subregion than in any other
- Industrial development oriented to the coasts
- Conservation of special ecological areas (both terrestrial and marine)
- A 1992 population target pushing 400,000
- Only a small population settled in the Southeast, even in the year 2000, reflecting rather modest resource endowment.

The Frontier and Dispersed strategies have in common an even stronger agricultural emphasis than All Coasts--close to the current national proportion of over 30 percent of total employment. All Coasts and Dispersed have similar amounts of employment in tourism. All Coasts and Frontier project similar populations for the Northwest Subregion.

In terms of national economic goals and regional economic objectives, each of the alternative strategies contributes positively under most of the headings shown in Table 5-7, although the Dispersed Strategy performs poorly under some of the economic objectives which are listed. Whereas Egyptians from the Delta are more easily attracted to urban locations, the Dispersed strategy sets up many rural communities. Frontier is similar in this respect. Dispersed also runs counter to a prime national goal for agriculture, stated in the current Five-Year Plan, which is to improve the productivity of existing agriculture rather than to extend the feddanage farmed in any major way. Neither Frontier nor Dispersed strategies project rapid industrial growth, and Dispersed does not encourage the conservation of current or anticipated water supplies. Dispersed is also more likely than the others to require long-term operating as well as capital subsidies for water supply. Nile water pipelines would cost an estimated total of LE 6.1 billion (compared with LE 3.2 billion for Frontier), and water is required in remote areas where its economic cost may exceed LE 0.95 per cubic meter, more than many cropping patterns can bear. All strategies,

Table 5-6

Summary of Economic Characteristics of Alternative Strategies

	<u>Three Alternatives (considered early 1983)</u>			<u>Recommended Strategy</u>
	<u>Frontier</u>	<u>All Coasts</u>	<u>Dispersed</u>	
<u>1. Total projected population (000)</u>				
1992	338.0	422.0	362.0	521.2
2000	944.0	1,058.0	1,100.0	973.1
<u>2. Projected employment (000), by sector</u>				
1992, total	90.0	118.0	98.0	146.0
Agriculture	37.0	38.0	40.0	56.6
Industry	7.0	16.0	3.0	21.6
Tourism	1.0	5.0	6.0	4.3
Other	45.0	59.0	49.0	63.5
2000, total	293.4	330.0	374.6	313.0
Agriculture	122.7	80.0	160.3	121.3
Industry	17.0	65.0	9.0	47.3
Tourism	7.0	20.0	18.0	11.2
Other	146.7	165.0	187.3	133.2
<u>3. Subregional Distribution of year 2000 population (percent)</u>				
NW	27.9	25.0	36.0	17.2
NE	59.1	44.5	38.4	46.6
UP	a/	a/	a/	17.5
SW	8.2	22.6	15.7	14.1
SE	4.8	7.9	9.9	4.6
a/ Included in Northeast Subregion				
<u>4. Phasing by Subregion:</u>				
	Spread from Canal NW to NE. SE also benefits from trade.	Continued emphasis along coasts to the limit of resources there.	Early emphasis NE, SW; later in NW.	Develop activities in each subregion; then integrate into peninsular economy.
<u>5. Special economic emphasis</u>				
	Agriculture the dominant employer, spreading from the East Bank of the Canal to the Wadi El Arish area.	Balanced employment with industry not far short of agriculture.	Agricultural employment, same percentage of total employment as Egyptian economy as a whole.	Major promotion of industrial activities and intensive irrigation; promote tourism, especially along beaches, to limit of market, balancing local and overseas clientele.
<u>6. Infrastructure</u>				
	High quality networks for Nile water, roads and power.	Heavy infrastructure lines along coasts; connecting lines E-W and N-S in interior.	Most "distributed" system; very high investment in Nile water to the interior; conscious effort, regardless of cost, to have population spread to all areas of peninsula.	Represents synthesis and refinement of major elements in previously considered strategies; aims at balanced achievement of several complex, sometimes competing, national goals.

SOURCE: Calculations by the Consultant.

Evaluation of the Alternative Strategies in Terms of
Economic Goals Achievements

<u>Economic Objective</u>	<u>Recommended Strategy</u>	<u>Alternative Strategies</u>		
		<u>Frontier</u>	<u>All Coasts</u>	<u>Dispersed</u>
1. <u>National Plan Goals Applied to Sinai</u>				
1.1 Improved standard of living:				
. all to benefit from growth	+++	++	+++	+++
. fast growth in industry and mining	+++	-	+++	--
. emphasis on food processing, clothing, local raw materials	+++	++	++	+
. new chemicals industries	+++	+++	+++	+
1.2 Slower population growth				
. reduce migration to large cities	+++	+	+++	-
1.3 Increase self-reliance and labor productivity:				
. reduce dependency on imports	++	++	++	+++
. increase poultry, eggs, fish production	+++	+++	+++	+++
. more intensive agriculture	+++	-	+++	--
. increased oil sector revenue	+++	+++	+++	+++
. import substitutions	++	++	+++	+
. high-value agricultural exports	+++	++	+++	+
. use gas so more oil exported	+++	+++	+++	+++
2. <u>Regional Objectives</u>				
2.1 Private sector activity	+++	+++	+++	+
2.2 High regional multiplier	+++	+++	+++	+
2.3 High-income jobs	+++	+++	+++	+
2.4 Attract "productive" investment	+++	++	+++	-
2.5 Water conservation	++	-	+	---
2.6 Minimize long-term subsidies	+++	-	++	---
2.7 Economic viability	++	+	+++	-
2.8 Permanent settlements	+++	++	+++	+++
2.9 Provide basic needs, especially to Bedouin	++	++	+	+++
2.10 Halt desertification	++	++	++	+++
2.11 Protect aquifers	++	-	+	---

aiming as they do at a population of about one million in the year 2000, will put some pressure on the local aquifers, but All Coasts less than others, since it would use Nile water intensively and thereby replenish surficial aquifers in areas of most rapid development. In the review presented in this table, All Coasts and Frontier Strategies perform best in terms of economic objectives, with All Coasts having a slight advantage in terms of an industrial rather than agricultural emphasis in a region where water conservation, including more jobs per unit of water used, will always be important.

However, a dispersed pattern of settlement is a very important overall national objective for Sinai, and the Dispersed Strategy was specifically designed to present one variant of that pattern. The Recommended Strategy presented at the subregional level in the next section, is partly a synthesis of the three alternatives conceived as an interim step in the overall process of preparing an optimum program. The Recommended Strategy deliberately includes and synthesizes inputs from these alternatives as well as many earlier analyses; it also incorporates insights offered by members of the Steering Committee and other senior government officials concerned with Sinai, who participated in discussions with the Study Team when the Recommended Strategy was formulated.

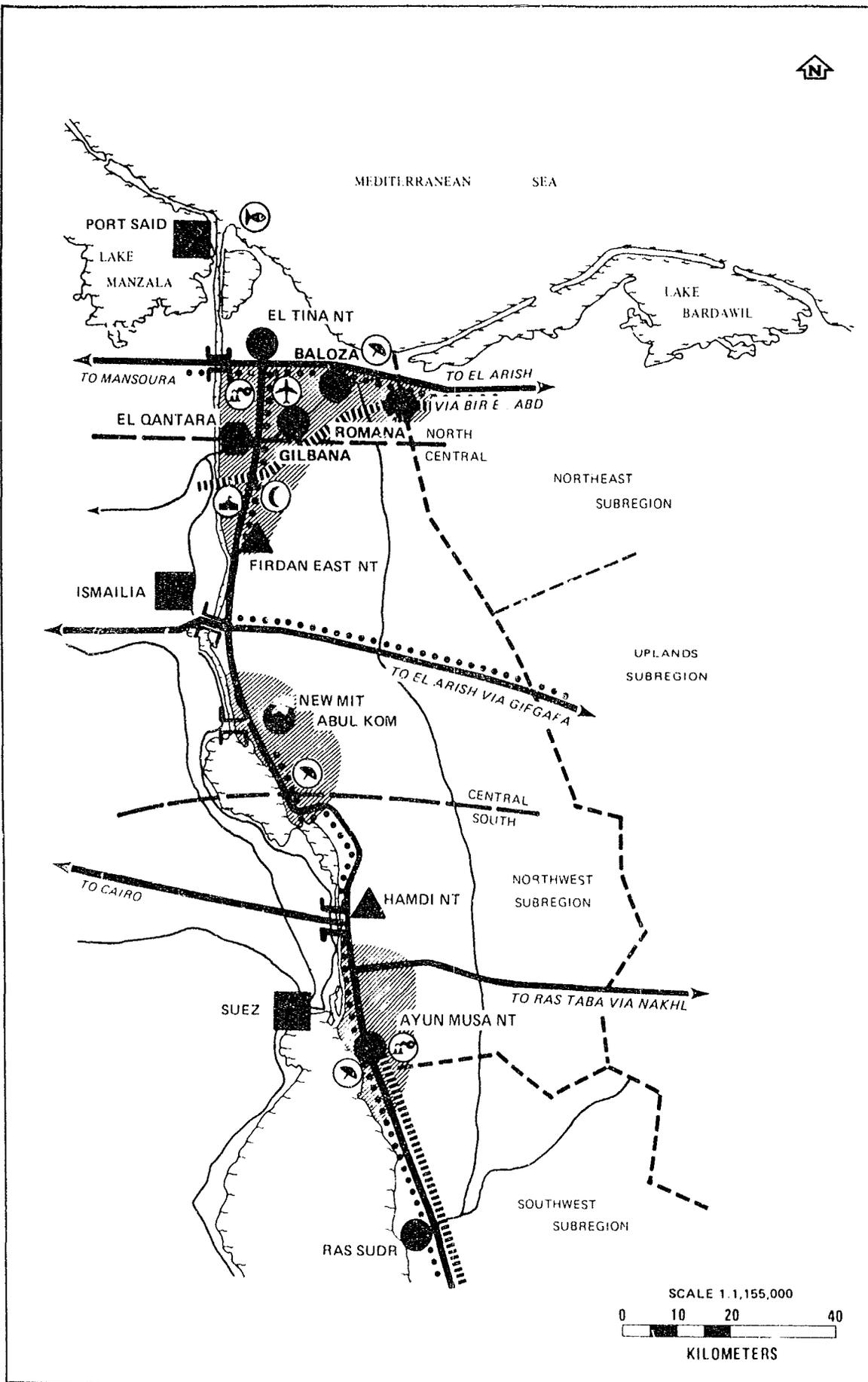
5.4 THE FIVE SUBREGIONS IN THE YEAR 2000

To conclude this volume, which has discussed many aspects of settlement and social development, it may be useful to portray briefly how each of the subregions would look in the year 2000, if the Recommended Strategy is implemented. The following sections also draw attention to some of the critical factors in reaching the conditions foreseen 20 years hence.

5.4.1 The Northwest Subregion (Figure 5.5)

In one short generation the Northwest Subregion has changed from the small-scale war reconstruction of El Qantara and the eager pioneer days at New Mit Abul Kom to an integrated 200 kilometer-long strip of development comparable to the Rafah Strip a generation before in the 1980s. Ismailia has begun to cross the Suez Canal but is still mostly a construction site on the east bank. El Qantara has grown to be a small city in the 25-50,000 class with a planned industrial zone, a hospital, technical college, and airport. It has recaptured its historic position as the fourth city of the Suez Canal Zone.

At the south end of the subregion a large new town has grown up at Ayun Musa. This new town combines the lifestyles of the industrial work force of El Shatt, the agriculturists of the "East of Suez" strip and the Ras Misalla vacationers from Cairo. The new Ayun Musa is more than a suburb of Suez and more than a holiday village. It is a service center with a diverse economy; it is a gateway to all of South Sinai and is well on the way to becoming a growth point or small city in its own right.



For legend to map, see Figure 5.10, Page 5.27.

FIGURE 5.5
RECOMMENDED STRATEGY:
NORTHWEST SUBREGION
SPATIAL HIERARCHY AND LINKAGES

At the Bitter Lakes we find two lifestyles side by side: The modern farmer's life at New Mit Abul Kom, and a traditional Egyptian holiday village along the coast with marinas, beaches, sport clubs, and a boulevard of boutiques.

The remainder of the Northwest Subregion is agriculture-dominated, with irrigation from the Ismailia sweetwater canal and the El Salaam drainage canal, and is served by towns at El Tina, Baloza, Firdan, and Hamdi.

Adding to the mix of farmers, holiday makers, and factory workers are the fishermen of Lake Malaha (which is made richer with agricultural drainage from El Tina irrigation) and the Gulf of Suez, and transport workers, including the drivers of coal trucks from Gebel El Maghara to Ismailia and Ayun Musa.

Most of the changes are linked to the introduction of Nile water at El Tina, El Qantara, Firdan, Deversoir, Hamdi, and El Shatt. Electricity sources are multiple as well. The middle zone is served from Abu Sultan, the south from a 600-1200 Megawatt thermal station south of Ayun Musa, and the north from a new gas-fired station near Baloza.

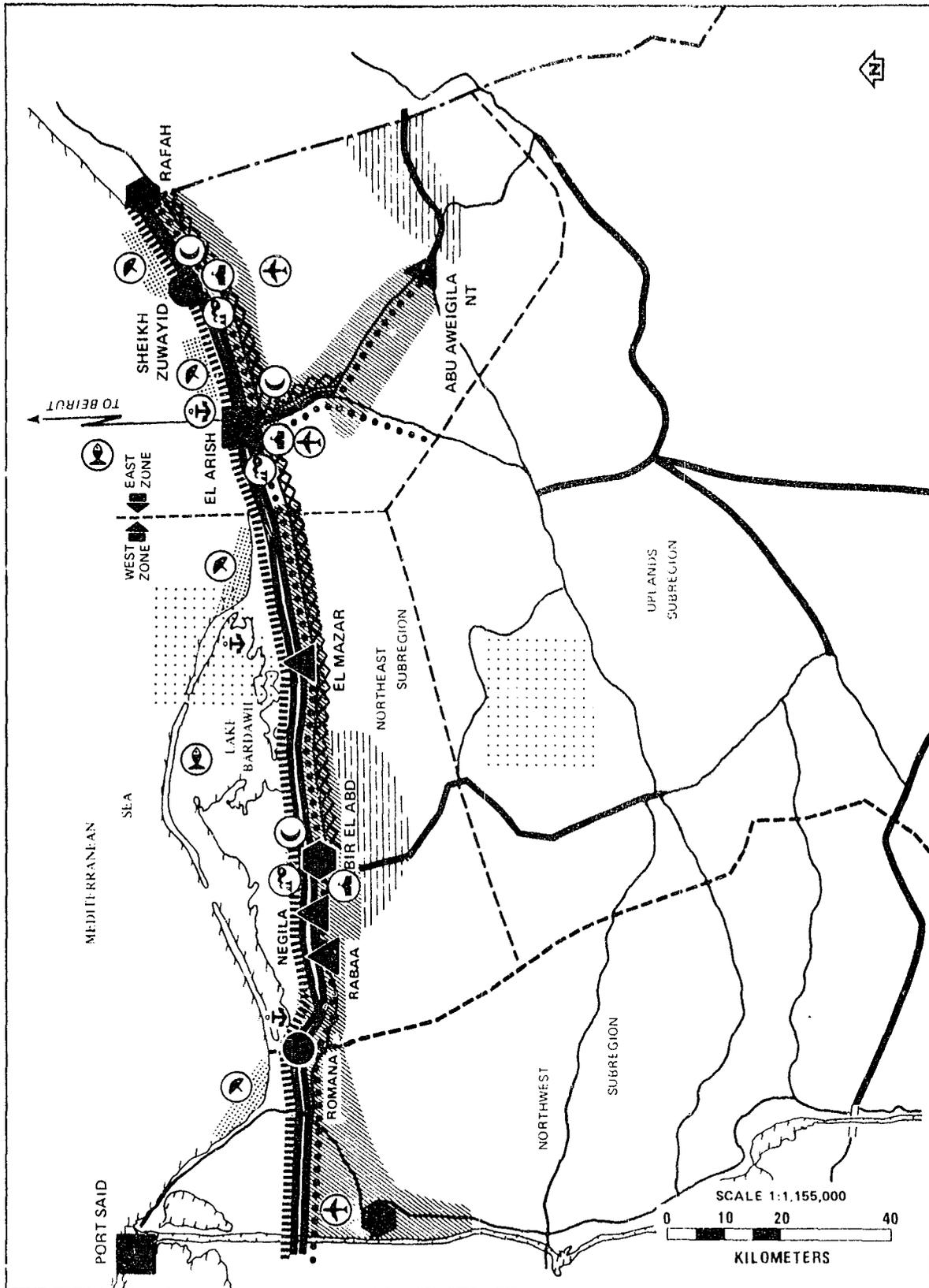
The key to phasing development in the Northwest has been to give priority to industry and tourism; the first at El Qantara and also north of Ayun Musa (at El Shatt), the second south of Ayun Musa (at Ras Misalla) and at Bitter Lakes. These activities will return investment quickly and, equally important, introduce a liveliness that is now missing. Irrigation was perhaps less urgent to start development here than it is in the Uplands and the Southwest, and should proceed at a similar pace during each Five-Year Plan. Early priority was essential to reserve the sites for the new towns and the special land uses.

5.4.2 The Northeast Subregion (Figure 5.6)

The visitor to El Arish in 2000, who has not been there since 1982, will hardly recognize the modern metropolis of over 200,000 residents. El Arish is the dominant commercial center for all of northern Sinai. Its liveliness is broadly based on manufacturing, distribution, tourism (mostly in the summer), and intensive agriculture. The seaport and airport operate around the clock, as do the bus station, truck terminals, and restaurants.

El Arish has two satellites: Rafah-Sheikh Zuwayid to the east and Bir El Abd to the west. Both satellites are firmly rooted in agriculture but both have hinterlands of their own with populations of over 50,000. Growth rates in the satellites, beginning from a smaller base, have been even more impressive than that in El Arish, and the towns are even less recognizable with their parks, colleges, hospitals and other urban amenities as well as industrial areas and significant business districts.

The predominant landscape feature of the Northeast is the plastic cloche or tent covering field crops. Often the fields are protected by dunes and some of the dunes are capped with windmills. The landscape is also full of touristic chalets and the masts of fishing boats on Lake Bardawil (which is also enriched by agricultural drainage) and the Mediterranean.



For legend to map, see Figure 5.10, Page 5-27.

FIGURE 5.6
RECOMMENDED STRATEGY:
NORTHEAST SUBREGION
SPATIAL HIERARCHY AND LINKAGES

The phasing of development on the Northeast has been complex. Tourism took early priority while the large Nile pipelines were built and fields prepared. Industry followed agricultural production and population (market) growth, except for construction and agricultural implements that were needed early in the process.

The possible infrastructure bottlenecks are Nile water and electricity. The two can be planned to be built together. Electricity can be generated from natural gas and can pump the water of the Nile from the El Tina Plain to Rafah. Electrical power generation plants might well be placed at Bir El Abd and Sheikh Zuwayid.

A major phasing issue to be faced concerns the timing of development emphasis on Rafah and Bir El Abd. As markets shift during the early 1980s from east to west, Bir El Abd should receive more investment. If eastern markets reopen, Rafah may appropriately be emphasized again. The timing of the Abu Aweigila reclamation depends upon studies and the implementation of dam projects further up the Wadi El Arish, the reclamation of the El SIRR Plain, and whether eastern, western, or northern export markets predominate.

5.4.3 Uplands Subregion (Figure 5.7)

The change in the lifestyle of the Uplands of Sinai from 1982 to 2000 is not that of rapid modernization but rather the simple, less obvious change of increased prosperity. Investment in rural development, with due attention to environmental requirements, has made its half-dozen villages into pleasant small towns with the amenities found in Nilotic Egyptian towns in the 1980's but not in Sinai. In 2000 each town has the ambience of an oasis, with the shadow of trees and spray of fountains (recycled water). There are two dramatic changes: first, large irrigated agriculture between Gifgafa and Bir El Thamada and at the El SIRR plain, and second, three new towns--New Bir El Thamada, Gebel El Maghara, and El SIRR. (There is also an option to develop agriculture at Wadi Hema.)

New Bir El Thamada is now the major central place of the Uplands, processing and selling the livestock and field crops of a large hinterland. Agricultural research facilities are here along with the staff of local, regional, and central government agencies. Bir El Thamada is where the five governors of Sinai meet to make peninsular decisions.

The new town of El Maghara is a mountain village with three personalities--miners and factory workers related to coal, farmers raising livestock and field crops based on shallow wells, and mountain tourists staying in "sport hotels" and "caravan parks" while visiting the Gebel El Maghara conservation area (national park) and the Romana beach. El SIRR new town is an agricultural village sited on a hill and exporting to Europe through El Arish and to Cairo, according to the season.

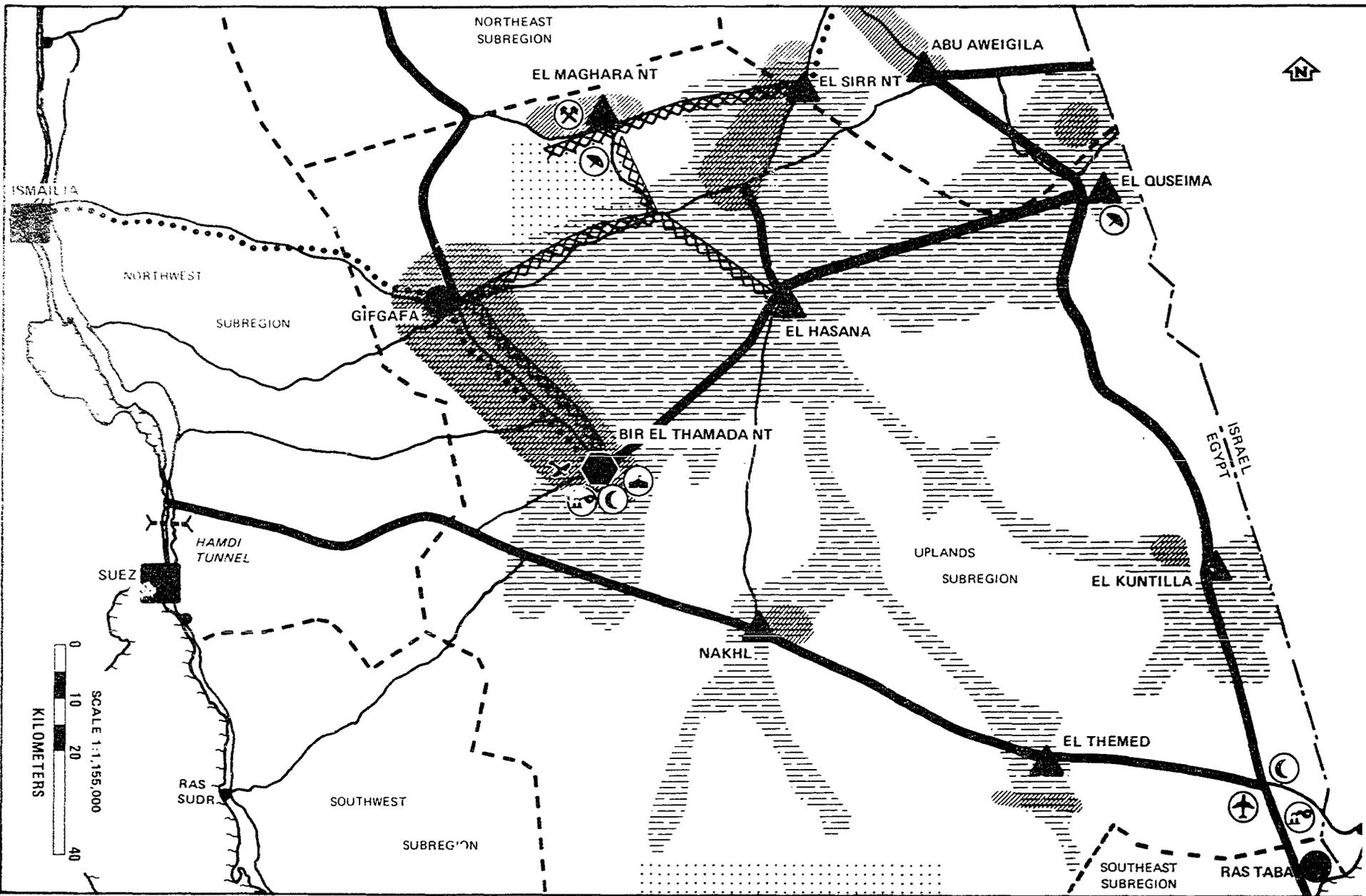


FIGURE 5.7

RECOMMENDED STRATEGY:
UPLANDS SUBREGION
SPATIAL HIERARCHY AND LINKAGES

For legend to map, see Figure 5.10, Page 5-27.

The eastern highlands have increased their livestock population more than the human population by drilling deep wells, building several small and a few large dams, and multiplying cisterns. Improved market outlets through Ras Taba, El Arish, and Bir El Thamada have increased the earnings per animal. Tourism to Ein Guderat (Kardesh Barnea) has expanded the El Quseima economy. With more water, much better communications, and investment funds Nakh1, El Themed, and El Kuntilla have more than doubled their populations. Gifgafa was the first town to benefit from the delivery of Nile water and has grown to a population of around 20,000. El Hasana is the center of the livestock and dry farming activities and has both research facilities and a meat processing plant.

The southern part of the Uplands benefited from major investment at the beginning of the "new map" strategy when the Hadj highway from Suez to Ras Taba was rebuilt in the middle 1980s; telecommunications became available to each village and hamlet; and deeper wells brought new dependable water sources for animal and local food security from oasis type horticulture.

The farmer's earnings from meat, dates, olives, and handicrafts jumped as markets became more accessible at the same time as their production increased. Over the years the population of Nakh1 and El Themed grew rapidly as more and more young people stayed at home and residents of other parts of the peninsula migrated to the interior, choosing not to adopt the new lifestyles of the coasts.

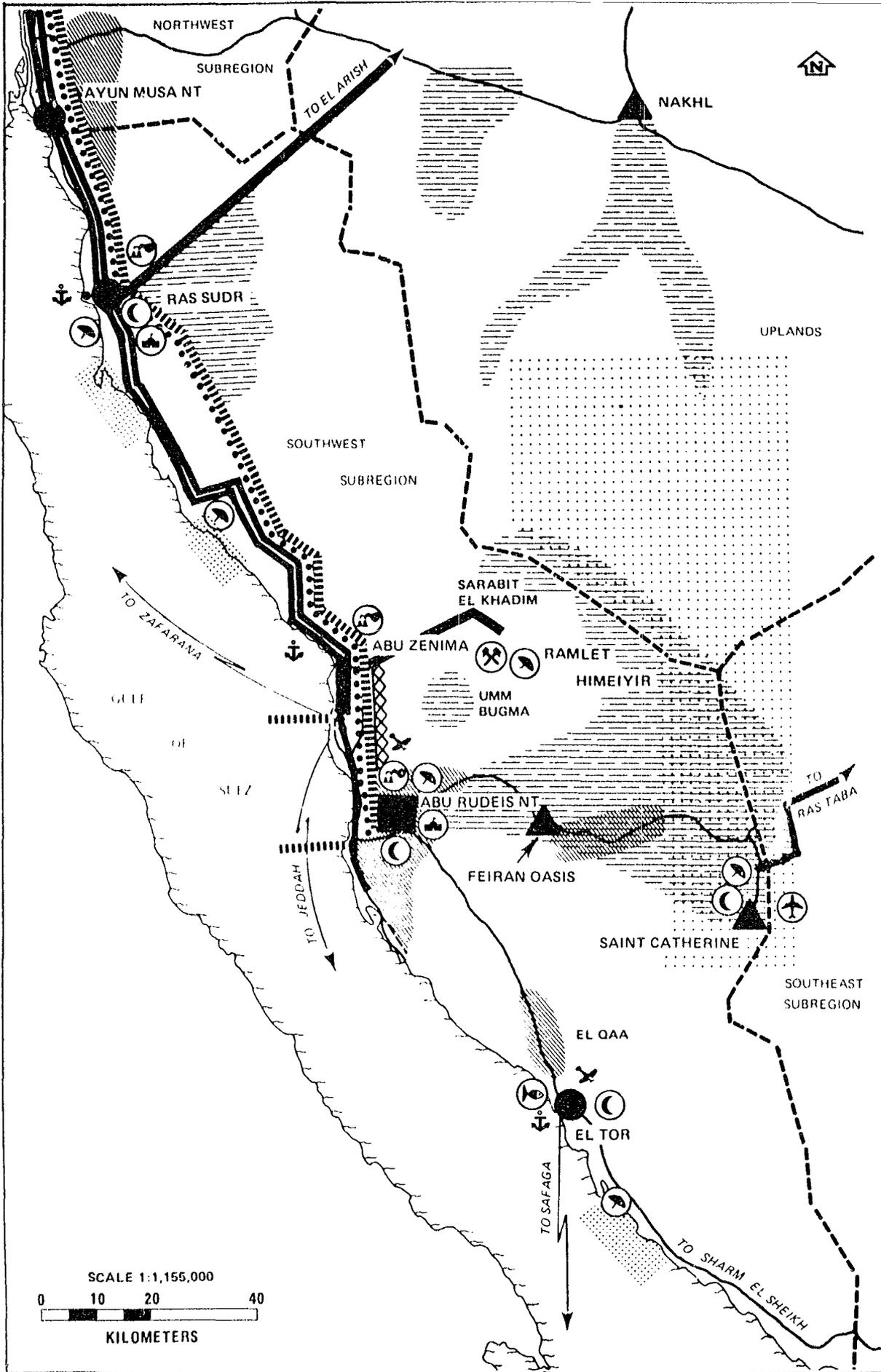
Phasing development in the Uplands is more demanding than for the other subregions. During the 1980s four major programs are needed:

- Hadj highway completed, including link road and ferry at Ras Taba
- New town at El Maghara (including a coal-fired electricity plant)
- Irrigation from Gifgafa to Bir El Thamada
- Major rural development program in the eastern Uplands.

The 1990s continues these developments and adds a new town and irrigation in the El Sirr Plain, a large new town at Bir El Thamada, the expansion and possible resiting of El Hasana, and new highways from El Quseima to Ras Taba and Bir El Thamada. As with the other subregions, the key to Uplands prosperity is water, and in this area, groundwater and surface water are equal in importance to Nile water.

5.4.4 The Southwest Subregion (Figure 5.8)

In the year 2000 the resited Abu Rudeis is a city of 50,000 to 75,000 perhaps as much as 300 meters above sea level, near the Wadi Sidri and the Wadi Feiran, both of which are being turned green with Nile water. The city houses a university of at least 5,000 students in fields particularly relevant



For legend to map, see Figure 5.10, Page 5-27.

FIGURE 5.8
RECOMMENDED STRATEGY:
SOUTHWEST SUBREGION
SPATIAL HIERARCHY AND LINKAGES

to Sinai. The largest employers are hydrocarbon-based industries which have moved many of their Cairo functions to the new town. Smaller economic activities include light manufacturing, tourism, agriculture, local government, and trade. New Abu Rudeis tourists go daily to Sarabit El Khadim, St. Catherine, Hammam Faraun, and the El Tor coral reefs. The wadi and coastal plain agriculturists produce crops before and after the seasons of their competitors to the north for local consumption and export to Saudi Arabia and Europe. At the site of the 1983 Abu Rudeis is agriculture, an airport, a sea jetty, and some on-shore facilities for petroleum operations.

Ten kilometers to the north, Abu Zenima is about the same size as in 1983, principally transshipping partly processed mineral ores. Behind Abu Zenima there are active mines, enhanced grazing based on groundwater, and tourists enjoying archeological and religious sites. Between Abu Zenima and Ras Sudr are two small beach tourist villages.

The physical boundaries of Ras Sudr have not expanded much, but north of it there is now a manufacturing center processing some of Egypt's petroleum wealth and shipping the products to Safaga, Suez, and the world. As a hinge connecting southern and northern Sinai, Ras Sudr is carrying a good many of the commercial functions found in 1983 at Suez. Nile water has turned the wadi behind the large town green.

El Tor to the south has retained its charm as a fishing port (now sending boats as far as Djibouti) and administrative center, but it also has much more agriculture (based on groundwater and new technologies for using seawater) and tourism, as it serves the excellent beaches and coral to the south and the islands between it and Hurghada.

In the higher elevations, the twin villages of Feiran Oasis and St. Catherine have grown into a premier tourist resort with a variety of mountain activities and associated food production and handicrafts. The scenery and flora and fauna are protected, as it is a conservation area.

The settlement system consists of one city, two towns, and three small settlements. The lifestyle of the new Sinaians in the southwest is mostly urban. The agriculturists are never far from towns and tourists. The petroleum industry, other mineral-based industries, the university community, and the international tourists contribute to a rather cosmopolitan lifestyle compared to rural Egypt.

The infrastructure that supports the vastly different lifestyle and economy is basically a water pipeline from Suez (although it may come from Minia under the Gulf) and a gas line going north from the oil fields. The highway along the coast has been widened. The Abu Rudeis airport and all the harbors have been expanded and improved.

The phasing of development cannot be smoothly plotted, but neither does it face any apparent bottleneck. Feasibility studies were underway in 1983 for a 600-1200 Megawatt electricity and desalinization plant near Ayun Musa and for a 500-millimeter water line from Hamdi to Abu

Rudeis. As the highway is already upgraded, the basic infrastructure can be in place in time. Decisions on four key issues need to be made prior to fixing the next Five-Year Plan:

- Nile water for irrigation
- Egyptian mineral processing industry to the southwest
- The new site for Abu Rudeis, which is expected to become a small city
- A university for Abu Rudeis.

The first requires studies of soils, groundwater, and Nile take-off points. The second is a strategic or policy decision (for example, processing minerals and chemicals north of Ras Sudr). The third requires the agreement by the petroleum companies to participate actively. The last is a political decision at the heart of the entire concept of settling Sinai. These four activities should be started in the 1987/8-1991/2 Five-Year Plan in order for the Southwest to achieve its settlement and population targets. Except for tourism and petroleum, it can be expected that development will be slow until the 1990s.

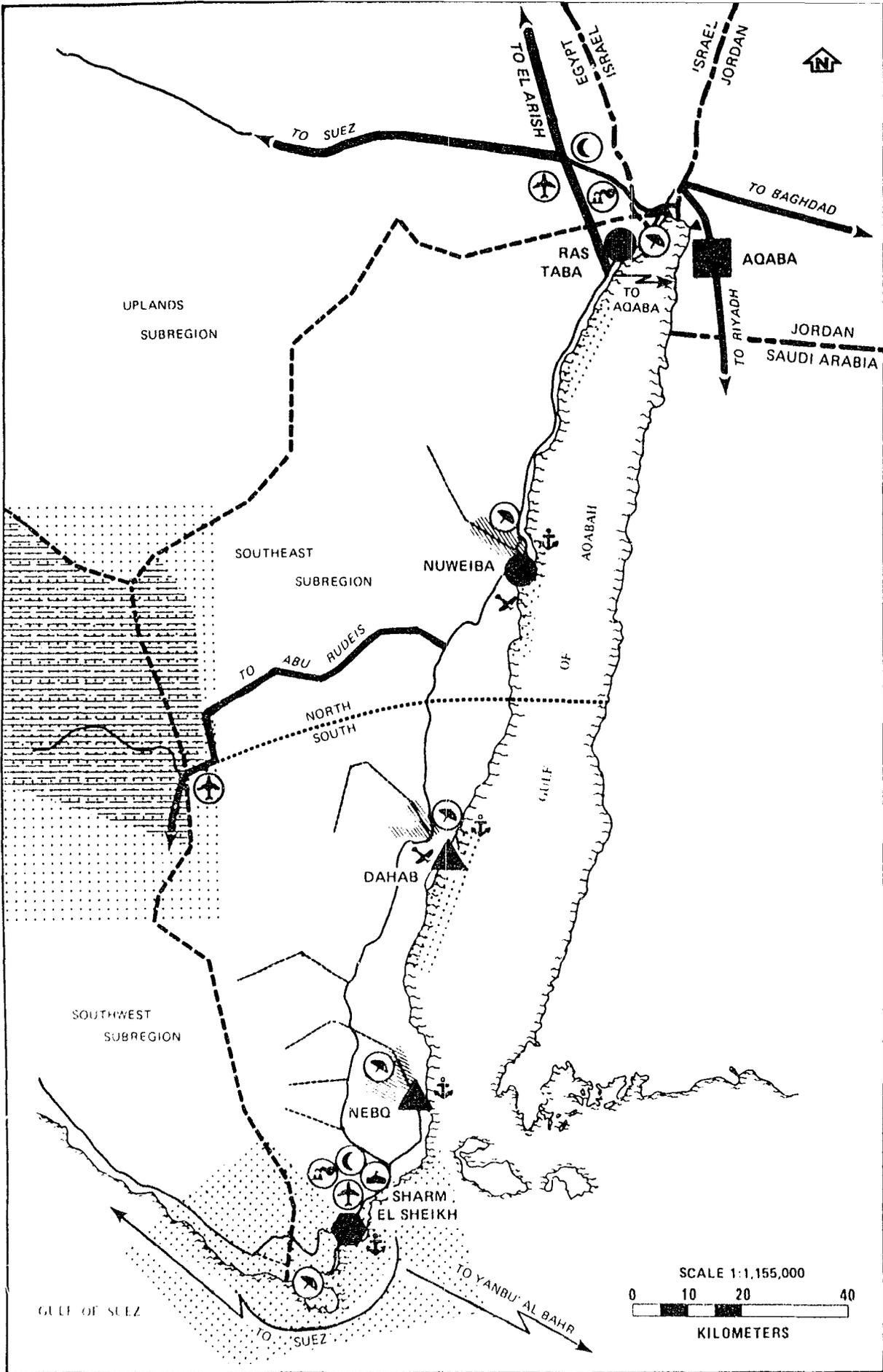
5.4.5 Southeast Subregion (Figure 5.9)

Sharm El Sheikh in 2000, with its suburbs, has become a large town of about 25,000. It is a tourist town with a difference, in part because of its isolation. Sharm El Sheikh produces a good deal of its own food under plastic cloches or tents, using groundwater, seawater and recycled wastewater. It has its own fishing fleet and a military base. It manufactures many of the needs of tourists and local residents. Rather than being principally an array of large hotels, Sharm El Sheikh offers a variety of large and small hotels, family flats, and villas.

It is settled as much by Egyptians and Middle Easterners, who come annually for long visits, as by short-term international tourists. The Marsa El Att Yacht Basin serves many boats from the Mediterranean and other seas during the winter.

At the upper end of the Gulf of Aqabah, Ras Taba in 2000 has lost its tourist image, mainly due to lack of flat developable land and the greater attractiveness of Sharm El Sheikh. Ras Taba has become an air and sea entrepot. Trucks bound for all Middle East destinations pass near Ras Taba, either by road, over ten kilometers in Israel, or by ferry to Aqaba. Above the town, the Ras El Nabq airport is framed with hotels, warehouses, and small assembly plants. It is the closest point in Egypt to Saudi Arabia and to the thriving Aqaba metropolitan economy.

A land capability analysis of these possibilities is discussed in Volume IV. The warehouse and trucking terminals are important as Ras Taba transships goods from El Arish, Abu Rudeis and Suez to other parts of Sinai.



For legend to map, see Figure 5.10, Page 5-27.

FIGURE 5.9
RECOMMENDED STRATEGY:
SOUTHEAST SUBREGION
SPATIAL HEIRARCHY AND LINKAGES

Nuweiba is a smaller edition of Sharm El Sheikh but also has a role in local administration for the Southeast. It caters to tourists on the circuit seeking sun and coral on the Gulf of Aqabah, as well as mountains at St. Catherine. Its palm trees have multiplied and new plantations of mangrove and other salty trees and shrubs have changed the landscape and climate.

The lifestyle of the Southeast Subregion in the year 2000 is new to Egypt. Alexandria and Luxor have managed to maintain their traditional way of life despite the hordes of tourists, as they each have another economic base. In the Southeast, tourism is king and the lifestyle of the residents is cyclical--outsiders set the pace during the winter and residents return to their own ways during the hot summer. This is more the case in Nebq, Dahab, and Nuweiba than in Ras El Naqb and Sharm El Sheikh, which have other activities. Some of the necessary infrastructure for this change in landscape and lifestyle is already in place. Key infrastructure improvements include the following:

- A link road from the Hadj highway to the Aqabah coast and
- A ferry terminus south of Ras Taba
- A marina at Marsa El Att
- Truck terminals at Nuweiba and Sharm El Sheikh and south of Ras Taba
- Shallow and deep wells for controlled environment agriculture and domestic consumption.

Phasing calls for concentration on Sharm El Sheikh and the Ras Taba-Ras El Naqb area in the 1980s and filling in at the other settlements in the 1990s. Such concentration will produce good results quickly, and the larger towns at the two ends of the Gulf can service the growth of the others.

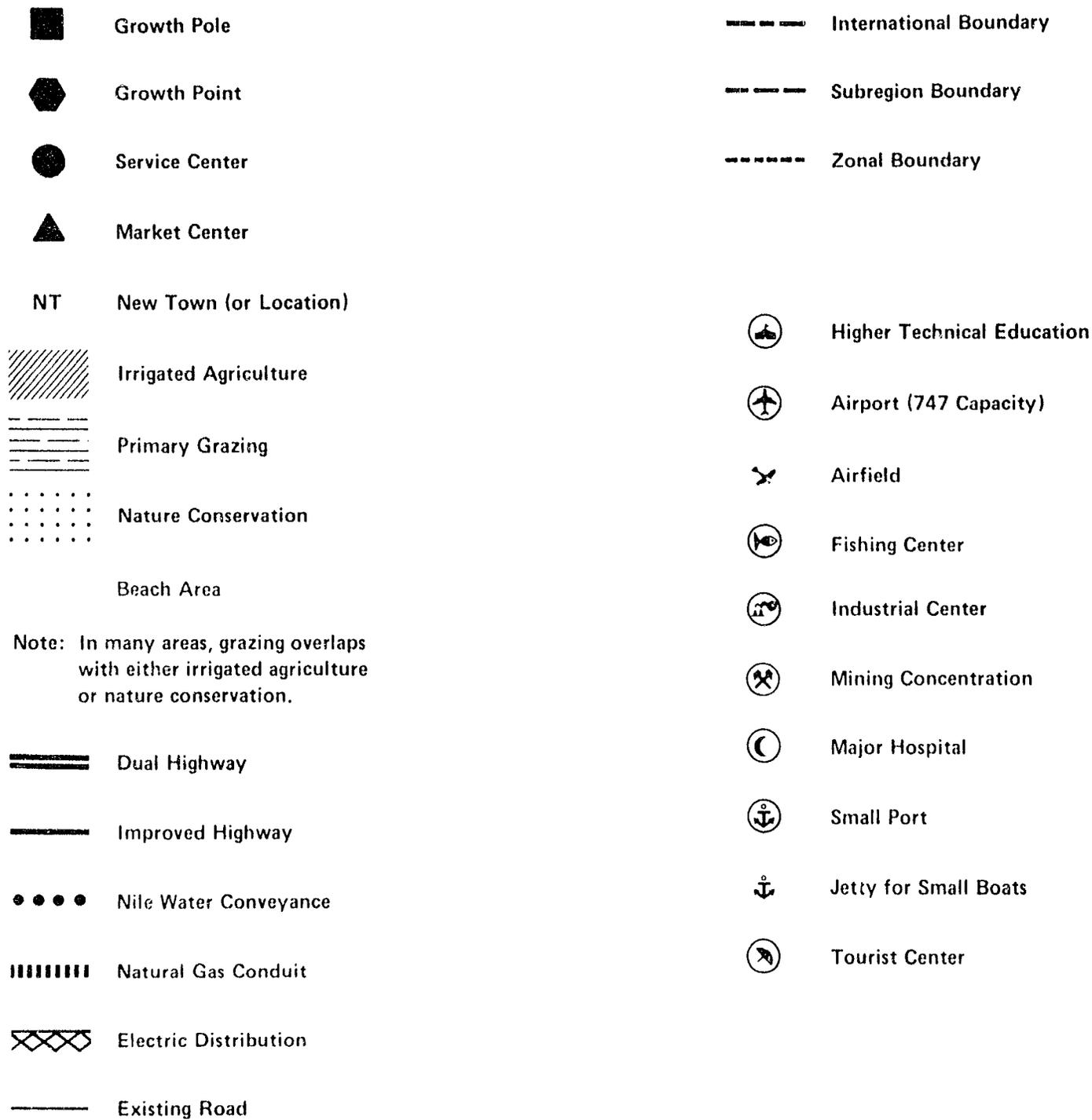


FIGURE 5.10
LEGEND FOR THE MAPS OF THE 5 SUBREGION

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