CHAPTER 5

ENVIRONMENTAL ASPECT

CHAPTER 5

ENVIRONMENTAL ASPECT

5-1 Policy, Legal and Administrative Frame Work

5-1-1 Pollution Control and Environmental Management

The legal authority in Egypt on environmental issues is dispersed among various ministries such as the Ministry of Petroleum, the Ministry of Public Works and Water Resources (MPWWR), the Ministry of Health, and the Ministry of Interior. In 1982 the Egyptian Environmental Affairs Agency (EEAA) was created under the auspices the Minister of Cabinet Affairs.

The Environmental Action Plan of Egypt was developed in 1992 with assistance of the World Bank. It describes the severity and diversity of the environmental problems in Egypt. The Action Plan calls for a comprehensive long term action program to reverse the on-going deterioration of Egypt's environment and depletion of its limited resources. The EEAA is presently also preparing an Environmental Profile for North Sinai which is planned to be completed by the end of 1996.

5-1-2 Environmental Legislation

Law Number 48 on Protection of the River Nile and Waterways from Pollution was enacted in 1982, but has yet not been fully enforced, due to the unrealistic phasing of discharge reductions to meet the standards. Included are water quality standards and discharge standards.

Law Number 4 of 1994 on Protection of the Environment spells out the powers of the EEAA. Further it includes sections on protection of land, air and water pollution. Procedures for Environmental Impact Assessment (EIA) are also included. Although the law specifies legal enforcement and penalties including permitting procedures, in reality the success of the EEAA in enforcing the law requires collaboration with a number of line ministries. Law Number 4 also includes penalty provisions for non compliance with Law Number 48.

5-1-3 EIA Capability

EIAs are required for "establishments requiring licenses". Establishments are defined in Annex 2 of the regulations, and infrastructural projects such as irrigation projects are included on this list.

The Environmental Impact Assessment for this project was prepared using the unpublished draft EIA guidelines of the EEAA. The complete assessment is included in Appendix G of this report.

5-1-4 Policies and Laws of Land Reclamation

The Government of Egypt has given priority to distributing the population into various governorates and encourage settlement in the rural areas. The third Five Year Plan covering 1992/93 to 1996/97

includes policy statements with respect to this population distribution. In 1994, the Ministry of Planning set forth the National Project for the Development of Sinai, in the light of urgent need of land resources development. Based on the results of investigations and studies made by various agencies and organizations concerned, top priority of land reclamation has been given to a 400,000 feddans area in North Sinai. Irrigation water will be supplied from the River Nile through the extension of the El Salam Canal called the Shikh Gaber El Sabah Canal.

The North Sinai Development Organization (NSDO) is responsible for construction of all facilities, resettlement planning and operation and maintenance after construction in co-operation with other ministries. The Organization consists of departments for agriculture, engineering, land settlement and finance/administration, but does not include an environmental department or even an environmental officer.

Civil Law and Customary Law

Under Law Number 148 all desert land is the property of the Egyptian government and approval needs to be obtained for development of this land. The law relates to land and water rights and recognizes original ownership.

In 1987 the North Sinai Governorate issued a decree offering land title to anybody in the region who has cultivated the land for three years. Many Bedouin tribe members however did not register their land as in their opinion customary law covers landownership. Some attempts were made by the Governorate to integrate customary law and civil law.

Presidential decrees 147 of 1993 and 103 of 1994 to Law Number 7 of 1991 state that all the land that forms part of the 400,000 feddans to be reclaimed in North Sinai is under holding of the North Sinai Development Organization. Although compensation will be given to those Bedouins presently cultivating land in the Study area, these decrees seem to contradict the North Sinai Governorate's attempts to integrate civil and customary law, and ignore the fact that Bedouins have used these land for grazing their livestock and camels for many decades.

5-2 Environmental Site Conditions

5-2-1 Landform

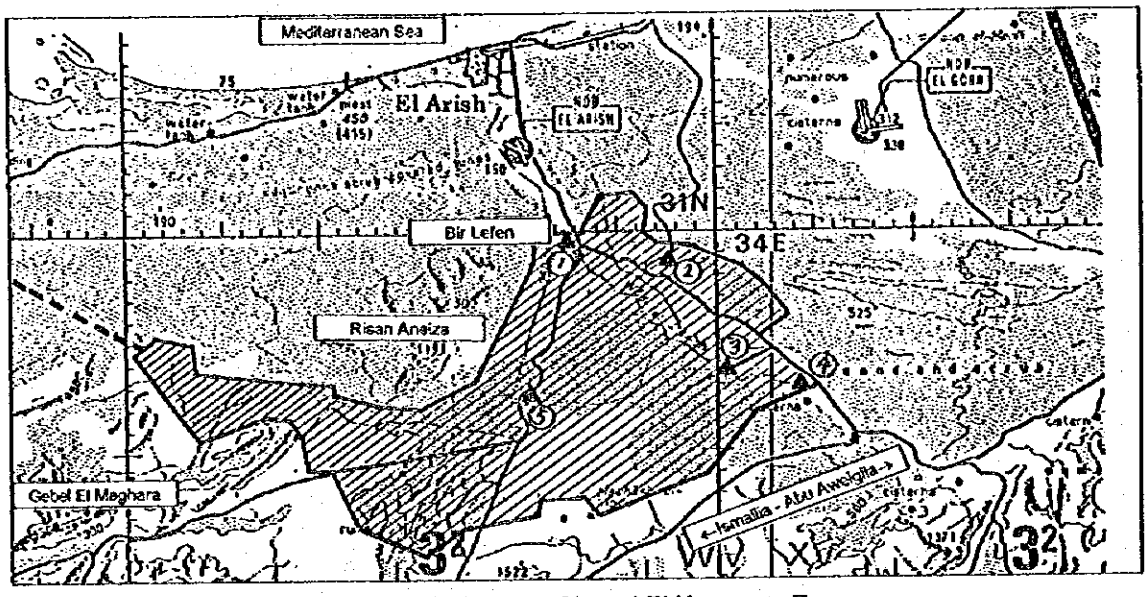
Most of the area is covered with wind formed sand dunes resting on older landforms. North of the site are limestone formations known as Risan Aneiza. The Gebels Maghara, which are located south west of the study area, were formed by tectonic movements of the African Precabrian Shield during the Cretaceous Period. The hill tops consist of Jurassic and Lower Cretaceous rocks with carboniferous layers. The deposits on the floor of Wadi El Arish consist of fine alluvium river sands.

5-2-2 Hydrology

The catchment in which the study area is located drains towards the Mediterranean Sea via a complex system of streams or wadis. These wadis are dry for most of the year due to low rainfall.

5-2-3 Geohydrology

The Quaternary aquifers are the main groundwater source in the El Arish region. Around 195 wells were recorded in the El Arish area in 1994 extracting a total volume of 100,000 m^3/day. The over-extraction has resulted in a water level recession of several meters since 1962.



The Study Area: El Sir and El Kawareer Zone

Existing Villages include: (1) Bir Lehfen, (2) El Koreah, (3) Magdaba, (4) Awlat Ali, (5) El Resan

5-2-4 Fauna and Flora

The fauna found in North Sinai consists mainly of small mammals. The most numerous are rodents such as gerbils and jirds. None of these mammals in the Study Area region are endemic. The vegetation of the North Sinai is dominated by sparse to very sparse hummock grass land on stabilized sand dunes. No truly endangered species are present in the area.

5-2-5 Birds

One of the main flyway paths of migratory births is situated along the northern coast of the Sinai Peninsula. Huge numbers of water birds overwinter in the area each spring and autumn, especially at Lake Bardawil. There are no endemic resident birds recorded in North Sinai.

5-2-6 Settlements

There are five settlements within the study area with a total population of approximately 4000, mainly Bedouin people. The houses in the villages are constructed from permanent materials such as concrete and brick, although temporary Bedouin shelters were seen in the vicinity of the villages.

5-2-7 Mining and Industry

The industry and mining sector in Sinai is of limited scale. Salt winning takes place 35 km west of El Arish. Coal mining near Gebel El Maghara started in 1991. A total of 200 hectare is intended to be mined using open mine techniques.

5-2-8 Sanitation and Water Supply

The treatment plant in El Arish has a capacity of 225,000 m^3/day, the sewerage system is presently being extended to connect other parts of the town to the plant. The settlements in the Study Area do not have centralized sewerage systems and usually rely on pit latrines. Solid waste collection and disposal is only organized in the main towns such as El Arish.

El Arish is supplied with drinking water from Kantara by a 120 km long pipeline which runs along the main road from Kantara to El Arish. Water shortages are however common and a second pipeline is planned. The villages El Koreah, El Makdaba and El Awlat Ali in the Study Area are supplied with drinking water via a pipeline from El Arish. Although due to water shortages drinking water is now being provided by tanker.

5-2-9 Power Supply

El Arish has three power stations with a total capacity of 80.6 MW. The villages El Koreah and Bir Lefen in the study area are supplied with power from El Arish while the other villages generate their own electricity using generators.

5-2-10 Historic Sites

North Sinai is one of the most important historical areas in the region forming an important land bridge between the different civilizations of Asia and Africa. Many archaeological sites can be found in this area, especially along the main road between El Arish and Kantara.

5-3 Significant Environmental Impacts

5-3-1 Population Distribution

The project will have a positive impact on the population distribution in Egypt and will encourage settlement in rural areas and relieve areas with a high population density.

5-3-2 Development of a New Habitat

The study area, after development, will act as a large cultivated feeding habitat and resting area for a large number of resident and migratory birds. This is considered a positive impact.

5-3-3 Stabilization of Sand Dunes

The reclamation of desert land and the development of wind breaks and shelter belts around the agricultural lands and settlements will have a positive impact on the micro climate in the project area and will reduce sand erosion and desertification and will result in stabilization of moving sand dunes. This is considered a positive impact of the project.

5-3-4 Loss of Historic Sites

At least two known archaeological sites are to be affected by the project. One historical site is located on the most preferred canal route B-C2 and one site is situated on the south west boundary of the

Study Area on the course of the main irrigation canal. Further investigations in rerouting sections of the canals is recommended during the detailed design stage to avoid the destruction of these historic sites.

5-3-5 Loss of Natural Habitat

The reclamation will result in native wildlife loosing their natural habitat and move to adjacent desert lands. This could result in a increase in pressure on the remaining wildlands. The project will therefore have a negative impact on the local flora and fauna populations.

5-3-6 Impacts On Local Population

Most of the Bedouins that have give up the nomadic existence and have settled in the villages have found employment in the El Arish region. Approximately 18 to 20 families are still believed to be nomadic in and around the Study area.

Development of earlier irrigation projects in Egypt have resulted in friction between authorities and Bedouins, with respect to land claims. It is therefore important that the local population is consulted in an early stage with respect to land ownership issues. If landownership can not be proved the NSDO will provide a 50% reduction in land prices for those farmers that are presently cultivating land in the to be reclaimed areas.

The following impacts on the local population were identified:

The Bedouins that have settled in the existing villages in the study area may not have to resettle due to the development of the region, but they will have to share their towns with the new settlers moving into the region from other parts of Egypt. The farmers practicing rainfed farming in the Wadi El Arish region will most definitely loose access to the land they are presently cultivating. Those farmers that can claim ownership of the land under Law Number 148 will be compensated for their loss of land.

Grazing practices will be reducing due to the development of the area. However some new areas will be opened for limited household grazing such as canal banks. The project should lead to improved conditions for animal husbandry, including supply of veterinary services, breeding farms, animal sheds, access to fodder and feed and market provisions. The canal will provide a regular and better quality supply of water and the use of modern farming practices proposed in the project will enhance the existing practices used.

The project will provide many employment opportunities during the construction and operation of the irrigation scheme and income levels of locals will rise as a result of the supply of water from the canals to the farms.

Urbanization of the area will reduce the mobility of women, which are allowed a large degree of freedom under tribal life due to the semi nomadic heritage and protection under customary laws. Better availability and access to drinking water, electricity and other facilities however will help ease the domestic activities of the local Bedouin women. Provision of electricity, drinking water, better roads and transport system will impact positively on the local population.

5-3-7 Availability of Irrigation Water

The total estimated water requirement for the El-Salam Canal Project is 4.45 billion m^3 per year of which 2.11 billion m^3 per year will be taken from the Damietta Branch. The remainder will be obtained by mixing drainage water from the Serw Drain (0.435 billion m^3 per year) and Hadous Drain (1.905 billion M^3 per year) with water from the Damietta.

Water shortages are predicted in May and June when the monthly water demands required from the drains exceeds the monthly drain flows, if unofficial drainage water reuse along Hadous Drain is not taken into account. If unofficial water reuse is include shortfalls will extend from the period March to August. It is therefore recommended that the unofficial use of drainage water along the Hadous Drain is discontinued otherwise irrigation water shortages will occur in the regions further downstream of the El Salam Canal. Shortages can partially be overcome by using additional sources such as the Faraskour Pumping Station. Other sources are presently still under investigation. Alternative solutions may include: reduction of the target area of reclamation, reduction of the area allocated for summer crops and improvement of the irrigation system efficiency.

5-3-8 Quality of Irrigation Water

The salinity, after mixing Serw and Hadous Drain water with water from the Damietta branch, will range from 900 to 1100 PPM with a maximum of 1300 PPM during May. This irrigation water can be regarded as "saline water". The use of this water will require adequate drainage and special management to control salinity. Soil degradation could occur where a downward flux to leach salts from the soil is not properly maintained.

5-3-9 Drainage Discharge Problems

Subsurface drainage will be provided in areas with soils that are "moderately" and "imperfectly drained" and should prevent water logging of soils. Drainage water will be discharged to the Wadi El Arish and two drainage infiltration areas. This water will mostly evaporate or infiltrate into the ground during its course, creating groundwater flows towards the aquifers in the El Arish area. Since the Wadi is not well defined and has no distinct "low" flow channel discharge of drainage water could lead to shallow low flowing water that could potentially become a breeding ground for mosquitoes, an ideal habitat for water snails and invested with aquatic weed. In the long term surface flows could develop and discharge to the Mediterranean Sea, which could result in aquatic weeds floating out to sea and ending up on the beaches of El Arish.

5-3-10 Salinity Effect on Plants

Plants vary in their tolerance to soil and irrigation water salinity and crop selection will need to take the plants salt tolerance into account. It is also important to provide sufficient excess irrigation water via leaching, to remove salts out of the root zone. Crops which tolerate water with a salt concentration of 500 to 1,500 PPM without a significant reduction in yield are: apple, pear, cauliflower, bell pepper, cabbage, broccoli, tomato, broad beans, field beans and sweet potato. Crops which tolerate 1,500 to 3,500 PPM of salt are: oats, wheat, rye, lucerne, sudan grass, various clover

varieties, millet, barley, olive, fig, pomegranate, cantaloupe, spinach, asparagus, garden beets and gherkins.

5-3-11 Sodium Impact on Soil and Plants

The Sodium Adsorption Ratios (SAR) calculated from the Na, Ca and Mg concentrations after mixing irrigation water with drainage water result in SAR values between 8 and 11. According to Reference 9 irrigation water with SAR values in this range are considered *"high sodium water"* which could present sodium problems in soils. The presence of natural presence of gypsum in the soil, and the coarse textured sandy soils in the project area should prevent serious sodium related problems, such as reduction in infiltration rates.

Some plants are sodium sensitive and can even be affected by low concentrations of exchangeable sodium, therefore crop selection and irrigation techniques should take this into account. Crops very sensitive to sodium with a SAR below 8 are citrus fruit, stone fruit and nut crops. Crops tolerant to high sodium concentrations are wheat, cotton, barley, tomatoes, beets, and grasses. Sodium toxicity can be modified or reduced by adding gypsum ($CaSO_4$) to the soil to provide free calcium. When irrigation water salinity is high and SAR values are also high, as is the case in this project, it is sometimes preferred to apply amendments such as low-grade gypsum or sulphur to the soil.

5-3-12 Heavy Metals

Heavy metals were monitored in the Damietta branch between El Zarka and El Sadd on the Damietta Branch, upstream of the El Salam Canal Intake and are reported in Ref. 11, Appendix G. Water samples were taken during the autumn of 1995. Cadmium and lead concentrations were higher than the recommended limits for irrigation water (Ref. 9, Appendix G). High cadmium and lead concentrations could affect crop growth. The zinc concentration exceeded the guideline limit in one location while the copper concentration was within the guideline limit according Degree No. 8 of 1983. No data on zinc, lead and cadmium residues in drainage water of Hadous and Serw was available however iron and copper concentrations were within the guide lines.

5-3-13 Impacts on Groundwater

The impacts expected from the project activities on the present groundwater conditions include rising groundwater tables due to percolation losses and changes in the quality of the groundwater. Percolation losses from the drains, infiltration of the discharged drainage water in Wadi El Arish, as well as seepage flows from the higher elevated irrigated land will most likely cause a groundwater flow towards the Quaternary aquifers in the El Arish area and result in an increase in the groundwater levels. These groundwater levels have been dropping 1 to 4 meters over the last 20 years due to overextraction of water for irrigation purposes. It is therefore hard to predict the extent of water level rise without more detailed study. There is a danger however that in the long term low lying areas could get water logged due to this rise in groundwater, which could affect existing vegetation and shallow wells. The quality of the groundwater is likely to be affected by the high salt concentrations of the drainage water, and the contamination of pesticides and fertilizer residues.

5-3-14 Land Erosion

Increasing wind erosion in sand sheet areas and desert sand dunes can be expected especially during the development phase of the project as result of the removal of natural vegetation and disturbance of the surface crust. This negative impact will continue until the project becomes operational and the soil moisture and vegetation slow down the rate of sand movement. Active sand dunes surrounding the reclaimed areas can however still threaten the crop lands and intrude into the fields during periods of high wind. Sand storms, also form a hazard for crop growth, especially during the blooming stage.

5-3-15 Aquatic Weeds in Channels

Excessive growth of aquatic weeds in irrigation and drainage canals due to increased nutrient levels can cause, choking of water ways, hampering of flow and increasing sedimentation of the canals. Apart from reducing the hydraulic efficiency of the canals, the plants also cause considerable amounts of water to be lost by evapotranspiration.

The water hyacinth is the most fast spreading aquatic weed. It can increase in volume by about 700% within 50 days and a pair of plants can increase to 1,200 plants in the space of four months (Ref. 12). This highlights the importance of weed control.

Mechanical control can be carried out in two ways namely, cutting or dredging. Rooted plants are usually harvested at a point near the base of the stem leaving the roots undisturbed giving the chance for regrowth of the plants in a short time period. Dredging on the other hand is much slower and more costly in operation than cutting. It also results in changes to the original cross section of the canals.

Chemical control of aquatic weeds was discontinued in the early 1990's due to the negative effects this method had on the environment.

The introduction of the grass carp (*Ctenopharyngodon idella*) in Egypt as a method of biologically controlling submerged aquatic weeds started in 1976 on a experimental basis, and is now a popular method of weed control. The advantage of biological control is that it provides a low cost perpetual control with minimum detrimental side effects to the environment and it also provides extra source of edible fish. Fungi and arthropod species have been used as biological agents for the control of water hyacinth elsewhere but they have not been introduced in Egypt. The use of these agents is still being studied in Egypt.

5-3-16 Pesticides and Fertilizers

Chlorinated hydrocarbons were predominantly used in Egypt from the 1950's until the 1970's. All these type of pesticides have now been banned in Egypt. These insecticides were used in large quantities due to the subsidies provided by the government. The use of pesticides has dropped considerable over recent years following the import limitations that took effect in 1985, and due to the phasing out of most of the subsidies in the early 1990's.

Deaths and abnormalities resulting from different pesticides have been reported in Egypt. Workers regularly exposed to pesticides were found to be suffering from neuritis, asthma and disturbances in liver and kidney functions. Some pesticides can persist in the environment for many years.

Overdosing of fertilizer on agricultural land can result in high levels of nutrients in the drainage water causing eutrophication. High nutrient concentrations will result in stimulation of aquatic weed and algal growth in the drainage canals.

5-3-17 Socio-Economic Impact

The project will provide many employment opportunities during the construction and operation of the irrigation scheme. The project will also have a positive impact on the industries related to agriculture, such as the fruit and vegetable processing industries. Improved farming practices using modern irrigation techniques will result in a higher productivity and better quality products.

5-3-18 Settlement Issues

The project is located far from main urban centres and it may take some time for the new population to settle. For the success of this project it is therefore most important that the new settlements provide good public facilities, such as a reliable water supply, public transport, schools, hospital shops and telecommunication to attract new settlers.

5-3-19 Diseases and Public Health

The introduction of Nile water into this region could pose a serious risk of introducing new diseases, such as malaria and schistosomiasis, and other water related diseases in the North Sinai.

Two species of human Schistosomisasis (Bilharzia) are endemic in Egypt: *Schistosoma mansoni* and the *Schistosoma heamatobium.* These parasites use water snails as their host. In Egypt, snail breeding is highest in March. The prevalence rate of this parasite in the different districts of North Sinai Governorate is still far below the prevalence at the national level. Aquatic plants provide a habitat and food for the snails that spread Bilharzia.

Malaria is transmitted from person to person by mosquitoes of the *Anopheles* genus. Seven species were recorded in the North Sinai Governorate while ten species of the *Culex* genus were found. The *Culex* transmits *Wucherieria bancrofti,* the parasite which causes filariasis, and rift valley fever (in cattle and sheep).

Anopheline mosquitoes have been recorded in four districts in the North Sinai Governorate: El Sheikh Zuwayd, Bir Al Ebd, Rafah and El Hasana. Culicine mosquitoes are present throughout the Governorate. At present the North Sinai Governorate is presently free from malaria and filariasis is not endemic.

Sandflies are responsible for the transmission of leishmaniasis caused by a species of flagellate protozoon, *Leishmania.* Cases of the cutaneous leismaniasis have been reported in the North Sinai Governorate.

Checking the new settlers for these infectious diseases before they move into the Study area is one way of controlling the spread of the diseases. Other methods involve engineering means to reduce the snail population, including appropriate channel design, adequate drainage, improved irrigation practices, fluctuation in water levels and construction of barriers to prevent snail drifting (refer to Appendix G).

5-3-20 Water Supply and Sanitation

The present methods used for human waste disposal are very primitive. In the villages pit latrines and septic tanks are mostly in use. Bedouins dispose of their excreta in the open desert.

To prevent health problems due to disposal of wastewater in drains, water supply for the new settlement in the Study Area should be accompanied by the construction of new sewer systems and waste water treatment plants. Wastewater stabilization ponds are usually recommended as treatment systems in hot climates when sufficient land is available. Lining of ponds will be required due to the high permeability of the soil to avoid contamination of groundwater.

Piles of refuse left uncovered could encourage fly and mosquito breeding and lead to an increased risk of transmission of diseases. A collection and disposal system should therefore be developed to alleviate these risks.

5-3-21 Power Demand Impacts

The energy allowance for the El Salam Project used by the Ministry of Electricity is 0.75 Megawatt per feddan. The total power requirement for the project (400,000 feddans) is therefore 300 Megawatts. The construction of additional high tension power lines from the power station in Abu Sultan has been started to meet the increasing power demand.

CHAPTER 6

IMPLEMENTATION AND OPERATION OF THE PROJECT

Практикум

по

технологии

CHAPTER 6

IMPLEMENTATION AND OPERATION OF THE PROJECT

6-1 Implementation Program

6-1-1 Executing Agency

The North Sinai Development Organization (NSDO) of the Ministry of Public Works and Water Resources (MPWWR) will be the executing agency responsible for implementation of the Integrated Rural Development Project of the El Sir & El Kawareer Zone having the gross land area of 135,000 feddans. The proposed Project is composed of six (6) sub-projects: water conveyance and water management project, land reclamation and main irrigation and drainage system project, on-farm irrigation and drainage facilities project, agricultural development supporting project, settlement and social infrastructure development project and agro-processing development project.

For the successful implementation of the Project, the NSDO would appoint a project director who has responsibilities for promoting the Project and organizing, coordinating and directing the sub-projects. The assignments of the project director are preparation of detailed designs of engineering works as well as bidding and contracting of construction works. During the construction period, construction offices will conduct supervision of works.

6-1-2 Implementation Schedule

The construction works of the Suez siphon is scheduled to be completed by the middle of 1997 by which the Nile water becomes available for use of irrigating 400,000 feddans in North Sinai. Under the situation, the MPWWR has revised the implementation schedule of the land reclamation projects in North Sinai so as to start irrigation by the year 2002.

In line with the policies set forth by the MPWWR, the implementation of the basic infrastructure is scheduled to be completed during the five (5) years from 1998 to 2002, including the sub-projects of water conveyance and water management, land reclamation and main irrigation and drainage systems, on-farm irrigation facilities, and settlement and social infrastructure. The implementation schedule is proposed to be completed in the shortest technically possible time (Table 6-1).

As the integrated rural development project is composed of technically independent sub-projects, the Project will be divided up into as many lots, and separate contracts will be signed for each lot. This is applicable to the construction of the water conveyance canals. Care should be taken to align the capacity of contractors with size of the works and to align the financing plan with the project timetable.

The implementation of agricultural development supporting services and the agro-processing project must begin before investments for infrastructure are completed. The on-farm drainage facilities will

be implemented in two (2) stages. The stage 1 implementation program includes construction of open drains as the present water tables are low, not requiring sub-surface drainage; however, water tables shall rise in the near future as irrigation water is continuously supplied. It is estimated that stage 2 works to install drainage pipes are required during the period from 2003 to 2012.

6-2 Operation and Maintenance

6-2-1 Responsibility

Upon completion of the construction phases, the NSDO is responsible for the operation and maintenance of the infrastructure related to agricultural production including the water conveyance system, and the main irrigation and drainage systems. On-farm irrigation and drainage facilities will be operated and maintained under the responsibility of the settlers in conformity with the Government policies.

The objectives of the Project could be achieved only with the full cooperation of the agricultural services agencies outside the NSDO's administrative control, as well as the cooperation of the private entities concerned; therefor, The NSDO will be responsible for coordinating their cooperation.

6-2-2 Organizations

The NSDO would establish an operation and maintenance sector in the head office. The director general of the said sector is responsible for operation and maintenance of the infrastructure and coordination with the agencies concerned.

With respect to the water management, the NSDO will establish the sub-master station in Kantara to cover 400,000 feddans and its zonal office covering 135,000 feddans as discussed in Chapter 4-2. For on-farm water management of the small farmers and graduate farmers, the water user associations will be organized at a rate of one (1) association to 100 feddans which is the terminal irrigation service unit comprising 10 farm households as discussed in detail in Chapter 4-3.

The NSDO will also establish the North Sinai Agricultural Development Center at Bir El Abd and its branch office in the Project area by which effective extension services will be implemented.

6-3 Monitoring and Evaluation

The management of the integrated rural development project is considerably complicated. The Project comprises a variety of activities including construction of infrastructure and on-farm facilities, provision of extension and marketing services, credit to farmers, training programs, and so forth. The Project is concerned with ways to organize and manage relationships among several sub-projects to achieve jointly the Project's development objectives. Project monitoring and evaluation systems should be introduced. The intention of monitoring system is to improve the efficiency of on-going project management and the intention of evaluation system is to contribute more effectively to revision of the previous programs.

Construction Phases

The NSDO will constantly evaluates the progress of the design work, contracting and construction works, and measure the achievement level of the project. These measurements have to be compared with standards to determine the need for corrective action in order to reach the cost, time, and technical performance objectives of the project. There will probably be some changes in the project as it is completed. The task of monitoring and evaluation are as follows:

Schedules: continuously monitor work in progress, communicate results to authorities concerned, forecast potential problems and consider alternatives.

Technical: resolve technical problems early, communicate schedule and budget restraints to technical personnel, emphasize early technical testing.

Manpower: forecast and communicate manpower requirement early, establish manpower requirement and priorities with functional and staff groups.

In case of phase-out:

Schedule: monitor schedules throughout cycle, consider reallocation of available manpower to critical project areas, attain prompt resolution of technical issues which may impact schedules.

Manpower: develop plans for reallocation of manpower upon project completion, maintain harmonious working relationships with project teams and supporting groups.

The economic return largely depends on the time which elapses between the beginning of the investment phase and time the full development production target is attained. The objective of the work timetable is therefore to reduce this period as far as technically possible. Testing to determine the effects of delay on the present worth of agricultural investments is an important part of the project evaluation, which will be discussed in Chapter 8.

Operation Phases

The NSDO would organize an agricultural development committee with representatives from different government agencies in order to provide a basis for decision-making so as to improve the management of the project in course of operation. Delay in implementation affects most agricultural projects. Farmers may fail to adopt new practices as rapidly as anticipated.

As in the construction phases, monitoring and evaluation during the period of project operation should be implemented by means of comparison between the progress actually made and the targets set. Evaluation during the operation period will be done by annual monitoring of the progress of the project. For this purpose, a systematic monitoring and evaluation has to include the following data:

- area irrigated
- crop yields
- production marketed
- consumption of inputs
- agricultural services and their affectiveness
- farm prices and operating costs
- operating costs of irrigation networks

Table 6-1 Implementation Schedule

Work Items	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Suez Siphon																						
(Zone No.7~NO.10 : 265,000 Feddan)																						
Shikh Gaber El Sabah Canal																						
- Tina Plain Area																						
- South Kantara Area																						
- Rabba Area																						
- Bir El Abd Area																						
Main Pumping Stations																						
- No.4 Station																						
- No.5 Station																						
- No.6 Station																						
Land Development & Settlement																						
- 265,000 Feddan Area																						
(Zone No.11 : 135,000 Feddan)																						
- Detail Design and Contract																						
- Conveyance Canal																						
- No.7 Pumping Station																						
- Land Development																						
- On-farm Irrigation																						
- On-farm Drainage																						
- Agro-processing Project																						
- Agricultural Development Supporting Services																						
- Settlement and Social Infrastructure																						
- Water Management System																						
Irrigable Area (1,000 Feddan)								50	125	265	265	400	400	400	400	400	400	400	400	400	400	400

CHAPTER 7

PROJECT COST

CHAPTER 7

PROJECT COST

7-1 Construction Costs

The construction costs were estimated based on the work quantity, current unit rates employed in NSDO projects, price quotations from manufacturers of pipes, pumps, motors and related equipment, and the proposed implementation schedule. The construction costs include costs for administration and engineering for detail design work and supervision of construction works. The project costs are divided into two (2) components of local currency and foreign currency portion. The foreign currency component is the amount of costs required for procurement of machinery, equipment, spare parts and materials to be imported, and parts of costs required for procurement of machinery, equipment spare parts and materials to be manufactured in Egypt.

Price escalation contingencies are added to the construction costs. The total construction costs amount to 4,521 million LE, of which the base costs are 3,906 million LE at a 1996 price level. A foreign currency exchange rate of US$ 1.00 = LE 3.389 = Japanese Yen 112.0 is applied. Table 7-1 ~7-6 presents the construction costs, which are summarized below:

Summary of Construction Costs in Million LE

Cost Items	Foreign Currency	Local Currency	Total
1. Water Conveyance and Water Management	559	630	1,189
2. Land Reclamation and Irrigation/Drainage Systems	201	588	789
3. On-farm Irrigation and Drainage Facilities	345	314	659
4. Agricultural Development Supporting Services	35	41	76
5. Settlement and Social Infrastructure	308	629	937
6. Agro-industries	100	70	170
7. Administration and Engineering	29	57	86
Base Cost (1 - 7)	1,577	2,329	3,906
8. Price Escalation Contingencies	197	418	615
Total Cost (1 - 8)	1,774	2,747	4,521

Annual Disbursement Schedule of Base Cost

Year	LE Million	Year	LE Million	Year	LE Million
1997	14	2003	41	2009	17
1998	197	2004	35	2010	16
1999	982	2005	7	2011	-
2000	1,007	2006	12	2012	11
2001	1,041	2007	31		
2002	468	2008	27	Total	3,906

7-2 Operation and Maintenance Costs

The costs required for operation and maintenance of the Project include the administrative expenses of the organizations and factories, the cost of maintenance of the engineering facilities, the cost of electricity and the cost of replacing pumps and other equipment. In the estimate of replacement cost, the useful lives in years are: 25 years for large pumps and motors, and 50 years for steel pipes and civil works.

The annual operation and maintenance cost is estimated at 105.4 million LE, of which the power cost for operation of No.7 pumping station shares 33.4 million LE, or 32% of the annual cost as summarized below:

Power cost	:	33.4 million LE
O&M cost	:	70.8 million LE
Replacement	:	1.2 million LE
Total		105.4 million LE (or, LE 950/feddan net)

7-3 Construction Cost Allocation

The base cost of 3,906 million LE will be allocated among the Government, investors, small farmers and graduate farmers (small holders) and the private sector in the following manner:

- Water conveyance and water management:
  to be born by the Government (Table 7-1)
- Land reclamation and irrigation/drainage systems:
  to be born by the Government (Table 7-2)
- On-farm irrigation and drainage facilities:
  to be born by the investors and small holders (Table 7-3)
- Agricultural development supporting services:
  to be born by the Government and small holders (Table 7-4)
- Settlement and social infrastructure (Table 7-6)
  to be born by the Government, investors and small holders
- Agro-industries (Table 7-5)
  to be born by the private sector
- Administration and engineering
  to be born by the Government

The following table gives the cost allocation to the Government, investors, small holders and private sector:

Cost Allocation in Million LE

Cost Items	Govern-ment	Investors	Small Holders	Private Sector	Total
Water Conveyance/Water Management	1,189	-	-	-	1,189
Land Reclamation and Irrigation/Drainage Systems	789	-	-	-	789
On-farm Irrigation and Drainage Facilities	-	495	164	-	659
Agricultural Development Supporting Services	27	-	49	-	76
Settlement and Social Infrastructure	880	10	47	-	937
Agro-industries	-	-	-	170	170
Administration and Engineering	86	-	-	-	86
Total	2,971	505	260	170	3,906
(Percentage)	(76.0)	(12.9)	(6.7)	(4.4)	(100.0)

Breakdown of costs for on-farm irrigation and drainage facilities and costs for settlement and social infrastructure is given below (for on-farm drainage, refer to 4-4-2 On-farm Drainage System and Figure 4-2):

On-farm Irrigation and Drainage Cost (Million LE)

	Investors	Small Holders	Government	Total
- Irrigation	474.0	162.3	-	636.3
- Drainage	20.9	1.9	-	22.8
Total	494.9	164.2	-	659.1

Settlement and Social Infrastructure Cost (Million LE)

	Investors	Small Holders	Government	Total
- Housing	9.8	47.3	335.7	392.8
- Social Infrastructure	-	-	544.3	544.3
Total	9.8	47.3	880.0	937.1

Table 7-1 Construction Costs : Water Conveyance and Water Management

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
(Water Conveyance)			
1. No.7 Pumping Station			
1.1 Pumps and ancillaries			
- Pumps, 8 units	23,488	5,872	29,360
- Motors, 8 units	33,424	8,352	41,776
- Valves, LS	9,033	2,258	11,291
- Pipings, LS	10,478	2,619	13,097
- Cranes and others, LS	6,143	1,536	7,679
- Electric equipment, LS	12,465	3,116	15,581
- Installation	14,253	3,563	17,816
Sub-total	109,284	27,316	136,600
1.2 Sub stations, open type	54,192	13,548	67,740
1.3 Buildings	545	1,635	2,180
1.4 Civil works	8,055	15,140	23,195
Total (1)	172,076	57,639	229,715
2. Conduit			
2.1 Steel pipeline, 12.6 km	287,004	361,506	648,510
2.2 Open canal, 24.6 km	23,365	68,049	91,414
2.3 Box culvert, 7.8 km	63,635	122,753	186,388
Total (2)	374,004	552,308	926,312
3. Electric Transmission, 4.0 km	1,100	1,100	2,200
4. Regulating Reservoirs			
4.1 Upstream: No.1 reservoir	3,412	6,711	10,123
4.2 Downstream: No.2 reservoir	3,454	6,695	10,149
Total (4)	6,866	13,406	20,272
5. Spillway	1,523	1,917	3,440
6. One-way Surgetanks, 6 locations	3,412	3,325	6,737
Total (1 - 6)	558,981	629,695	1,188,676
(Water Management)			
1. Sub-master Station, 135/400	98	25	123
2. RTU, 3 units	105	26	131
3. Zonal Office	80	61	141
Total (7)	283	112	395
Grand Total (1 - 7)	559,264	629,807	1,189,071

Table 7-2 Construction Costs : Land Reclamation and Irrigation/Drainage Systems

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
1. Land Reclamation			
- 54,510 feddans	6,164	19,787	25,951
- 36,050 feddans	7,251	21,545	28,796
- 20,440 feddans	854	3,530	4,384
Total (1)	14,269	44,862	59,131
2. Irrigation Systems			
- Main canals, 71 km	46,200	123,284	169,484
- Secondary canals, 464 km	112,425	283,719	396,144
Total (2)	158,625	407,003	565,628
3. Drainage Systems. 476 km	28,025	136,542	164,567
Total (1 - 3)	200,919	588,407	789,326

Table 7-3 Construction Costs : On-farm Irrigation and Drainage Systems

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
(On-farm Irrigation Systems)			
1. Small farmer / Graduate			
- Small farmers, 16,650 feddans	43,457	51,837	95,294
- Graduate farmers, 5,550 feddans	15,663	19,597	35,260
- Graduate farmers, 5,550 feddans	14,494	17,300	31,794
Total (1)	73,614	88,734	162,348
2. Small Scale Investors			
- Vegetables and cattle, 8,325 feddans	32,580	30,697	63,277
- Vegetables and fruits, 8,325 feddans	21,700	22,144	43,844
Total (2)	54,280	52,841	107,121
3. Large Scale Investors			
- Land use crops, 16,650 feddans	73,256	59,360	132,616
- Dairy, fixed sprinkler, 16,650 feddans	67,790	49,093	116,883
- Dairy, center pivot sprinkler, 16,650 feddans	34,502	23,187	57,689
- Fruits, 16,650 feddans	29,856	29,868	59,724
Total (3)	205,404	161,508	366,912
Total (1 - 3): On-farm irrigation	333,298	303,083	636,381
(On-farm Drainage Facilities)			
4. Class II Land			
- 100 fed. service unit, 2,700 feddans	676	708	1,384
- 720 fed. service unit, 4,200 feddans	1,157	1,229	2,386
Total (4)	1,833	1,937	3,770
5. Class III Land			
- 100 fed. service unit, 12,100 feddans	5,602	5,277	10,879
- 720 fed. service unit, 8,200 feddans	4,211	3,997	8,208
Total (5)	9,813	9,274	19,087
Total (4 - 5): On-farm drainage	11,646	11,211	22,857
Grand Total	344,944	314,294	659,238

Table 7-4 Construction Costs : Agricultural Development Supporting Services

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
1. North Sinai Agricultural Development Center			
- Main office	2,856	5,434	8,290
- Branch office	2,374	3,402	5,776
Total (1)	5,230	8,836	14,066
2. Branch Extension Office	-	4,946	4,946
3. Branch Veterinary Office	3,839	3,657	7,496
4. Farmer Organizations			
- Cooperatives	24,857	16,576	41,433
- Associations, 9 offices	902	7,106	8,008
Total (4)	25,759	23,682	49,441
Grand Total	34,828	41,121	75,949

Table 7-5 Construction Costs : Agro-processing

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
1. Concentrated Feed Factory	7,189	6,267	13,456
2. Tomato Paste Factory	44,710	14,661	59,371
3. Olive Oil Factories (31)	29,140	24,986	54,126
4. Slaughter House	8,074	7,443	15,517
5. Milk Processing Factory	11,342	16,473	27,815
Total (1 - 5)	100,455	69,830	170,285

Table 7-6 Construction Costs : Settlement and Social Infrastructure

Unit: LE 1,000

Cost Items	Foreign Currency	Local Currency	Total
1. Housing			
- Small farmer / graduate, 2,215	11,825	35,475	47,300
- Small scale investors, 170	1,368	4,102	5,470
- Large scale investors, 90	1,083	3,247	4,330
- Officers, 3,870	30,278	90,832	121,110
- Bedouins, labors, etc., 16,875	53,654	160,966	214,620
Total (1)	98,208	294,622	392,830
2. Village Roads Networks	37,520	91,180	128,700
3. Water Supply	33,310	40,570	73,880
4. Electric Supply	48,000	43,500	91,500
5. Sewerage and Refuse	62,710	96,600	159,310
6. Educational Facilities	21,281	47,749	69,030
7. Other Public Service Facilities	6,703	15,197	21,900
Total (1 - 7)	307,732	629,418	937,150

CHAPTER 8

PROJECT EVALUATION

CHAPTER 8

PROJECT EVALUATION

8-1 Introduction

An extreme maldistribution of the population to the Nile Valley is the centuries-old problem in Egypt and in an attempt to putting this problem an end, the Government of Egypt has formulated various plans to redistribute the over-population to other regions of the country where have sparse population in comparison with their extension of lands. The El Salam Canal-Shikh Gaber El Sabah Canal Project, which aims to irrigate some 620,000 feddans of lands for agricultural purpose located in the northeastern Delta and in the northwestern and northern Sinai, is one of the measures conceived to put the afore-mentioned plans into practice; of 620,000 feddans irrigated area, the command area benefited by the El Salam Canal (1st phase project) is 220,000 feddans and that by the Shikh Gaber El Sabah Canal (2nd phase project) is 400,000 feddans. Major source of the irrigation water for the project is the discharge deviated from the Nile River and conveyed through the two canals, and the use of drainage water exhausted from existing agricultural lands would be also proposed as complementary irrigation water.

The North Sinai Integrated Rural Development Project (135,000 feddans of the gross reclamation land) is one of the five districts constituting the 2nd phase project area. Irrigation water discharged through the Shikh Gaber El Sabah Canal will be distributed to the area owing to construction of pumping station and water conveyance canal. This is a new land reclamation project which is designed to receive some 3,000 settlers of different category (investors, graduates and small farmers including Bedouin people) coming in their greater majority from other regions of the country, so construction of social infrastructures such as living quarters, water supply and sewerage system, electricity, education, medical care center, etc. are a critical part of the project. In addition, so as to increase value-added of the agricultural produces within the project area, the project contemplates development of agro-industry and marketing center.

The present project evaluation has a core objective to verify the impact for implementation of the North Sinai Integrated Rural Project from the view point of the national economy.

Apart from this economic evaluation, financial analysis on the basis of profitability at farm level was realized in view of the fact that, even if the implementation of the present project is proved to be justifiable from the standpoint of the national community taken as a whole, there is no guarantee for the project to be succeeded unless it is attractive to its beneficiaries from financial point of view.

8-2 Economic Evaluation

8-2-1 Evaluation Methodology

The economic evaluation is conducted in compliance with the conventional methodology that is commonly applied for evaluation of development projects in Egypt under finance of the Word Bank, USAID and other agencies concerned with technical and/or financial assistance projects.

The indicator used for economic evaluation is the Economic Internal Rate of Return (EIRR) and apart from this EIRR, the Net Present Value (NPV) shall be also calculated so as to present the magnitude of the project's incremental benefits.

In Egypt, the Ministry of Planning, MPWWR and other agencies responsible for development projects had been applied the discount rate of 12% as an opportunity cost of capital for most of the cases in the past. Nevertheless, for this project, in compliance with the recent recommendation of the World Bank's mission, the discount rate of 10% was used for calculation of the NPV (The official discount rate of the Central Bank of Egypt is set as 13.5% at present).

Costs and benefits of the project in the course of the whole project life are subject to increase/decrease as an outcome of the change of project circumstances from the time of project evaluation for the feasibility study, so sensitivity test was conducted to find out what parameters would have the strongest effect on the project's profitability for a given percentage of variation.

8-2-2 Component of the Costs and Benefits

The quantificable benefits for the present project accrue from agricultural production as well as from agro-industry and marketing system development. The former is attributable to the net return of crop production to cover 110,500 feddans of the net irrigable area together with livestock activities to be carried out in parallel with crop production. It is worth while to indicate that the comparison of agricultural production between "With" and "Without" project situations was not undertaken in this project due to the fact that the actual agricultural production in the proposed land reclamation area is almost negligible. Crop production benefits can be expected from both main products and by-products (some crops). Meanwhile, the benefits stemmed from agro-industry and agricultural marketing system development deem to be an operational margin of agricultural commodities processing and marketing enterprises (concentrated feed factory, tomato paste factory, olive oil press factory, slaughterhouse, milk processing factory and market-oriented cooperatives).

Meanwhile, the total cost of the project consists of the costs required for development of:

- Suez Canal siphon, Shikh Gaber Sabah Canal & Pumping stations No. 4, 5 & 6 (Common civil works to cover 400,000 feddans of reclamation land)
- Water conveyance and water management; Land reclamation and irrigation/drainage systems; On-farm irrigation and drainage facilities

- Agricultural development supporting services and agro-industries
- Settlement and social infrastructure
- Administration and engineering

For development of these works, capital cost (initial investment cost for construction works and engineering services) and recurrent cost (routine operation and maintenance cost of project office and completed works and replacement cost for obsolete equipment and works) are to be incurred. Furthermore, physical and price escalation contingencies are added to constitute the total cost of the project.

8-2-3 Valuation of Project Benefits

(1) Economic Pricing of Farm Inputs and Outputs

For valuing economic farm-gate prices, the crops and livestock products envisaged in the present project are classified into traded commodities and non-traded commodities in the following manner:

Traded commodities: wheat, maize, soybean, potato, onion, tomato, grape, orange, beef & milk

Non-traded commodities: barley, sorghum, berseem, fodder beet, sesame, broad beans, cabbage, cantaloupe, water melon, squash, green pepper, olive & peach

The economic farm-gate prices of some traded commodities were estimated making reference to the World Bank's commodity price projections for the year of 2005 (long-term projections) in constant 1990 US dollars, while for traded vegetables and fruits except for orange the same economic farm-gate prices were gained based on their prevailing export prices (FOB Port Said).

As for the non-traded commodities, the financial farm-gate price is assumed to represent the economic farm-gate price.

A line-up of economic and financial farm-gate price of project produces is as per attached Table H - 16.

The economic production cost of crop cultivation per feddan of land comprising essential farm inputs is estimated at first using market price and then converted to economic pricing with necessary adjustment by means of shadow prices and exclusion of transfer items. Detailed methodology to correct financial price into economic price is explained in Appendix H-6-2.

(2) Build-up of the Project Benefits

Crop production on new reclamation lands shall start in the 6th year of the project for small farmers/graduates as well as for some portion of investors and in the 7th year for the rest of investors. On the other hand, the livestock activity which envisages use of the project's produces as fodder for

animals shall begin one year later for respective case and the benefits anticipated from this activity are scheduled to be generated at the end of the 2nd year from the commencement of cattle raising.

Farmers to be engaged in crop and livestock production are settlers who are not familiar with local natural and social conditions, so crop yields at initial years have been conservatively estimated at modest level and they are scheduled to reach the target yields following sigmoid curve. The interval to attain the target yield, which varies crop by crop, is proposed in the range of 4th - 9th year. Benefits stemmed from crop by-products shall be gained in proportion with yields of main products. Due to the fact that the present project conceives to procure soilage to feed animals at the same farms, the head of cattle to be raised in the project has been proposed conservatively in conformity with the output of fodder crops. Milk production capacity of cows, although it generally differs for respective calving, was averaged to cover the whole calving period.

Referring to the above-cited assumptions , annual flow of the project's agricultural benefits has been prepared as given in Table H - 20. According to this table an annual sum of the agricultural benefit quoted in economic price reaches LE 576,832,983 at full development stage of the project.

Apart from on-farm benefits cited above, included in the project's benefits are agro-based processing and marketing benefits which are summed in economic price to be LE 84,572,000 a year at full development stage. (Refer to Table H - 21 for detailed information).

8-2-4 Economic Pricing of the Project Cost

The cost components which build up the total cost of the project are exposed in the sub-section H-6-2 (2) of this Appendix. Of these components, only such items as are directly related with generation of project's tangible benefits (agricultural production and agro-based processing and marketing benefits) are to be identified as cost components to be involved in the base case of project evaluation (this implies that the cost forked for development of social infrastructures is to be ruled out from the base case of the project evaluation). Despite this principle, considering the importance of the component of social infrastructure within the context of new land reclamation project, a sensitivity test shall be conducted to verify how an economic profitability of the project would be affected if the total project cost encompasses cost for social infrastructures.

The project cost has been estimated being broken down into foreign currency portion and local one and the economic price of the former has been assumed to be equivalent to their financial (market) price; meanwhile, the economic price of the latter has been valued pursuant to the principles set forth in Appendix H-6-2 (4).

As a consequence of this economic pricing principles exposed above, the capital cost of the project was corrected from financial price to economic one and is scheduled to be disbursed per annum in the following manner.

Annual Disbursement Schedule of the Project's Capital Cost

Year in Order	Year	Financial Price (LE x 10^3)	Economic Price (LE x 10^3)
-5	1991	1,887	1,442
-4	1992	2,831	2,164
-3	1993	6,955	5,743
-2	1994	12,352	10,471
-1	1995	26,936	23,630
0	1996	41,372	36,730
1	1997	57,487	51,724
2	1998	231,976	198,835
3	1999	774,871	664,037
4	2000	700,260	583,300
5	2001	731,610	625,201
6	2002	390,058	344,826
7	2003	41,260	38,331
8	2004	34,712	32,048
9	2005	6,923	6,154
10	2006	11,839	10,452
11	2007	31,065	27,163
12	2008	26,989	23,337
13	2009	16,634	14,827
14	2010	16,634	14,827
15	2011	0	0
16	2012	11,429	10,195
Total		3,176,081	2,705,442

And, the recurrent cost of the project which is composed of routine operation and maintenance expense of the project's facilities and replacement cost for obsolete equipment and works was also corrected in the same manner. It is thus estimated that economic cost of the recurrent cost (without replacement cost) would reach LE 97,647,450 a year (Table H - 22 demonstrates annual disbursement schedule of relevant cost including replacement cost).

8-2-5 Economic Internal Rate of Return

With the annual inflow (benefits) and outflow (costs) at economic price estimated before, an annual incremental net benefits (annual benefits minus annual costs) have been incorporated to cover the whole project life of 50 years, or 56 years if common civil works for 400,000 feddans reclamation area is included. (Refer to Table 8-1). This incremental net benefits stream constitutes the basis for calculating an economic internal rate of return (EIRR) and a net present value (NPV) of the project. For calculation of NPV, a discount rate of 10%, which is assumed to represent an opportunity cost of capital in Egypt, was applied.

As a result of this calculation, EIRR and NPV were obtained as follows:

EIRR: 11.25 %
NPV: LE 190,603,810

The above calculation result intimates that the implementation of the present project is justified from economic viewpoint, because the calculated EIRR is superior to an assumed opportunity cost of capital in Egypt.

8-2-6 Sensitivity Analysis

Bearing in mind that the project would face various risks at the time of its implementation, a sensitivity analysis has been conducted to examine how the project's EIRR would be affected if crucial variables were to differ from the expected values used in its calculation. The possible sources of risk included the danger of cost over-runs, decrease in crop yields, delay in completion of construction works, and the implications of these risks have been quantified both singly and in possible combination. In addition to these factors, the present sensitivity analysis has been undertaken for the cases that the project cost involves components of social infrastructures and summing cost of the common civil works for 400,000 feddans in single year.

The result of the sensitivity analysis is as summarized below.

Factors Subject to Variable	EIRR(%)	NPV at 10% (In LE)
Base case	11.25	190,603,810
1). Total project cost hiked by 10%	10.30	49,175,534
2). Overall project benefits reduced by 10%	10.20	30,115,153
3). Combination of 2) and 3)	9.29	-111,313,123
4). Construction of main civil works prolonged to 5 years	10.13	18,884,553
5). Inclusion of the cost for social infrastructure	9.16	-155,673,214
6). Summing cost of the common civil works for 400,000 feddans in single year	11.29	314,558,305

8-3 Financial Analysis

The financial analysis under the present new land settlement project is carried out through farm income analysis on various model farms established in accordance with social categories of settlers and farm operational patterns. The major purpose to realize this financial analysis falls on assessing whether setters by different categories of farm size and farming pattern are capable of realizing financially sound farm operation with attaining sufficient returns after canceling payment for farm land acquisition and capital and recurrent expenses incurred in relation with on-farm irrigation system.

8-3-1 Establishment of Model Farm

Candidates who are supposed to undertake farm operation at new land reclamation area are classified into the following four groups, namely:

Category of Settlers	Proposed Land Holding Size
Large scale investor	Larger then 500 feddans
Small scale investor	10 - 500 feddans
Graduate farmer	10 feddans
Small farmer	10 feddans

In line with land holding size and farming system for respective category of settlers, the following nine (9) model farms have been established for the sake of their farm income analysis.

Model Farm No.	Category of Settler	Land Size (Fed.)	Cultivable Area (Fed/year)	Proposed Farming System
1	Large Scale Investor	748	720	Fruits production
2	Large Scale Investor	748	1,156	Cattle fattening with fodder
3	Large Scale Investor	748	1,440	Dairy farming with fodder
4	Large Scale Investor	748	1,440	Perennial crops production
5	Small Scale Investor	70	140	Mixing of perennial crops and fruits production
6	Small Scale Investor	103	200	Cattle fattening with fodder and vegetables
7	Graduate Farmer	10	20	Mixing of perennial crops and fruits production
8	Graduate Farmer	10	20	Cattle fattening with fodder and vegetables
9	Small Farmer	10	20	Cattle fattening with fodder and vegetables

8-3-2 Estimation of Farm Inputs and Outputs

In build-up of crop budget all prices are quoted in market price prevailed as of 1996. Cost for family labor was excluded from this crop budget, and cost of mechanical operation was estimated for all type of settlers on the basis of hours of operation and unit cost of machine hire. In livestock operation, it is proposed that fodder needed to feed cattle will be supplied by the same farm, so cost of fodder except concentrates has been neglected.

Crop and livestock yields correspond to those which have been applied for economic evaluation, meanwhile farm-gate prices are calculated in actual term.

Farmers to be engaged in crop and livestock production are proposed settlers who are supposed to be deficient in financial resources to realize crop and livestock production with their own fund. Thus, they shall have to depend on credit rendered by PBDAC or other financing institutions. The prevailing interest rate of the PBDAC's farm credit is set as 11%, 12% and 13% for short-term, medium-term, and long-term period, respectively.

8-3-3 Assumptions on Land Allocation and Other Relevant Terms

The policy for recruiting settlers of the project has not been established up to date, so an assumption is made for the sake of the present financial analysis that the same procedure and terms would be put into force as the case of Tina Plain area in which recruiting procedure of settlers has just taken place in last August 1996. An assumed procedure and terms on recruiting settlers are as follows:

1. Settlers are to be selected by means of pre-qualification (small/graduate farmers and small scale investors) and through bidding (Large scale investors). The price of land to be allocated to small/graduate farmers is fixed at LE 3,000 per feddan and the same for small scale investors is at LE 10,000 per feddan, while the land for large scale investors is to be priced through bidding subject to a minimum price of LE 10,000 per feddan.

   Selected candidates for settlement are required, at first, to make a rental contract for use of the agricultural land with a validity of one year which may be renovated yearly and be extended up to four years. If these candidates are proved to be serious in agricultural production at allocated land during this rental period, NSDO shall enter into contract with them for sale of land after being expired the rental contract. The rental charge of land per year shall be 2% of the price of land for respective category of settlers and shall be deducted from the price of land.

   The terms of payment for land are proposed as follows:

   - For both large and small investors: they have to offer their terms with a percentage of advance payment (minimum 10%); the remaining amount should be paid over 10 years (equal installment for each year) with an interest rate of 6% per annum.
   - For graduate/small farmers: An advance payment is not obligatory; the land cost should be canceled over 15 years (equal installment for each year) with an interest rate of 6% per annum.

2. NSDO does not prepare houses for settlers, but they only sell lots to be occupied by houses. The price of lot for house is set at LE 1/m^2 and proposed lot areas of house to be allocated to settlers together with proposed cost of houses are as given in Appendix H-6-3 (4).

3. The price of land is considered to be established in an attempt to recover some portion of the capital cost for water conveyance and irrigation and drainage system except for on-farm facilities. In this context, water charge will not be imposed on beneficiaries of irrigation and drainage system. NSDO is deemed to construct lateral network for all categories of settlers, but the cost adhered to this network shall not be charged to its users. By contrast, in so far as on-farm irrigation and drainage system is concerned, both investors and small/graduate farmers have to install the required system by themselves(Its cost per feddan is estimated in Appendix H-6-3(4)).

   The policy to recover operation and maintenance (O&M) cost for respective system shall comply with that for the capital cost, which may be resumed in the following manner:

   - Conveyance system including pumping station and irrigation and drainage canals: no charge is imposed on neither investors nor small/ graduate farmers.
   - On-farm system: both investors and small/graduate farmers shall bear the cost which ranges from LE 74/fed./year to LE 446/fed./year.

4. The cost of reclaimed land, house and on-farm irrigation system to be paid by settlers is as given in table below.

Unit: LE

Cost Items	Large Investor	Small Investor	Graduate Farmer	Small Farmer
Reclaimed land	More than 10,000/fed	10,000/fed.	3,000/fed.	3,000/fed.
Land for house	112	88	66	66
House	47,000	32,700	21,300	21,300
Water, electricity, etc.	1,500	1,500	1,500	1,500
Capital for On-farm irrigation system	3,465/fed.- 7,965/fed.	5,267/fed. - 7,611/fed.	5,728/fed. - 6,353/fed.	5,723/fed.
O/M for on-farm system	74/fed. - 126/fed.	151/fed. - 180/fed.	201/fed. - 245/fed.	199/fed.

8-3-4 Result of Financial Analysis on Model Farms

Most of settlers have to undertake farming activity without any property, so large amount of capital cost is required for procurement of on-farm irrigation facilities and agricultural equipment as well as for construction of houses. Under the situation, it is predicted that the farm operation would result in deficit for some years from the commencement of farm operation, and an accumulated debt would not be written off until 5th year (model farm No. 7, 8 and 9) and even until 15th year for the case of the model farm No.5 who will engage exclusively in fruits production.

The price of reclaimed land prepared by NSDO has great influence on profitability of farm operation; graduates and small farmers who are offered more gentle condition for purchase of land (unit price of land: LE 3,000/feddan and terms of payment: equal installment over 15 years with interest rate at 6% p.a.) would anticipate higher returns over the period of 20 years with FIRR of 31 - 33% and NPV ranging from LE 7,507/feddan to LE 11,750/feddan, while investors with the exception of No. 3 model farm (dairy farming with fodder crops) would face less profitable farm operation with FIRR of 14 - 25% and NPV in the range of LE 270/feddan and LE 2,304/feddan because they have to pay LE 10,000 or more per feddan of land and to amortize the same in ten years.

Indicators relevant to financial analysis of model farms are as given hereinafter (Refer to Table II-25 for detailed information).

Unit: LE

Model Farm No.	Turning Year 1/	Annual Surplus 2/	FIRR over 20 Years	NPV at discount rate 13.5%	
				Total	Per Feddan
1	10th	4,022,280	15	1,108,044	1,539
2	10th	1,801,810	14	285,986	247
3	6th	7,807,880	28	15,484,164	10,753
4	6th	2,188,900	25	3,317,601	2,304
5	15th	319,760	20	342,542	1,713
6	9th	357,639	14	54,104	270
7	5th	69,765	31	175,012	8,751
8	5th	52,153	33	150,142	7,507
9	5th	54,073	35	235,011	11,750

Note: 1/ The year when accumulated debt is to be written off
2/ After canceling payment for agricultural land and completing repayment for loans

The above financial analysis may lead to draw a suggestion that, with an eye to encouraging more candidate to participate in the project as investor and to promise them more profitable farm operation, the terms for sale of agricultural land for investors should be alleviated.

8-4 Project's Indirect Benefits

The implementation of the North Sinai Integrated Agricultural Development Project is anticipated to bring about important side effects in the realm of the social and economic development of Egypt in the future; economically, it will contribute to increasing foreign exchange earning by producing import substitute crops and potential exports; socially, on the other hand, it will relax over-population at Nile Valley and Delta regions and will generate more job opportunity among Egyptian people whose unemployment rate reaches almost 10% at present.

Following are another important effects and social benefits that are anticipated through implementation of this important new land reclamation project.

1. Strengthening the land ties between Egypt and the neighboring Arab Countries in the eastern part of the country and to play core role in this political and strategic tie.
2. To become a catalyst for development of tourism and industry as well as transport infrastructures in the peripheral areas.
3. To realize reuse of drainage water in cultivating new lands instead of discharging them uselessly into the sea.
4. To contribute to food security of the country.

8-5 Environmental Impacts and Recommended Mitigation

8-5-1 Impacts Related to the Location of the Establishment

The following positive impacts are generated by the project:

- The project will relieve high density population areas in the Delta Region and encourage population distribution over other Governorates
- The socio economic conditions in the region will improve, and the income levels of the local population are expected to rise
- New employment opportunities will be created for the local population and for settlers
- New opportunities will be created for agriculture related industries
- New public utilities such as electricity, drinking water, better roads and communication systems will impact positively on the local population

- The establishment of settlements will result in the availability of more educational facilities and health services
- Improved farming practices using modern irrigation techniques will result in a higher productivity and better quality agricultural products
- The desert reclamation and irrigation, and especially the development of wind breaks and shelter belts around, the settlements, and agricultural lands will have a positive impact on the micro-climate in the Study area and should result in a stabilization of moving sand dunes, reduce desertification and sand dune encroachment
- The new habitat created by development of desert land will act as cultivated feeding habitat and resting area for a large number of resident and migratory bird species.
- The availability of drinking water and electricity provided by the project should help ease the domestic activities of local Bedouin women.

Negative impacts include:

- The reclamation will reduce the area of natural desert land and wilderness
- Possible loss of two or more archaeological sites due to canal construction,
- Existing farmers in the Study area will loose their land unless they can claim ownership
- Bedouins will have to share their existing settlements with new settlers that are moving into the region, which could result in a loss of their culture
- Grazing land for the Bedouins will reduce as a result of the land reclamation
- Urbanization of the area will have a reduced mobility Bedouin women

8-5-2 Impacts Related to Design of the Establishment

Positive Impacts include:

- Reuse of drainage water will reduce the water demand required from the Damietta Branch
- The proposed modern farming practices and irrigation methods are proposed which will lead to a higher productivity and better quality products

Negative Impacts include:

- Mixing of drainage water with Damietta water will increase the salinity of the irrigation water and will limit the crop selection and may reduce crop yields
- Water shortages of required drainage water are predicted for May and June. Additional sources, such as using the Faraskour drain, are being investigated by the MPWWR.
- The re-use of drainage water, which could potentially be polluted by sewage discharges upstream, could cause an increased health risks for water users
- Drainage water discharge into the wadi and designated drainage areas could lead to habitats invested by mosquitoes, water snails and aquatic weeds.

8-5-3 Impacts Related to Operation of the Establishment

Positive Impacts include:

- The project will result in an increase in employment in the region
- New job opportunities will be provided during project construction and operation

Negative impacts include:

- The high salinity and sodium content of the irrigation water limits the crop selection, and could affect crop yields.
- Heavy metals in the irrigation water are high and could affect crop growth
- Seepage of groundwater contaminated with agro-chemicals could potentially pollute the aquifers in the El Arish region
- High nutrient levels due to indiscriminate fertilizer use could result in excessive growth of aquatic weeds, cause sedimentation of the canals and a reduction in the flow efficiency
- The introduction of Nile water into the North Sinai could pose a serious risk of introducing new diseases, such as malaria and schistosomiasis into the region
- Health problems could be created in the settlements if no proper human waste disposal systems are incorporated
- Re-use of treatment plant effluent could create additional health hazards

8-5-4 Mitigation Measures

The following mitigation measures are proposed to reduce the negative effects of the development on the local environment.

It is recommended that a inland conservation area is established, similar to the protected areas of Lake Bardewill and Zanarik, which can provide protection to the local inland vegetation and wildlife of the North Sinai.

The present action plan for conservation of archaeological sites in North Sinai should be continued during the development of the area in El Sir and El Kawareer Zone. Alternative canals routes should be further investigated during the detailed design stage to prevent the destruction of two known archaeological sites which are presently situated on canal routes.

Management of water quality and quantity in drains and canals is essential for the success of the project. Is important that the telemetry system presently used for the distribution of Nile irrigation water and control of salinity levels is extended to the projects in the North Sinai. Especially since reuse of drainage water is involved. It is recommended that water management strategies are developed using simulation software taking into account physical, hydrological, crop physiological and agronomic processes. The management strategies will require continuous adjustments to allow for changing conditions e.g. changes in water quality, soil conditions and cropping patterns.

Soil management should include irrigation strategies, such as leaching, subsurface drainage, land smoothing, etc. to maintain salinity and sodium levels within the tolerance range of the crops, and soil infiltration rates are not reduced. For the cultivation of citrus the addition of gypsum to the soil maybe required if not enough natural gypsum is available to control sodium effects on these crops

Reduction in heavy metal levels in the irrigation water should be achieved by a stricter enforcement of water quality discharge standards to improve water quality upstream in the Nile and its tributaries. This will at the same time reduce the potential increase in health risks for water users that could be

associated with the re-use of drainage water. Already there is more emphasis on the treatment of wastewater in Egypt and construction of more new treatment plants should improve water quality further.

Channel maintenance programs will need to be developed to prevent aquatic weed infestations in the irrigation and drainage canals, these should include biological and physical control methods. Nutrient levels in drainage water should be kept under control by providing training to farmers in the effective use of fertilizers.

Contamination of drainage water and groundwater by pesticides can also be reduced by raising the awareness of the users through training programs. It is also recommended that pesticides with a high mobility in the soil or which are highly toxic are banned from the project area. Disposal facilities of redundant pesticides and pesticide containers should be set up to prevent indiscriminate dumping of this waste.

Shelter belts and wind breaks should be installed around the settlements and agricultural fields to prevent protect crops from sand storms and moving sand dunes from intruding into the fields. Sand dune stabilization may be required in the heavy sand dune areas using geotextiles and other methods.

If low flowing or still standing shallow surface water bodies develop in Wadi El Arish from drainage water discharged to the flood course, formation of a "base" flow channel may be necessary to provide a controlled flow path for the drainage water.

The spread of schistosomiasis can be restrict by engineering methods to control the host snail populations, these could include such measures as increasing water velocities in channels, providing adequate drainage, emptying out overnight storage reservoirs completely so they do not act as snail nurseries, controlling aquatic weed growth in channels, and chemical control. Malaria control measures should focus on avoiding creating suitable mosquitoes breeding habitats.

Wastewater effluent reused for irrigation should be sufficiently treated to avoid health hazards or use should be restricted to irrigation of e.g. windbreaks, shelter belts, etc.

8-5-5 Monitoring Plan

Water quality and quantities in irrigation and drainage channels before mixing should be monitored and at various other location for the proper management and distribution of irrigation water. Water quality parameters to be monitored continuously are dissolved oxygen, electrical conductivity, temperature and pH.

Groundwater quality and flows in the Study area should also be monitored during operation of the project so the impact of seepage flows and drainage water discharge on the existing aquifers can be determined. Water quality parameters to be monitored regularly should include e.g. electrical conductivity, temperature, pH, nutrient levels, etc.

No up to date information on pesticide levels was available, it is recommended that regular monitoring for pesticides levels be carried out of drainage water and Nile water.

Data on zinc, cadmium and lead levels in the Hadous and Serw drains are currently not collected. It is recommended that the levels of these metals are monitored along with the already collected data on copper, magnesium and iron levels.

Regular monitoring of channels for infestation of host snails of the schistosomiasis parasite is recommended, as well as periodic health checks of the population living in the Project Area to assess the incident rate of the disease.

8-5-6 Further Recommended Studies

A groundwater flow model study should be conducted to predict the impacts of the groundwater seepage and the drainage water discharge via the wadi and other drainage soakage areas on the aquifers near El Arish. This model could later be used for designing groundwater management strategies.

Table 8-1 Project's Cash Flow of Economic Costs and Benefits (Base Case)

Unit: LE

Year in Order	Costs				Benefits			Net Incremental Benefits
	Capital	Recurrent O/M	Recurrent Replacement	Total	Agricultural Production	Agro-based Enterprise	Total	
-5	1,442,294	0	0	1,442,294	0	0	0	-1,442,294
-4	2,163,679	0	0	2,163,679	0	0	0	-2,163,679
-3	5,743,622	0	0	5,743,622	0	0	0	-5,743,622
-2	10,471,339	0	0	10,471,339	0	0	0	-10,471,339
-1	23,630,405	0	0	23,630,405	0	0	0	-23,630,405
0	36,730,346	0	0	36,730,346	0	0	0	-36,730,346
1	51,723,780	0	0	51,723,780	0	0	0	-51,723,780
2	198,835,429	4,324,760	0	203,160,189	0	0	0	-203,160,189
3	644,037,290	8,944,740	0	652,982,030	0	0	0	-652,982,030
4	583,299,692	11,100,330	0	594,400,022	0	0	0	-594,400,022
5	625,201,253	28,438,370	0	653,639,623	0	0	0	-653,639,623
6	344,826,152	74,844,246	0	419,670,398	54,117,136	13,645,320	67,762,456	-351,907,942
7	33,330,640	87,782,027	0	126,112,667	83,845,629	16,249,732	100,095,361	-26,017,306
8	32,048,331	88,506,367	0	120,554,698	199,848,100	29,112,832	228,960,932	108,406,234
9	6,153,824	88,965,553	192,000	95,311,377	280,693,073	36,276,696	316,969,769	221,658,392
10	10,452,291	89,255,840	0	99,708,131	377,817,920	39,245,137	417,063,057	317,354,926
11	27,163,498	90,288,516	0	117,452,014	436,407,288	40,203,261	476,610,549	359,158,535
12	23,337,409	91,415,359	32,410,170	147,162,938	474,336,201	40,392,718	514,728,919	367,565,981
13	14,827,521	92,590,331	0	107,417,852	512,505,333	81,837,321	594,342,654	486,924,802
14	14,827,521	92,788,007	1,545,030	109,160,558	544,484,153	82,026,778	626,510,931	517,350,373
15	0	97,633,545	0	97,633,545	576,832,983	84,572,698	661,405,681	563,772,136
16	10,195,724	97,640,545	0	107,836,269	576,832,983	84,572,698	661,405,681	553,569,412
17	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
18	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
19	0	97,647,450	110,003,640	207,651,090	576,832,983	84,572,698	661,405,681	453,754,591
20	0	97,647,450	32,410,170	130,057,620	576,832,983	84,572,698	661,405,681	531,348,061
21	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
22	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
23	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
24	0	97,647,450	1,540,530	99,187,980	576,832,983	84,572,698	661,405,681	562,217,701
25	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
26	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
27	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
28	0	97,647,450	32,410,170	130,057,620	576,832,983	84,572,698	661,405,681	531,348,061
29	0	97,647,450	342,271,130	439,918,580	576,832,983	84,572,698	661,405,681	221,487,101
30	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
31	0	97,647,450	18,313,600	115,961,050	567,334,001	84,572,698	651,906,699	535,945,649
32	0	97,647,450	16,417,060	114,064,510	568,712,881	84,572,698	653,285,579	539,221,069
33	0	97,647,450	95,225,980	192,873,430	568,698,981	84,572,698	653,271,679	460,398,249
34	0	97,647,450	190,799,210	288,446,660	568,672,571	84,572,698	653,245,269	364,798,609
35	0	97,647,450	24,381,610	122,029,060	570,478,181	84,572,698	655,050,879	533,021,819
36	0	97,647,450	43,641,030	141,288,480	572,269,907	84,572,698	656,842,605	515,574,125
37	0	97,647,450	12,259,720	109,907,170	574,024,627	84,572,698	658,597,325	548,690,155
38	0	97,647,450	9,324,830	106,972,280	575,611,173	84,572,698	660,183,871	553,211,591
39	0	97,647,450	9,461,560	107,109,010	576,832,983	84,572,698	661,405,681	554,295,671
40	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
41	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
42	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
43	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
44	0	97,647,450	34,165,950	131,813,400	576,832,983	84,572,698	661,405,681	529,592,281
45	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
46	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
47	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
48	0	97,647,450	0	97,647,450	576,832,983	84,572,698	661,405,681	563,758,231
49	0	97,647,450	109,971,640	207,619,090	576,832,983	84,572,698	661,405,681	453,786,591
50	0	97,647,450	-95,308,765	2,338,685	576,832,983	84,572,698	661,405,681	659,066,996

EIRR= 11.25%

NPV= 190,603,810

Table 8-2 Environmental Evaluation Matrix Including Proposed Mitigation Measures

(Evaluation Matrix is based on JICA Environmental Guidelines)

Environmental Item	Evaluation	Issue	Mitigation
Social Environment			
1. Resettlement	-B	New settlers will live under harsh conditions, in a remote area	Provide good public facilities and access routes
2. Economic Activity	+A	Increased economic activity, creation of employment opportunities	-Beneficial
3. Traffic and Public Facility	-B	Increase in transportation activities: people, agricultural products and supplies Increase in demand for drinking water and electricity	Provide new roads and access routes Provide additional water and power supply
4. Split of Communities	-B	Bedouins will need to share the area with new settlers Nomadic Bedouins will lose some grazing land for livestock	Provide incentives for local population to participate Provision for easy access to drinking water and fodder for livestock
5. Cultural Property	-B	Possible destruction of two known historical sites	Change proposed canal route Develop a management plan for the excavation and conservation of historic sites in cooperation with the SCA
6. Water rights/Rights of Common	-B	Existing population uses groundwater and tanker water	Provide additional piped water supply for drinking water
7. Public Health Conditions	-B	Introduction of new water borne diseases Reuse of treated wastewater for irrigation could introduce infectious diseases	Provide regular weed control in canals, introduce engineering means to reduce infestation of parasites Provide proper treatment, use for irrigation of wind breaks only
8. Waste	-B	Additional wastewater and refuse produced by new population	Construct wastewater treatment ponds and controlled land fills
Natural Environment			
9. Topography	-B	Levelling of some areas to allow irrigation Soil Erosion	Avoid construction activities during May (windy season) Provide temporary erosion control by physically covering
10. Soil	-A	Salinity, infiltration rate Sodium effects	Provide leaching to prevent built up of salts in the soil Monitor chemical composition of soil regularly Add gypsum where necessary
11. Groundwater	-C	Seepage of drainage water may affect Quaternary aquifer at El Arish	Geo hydrological study required to establish management strategies
12. Hydrological Situation	-C	Introduction of irrigation will result in drainage water that may affect groundwater and surface water flows	Geo hydrological study required to establish management strategies

Environmental Item	Evaluation	Issue	Mitigation
13. Fauna and Flora	-B +B	Displacement of local fauna, no endangered species are known in the area. Creation of new forage area for migratory birds	Create an inland conservation area in the region
14. Meteorology	D		
15. Landscape	+A	Change of desert land into agricultural land	Enhancement of landscape
Pollution			
16. Air Pollution	-B	During construction wind induced soil erosion maybe increased	Prevent construction activities during May (windy season)
17. Water Pollution	-B	Pollution of irrigation water during mixing with drainage water Discharge of drainage water, will have high salinity , high nutrient content, high BOD (if untreated wastewater is discharged to drains)	Provide water quality monitoring system Discharge high saline water to sea Manage fertiliser use to reduce nutrients in water Construct treatment plants
18. Soil Contamination	-B	Indiscriminate use of agro chemicals could result in contamination of soil Disposal excess pesticide Booster pump fuel leakage	Management of pesticide use and fertilizer use to prevent contamination Provide safe disposal facilities for pesticides Provide spill containment at pumps
19. Noise and Vibration	-B D	Minor impact during construction No impact during operation	Impact insignificant, no major inhabited areas are present
20. Weeds	-B	Infestation of canals with aquatic weeds	Reduce nutrients in water by management of fertilizer use Provide regular maintenance of canals
21. Sedimentation/ Desertification	-B	Sedimentation of canals due to wind induced soil erosion Desertification can affect cultivated lands Sand storms can affect crops	Provide physical erosion control by covering Contain sand dunes by installing palisades, planting vegetation Provide protection using windbreaks and shelter belts Introduce strip cropping

A = Serious impact expected
B = Some impact expected
C = Extent of impact not known
D = No impact
+/- positive or negative impact

ANNEX

ANNEX

References

The Agricultural Cooperative Law, No.122, 1980
- Arab Republic of Egypt

Set of Laws and Decrees on Pollution, Includes Law Number 93 of 1962, Law 48 of 1982 and Law 57 of 1978
- Middle East Library for Economic Services

The Executive Regulations of the Law on Environment, Includes Decrees and Annexes to Law Number 4
- Middle East Library for Economic Services

Land Master Plan, Final Report, Main Report, Nov. 1986
- Euroconsult and Pater Consultant

Feasibility Study, Tina Plain Development Project, (Draft Final Report), Jun. 1988
- GARPAD/Atkins Land & Water Management

Feasibility Study, North Sinai Integrated Development Project, Aug. 1989
- GARPAD/JICA

Report, Northern Sinai Agricultural Development Project, Dec. 1989
- FAO/World Bank, Investment Centre

Study on North Sinai Integrated Rural Development Project, (Final Report), 1989
- JICA

Preliminary Feasibility Study, Provision of Fundamental Structures for Reclaiming 400,000 Feddans in Sinai, Feb. 1990
- MPWWR

Feasibility Study, North Sinai Agricultural Development Project, (Draft Final Report), Apr. 1991
- GARPAD/Atkins Land & Water Management

North Sinai Agriculture Development Project Environmental Impact Assessment, Volume 1 Main Report, Jan. 1992
- Euroconsult and Pacer and Darwish Engineers

Summary of the Third Five Year Plan (1992-1996), 1992
- Ministry of Planning

North Sinai Groundwater Resources Study in the Arab Republic of Egypt, Final Report, Executive Summary, Oct. 1992
- JICA

Australian Water Guidelines for Fresh and Marine Waters, Nov. 1992
- Australian and New Zealand Environmental Council

Arab Republic of Egypt, An Agricultural Strategy for the 1990s, 1993
- World Bank Country Study

Statistical North Sinai Governorate, 1993
- North Sinai Governorate Office

Report of the FAO/World Bank Cooperative Programme Investment Centre, 1993
- FAO

Drainage Water, Volume 3 Drainage Water Reuse Projects, Mar. 1993
- DRI

The Guinness Guide to Nature in Danger, 1993
- Noel Simon and The World Conservation Monitoring Centre Cambridge Guinness Publishing

Preliminary Feasibility Study, An Area of 135,000 Feddans in El Sier and El Kawarir Region of El Arish Valley, Dec. 1994
- MPWWR/Ministry of Agriculture and Land Reclamation

National Project for the Development of Sinai, Sep. 1994
- Ministry of Planning

Main Plan for Water Resources Development in Sinai Peninsula, 1994
- Ministry of Public Works and Water Resources

Law Number 4 of 1994, Promulgating a Law Concerning Environment
- Middle East Library for Economic Services

Feasibility Study, Updating for 400,000 Feddans Reclamation in North Sinai, Dec. 1995
- MPWWR

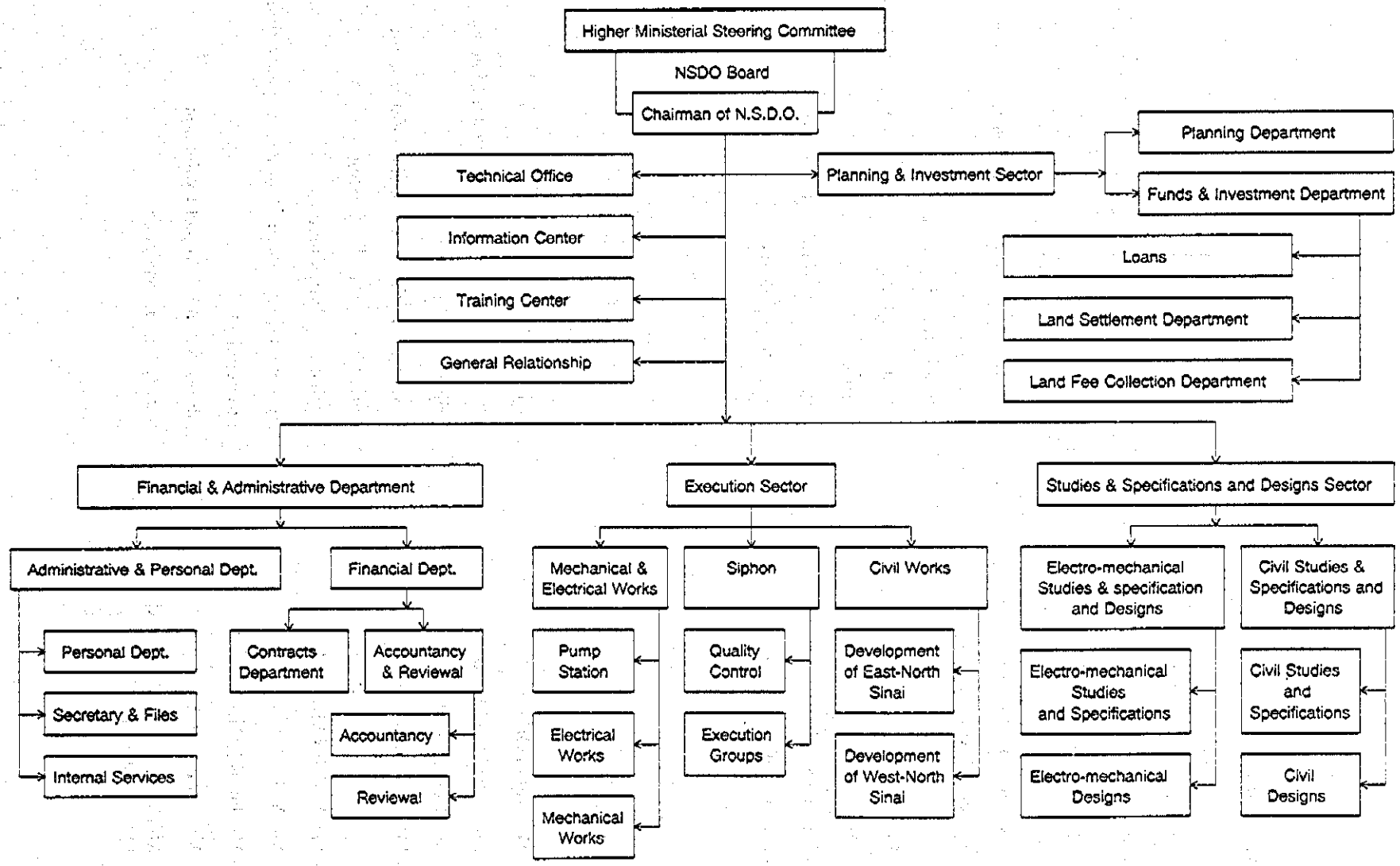
Mubarak's National Project for New Graduates, 1995
- Ministry of Agriculture and Land Reclamation

Statistical Year Book, Jun. 1995
- Central Agency for Public Mobilization and Statics (CAPMAS)

North Sinai Year Book, 1995
- North Sinai Governorate Office

A Report on Agricultural Extension in Egypt, 1996
- Asharaf Abou EL-ELA

ORGANIZATION CHART OF NSDO



List of Counterpart Personnels and Study Team

Counterpart

Name	Expertise
- Mr. Mohamed Nabil Nagiub	Team Leader
- Mr. Mohamed Sameh Mohamed	Water Conveyance Planning / Water Management
- Mr. Ibrahim Abu El-Naga	ditto
- Mr. Mohamed I. El-Desoky	Irrigation and Drainage
- Mr. Emad El-Awady	Resettlement Planning / Social Infrastructure
- Mr. Samir Ahmed Mohamed	Agriculture / Agro-Processing / Agricultural Infrastructure
- Mr. Youssef Hassan M.	Agricultural Extension / Farmers' Organization
- Mr. Amer Deiab	Environment
- Mr. Bahaa El-Din Ghonam	Agro-Economy / Project Evaluation
- Mr. Ashraf El-Shaer	Survey Superintendence

Study Team

Name	Expertise
- Mr. Kunio OHTA	Team Leader
- Mr. Tatsuhiko MORI	Water Conveyance Planning / Water Management
- Mr. Kosei HASHIGUCHI	Irrigation and Drainage
- Mr. Gunjiro OZAWA	Resettlement Planning / Social Infrastructure
- Mr. Hideo HARA	Agriculture / Agro-Processing
- Mr. Yudai NAKAZAWA	Agricultural Infrastructure
- Mr. Yukio SATO	Agricultural Extension / Farmers' Organization
- Mr. Jan KAMER	Environment
- Mr. Tamio OTA	Agro-Economy / Project Evaluation
- Mr. Masakuni NAKAYAMA / Mr. Kentaro USUDA	Survey Superintendence

JICA