ENVIRONMENTAL IMPACT ASSESSMENT Study For Abu Qurqas – Asuit Onshore Gas Pipeline Project

Egyptian Natural Gas Co. (GASCO)

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August 2006

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Executive & Non Technical Summary

This Environmental Impact Assessment (EIA) has been prepared to comply with the Egyptian Environmental Regulations (Law No. 4, 1994 and its Executive Regulations), in line with the principles with the *European Communities/Directive 97/11/EC* guidelines and ***GASCO's*** Health, Safety and Environment Policy (*Appendix (5)*).

The scope of work includes construction of Abu Qrqas – Asuit pipeline. This pipeline will be constructed for the purpose of:

- ***Feed number of cities by Natural Gas (Malawy, Dashlot, Dayrot, Manflot, Asuit, Elwalidia ,and New Asuit)***
- ***Kosiya Industrial area.***
- ***Asuit Petroleum Company***
- ***Asuit Cement Company***
- ***Arab El-Oamra Industrial Area***
- ***El-Safa Industrial Area***

The route of pipeline starts in the agriculture area of the back area of Abu Qurqas Sugar Plant. ***(long. 30o 48' 48.9" lat. 27o 54' 48.3")*** heads to the western south near Hour city from south site crossing Bahr Yossef, continue in the same direction to reach Asuit western road near El-Dlengat city, then parallel with the high voltage lines east Asuit western road, then to the south direction near Dashlot and Mera Cities, then parallel to the High voltage lines to the eastern south near ELdier EL-Mahrok and Khashaba Building, Banie Sharan, Banie Adie El-bahariea, to reach Asuit Breck Cement plant and finally to Asuit city in the east direction. ***(long. 31^o 09' 27.2" lat. 27^o 10' 11.8")***.

All positive and negative impacts were analyzed, and suitable mitigation measures were designed for the negative impacts.

The undertaken project has major environmental and socio-economic positive impacts. From the environmental point of view, the use of natural gas (green fuel) will help in conserving the surrounding air quality due to the following reasons:

- Natural gas produces neither particulates nor significant quantities of sulphur dioxide (SO_2) and/or nitrogen oxides.
- Only minute quantities of unburned residues of combustion, carbon monoxide (CO) or hydrocarbons remain after burning of the natural gas.
- Natural gas is clean also in terms of trace elements as it does not contain more than minute quantities of the heavy metals encountered in other fuels.
- The properties of natural gas have advantages with regard to the prevention of acid rain and ozone depletion.

From the socio-economic point of view, the proposed project represents an economic attractive option because of the following reasons:

- This project will effectively improve the Egyptian natural gas transmission infrastructure.
- It represents a core element for transporting natural gas to Upper Egypt zones.
- It will provide the mentioned areas with the required fuel supply.

Moreover, pipelines are a safe and reliable method of transportation of natural gas. Also they have a very low accident rate compared with other transportation methods (e.g. manual handling for gas cylinders).

In addition, the construction phase of the proposed project Such man power employed will improve the economic profile of the inhabitants of neighboring areas.

1. ABOUT THE EIA

This Environmental Impact Assessment (EIA) has been presented in compliance with the Egyptian Environmental Regulations and ***GASCO/EGAS*** Environmental Conscious Policy. It has been designed specifically to support the future environmental management of the area and to be a reference document for the life of the project. This assessment describes the project activities, the current and proposed Egyptian environmental legislation, and the existing environmental features around the study area. It evaluates the potential impact of the operations and identifies the mitigation procedures to be followed in order to eliminate any risk of contamination through construction and operation phases. It provides the framework for the future environmental management of the area in order to minimize the negative impacts of construction and operations.

A description of the existing environment in the study area provides details on physical, chemical and biological features.

The contents of this report cover the findings of the environmental impact assessment of the proposed project. It deals with several stages of the project as outlined in the sections through this report:

Section 1: **Introduction**

It gives description of the aim of the EIA, the system of the review and the history of EIA. It also set out the objectives of establishing EIA for the project.

Section 2: **Environmental Legislation And Regulations**

It discusses the policy, legal, and administrative framework within which the EA is carried out. Also, it explains the environmental requirements of any co financiers. Identifies relevant international environmental agreements to which the country is a party.

Section 3: **Project Description**

It gives description of the project location and surrounding environment. It also includes an assessment of activities of the proposed project facilities.

Section 4: **Existing Environment**

This section gives analysis of the environmental data regarding the surrounding environment to identify any particular areas of significant environmental sensitivity.

Section 5: **Analysis of Alternatives**

Systematically compares feasible alternatives to the proposed project site, technology, design and operation including the "no action" situation.

Section 6: **Environmental Impacts**

It gives prediction of the likely effective potential environmental impacts and assessment of their significance.

Section 7: **Environmental Mitigation & Management**

It describes of the mitigation measures during construction and operation to minimize potential environmental negative impacts from the different project stages.

Section 8: **Monitoring Plan**

Environmental monitoring during project implementation provides information about the key environmental aspects of the project, particularly the environmental impacts of the project and the effectiveness of mitigation measures.

Section 9: **Conclusions**

This section segregate the conclusions derived through the EIA process.

Section 10: **Public Consultation**

This section discusses the public consultations that were held. It details the response of public and landowners towards the project, supported with photos.

2. Fundamentals

2.1. The Preliminary Environmental Assessment

Prior to the EIA, a preliminary phase was carried out in the purpose of evaluating the selected route of the pipeline from the environmental point of view; this phase is named the *Preliminary Environmental Assessment (Appendix (2)).*

The Preliminary Environmental Assessment study outlines the findings of the site survey of the routes of the pipelines and gives overall conclusion of how far the ROWs are comparable with the environmental aspects. The preliminary EA is carried out to help the responsible people for the engineering design of the project during the engineering designing phase.

Following are the objectives of conducting the preliminary Environmental Assessment Study for the proposed onshore pipelines:

- Carry out screening study and identification of key environmental issues/ aspects.
- Identify the potential impacts/ risks associated with each section of the pipeline route.
- Preparation of the preliminary environmental assessment screening report as per the field visit and desk studies, in compliance with ***GASCO/EGAS*** regulations and European Investment Bank regulations.

In addition, the preliminary EA screening will assist ***GASCO/EGAS*** to fulfill the requirements of European Investment Bank and considered as terms of reference for subsequent studies.

2.2. THE SITE VISIT

A site visit was held for the route of the pipeline on 16-17/8/2006. The need of the site visit is to examine the route to record the surrounding environments along the line and to specify the environmental aspects which must be considered.

The methodology adopted for the site visit is as following:

- Review of all the technical data and maps.

- Determination of the environmental aspects that shall be considered during the site visit. It was found that eight environmental aspects must be examined along the pipeline route, which are:

  1.Environmental protected areas.
  2.Water bodies.
  3.Agriculture / Land use
  4.Existing corridor.
  5.Topography / Seismic.
  6.Social sensitivities.
  7.Archaeological / Historical sites.
  8.Third party interference.

- Dividing the route into sections for the ease of the examining the whole route. In the proposed pipeline, valve rooms locations were considered for the sectioning the route.
- Preparing a checklist for the sections to record the site visit notes versus the chosen environmental aspects.
- Taking photographs as pictorial records.
- Consulting the concerning parties such as:

  – *EEAA*
  – *Ministry of Irrigation & Water Resources*
  – *Ministry of Agriculture*
  – *Military*
  – *Authority of Railway*
  – *Authority of Roads & Bridges*
  – *Authority of Archeology*

2.3. MAJOR ENVIRONMENTAL IMPACTS

The assessment of the potential environmental impacts of the proposed pipeline project revealed that the main potential sources of impact are almost exclusively associated with the construction phase which is temporary. Operational impacts could only arise through unforeseen accidents since the operating company (***GASCO***) will take all necessary precautions against such incidents to protect pipeline from damage and maintain its integrity.

In general, the basic environmental impacts associated with the construction and operation phase of the proposed pipeline could be summarized as following:

- Temporary disturbance to the surrounding nature (desert, canals, roads, agricultural and urban areas, etc.) from the pipeline crossings.
- Temporary disturbance to local community.
- Discharge of air pollutants due to the following:
    - Potential pipeline rupture or leak.
    - Small controlled amount of natural gas which commonly releases during operating safety devices and maintenance procedures.

The potential environmental impacts from the construction phase will be temporary and limited to the construction sites, but even these areas will be rapidly rehabilitated.

There is a low risk of major accidental gas release. However, ***GASCO*** will take all necessary precautions against such incidents and a contingency plan will be in place.

The mitigation measures cover the whole life cycle of the proposed project in order to minimize the expected environmental consequences as far as possible. These mitigation measures are covered in details in the report.

A briefing of the most significant impacts is listed below.

2.3.1. HYDROSTATIC TEST WATER

The hydrostatic test is one that being done for the pipeline to examine its quality and being free from any leak or defects. It is done by filling the pipeline with water which is subject to high pressure equal to 1.5 times to the pressure of the gas that will pass in the pipe. The pressure is left for 24 hours, meanwhile patrolling along the pipe is done to check any leakage in pressure along the pipeline.

In general, the impact arising from test is resembled in the water used in the test on three axes: (*a) source of water; (b) the place of disposal of the water after test, and; (c) the additive to the water like the corrosion inhibitor*. The receptors of the hydrostatic water

are the soil, the surface water or the groundwater or all of them; this is in case that the water was discharged to them.

As for our project, the impact significance of this test is low. The water used for this test is fresh water taken from the *Ibrahimia canal* and shall be gradually discharged into drainage canal. No discharge to soil or ground water fresh water bodies shall take place. Also, no chemical additives, corrosion inhibitors or biocides shall be added to water. So, the impact of this test is of low magnitude and short duration; since the test last only for 24 hours. However, sampling and analysis for the water after test as well as the drainage canal to assure that no change in the water features that may affect the quality of water before discharging into the drainage canal(s), shall be done.

2.3.2. SOLID WASTE

Solid waste in this project arises only from the construction phase. The solid waste resembled in the sands, stones and rubbles resulting from the trenching the tunnels of the pipeline and flattening the route, empty containers, scraps, garbage, wood and waste from the welding works. The receptors in this case are the soil and/or the surface water if this waste being thrown on them. The impact resembled in affecting badly the quality of the water bodies besides its aesthetic value if these waste were thrown on the ground or into the surface water.

As for our project, the soil, sands and rubbles that shall arise will be reused in backfilling of the pipeline after laying in the trench. The areas along the pipeline shall be restored as before. Regarding the garbage and other types of solid waste, ***GASCO*** shall use an authorized contractor for collecting and disposal of this waste in coordination with the local authorities. Therefore, the project will have a short-term and low magnitude impact on aesthetic.

2.3.3. THE PIPELINE THROUGH THE AGRICULTURAL LANDS

The pipeline extends through the agricultural lands for 14 Km. the receptor is the farms and cultivated areas. The impact resembled in removing of the fertile soil in these areas.

The project has a short-term, localized and moderate magnitude on the agricultural lands. The impact is restricted on the construction phase, so it is a short term impact. Removal of the soil shall not be done in an aggressor manner; it shall be localized limited to the pathway of the pipeline. Also, the soil arising from the trenching process shall be reused in the backfilling after laying the pipeline. The areas shall be re-habilitated and restored as before. This shall not affect the fertility or quality of the soil and it is capable to be re-vegetated since the trench is as deep as 1.5 m. Besides, the owners of these farms shall be compensated according to the decree No. 318/1993 declared by the Ministry of Agriculture and Reclamation. Appendix (7)

2.3.4. CROSSING OF WATER BODIES

The pipeline project encounters crossing of number of water bodies; such as Bahr Yossif. The impact resembled in disturbance on the water bodies such as turbidity affecting the sediment and marine funa besides the risk from laying the pipeline on the canal bed. However, crossing of water bodies and main canals in this project shall not be done by the traditional open-cut method. It shall be done using a new technology named *Horizontal Directional Drilling (HDD)*. Horizontal Directional Drilling (HDD) is a trench-less methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut. HDD can be implemented with very little disruption to surface activities, requires less working space, and may be performed more quickly than open-cut methods. In this technique, a tunnel is drilled beneath the bed of the water body. From one side, a rig is drilling with an angle between 5° and 30° associated with equipment pulling the pipeline till being settled in the tunnel then the rig exits with the equipment to the other side.

Using this technique, the project has low magnitude and short-term impact and does not significantly affecting the water bodies.

2.4. GENERAL CONCLUSION

Natural gas will be used primarily as a substitute for Mazout, therefore it can be concluded that this project will greatly contribute in conserving the air quality through maximizing the use of natural gas which is much cleaner than other conventional fuels in different industrial and domestic sectors. Additionally, the project is economically attractive because the natural gas is cheaper than other fuel sources, it does not require extensive chemical transformation before utilization and the process of replacing other fuels by natural gas in existing installations poses no major problem. On the other hand, short and long term risks to the environment of the proposed pipeline project will cause no major consequences to the ecosystem. Moreover, implementation of the recommended mitigation measures and management plan will significantly reduce the potential environmental risks associated with the proposed project.

1.0

Introduction

1.0 Introduction

In 1986, member countries of the "Organization for Economic Co-operation and Development" OECD agreed to ensure that:

> "*development assistance projects and programmes which, because of their nature, size and/or location, could significantly affect the environment, should be assessed at as early a stage as possible and to an appropriate degree from an environmental standpoint" [OECD 1985]*.

The aim of EIA's is to examine the environmental effects, adverse and beneficial, of new projects and to ensure that these effects are taken into account in an appropriate way at all stages of the project cycle.

Also, environmental impact assessment can be defined as the systematic examination of the unintended consequences of a development project or programme, with a view to reducing or mitigating the negative consequences and capitalizing on the positive ones. The basic purpose of EIA is to strengthen the development process. That is to improve development, not prevent it. Unfortunately, the perception is some times otherwise. Environmental assessment is sometimes seen as "anti" development or opposed to growth. But this ought not to be the case. The fundamental reason for carrying out an EIA is to try to ensure that development is sustainable - "to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs".

Thus, Environment and development are really two sides of the same coin. On the one hand, development cannot take place without its affecting the environment or context in which it occurs. On the other hand, if the environment is affected, then that results in over

exploitation of the natural resources and limits the range of development opportunities available in the future.

In other words, environmental impacts are not necessary a sign of a poorly designed project. On the contrary, some such impacts may be inevitable in most development projects and programmes.

Socio economic development programs and population growth during the 1980s have stimulated the increase in demand for petroleum products, natural gas and electricity, which grew at average annual rates of 5 %, 15 % and 10.5 % respectively.

Egypt's energy policy has therefore been developed to promote the expansion of natural gas and to substitute liquid fuels in various economic sectors.

This is to realize the following objectives:

- Achieve self-sufficiency in LPG.
- Establish important strategy industries (e.g. cement, fertlizer, and steel industries) that rely on natural gas as a convenient fuel.
- Reduce petroleum imports of some products (e.g. gas oil) that are used in power generation.
- Reduce environmental pollution.

To realize these objectives, EGAS has pursued a set of strategies that include:

- Developing a gas infrastructure.

- Expanding the local gas market and developing gas demand all over Egypt

- Prompting investment in gas exploration and production.

- Encouraging private sector participation in different aspects of the gas industry.

1.1 DEVELOPMENT OF NATURAL GAS CONSUMPTION

Due to the sharp increased in gas production as a result of more gas reserve development and the promotion of natural gas use in key consuming sectors, gas consumption growth rates have experienced a boom since the early 1980's.

The main natural gas consuming sectors are:

- Industrial sector.

- Electricity sector.

- Residential & commercial sector.

1.2 ENVIRONMENTAL CONSIDERATIONS OF NATURAL GAS

Natural gas is an environmentally benign fuel. It is composed of at least 90% methane and small amounts of other hydrocarbons (e.g. ethane, propane and butane). Since methane is a relatively pure components, natural gas produces much lower emission levels of CO, CO_2 , NO and hydrocarbons than competing fuels when burned. In addition, the lack of sulfur produces no (or negligible) SO emission during burning.

Based on the above mentioned facts, it can be concluded that natural gas switching policy is considered to be a mitigation option for green house gas emissions.

1.3 OBJECTIVES

The main objectives of this EIA are to:

- Develop a complete understanding and a clear definition, of the proposed project including both construction and operation phases.
- Gain a complete understanding of the affected environment, including both biophysical and socio-economic characteristics.
- Conduct an assessment of the potential impacts from the proposed project.

- Recommend the required mitigation measures to eliminate and / or minimize the potential environmental impacts.
- Report the results of the study and produce the required documented EIA.

1.4 WORK

The work accomplished to produce the report includes:

- Data concerning the prevailing environmental conditions of the study area was collected such as topography, geology, hydrology,etc.
- During the baseline environmental survey the general ecosystem of the study area was described and evaluated.
- The pertinent regulations and standards governing the environmental quality was reviewed and presented.
- The expected environmental consequences from the proposed project were assessed.
- The mitigation measures with an integrated plan for managing the identified environmental hazards and effects were accomplished.
- An environmental monitoring plan for the proposed project was suggested.

2.0

Environmental Legislation

2.0 Environmental Legislation

2.1 INTRODUCTION

The proposed project is subject to a variety of Egyptian regulatory requirements and policies in accordance to the published Egyptian laws. This section illustrates the permits required for the construction and operation of the project from the different agencies, governorates and municipalities. It also briefly describes the responsibilities and obligations of each agency and gives shortcuts on the laws enforced by them and most relevant to the project..

Because the Environmental Impact Assessment (EIA) of a project is mainly required by the Egyptian Environmental Affairs Agency (EEAA) and the Egyptian Natural Gas Holding Company (EGAS), found herein this section an overview of the requirements of the guidelines of both EEAA and EGPC (EGAS) concerning EIA. Also special attention was paid to Law 4/1994 (Environment Law) and its Executive Regulations (ER) issued by the Prime Minister's Decree No. 338 of 1995. The articles of the law and that of the ER which are most relevant to the project are explained in this section. In addition, the maximum permissible limits of the emissions and maximum exposure periods are outlined below.

This section also illustrates the requirements of the *European Communities/Directive 97/11/EC* guidelines. The EA process of this project is done in line with the principles of these guidelines.

2.2. ADMINISTRATIVE RESPONSIBILITIES OF EGYPTIAN AGENCIES

Besides to their ultimate major responsibilities in the different sectors, a lot of Egyptian Ministries and Authorities have an implicit mandate on the environment. They are responsible for the enforcement of a set of laws which either directly or indirectly give hand in the protection of the environment. But, when dealing specifically with EIA, its purpose, role, and how officially to be established before the commencement of the project for the licensing of the construction and operation activities, the responsibilities of three major authorities should be particularly outlined, the Egyptian Environmental Affairs Agency (EEAA), the Egyptian Natural Gas Holding Company (EGAS) and the Governorates and Local Authorities.

2.2.1. EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY (EEAA)

The EEAA is established by virtue of law No.4 of the year 1994. The EEAA is responsible for the enforcement of law 4/1994 for the environment, environmental management plans, environmental data collection, pollution prevention & control and adaptation of International Environmental Agreements. It operates as the central environmental enforcement agency and coordinates between government entities. Regarding the EIA, responsibilities of EEAA are summarized in the following:

- EEAA is responsible, in agreement with EGPC, for issue a decree identifying the elements, designs, specifications and bases (EIA Guidelines) in the light of which the EGPC shall assess the environmental impact of the project for which the license is required.

- The Board of directors of the EEAA shall develop the selection criteria for consultants to be assigned by the EEAA to review the EIA.
- On receiving the documents of EIA sent by the developer via the Competent Administrative Authority (EGAS), EEAA undertakes the evaluation of these documents and submits to EGPC its opinion and possible proposals for measures to be taken in order to ensure the protection of the environment within *60 days* of the EEAA's receipt of the completed documents. Failure to do so is considered as an approval of the assessment.
- Legally, the developer has the right to appeal the final results of EEAA about the EIA evaluation when the decision is either *approval with certain condition* or *disapproval*. In such a case, EEAA is responsible for the invitation of the Appeal Committee to convene within fifteen days as of the date of the Agency's receipt of the written objection.

2.2.2. EGYPTIAN NATURAL GAS HOLDING COMPANY (EGAS)

The EGAS is responsible for licensing gas pipelines construction & operation and processing activities. Concerning the EIA, EGAS has particular responsibilities represented by the following:

- The EGPC /EGAS, in coordination with EEAA, have a role in issuing the EIA Guidelines.
- On receiving the EIA documents from the developer, the EGAS should undertake the register of the documents and check whether information included in the EIA study complies with the EIA guidelines. The EGAS should formally submit the applicant's documents to the EEAA for review and evaluation.
- The EGAS is responsible for the notification of the developer by registered letter with an acknowledgment of receipt about the final result of the evaluation of EIA when received from the EEAA.
- After that, EGAS is responsible to ensure the implementation of the decision.

2.2.3. GOVERNORATES

The governorates have the responsibility for implementation, monitoring and enforcement of the national laws. They are also responsible for the specification of a land to serve as a landfill for dumping of any waste materials either industrial or domestic. EEAA is responsible for the establishment of regional offices in each governorate. These offices, in coordination with the governorate, shall undertake the requirement and evaluation of the EIAs of projects proposed to be established in the governorate. It is worth mentioning that the governorates have the right to refuse the establishment or operations of any project within its boundaries whenever find that the project seriously affects the residents or drastically consumes its natural resources.

2.3. LAW NO. 4 OF 1994 AND ITS EXECUTIVE REGULATIONS

2.3.1 LAW NO. 4 OF 1994

Within the frame work of sustainable development and the increasing need to develop the country without causing any depletion or deterioration to our limited natural resources, Egypt has issued Law No. 4 of 1994 concerning the protection of the environment, the objectives of this law has not confined to addressing pollution problems emanating from existing establishments, but also to involve new establishments/factories including expansions of the existing ones.

Because EIA aims to insure the protection and conservation of the environment and natural resources including human health aspects against uncontrolled development, Law 4/1994 states that new establishments or projects, expansions or renovations of existing establishments must be subjected to and environmental impact assessment before a permit is issued.

Measures concerning the assessment of environmental impact of establishments or projects are stipulated in articles No.: 19, 20, 21, 22 & 23 of Law 4/1994.

Article 19

An assessment of the environmental impact of establishments requiring licenses shall be undertaken by the competent administrative authority or the licensing authority. The study shall include the elements, designs, specifications and the bases as determined by EEAA in agreement with the competent administrative authority. The Executive Regulations of this law shall specify the establishments that should comply with the regulations of this Article

Article 20

The competent administrative authorities, or the licensing authority shall send a copy of the environmental impact assessment study mentioned in the previous article to EEAA in order to present its opinion. EEAA will submit suggestions required to be implemented in the field of preparations and systems necessary for treating negative environmental effects. Such authority will carry out and verify the implementation of EEAA's suggestions. EEAA is required to reply to the competent administrative authority or the licensing authority stating its opinion within a maximum of 60 days of receipt of the study, otherwise, the evaluation is considered to be accepted by EEAA.

Article 21

The competent administrative authority shall inform the owner of the establishment of the result of the evaluation through a certified registered letter. The owner of the establishment may appeal such evaluation in writing thirty days after receiving the evaluation results to a committee to be established by a decision from the Minister of Environmental Affairs. Representatives of EEAA, and the competent administrative authority or the licensing authority, and the owner of the establishment will be members of this committee. The Executive Regulations shall specify the assignments of this committee and its operating procedures as well as the complaint procedures.

Article 22

According to the provisions of this law, owners of establishments shall keep writing records of the environmental impact of their establishment's activities. The Executive Regulations will determine the standard form of the required written document as well as its time table to assure the compliance of establishments with such a record. EEAA is designated to review the data of these written records to ensure that they are truthful, to take the required samples, to analyze them, and to measure the environmental impact of the norms established for the protection of the environment. In case of any violation, EEAA will notify the competent administrative authority to mandate the owner of the establishment to rapidly correct these violations. If the owner does not comply within 60 days form the date of the notification EEAA in agreement with the competent administrative authority, will take the required legal and legislative procedures to shut down the activities of the establishment and will request adequate compensation to trait the harm resulting from these violations.

Article 23

Extensions and renovations of existing establishments shall be subject to the same rules mentioned in Articles 19, 20, 21 and 22 of this law.

2.3.2. PRIME MINISTER'S DECREE NO. 338 OF THE YEAR 1995

On February 28,1995, the Egyptian Official Journal "al-wakaa al masriya" has published the Prime Minister's Decree No. 338 promulgating the Executive Regulations of the Law for Environment, Law No. 4 of 1994.

The objectives of these regulations represented by, but not limited to, the following:

- To specify the establishments that should undertake an assessment of the environmental impact.
- To specify the assignments of the Appeal Committee and its operating procedures as well as the complaint procedures.
- To define the specifications and norms which must be compiled with by industrial establishments allowed discharging treated degradable polluted substances.
- To specify the non-degradable polluting substances which are prohibited from discharge into the water environment.
- To specify the permissible limits of air pollutants in emissions.
- To specify the permissible limits of sound intensity and safe exposure periods.

To regulate the procedures and conditions that shall be followed in cases of construction of any installations on or near the seashore.

Besides the aforementioned, articles of Law 4/1994 concerning the EIA, they are complemented by the provisions of articles No. 10, 11, 12, 13, 14, 15, 16, 17, 18 & 19 of the Executive Regulations (ER).

Article 10

The competent administrative body or the body that grants permits shall assess the environmental impact of establishments that are requesting permits, according to the elements, designs, specifications and bases which are issued by the EEAA in agreement with the competent administrative body and which shall be reviewed by EEAA, whenever necessary.

Article 11

The provisions of article 10 of these Executive Regulations shall apply to the establishments given in Annex 2 of these Executive Regulations.

Article 12

It shall be mandatory for permit applicants to attach to their applications a statement, duly filled out, containing the data included in the form prepared by the EEAA in agreement with the competent administrative authority. The EEAA shall prepare a register including copies of this form and the assessment results as well as the EEAA requirements form establishment owners.

Article 13

The EEAA may resort to any experts whose names are included in a list to be issued by the EEAA according to the criteria set by the EEAA's board of directors, so that such experts may give their opinions on the assessment of the environmental impact of an establishment intended to be constructed and for which a permit is being requested.

Article 14

The competent administrative body shall notify owners of establishments of the assessment results by registered letter with return receipt requested. The owner is entitled to object in writing to this result before the Permanent Review Committee with in a period of thirty days from the date of his notification. This committee shall be formed by decree by the competent minister for the environment. It shall be chaired by a counselor from the state council and the membership is as follows:

- A Representative from EEAA nominated by its Executive Head.
- The establishment's owner or his representative with an official power of attorney.
- A representative from the concerned body or the body granting permits unless it is the competent body.
- Three experts to be selected as members of the committee for three years upon their nomination by the EEAA's executive head.

The committee may form, from among its members and others, sub-committees to study the objections referred to them and to present reports thereof to the committee. The said committee may also, when carrying out its duties, resort to whomever they consider advisable for that purpose. It shall issue its decision within sixty days from the date of receipt of the completed objection documents.

Article 15

The permanent review committee, described above in article 14 of these executive regulations, shall be concerned with hearing the objections to assessment results that are submitted or referred to it or with the proposals that revue execution as seemed necessary by EEAA. It shall issue its opinion regarding these objections with respect to the standard prescribed in article 10 of these Executive Regulations. Objections shall be submitted in writing to the EEAA and shall include the reasons for the objection and the legal and scientific grounds on which the project owner substantiates his objection. He shall also attach there to the documents that he seems support the reasons for his objection.

Article 16

The committee shall convince upon an invitation form the EEAA's Executive Head within 15 days from the date of the EEAA's receipt of the written objection. A EEAA representative nominated by the Executive Head shall draw up the meeting's minutes. He shall not have a note in the discussions taking place. The committee's decision shall be issued by simple majority of votes. The meeting's minutes shall be signed by all attending members.

Article 17

Establishment owners shall, according to the provisions of these regulations, maintain a register to record the extent of their establishment's impact on the environment as follows:
Emissions there from or discharges.
Specifications of discharges after the treatment process, and the efficiency of utilized treatment units.
Procedures of follow-up and environmental safety applied at the establishment.
Periodical tests and measurements and their results.
The name of the person in charge of follow-up.
The register shall be prepared according to the form described in Annex 3 of these Executive Regulations.
Establishment owners or their representatives are obliged to notify the EEAA immediately, why registered letter with return receipt requested, of any deviation in the criteria and specifications of emitted or discharged pollutants and the procedures taken to rectify them.

Article 18

The EEAA shall be competent for the follow-up of the registered data to ascertain its conformity with actual fact. It shall also take the necessary samples and conduct the appropriate tests that show the impact establishment activities on the environment and establishment compliance with the criteria set for protecting the environment.
Such follow-up shall be undertaken every year. A report on each follow-up shall be filed with the competent sector within the EEAA, shall be signed by the officer in charge of follow-up tests, and shall include dates. If any violations are discovered, the EEAA will notify the competent administrative authority which shall demand for the establishment's owner, by registered letter with return receipt requested, expeditious rectification of such violations according to industry norms. If he fails to accomplish this within 60 days, the Executive Head is entitled, in coordination with the competent administrative authority, to take the following measures:

1. to close down the establishment.
2. to suspend the damaging activity.
3. to file a lawsuit demanding suitable compensation to remedy the damages resulting from the violation.

Establishments shall maintain the registers, daily completed, on a permanent basis according to the form in article 17 of these Executive Regulations. Whenever new data is registered, establishments shall maintain it for a period of ten years effective from the date of the signature of the EEAA representative in the register confirming its review.

Article 19

Expansion or renewals of existing establishments are subject to the same provisions as prescribed in articles 19, 20, 21 and 22 of the aforementioned law for the environment.
Changes in production patterns of the operating machines or an increase in the number of staff in a way that exceeds the capacity of the working place or any essential modifications to an establishment's buildings are considered to be expansions and reveals. Particularly, essential modifications concerning the ventilation system or the change of work location or other similar modifications that may result in harmful effects on the environment or on the establishment's staff, are considered to be expansions and renewals.

2.3.3 STANDARDS OF ANTICIPATED IMPACTS AS SPECIFIED IN ER

The legislative framework for air, water & soil pollution is included in Law No. 4/1994 and its Executive Regulations (Decree 388/95). The law establishes regulations for air quality to protect health and environment. The ER, as described before, specifies the maximum permissible limits of pollutants which may be generated from the various industrial activities and affect the environment parameters and defines the standards that must be obeyed. Hereinafter, a discussion of the limits of the pollutants that are likely generated from the proposed project and illustration of the maximum standards in accordance to those mentioned in the Executive Regulations.

2.3.3.1 ATMOSPHERIC EMISSIONS AND AIR QUALITY

The Egyptian law for environment (Law 4/1994) stipulates that for granting a permit for the establishment of a project, the site chosen should be appropriate for its activity to ensure compliance with the accepted limits of air pollutants, and that it should be observed that the total pollution resulting from all the establishments in one area lies within the permissible limits. Thus the project, while practicing its activities, must ensure that no leaked or emitted air pollutants exceed the maximum permissible levels specified in the Executive Regulations of the law. The law also prohibited the use of machines, engines or vehicles that emit exhaust fumes exceeding the limits set by the Executive Regulations. Tables (2.1, 2.2 & 2.3) set out the maximum permissible limits of air pollutants in emission as passed in the ER of the Law.

Table (2.1) The Maximum Limits Of Emission From Fuel Burning Sources

POLLUTANT	MAXIMUM PERMISSIBLE LIMIT
Smoke	250 mg/m^3
Suspended Ashes	
Sources in urban areas or near residential areas.	250 mg/m^3
Sources far from inhabited urban areas	500 mg/m^3
Burning of waste	500 mg/m^3
Sulfur Dioxide	
Existing	4000 mg/m^3
New	2500 mg/m^3
Aldehydes	
Burning of waste	20 mg/m^3
Carbon Monoxide	
Existing	4000 mg/m^3
New	2500 mg/ m^3

Table (2.2) Maximum Limits Of Outdoor Air Pollutants (micrograms/m^3)

POLLUTANT	MAXIMUM LIMIT	EXPOSURE PERIOD
Sulfur Dioxide	350 150 60	1 hr 24 hrs 1 year
Carbon Monoxide	30 mg/m^3 10 mg/m^3	1 hr 8 hrs
Nitrogen Dioxide	400 150	1 hr 24 hrs
Ozone	200 120	1 hr 8 hrs
Suspended Particulate *(to be measured as black smoke)*	150 60	24 hrs 1 yr
Total Suspended Particulate	230 90	24 hrs 1yr
Thoracic Particles (PM_{10})	70	24 hrs
Lead	1	1yr

Table (2.3) Permissible Limits of Air Pollutants In Emissions-Total Particulate

KIND OF ACTIVITY	MAXIMUM LIMIT FOR EMISSIONS (MG/ M3 IN EXHAUST)
Petroleum Industries and Oil Refining.	100

2.3.3.2 NOISE LEVELS

Law 4/1994 stipulates that all entities while performing production or other activities and using tools or equipment must abide by the permissible limits of sound intensity. Authorities issuing licenses for noise emitting sources must monitor and ensure that total sound produced from fixed sources within one area being within the permissible limits. The permissible limits of sound intensity and the permissible time limits for exposure to said sound as defined by ER are set out in tables (2.4, 2.5, 2.6 & 2.7).

Table (2.4) Maximum Permissible Limits Of Sound Intensity Inside Places Of Productive Activities

NO.	TYPE PLACE / ACTIVITY	MAXIMUM ALLOWABLE SOUND LEVEL DECIBEL (A)*
1	Work premises with up to 8 hour shifts with the aim of limiting noise hazards on hearing	90
2	Places of work for the follow up, measuring and adjustment of operations, with high performance.	80
3	Places of work with computers or typewriters or similar equipment.	65
4	Places of work with computers or typewriters or similar equipment	70
5	Places of work for activities that require routine mental concentration.	60

* A : intensity of noise not exceeding 90 dB during a daily work shift

Table (2.5) The Maximum Permissible Periods For Exposure To Noise At Work Premises

Noise Intensity level decibel (A)	95	100	105	110	115
Period of Exposures (Hours)	4	2	1	1/2	¼

Table (2.6) Maximum Permissible Exposure Periods (Number Of Knocks During The Daily Shift) Depending On The Noise Intensity

Noise intensity (Decibels)	Number of Permissible Knocks During Daily Working Hours
135	300
130	1000
125	3000
120	10000
115	30000

Table (2.7) Maximum Permissible Limits For Noise Intensity In Different Zones

TYPE OF ZONE	PERMISSIBLE LIMITS FOR NOISE

	INTENSITY DECIBEL (A)*					
	Day		Evening		Night	
	from	to	from	to	from	to
Commercial, administrative and downtown area	55	65	50	60	45	55

Cont'd Table (1.7)

TYPE OF ZONE	PERMISSIBLE LIMITS FOR NOISE INTENSITY DECIBEL (A)*					
	Day		Evening		Night	
	from	to	from	to	from	to
Residential areas including some workshops or commercial businesses or on public roads	50	60	45	55	40	50
Residential areas in the city	45	55	40	50	35	45
Residential suburbs having low traffic flow	40	50	35	45	30	40
Rural residential areas (hospitals and gardens)	35	45	30	40	25	35
Industrial areas (Heavy industries)	60	70	55	65	50	60

* A : intensity of noise not exceeding 90 dB during a daily work shift
Day time: form 7 am to 6 pm
Evening time: from 6 pm to 10 pm
Night time: from 10 pm to 7 am

2.3.3.3 WASTE MANAGEMENT

Law 4/1994 strictly prohibits the dumping, treating or burning of garbage and solid waste except in especially designated places which must be far from residential, industrial and agricultural areas and waterways.

Law 4/1994 also stipulates that when carrying out activities requiring exploration, digging, construction or demolition work, or while transporting waste substances or soil, necessary precautions must be taken to store or transport this waste in a safe way to prevent it from being dispersed. The licensing authority for building or demolition should monitor the following:

- Safe stacking of waste on site so that no impediment to traffic and pedestrian movement may take place.

- Transportation of waste substances and soil resulting from digging, demolishing and constructing work in special containers or receptacles by using licensed trucks for this purpose.

2.2.3.4 WATER POLLUTION

Giving the consideration to the provisions of Law No. 48 of 1982 concerning the protection of the River Nile, and its Executive Regulations, the analysis of effluent generated from the hydrostatic test shall be done versus the parameters indicated hereunder.

Table (2.8) Maximum Permissible Limits and Specifications of water quality

PARAMETER	MAXIMUM LIMITS AND SPECIFICATIONS (MG/L- UNLESS OTHERWISE INDICATED)
Temperature	Not more than 10 degrees over existing level
pH	6-9
Color	Free of colored agents
Biochemical Oxygen Demand	60
Chemical Oxygen Demand (Dichromate)	100
Total Dissolved Solids	2000

2.4. EEAA/ EGPC GUIDELINES FOR EIA

The Executive Regulations relating to Law No. 4 identifies establishments or projects which must be subjected to an Environmental Impact Assessment based upon the following main principles:

1. Type of activity performed by the establishment.
2. Extent of natural resources exploitation.
3. Location of the establishment.
4. Type of energy used to operate the establishment.

The numbers of projects subject to this provision are many and will form a heavy burned to administrative authorities and the EEAA. A flexible system for the management of EIA projects has therefore been developed in order to use limited economic and technical resources in the best possible way.

The system encompasses a flexible screening system and projects are classified into three groups or classes reflecting different levels of Environmental Impact Assessment according to severity of possible environmental impacts.

1. ***Category 'A'*** list projects for establishments/projects with minor environmental impact:
2. ***Category 'B'*** list projects for establishments/projects which may result in substantial environmental impact.
3. ***Category 'C'*** list projects for establishments/projects which require complete EIA due to their potential impacts.

With respect to the ***GASCO*** project, a full EIA is required as the onshore pipeline more than 50km project is categorized under the Category 'C' as described in the Egyptian Guidelines for the Environmental Impact Assessment issued by EEAA.

2. 5. THE APPEAL SYSTEM

The decision taken by the authorities regarding the assessment and/or the proposals required to be implemented as considered necessary by the EEAA can be appealed to the Permanent Appeals Committee by developer within 30 days after receiving such decision. The classification according to environmental impacts of the project (*Category 'A'*, *Category 'B'* or *Category 'C'*) cannot be appealed.

The appealed must be presented in writing to the EEAA and sent by registered letter with acknowledgment of receipt. The appeal must fulfill reasons for the

objection, legal and scientific grounds on the part of the project's owner. Documents supporting the appeal shall be attached.

The Permanent Appeals Committee has to make its decision within 60 days from the date of receiving the appeal documents.

2.6. PERMITS REQUIRED FOR THE CONSTRUCTION AND OPERATION OF THE PIPELINES

For the purpose of constructing and operating the pipelines, ***GASCO*** shall obtain number of permits from several governorates and authorities mainly:

AUTHORITY/GOVERNORATE	ABU QURQAS – ASUIT
Asuit Governorate	√
Al-Minya Governorate	√
Ministry of Irrigation & Water Resources	√
Ministry of Agriculture	√
Military	√
Authority of Railway	√
Authority of Roads & Bridges	√
Authority of Archeology	√

2.7. THE EUROPEAN COMMISSION GUIDELINES

The EIA study shall be conducted according to the Egyptian Environment Law 4/94 and the EIA guidelines issued by the EEAA/EGPC and shall be in line with the principles of the European Commission Guidelines.

Environmental Impact Assessment (EIA) is a key instrument of European Union environmental policy. Since passage of the first EIA Directive in 1985 (Directive85/337/EEC) both the law and the practice of EIA have evolved.

Article 2 of the Directives requires that "*Member States shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects.*"

Article 3 states *"The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in*

accordance with Articles 4 to 11, the direct and indirect effects of a project on the following factors:

- *Human beings, fauna and flora;*
- *Soil, water, air, climate and the landscape;*
- *Material assests and the cultural heritage;*
- *The interaction between the factors mentioned in the first, second and third indents."*

Article 4(1) requires that *"…projects listed in Annex I shall be made subject to an assessment…"* EIA is therefore mandatory for the categories of projects listed in Annex I. The Annex I define about 21 categories of projects for which EIA is mandatory. *"Pipelines for the transport of gas, oil or chemicals with a diameter of more than 800 mm and a length of more than 40 Km"* is listed in Annex I. ***Thus, Abu Qurqas – Asuit Pipeline are subjected to EIA which is mandatory by the European Commission Directives.***

Article 4(2) requires that for *"…projects listed in Annex II, the Member States shall determine through (a) a case-by-case examination, or (b) thresholds and criteria set by the Member State whether the project shall be made subject to an assessment…..…..Member States may decide to apply both procedures referred to in (a) and (b)"*

Article 6(2) this requires *"… Member States shall ensure that any request for development consent and any information gathered pursuant to Article 5 are made available to the public within a reasonable time in order to express an opinion before the development consent is granted".*

Article 6(3) this states *"The detailed arrangements for such information and consultation shall be in particular, depending on the particular characteristics of the projects or sites concerned:*

- *Determine the public concerned,*
- *Specify the places where the information can be consulted,*
- *Specify the way in which the public may be informed, …,*
- *Fix appropriate time limits for the various stages of the procedures in order to ensure that a decision is taken within a reasonable period".*

Article 8 then requires that "*The results of consultations and information gathered pursuant to [the EIA procedure] must be taken into consideration in the development consent procedure*".

3.0

Project Description

3.0 Project Description

3.1 INTRODUCTION

The route of pipeline starts in the agriculture area of the back area of Abu Qurqas Sugar Plant. ***(long. 30o 48' 48.9" lat. 27o 54' 48.3")*** heads to the western south near Hour city from south site crossing Bahr Yossef, continue in the same direction to reach Asuit western road near El-Dlengat city, then parallel with the high voltage lines east Asuit western road, then to the south direction near Dashlot and Mera Cities, then parallel to the High voltage lines to the eastern south near ELdier EL-Mahrok and Khashaba Building, Banie Sharan, Banie Adie El-bahariea, to reach Asuit Breck Cement plant and finally to Asuit city in the east direction. ***(long. 31^{o} 09' 27.2" lat. 27^{o} 10' 11.8")***.

The purpose of construction Abu Qurqas – Asuit 32″, 116 km pipeline as follows:

- ***Feed number of cities by Natural Gas (Malawy, Dashlot, Dayrot, Manflot, Asuit, Elwalidia ,and New Asuit)***
- ***Kosiya Industrial area.***
- ***Asuit Petroleum Company***
- ***Asuit Cement Company***
- ***Arab El-Oamra Industrial Area***
- ***El-Safa Industrial Area***

The pipeline shall be designed, constructed and tested in general accordance with ASME 31.8 and relevant ***GASCO/EGAS*** codes and standards. Thus, it will be free from significant defects.

Its continued fitness for purpose requires that it shall be operated in accordance with ASME 31.8, ***GASCO/EGAS*** relevant codes and standards and specific factors. One of the main factors is that it is protected against corrosion.

3.2. SCOPE

These procedures set down the actions to be taken to implement the policy of assessing the effectiveness of the corrosion protection for a newly commissioned pipeline.

The results of these procedures will form the bases of the cathodic protection finger print for the new pipeline. The results of these finger print procedures will enable the Engineer to compare future results with this finger print.

The actions set down in these Procedures are minimum requirements which do not preclude the application of additional procedures or the application of new approved procedures as they become available, at the discretion of the Engineer.

GENERAL DESIGN ASPECTS AND STANDARDS

- API 5L For line pipes
- API 6D for valves
- ANSI B 16.9 and MSS SP 75 for fittings
- ANSI B 16.5 and MSS SP 44 for flanges
- ASME B 31.8 and ***GASCO/EGAS*** Local regulations for construction and pipeline design.

3.3. PIPELINE SPECIFICATION

Pipeline material: API 5L X60PSL2

3.4. GAS ANALYSIS & VOLUMETRIC RATES

The natural gas that is to be transported by the proposed pipeline was chemically analyzed for contents and the specification are summarized in the following table:

Table (3.1) Gas Specification

COMPONENT	RICH MOL%	LEAN MOL%
N_2	0.83	0.11
CO_2	3.44	0.1.
C_1	77.21	99.73
C_2	11.74	0.05
C_3	4.73	0.01
IC_4	0.76	0.00
NC_4	0.98	0.00
IC_5	0.16	0.00
NC_5	0.08	0.00
C_6+	0.08	0.00
TOTAL	100	100
GHV (BTU/SCF)	1176.59	1008.41
Specific Gravity (Air=1)	0.7251	0.5557

3.5. DESIGN

A pipeline which has been designed constructed and tested in general accordance with ASME 31.8 and relevant ***GASCO/EGAS*** codes and standards will be free from significant defects. Its continued fitness for purpose requires that it shall be operated in accordance with ASME 31.8, ***GASCO/EGAS*** relevant codes and standards and specific factors given in a) to e) inclusive.

a) The pipeline is protected against corrosion.
b) The pipeline is protected against external interference.
c) The pipeline is not adversely influenced by ground movement, from natural or man made causes (e.g. geological faults and mining).
d) Modification, maintenance and repair of the pipeline is carried out in such a way that its integrity is preserved.
e) The pipeline is not adversely affected by fatigue.

The factors a) to d) above inclusive, routine inspection and preventive measures shall be implemented.

3.6. TIME SCHEDULE

Generally, it is to be expected that working hours will be restricted to the daylight hours except in the case of the river crossing that involves a continuous process and could last up to two months.

The time schedule of the pipeline construction shall be as follows:

Table (3.2) Time Schedule of the Project

P I P E L I N E		
ENGINEERING WORK		
SURVEY	01DEC06	30APR08
DESIGN AND SPECIFICATION	30DEC06	01JUL07
WORK PERMITS AND LAND COMPANSATION	11DEC06	29NOV07
PROCUREMENT WORK		
1ST MRO FOR PIPES & BENDS	15DEC06	
1ST MRO FOR PIPELINESBULKSAND VALVES	18DEC06	
PROVIDING FUNDING	01JAN07	
TEND. & P.O. FOR PIPES & BENDS	01JAN07	21MAR07
TEND. & P.O. FOR PIPELINE BULKS AND VALVES	15FEB07	15JUL07
PIPES AND BENDS DELIVERY	01JUL07	28SEP07
PIPELINE BULKS AND VALVES DLIVERY	15SEP07	20NOV07
CONSTRUCTION WORK		
PIPELINE COATING	16JUL07	31OCT07
PIPELINE CONSTRUCTION & HYDRO-TESTING	16JUL07	31JAN07

CATHODIC PROTECTION	01JUL07	31MAR07
DRYING, COMMISSIONING & STARTUP	31JAN07	15NOV07
R E D U C T I O N & M E T E R I N G S T A T I O N		
ENGINEERING WORK		
ENGINEERING WORK	01JAN07	31OCT07
PROCUREMENT WORK		
PROCUREMENT WORK	02MAR07	30JUN07
CONSTRUCTION WORK		
CONSTRUCTION WORK	01SEP07	03MAR07
S C A D A		
CONSTRUCTION WORK		
ENGINEERING WORK	01FEB07	31MAY07
PROCUREMENT WORK	01JUN07	31DEC07
CONSTRUCTION WORK	01JAN08	31MAR08

Gas volumetric rate along all sections: 13 million m^3/day

3.7. NUMBER OF CASUALS, LABOURS AND ENGINEERS WORKING IN THE PROJECT

Table (3.3) Number of casuals, labours and engineers working in the project

S	Title	Qty.	S	Title	Qty.
1	Project Manager	**1**	2	Civil Forman	**2**
3	Project Engineer	**2**	4	Surveyor	**3**
5	Technical Office Engineer	**2**	6	H.S.E Forman	**3**
7	Managerial Supervisor	**1**	8	Welders Forman	**2**
9	Director	**2**	10	Riggers Forman	**2**
11	Accountant	**1**	12	Welder	**30**
13	Doctor	**1**	14	X-Ray Technician	**10**
15	Wear House Keeper	**2**	16	Fitters Forman	**1**
17	Photographer	**1**	18	S.P Technician	**2**

19	Mail Boy	**1**	20	Coating Technician	**4**
21	Purchaser	**1**	22	Transportation Form	**2**
23	Security	**2**	24	Car Driver	**6**
25	Radio	**1**	26	Pick Up Driver	**8**
27	Pick-up Driver	**10**	28	Equipment Forman	**1**
29	House Keeper	**4**	30	Heavy Gear Driver	**29**
31	Photographer	**1**	32	Light Gear Driver	**13**
33	Buffet Boy	**3**	34	Maintenance Engineer	**3**
35	Chef	**4**	36	Maintenance Forman	**2**
37	Carpenter	**1**	38	Equipments Technician	**10**
39	Plumber	**1**	40	Equipment Electrician	**7**
41	Guard	**5**	42	Pipes Fitter	**5**
43	Electrician	**1**	44	Fitting Electrician	**5**
45	Assistant Chef	**4**	46	Assistant Surveyor	**2**
47	Waiter	**4**	48	Drawer	**1**
49	Executive Manager	**1**	50	Grinder	**35**
51	Civil Engineer	**3**	52	Rigger	**24**
53	Mechanical Engineer	**4**	54	Fire Fighter	**4**
55	Q.C Engineer	**4**	56	Tire Worker	**1**
57	H.S.E Engineer	**1**	58	Grease Worker	**1**
59	Survey Engineer	**1**	60	Power Electrician	**4**
61	Painting Engineer	**1**	62	C.P Engineer	**1**

**** Note:** The residence of project stuff will be at Ismalia City*

3.8. TYPES & NUMBER OF EQUIPMENTS USED DURING CONSTRUCTION

Table (3.4) Types & number of equipments used during the construction phase

S	Equipment	Qty.
1	Pick Up	4
2	Double Cabin Car 4*4	2
3	Double Cabin Car	3

4	Private Car	1
5	Bus (26 Persons)	12
6	Puller	4
7	Generator 200-250 K.V	2
8	Crane 50 Ton.	1
9	Side Boom D8	10
10	Pipe Welder	2
11	Pipe Carrier	1
12	Welding Machine	25
13	Low Bed	2
14	Water Tank Car	1
15	Solar Tank Car	1
16	Agriculture Excavator	5
17	Truck	6
18	Excavator	5
19	Loader	2
20	Bulldozer D8	2
21	Trailer	2
22	Compressor	3
23	Sand Plaster	4
24	Cement Mixer	1
25	Boom Excavator	2
26	Ambulance	1
27	Compression Pump	1
28	Filling Pump	1
29	Handling Pump	1
30	Test Compressor	1

3.9. CONSTRUCTION

Construction will be carried out by qualified and approved contractors under the supervisions and monitoring of ***GASCO/EGAS*** personnels.

The work will broadly be split into the following phases:

- Right of Way.
- Pipe storage and stringing of pipe.
- Trenching.
- Welding and weld inspection.
- Wrapping of joints.
- Visual wrap inspection.
- Holiday Detection
- Air tests.
- Ditching.
- Installation of valves.
- Tie-ins including valve installations etc.
- Backfilling.
- Cleaning.
- Gauging Pig.
- Hydro test.
- Additional air test.
- Dewatering.
- Magnetic cleaning pig.
- Geometric pig.
- Drying & commissioning.

Brief descriptions of the key activities contained in each phase are outlined below.

3.10. R.O.W.

The Company and Contractor will manage access to the construction areas through permits. The Company is responsible for providing permits and documents etc. for access to the Right of Way for the construction of the pipeline and all crossings. Clearing the R.O.W. and preparing it for the construction work shall be done by the Contractor at his own expense.

The Contractor shall ensure that they have written clearance form the Company's Archaeologist indicating the location of any suspected remains/relics before commencing excavation.

The Contractor shall avoid undue damage to crops, trees, roads and properties on the Right of Way. The Contractor is responsible for all damages to crops, buildings, installations and properties adjacent to the Right of Way which may occur, however caused, due to the construction works. Any expenses for such damages shall be borne by the Contractor.

Where any irrigation or drainage installations (Canals, ditches, etc.) are encountered on the Right of Way the Contractor shall provide and install temporary connections so as to avoid interruption of, or variation in the required flow of water. This will be to the satisfaction of the authority in control of the waterways. The Contractor shall as soon as possible construct or reinstate to the original condition and the satisfaction of the Company, all structures and installations connected with irrigation which have previously been disturbed by the works.

The Contractor shall prepare the Right of Way in a manner allowing ditching, stringing and laying of the pipeline correctly without injuring pipe coating, or endangering human life.

The Contractor shall maintain the necessary day and night warning signs to protect persons, automotive vehicles…etc. The Contractor shall provide night watchmen at

known crossing points of the pipeline and at all other areas where items of value are stored.

3.11. PIPE STORAGE & STRINGING

In coordination with the administrative authority (i.e. Asuit Governorate), the Company will carefully select the needed sites for storing the pipes along the whole pipeline route. The Contractor will pay great attention in adapting appropriate procedures (approved by ***GASCO***) during transporting, handling, and stacking pipes to ensure that no damage whatsoever results to the pipe or coating.

The Contractor will string the pipes in such a manner as to leave gaps across the Right of Way where requested to facilitate movement of livestock or access for vehicles, personnel etc. Stringing will not take place further than 10 km ahead of the location at which welding is taking place.

3.12. TRENCHING AND EXCAVATION ACTIVITIES

The contractor shall excavate and maintain the trench in which the pipeline is to be laid exactly along the marked route as established by the survey and not less than the following dimensions with +10% where required by works in some areas:

Depth to the pipe top elevation below the ground level:

- **1m for all types of land other than rocky area.**
- **0.7m for rocky areas.**
- **Width of trench D+0.4m (where D is the outer diameter of pipe with coating).**

For Abu Qurqas – Asuit, expected 288000 m^3 of desert land sand and agriculture land soil.

The Contractor may only deviate from the marked line with the written permission of the Company.

The ditch bottom shall be uniformly graded and free from coarse rocks or gravel or any similar bodies which could injure the pipeline coating.

3.13. PIPELINE LAYING TECHNIQUE

Pipe is not laid in a stressed condition; lowering operation shall be undertaken in such a manner to minimize induced stresses due to construction procedures, due consideration shall be given to the timing of these operation with respect to maximum and minimum ambient temperature and ASME B 31.8 the trench shall be maintained in dry conditions during lowering and back filling operation.

The following steps must be followed:

1) Three side booms shall be used for the lowering in operation.
2) Side booms shall work from the R.O.W side of the trench and to be positioned 15m apart and 3m from the trench centre line.
3) The portion of pipe line between trench and the bank shall be supported by side booms holding the line in a gentle 'S' curve.
4) The vertical and horizontal alignment of the pipe shall conform to the contour of the trench and there shall be no undue sag, twist or bend.
5) The 1st side boom shall position its boom over the trench centreline with the 2nd and 3rd side booms positioning their booms to suit.
6) The 1st side boom shall lower the line into the trench carefully, the 2nd and 3rd side booms shall lower in sequence to maintain a smooth line 'S' curve.
7) When the 1st side boom has completed lowering the pipeline, riggers shall unhook the sling and the 1st side boom shall move 15m beyond the 3rd side boom and hook-up the sling to its new position.
8) The sequence (5, 6&7) shall be repeated with the 2nd and 3rd side booms as the line is lowered and the side boom advance in sequence along the pipeline.

The lowering-in Forman shall be the person with sole responsibility for controlling the movement of the equipment.

3.14. METHODS OF PIPE TESTING

3.14.1. WELDING AND WELD INSPECTION

a) Welders qualification test.
b) Non destructive tests:

- Radiographic test (R.T. 100%)
- Ultrasonic test (U.T. 10%)
- Diepenetrant test for weldlet, sweepolet and nippolet (½", 1")

c) Destructive tests (Mechanical Test), includes:

- Tensile test
- Bending test
- Macro etching test
- Impact test
- Nick break test
- Hardness test

Every 200 weld joint we made this test (0.5% of all welds) in the laboratory of the faculty of engineering.

3.14.2. COATING

a) Pealing test (for weld joints coating).
b) Holiday detector test (for all pipe line coating).

3.14.3. PAINTING (VALVE ROOMS)

For measuring the quality and thickness of the layers of painting.

All the waste disposal of above mentioned tests will be handled with subcontractors certified for the job.

3.15. DITCHING

The Contractor shall excavate and maintain the trench in which the pipeline is to be laid exactly along the marked route as established by the survey and not less than the following dimensions with + 10% where required by works in some areas

Depth to the pipe top elevation below the general ground level

1 m for all types of land other than rocky area

0.7 m for rocky areas.

Width of trench

D + 0.4 m

Where D is the outer diameter of pipe with coating.

Angle of trench

Rocky area- vertically cut

Agricultural areas - 20° to vertical

Desert areas:

Compacted sand - 40° to vertical

Running sand - 70° to vertical

The ditch bottom shall be uniformly graded and free from coarse rocks or grave or any similar bodies which could injure the pipeline coating.

At locations with irregular ground elevations (contours) additional excavation may be necessary to eliminate undue bending of the pipe.

Where the route of the pipeline crosses with other underground utility lines, the trench shall be deepened. The pipeline shall be installed below or above existing lines or cables in accordance with drawings approved by the company.

Procedures and minimum clearances are given in Local Regulation L.R.l.6.5.C&S Proximity of GASCO Gas Business Pipelines to Other Services, must be followed.

Where the route of the pipeline crosses roads, railways, canals and rivers, the requirements specified in Local Regulations L.R. 1.5.C&S - Canal & River Crossing and L.R 1.6 C&S – Road & Rail crossing, must be followed.

3.16. IMPACT PROTECTION

In normal circumstances, impact protection measures shall only be provided on pipeline crossings as required in the above mentioned Local Regulations, and the protection measures shall be undertaken as described in these Local Regulations.

The pipeline route would have been checked in accordance with criteria for population density proximity distances to buildings, roads, location classes .etc, as defined in Local Regulation L.R. 1.2. C&S - Design & Construction of Pipelines Proximity Criteria

Where it is not possible to meet this criteria, shall impact protection be designed to meet the requirement of Local Regulation L.R. 1.6.5. C&S.

3.17. SPECIFICATIONS FOR CATHODIC PROTECTION

3.17.1. DESIGN

After consideration of the options in proprietary designs available the type currently use by ***GASCO*** is generally satisfactory so this type shall continue to be used, but modifications to prevent loss of cover plates is recommended.

3.17.2. CABLING

Standardized cabling arrangements shall be used throughout the pipeline network.

3.17.3. LOCATION AND SPACING

Test points shall be located at spacing not generally exceeding 2 Km to both provide sufficient test points for routine monitoring and also to facilitate the carrying out of close interval potential surveys.

Test points shall be specified at:

a) Insulation Joints.
b) Sleeves.
c) Major crossings (e.g. roads, railways, canals and rivers).
d) Interference points (e.g. D.C. traction)

All tests facilities shall be accessible

3.17.4 REFERENCE NUMBERS

Each test point shall be given a unique reference number as per the cathodic protection schedule for the pipeline section.

3.18. LOWERING AND BACKFILLING OF A PIPELINE

Lowering of pipeline shall only be carried out following a successful test of the whole of the coating by the holiday detector and insuring that the testing is 100% passed (voltage according to the coating specifications) and free from damage or any pinholes. The certification will be issued and signed by the contractor to confirm a satisfactory test.

The bottom of the trench must be cleaned of any rocks, stones or hard objects. The trench shall be padded with a minimum of 20 cm of sieved sand.

Wide non abrasive belts shall be used in all lowering operations and care shall be taken when removing the belts from around the coated pipe. Any damage caused to the pipe coating during the lowering operation shall be repaired before lowering the pipe in the ditch.

No lowering operations shall be undertaken except in the presence of the company or their representative. During this operation special care shall be taken to ensure; that the pipe coating sustains no damage and that the pipe is not laid in a stressed condition.

Lowering operations shall be under taken in such a manner to minimise induced stresses due to construction procedures. Due consideration shall be given to the

Company who must be satisfied that the pipe is evenly, bedded throughout its length upon the bottom of the trench and is not riding upon stones or other objects etc.

The trench shall be backfilled within 48 hours after lowering of pipe. Initial backfill will be to a minimum height 20 cm. of sieved sand. The trench shall be clear of any rocks stones or hard objects, the trench shall be padded with 20 cm of sieved sand. Above and around the pipe a minimum of 20 cm sieved sand backfill must be compacted around the pipe to provide protection from the remainder of the backfill. The backfill will be thoroughly compacted by wet tamping in 15 cm layers.

The backfill shall normally be crowned to a height of not less than 20 cm. above the adjacent ground level.

Backfilling of trenches through roads shall be carried out immediately after the pipe has been laid and with material as above. The backfill shall be compacted in layers not exceeding 15 cm and finished level with the road surface. The road surface shall be finally restored to the same condition as before work started.

Backfilling of crossings must take place immediately after the pipe has been laid and tested. The trench shall be clear of any rocks stones or hard objects, the trench Shall be padded with a minimum of 20 cm of sieved sand.

Above and around the pipe a minimum of 20 cm sieved sand backfill must be compacted around the pipe to provide protection from the remainder of the backfill. The backfill will be thoroughly compacted by wet tamping in 15 cm layers.

3.19. REINSTATEMENT OF THE RIGHT OF WAY AND SITE

As soon as the pipe is laid and backfilled, the Contractor shall reinstate and clean up the right-o-way.

All creeks, water courses, wells, siphons, drains, streams, ditches and irrigation channels shall be reinstated to their former condition and if necessary their banks shall be pitched with stone and/or faced with gabions to prevent washing out or erosion.

The stripped top soil shall be replaced carefully in position after the completion of the pipe laying operation.

All walls, fences, tracks, roads etc. shall be reinstated to their original condition.

Excess excavated material to be removed and disposed of in line with local regulations. Reinstatement shall be carried out within one week of backfilling of the section backfilled.

3.20. PIGGING METHODS

T20 contractor shall clean, gauge, and repair the pipeline after construction immediately. Clean water will be the test medium.

3.21. CLEANING FLUSHING AND GAUGING

- The pipeline shall be swabbed six times with air driven foam bodied pigs or rubber cupped bi-directional pigs until it become clean of foreign material, then cleaned with clean water at a flow rate determined by the company for 24 hours, at least, it shall then immediately be gauged with an air driven gauge pig, fitted with an aluminium gauging plate having a diameter equal to 95% of the internal diameter of the pipe for above 300mm and 90% for 300mm and below, temporary scraper station shall be supplied by contractor for stage testing.

The discharge will be:

- A) small amount of dust from cleaning and will be disposed to industrial dump.
- B) Water from flushing and will be disposed to industrial drain sewage.

3.22. HYDROSTATIC TESTING

- Water shall be clean fresh water and free from any substance which may be harmful to pipe material.
- Fitter of sufficient capacity to accommodate the filling capacity of the pumps shall be installed between the water source and the suction flange of the pump and shall be kept in good order all the time of the operations (mesh 20). Static pressure will be maintained by the lines for 24 hours with no unexplainable drop in pressure for test to be acceptable.

- A pressure recording instrument shall be connected to the pipeline for the duration of the test.
- Hydrostatic testing must be followed by dewatering and gauging, the pipeline must not be left water in it.
- The pipeline will be tested in two sections; the water used in the first section will be tested to show the possibility of using it in the second section.
- There is no need to use corrosion inhibitors.
- The steps of the hydrostatic test are as following:
  - A 'by direction' is placed in the beginning of the pipeline before water flushing.
  - The pipeline is filled with fresh clean water by use of pumps. Filters are placed between the pumps and the pipeline to remove any contaminants to enter to the pipeline.
  - The by direction is moving in the entering water inside the pipeline to guarantee the emptiness of the pipeline from air.
  - The by direction comes out from the receiver trap.
  - Assure that there are no 'air pockets' inside the valve rooms.
  - The pressure is raised inside the pipeline till reaching 50% of the required pressure for the test; for example: if the required pressure is 105 bar, then the pressure is raised to 52.5 bar.
  - The pressure is stopped for 12 hours. Patrolling on the pipeline and the valve rooms to ensure the absence of any leakage.
  - After 12 hours, the pressure is raised again till reaching to 105 bar.

- The pressure is for 24 hours observed and recorded on a chart recorded.
- After checking and being sure that the pressure is stable for 24 hours, the pressure is lowered to 0 bars.
- The receiver trap is opened again and the 'by direction' is placed for sweeping the water.
- There is no need for using corrosion inhibitor in the hydrostatic test for the following reasons:
    - The water used in the test is clean freshwater (*NaCl=3%*) not sea water.
    - The pipes are internally coated with anti-corrosion substances that don't be affected by the pigging.
    - The test duration is short; 24 hours, then the pipelines is emptied of the water after.

The water that will be used in this test shall be taken from the *Bahr Yossif*, and the generated effluent shall be gradually discharged in *drainage* drain. The estimated quantities of water are **9722 m^3**. Sampling and analysis for the wastewater before discharging shall be done versus the limits passed in Law 48/82 (*refer to section #2 "Water Pollution"*).

3.23. DEWATERING

- Dewatering will follow immediately upon completion of a satisfactory hydrostatic test the pipeline must not be left with water in it.
- As a minimum this procedure will be based upon the use of foam bodied pigs or rubber cupped bi-direction pigs.
- Pigs will be run until there is no evidence of water in the pipeline as determined by the company.

- Test for water shall include assessment of the gain in weight of any foam pig or measuring of the dew point of the compressed air into and out of the pipe line.
- Measurement will take place before dewatering to complete arrangement with the responsible authorities.
- Dewatering will continue until the company's engineer is satisfied that pipeline is free from water within acceptance limit.

3.24. MAGNETIC CLEANING AND GEOMETRIC PIGGING

- A series of magnetic cleaning pigs will be run until the pipeline is judged by the company to be free of magnetic debris.
- After the pipeline has been cleaned by the magnetic cleaning pig the contractor will run a geometric pig. Acceptance of the pipeline will be based upon a successful report by this pig.

- Following a successful run by the geometric pig the pipeline will be left with positive pressure in it of at least 2 bar. The medium be with either dry air or dry nitrogen as determined by the company.

- The discharge will be some metallic components and will be disposed to industrial dump.

3.25. DRYING AND COMMISSIONING

The pipeline will be dried by the application of either vacuum drying or by flashing with dry nitrogen at ambient temperature to ensure that no operational problems arise from water left in the pipeline

3.26. RECORDS & OPERATING MANUALS

The constructing contractor will be responsible for the production of all kinds of records relating to the whole construction job. These records include but not limited to:

(One) **Materials records** that contain identification number, inspection certificates, test certificates, etc.

(Two) **Welding records** (e.g. welder qualifications, welding procedure, etc.).

(Three) **Protective coating records** that contain date, method of cleaning, material used, repairs, etc.

(Four) **Painting records** (e.g. paint type, grade of paint, paint batch number,etc.)

(Five) **Mechanical installation records** (e.g. testing procedure, insulation procedure, pipe alignment, etc.)

(Six) **Structural steel work records** (e.g. line, level, plumbness, tightness of bolts, etc.)

In addition, Contractor shall supply all necessary maintenances manuals and training in their application.

3.27. FOR CORROSION CONTROL

The buried metallic structures (pipelines, valves) are coated and cathodically protected according to BS, 739, part 1 as all gas networks.

3.28. PIPELINE CROSSINGS

3.28.1. GENERAL

All pipeline crossings will be uncased unless otherwise specified by the company.

Impact protection measures (cast in site or pre-cast concrete slab) shall be provided on all pipeline crossings. Warning tape shall be placed above and below such impact protection.

Above ground pipeline crossings shall not be used in situation where alternative methods are possible.

Backfilling of crossings must take place immediately after the pipe has been laid. The trench shall be clear of any rocks stones or hard objects, the trench shall be padded with a minimum of 20 cm of sieved sand. Above and around the pipe a minimum of 20 cm sieved sand backfill must be compacted around the pipe to provide protection from the remainder of the backfill. The backfill will be thoroughly compacted by wet tamping in 15 cm layers.

The wall thickness shall be greater of 0.5 inch or a wall thickness to give a design factor of 0.4 with max. Wall thickness 0.75 inch providing that the design factor shall not exceed 0.5.

Specific requirements for the various types of crossings are detailed below.

3.28.2. CASED CROSSINGS

Cased crossings shall not be used in situations where alternative methods are available. (Used in crossing which will be done by boring, … etc.)

All cased crossings will be carried out by thrust bore.

The coated pipeline shall be laid in either concrete or steel casings. This will be thrust bored in accordance with API and ASME standards plus any attached specification drawings. The casing should be extended 3 meter (min) from the end of crossing at both sides.

The inside of the casing should be cleaned before the pipe is pulled or pushed into place. Immediately after the pipe is in place where applicable casing and seals shall be installed.

Where the casing is steel the complete cased crossing shall have an electrical resistance between pipe and casing of more than 100 ohms before being tied in. if a lower resistance is measured, the pipe shall be removed from the casing, the insulation repaired and the pipe re-installed.

For a distance of 8 meters from each end of the casing the pipe shall have firm bearing on the bottom of the trench to prevent the pipe from settling. This may be accomplished by either compacting the bottom of the trench or by placing earth filled bags under the pipe at 1 meter intervals.

The distance between insulators shall be submitted by the contractor for approval by the company. This shall be in advance. They will be 0.5m from each end of the casing and then 1.5m apart.

The wall thickness shall be the greater of 0.5 inch or a wall thickness to give a design factor of 0.4 with max. Wall thickness 0.75 inch providing that the design factor shall not exceed 0.5.

3.28.3. UNDERGROUND CROSSINGS

The pipes shall be laid 1.5 meter below the lowest bed of the water course or road crossing.

The wall thickness for a coated pipeline for underground crossings should be the greater of 0.5 inch or a wall thickness to give a design factor of 0.4 with max. Wall thickness 0.75 inch providing that the design factor shall not exceed 0.5.

The pipe shall be laid with concrete slabs. The concrete slabs should be laid above the pipeline by distance of 50 cm, at least, to protect the pipeline from third party activities and to minimize the life loads on the pipeline.

The concrete slabs should be laid in contact with each other to be as one unit in distributing the load.

Backfilling for the crossing should be with well compacted sieved sand.

Concrete slabs should be prefabricated (precast) before lowering the slab in position.

For railway crossing ***GASCO*** prefer using horizontal directional drilling with the same condition in item 2.3.2 and the depth not less than 4m at any point under railway.

3.28.4. DRAINAGE AND CANAL CROSSINGS

Crossings may be constructed by open-cut, boring, directional drilling or tunnelling methods. Where open cut method is used the pipeline should be laid at a cover allowing for future bed movement and dredging operations or similar. Temporary flume pipes or other methods should be considered to ensure that there is no disruption of weight coating if required such as reinforced concrete to maintain negative buoyancy of the pipe both during construction and in service. Attention to be given to the integrity of flood or tidal barriers during construction and care to be taken to prevent pollution of water courses.

In all cases the minimum pipe wall thickness shall be 0.5 ins, or using a design factor of 0.4, which ever is greater.

Where a pipeline crosses water courses such as a ditch or stream, the pipeline should be located at such depth as will provide a minimum cover of 1 meter from the true cleaned bottom of the ditch or stream to the top pf the concrete pad or 2 meter of the adjoining field level.

3.28.5. NAVIGATIONAL CANAL CROSSINGS

Major submerged crossings shall be treated as follows:

- The wall thickness for pipe used for canal crossings shall be the greater of 0.5 inch or a wall thickness to give a design factor of 0.4 with max. Wall thickness 0.75 inch providing that the design factor shall not exceed 0.5.
- The pipes shall be laid 2.5 – 3 meters below the lowest bed of the water course and according to the irrigation authority approved.

- The trench shall be of sufficient width to lay the line of the crossings as shown on the drawing and shall be graded to ensure maximum support of the pipeline, immediately after laying the pipeline.
- The navigational canal crossing shall be crossed with concrete coated pipe.
- No cold bends shall be accepted under water.
- The Contractor shall submit to the Company for approval, the details of the method he intends to use in the crossing construction, the equipment to be used, calculations of maximum bending stresses, calculations of the loads, timing of operations and any information the company may require.
- ***GASCO*** prefer using horizontal directional drilling (HDD) with the same condition in 1st item and the depth not less than 4m at any point under water stream.

3.29. RUPTURE PROTECTION TECHNIQUE

Protection of pipelines at crossings is wholly dependent on the type of crossing. The following guidelines shall be applied:

3.29.1. GENERAL

With the exception of crossings done by Boring machines (railway, highway, etc.), all pipeline crossings with open cut shall be unsleeved. Impact protection measures such as cast in-situ or pre-cast concrete slabs shall be provided on all pipeline crossings as a minimum requirement.

3.29.2. UNDERGROUND

Backfilling of crossings must take place immediately after the pipe has been laid. The trench must be clear of any rocks, stones or other hard objects which could damage the external polyethylene coating. The trench shall be padded with a minimum of 20 cm of

sieved sand also above and around the pipe a minimum of 20 cm of sieved sand backfill must be compacted to provide protection from the remaining backfill.

The back fill will be compacted by wet tamping in 15 cm layers. The pipe shall be laid and concrete slabs placed above the pipeline by a distance of 50 cm (minimum). Concrete slabs should be laid in concrete with each other to distribute external loads of backfill.

3.29.3. DRAINAGE AND SMALL CANALS < 4M WIDTH

No concrete or slabs required.

3.29.4. DRAINAGE AND CANALS > 4M WIDTH

Concrete slabs shall be used

3.29.5. NAVIGATION CANALS AND RIVERS CROSSINGS

Reinforced concrete coated pipe shall be used.

3.29.6. RAIL SLEEVE

Externally coated H.S. (High Strength) carbon steel sleeve pipe shall be used for protection

3.30. NUMBER OF LINES AT EACH CROSSING

Unless specifically called for to lay one or more other pipelines to reduce overall construction costs, all crossings shall be of a single pipeline only for the specific duty.

3.31. COVER OF PIPELINE

Cover of pipelines will be dependent on the type of crossings, the following guidelines shall be applied:

3.31.1. ROADS

Minimum cover to top of pipe shall be 1.5 meters

3.31.2. DRAINAGE AND SMALL CANALS < 4M WIDTH

Minimum cover of I meter from true cleaned bottom of ditch or stream.

3.31.3. DRAINAGE AND CANALS > 4M WIDTH

Minimum cover of 1.5 meters to top of pipe.

3.31.4. NAVIGATION CANALS AND RIVERS CROSSINGS

Concreted coated pipelines shall be laid 2.5 meters min. to 3 meters max. below the lowest bed of the water course.

3.31.5. RAIL SLEEVE

Minimum cover of sleeve to be at 1.5 meters below rail level.

SUITABLE WARNING TAPS SHALL BE PLACED ON ALL PIPELINES.

3.32. WATER BODIES CROSSING METHODOLOGY

Crossing of Water bodies and main canals in this project shall not be done by the traditional open-cut method. It shall be done using a new technology named *Horizontal Directional Drilling*.

Horizontal **D**irectional **D**rilling (HDD) is a trenchless methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut. HDD can be implemented with very little disruption to surface activities, requires less working space, and may be performed more quickly than open-cut methods. Also, it can simplify or eliminate certain permitting processes. This type of installation which was applied in municipal underground infrastructure systems and petroleum products pipelines has seen a dramatic increase in recent years. Although there are currently no national standards regarding HDD installations for any pipe material, HDD pipeline installations are becoming more and more common and may be the fastest growing trenchless construction method today. They can be used to install new pipelines or replace existing ones.

The technique stages are illustrated in Fig. (3.1), which shows the operation in three stages, as follows:

Stage 1

The drilling rig and its associated equipment is set up and positioned on one side of the crossing. The carriage framework is inclined to the desired entry angle, which can be between 5° and 30°. Typically the entry angle is set between 10° and 14° to the horizontal.

An 80mm dia. Pilot hole is drilled using either a mud motor or a jet bit, attached to 73mm dia. Pilot drill pipe. The steering mechanism is provided by means of a small bend or bent sub, usually less than 1° and situated behind the drill. Changes in direction are

achieved by partial rotations of the bent sub, as the pilot string proceeds forward. Figure (3.1) gives a detail of the downhole drilling assemblies with mud motor and jet bit.

The progress of the pilot hole is monitored by a directional survey steering tool package. A survey probe is positioned just behind the drill head, which is linked by a hard wire up the center of the drill pipe to a computer and printer located in the control cab. The probe contains fluxgates and transducers which measure data in a three-dimensional plan by vector measurement, enabling the course of the pilot hole to be plotted joint by joint. Continuous read outs give the following information:

(a) Inclination relative to the vertical plane.
(b) Direction of hole relative to magnetic north, and.
(c) The orientation of the steering mechanism or bent sub relative to the high side of the hole.

The drilled distance is measured at the drilling rig by physically monitoring the down hole pipe lengths.

The readily available survey information, combined with the ability to steer and drill, allow the pilot hole to be drilled along the planned profile.

Progress or drilling speed depends on the suitability of the drilling medium.

As the pilot hole progresses the frictional force gradually increases on the 73mm dia. Pilot string and it then becomes necessary to wash-over the pilot string with 127mm dia. Washpipe. The front of the washpipe is fitted with a cutting bit, typically 300mm dia. And fitted with round 20 kennametal cutting teeth. Unlike the pilot string, the entire wash pipe rotates in moving forward.

In addition to reducing frictional forces the wash-over pipe increases the diameter of the drilled hole. It also serves to smoothen the curve and to eliminate any irregularities which may have occurred by use of the steering mechanism.

Stage 2

Drilling progresses with alternate drilling of pilot drill pipe followed by wash-pipe. The distance between the wash-over pipe cutting bit and the pilot drill bit will be in the range of 25.0 m to 80.0 m. It is not advisable to have wash-over pipe closer than 25.0 m as the proximity may adversely affect the accuracy of the survey tool. Alternate drilling continues until both the pilot string and wash-over pipe exit in the target area.

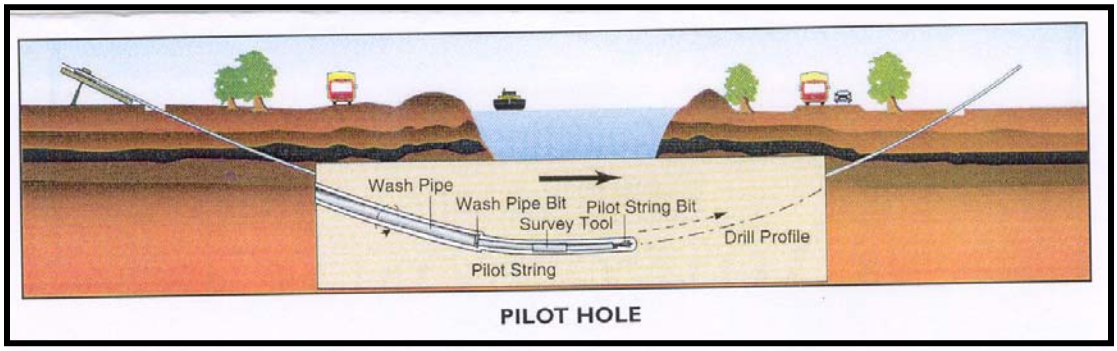
The pilot string is now removed from the system by pulling back to the drill rig, leaving the wash pipe in places as a drawstring for the pre-ream operation.

For the pre-ream operation a barrel reamer, fitted with jets and cutting teeth, is attached to the end of the wash pipe. The diameter of the pipe to be installed dictates the diameter of the barred reamer. Typically the diameter of the chosen reamer will be twice the diameter of the pipe to be installed. The barred reamer is rotated along the drilled path enlarging the formed annulus.

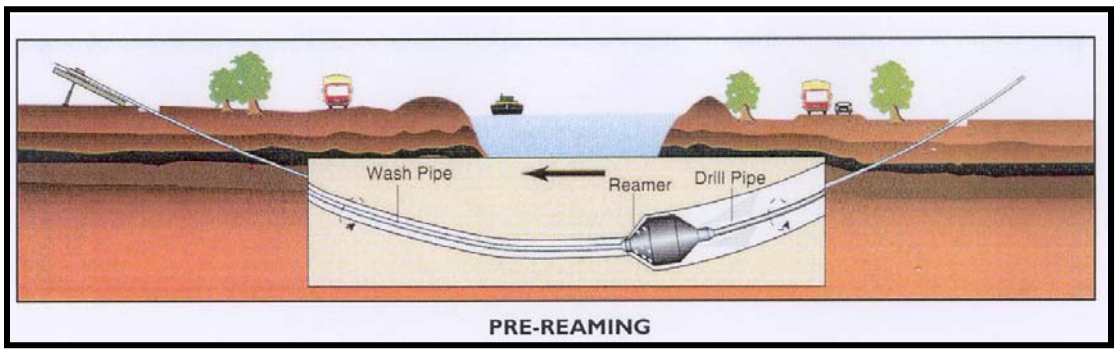
As the reamer is pulled back, additional lengths of 127mm drill pipe are added on behind, to ensure that a complete drill string remains in the hole for the next operation.

Stage 3

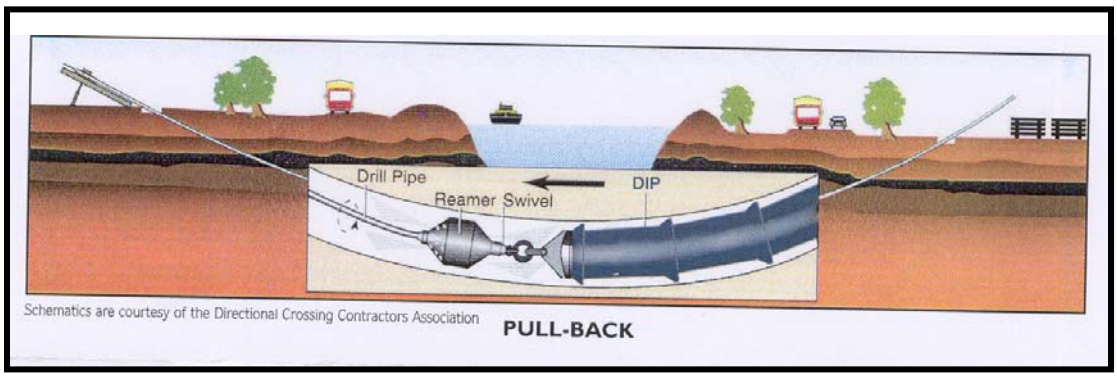
Either before or during the drilling operation, the pipeline has been fabricated on the target side of the crossing. On completion of hydrostatic testing, the pipeline fabrication is raised onto conveyors. A pulling head is welded onto the front end of the fabrication. The reamer is then transported to the target area, i.e. the opposite side of the crossing. On completion of the pre-ream operation, the reamer is disconnected. The assembly for the pipeline insertion consists of the barrel reamer, followed by a universal joint, and a swivel to prevent rotation of the pipeline being installed. The reamer and pull head assembly are rotated and pulled back from the drill rig using the wash-over pipe. Accordingly a further reaming of the hole takes place as the pipeline is being inserted into the reamed hole.



Stage (1)



Stage (2)



Stage (3)

Figure (3.1) Stages of the Horizontal Directional Drilling Technique (HDD)

3.33. PIPELINE SURVEILLANCE - PATROLLING AND LEAKAGE

It is important that GASCO should take all reasonable precautions to safeguard its pipeline and people living in the vicinity of its pipelines.

This code has been written to cover two specific areas of Pipeline Surveillance.

1) Pipeline Patrolling
2) Leakage Survey

3.33.1. PIPELINE PATROLLING

Pipeline Patrolling is carried out in order to identify activities or actions that could damage the pipeline. It also identifies areas of concern such as land slippage etc. in the general area of the pipeline that could cause subsequent problems. The frequency of the patrol will vary for differing areas. In desert regions there is minimal work carried out around the pipeline. In Urban areas where there is a lot of excavation activity on water mains, sewers, etc. and the frequency of inspection needs to be highest.

3.33.2. LEAKAGE SURVEY

Leakage Survey is carried out to protect the population and staff against the effects of escaping gas and detect damage to the pipeline. It is therefore carried out where the pipeline runs close to buildings and where staff work.

This Code is supported by Two Report Sheets one for each day of the survey for Patrolling Duties and one for Leakage Survey duties. These two sheets are designed to be the only documentation the operative needs to carry in the performance of the task.

The locations for both the Pipeline Patrolling and frequency and leakage survey must be determined in advance by a Responsible Engineer and reviewed at least annually.

All pipeline routes should be classified fully according to ASME 31.8 within 6 months of implementation of this code by a Responsible Engineer. This should also include those areas where regular leakage surveys will be carried out.

It is essential to take all reasonable precautions to reduce the risk of pipelines being struck or damaged. The inspection and surveillance, applied to a particular section of a pipeline, should reflect the likelihood of such damage at that location and the type of frequency levels should be regularly reviewed at intervals not exceeding two years.

All staff undertaking the Patrol duties and the leakage surveys must be fully trained before carrying out these duties.

Where the two surveys coincide in terms of frequency they can be combined into a Patrol and Leakage survey.

The Pipeline Patrolmen will carry out vehicle and walking surveys along the pipeline route, at the following frequencies:

3.33.3. FREQUENCY OF PATROL

Table (3.5)- Frequency of Patrol

PIPELINE LOCATION	VEHICULAR	WALKING
Location Class 1	6 Months	No survey
Location Class 2	1 Month Vehicular accessible areas inc canal and river crossings	6 Months Arable land, AGIs, valve rooms, crossings, sleeves
Location Class 3		2 Weeks Survey all areas
Location Class 4		2 Weeks Survey all areas

The Patrol will observe and report findings to the Sector Office on a daily basis and where the safety of the pipeline is at risk, notification will be as soon as possible.

The Patrol will be issued with written authorization to instruct other people, affecting the safety of GASCO property, to stop their work or actions immediately.

The Patrolman will need to complete a written Daily Report. These will be logged again on a daily basis, in the Area Office. These Daily Reports will be audited on a random basis by the Patrol's Supervisor.

The Survey Diary, issued to each Patrolman, will be completed by the end of each day. The Survey Diary will contain all observations along the pipeline route for a particular day. This Diary will be used as a check by the Patrol Supervisor.

All necessary Permits or permission will be obtained from landowners, farmers, railways, etc. prior to starting work. The Patrol will ensure that he holds a valid Identity Card or Letter of Authorization.

In addition to watching and reporting on the GASCO pipelines, the Patrol will establish a good liaison with farmers and landowners along the pipeline route.

It is not the intent to specifically test for the presence of leakage with gas detection equipment during this survey.

3.33.4. VALVE ROOMS

The following table illustrates the valve rooms proposed to be constructed and their specifications.

Table (3.6)- Specifications of Valve Rooms

ROOMS FOR ABU QURQAS – ASUIT PIPELINE					
ITM	**Room №**	**Kp**	**Length**	**Width**	**area**

1	1	0+00	53	40	2120
2	2	15+600	25	25	625
3	3	26+800	25	17	425
4	4	36+780	25	15	375
5	5	40+350	25	25	625
6	6	50+400	25	17	425
7	7	59+519.798	50	50	2500

4.0

Existing Environment

4.0 Existing Environment

4.1 INTRODUCTION

The route of pipeline starts in the agriculture area of the back area of Abu Qurqas Sugar Plant. ***(long. 30^o 48' 48.9" lat. 27^o 54' 48.3")*** heads to the western south near Hour city from south site crossing Bahr Yossef, continue in the same direction to reach Asuit western road near El-Dlengat city, then parallel with the high voltage lines east Asuit western road, then to the south direction near Dashlot and Mera Cities, then parallel to the High voltage lines to the eastern south near ELdier EL-Mahrok and Khashaba Building, Banie Sharan, Banie Adie El-bahariea, to reach Asuit Breck Cement plant and finally to Asuit city in the east direction. ***(long. 31^o 09' 27.2" lat. 27^o 10' 11.8")***.

A general survey was carried out on 16-17/8/2006 to provide the environmental profile requested for the concerned area. The site survey regarded the geological and meteorological data, topography, flora and fauna and socio-economic status. This area is of previous environmental profile knowledge.

This section gives an overview of the environmental and related issues in such area in relation to oil exploration. It also describes the environmental setting in the concerned area in terms of physical, geological and biological issues. It also details the prevailing climatic conditions within the area of concern.

4.2 GEOLOGICAL FORMATION

It is quite obvious that the area under consideration has two geological characteristics. One belongs to the Eastern Desert of Egypt and the second one is

the cultivated banks of the River Nile. Both, the desert and a part of the cultivated land have been developed for urban uses.

Generally, the Eastern Desert of Egypt consists essentially of a backbone of high and rugged igneous mountains running parallel to the Red Sea Coast. The mountains do not form a continuous range, but rather a series of mountain groups with some detached masses and peaks flanked to the north and west by intensively dissected sedimentary limestone plateau. The study area is one of these formations.

The formation of these limestone plateaus mainly Upper Eocene (Bartonian) and Middle Eocene (Lutetiam). The former includes a series of sands, clays and marly limestone which are separated, more easily eroded and contain larger amounts of gypsiferous and ochreous materials. The Middle Eocene formation includes various types of limestones which are more solid and contain a hard dolomite bands.

The most pronounced geo-morphological feature of the whole Eastern Desert of Egypt is its dissection by independent valleys and ravines. Between the highlands and the banks of the River Nile a gentle slope can be observed. It is divided into salt marshes with sandy hillocks and flats of calcareous silt, and an inland desert plain covered with coarse boulders which become less coarse as we go further away from the hills.

The River Nile North of the Aswan High Dam runs for about 900 km through a valley that consists of a level-floored groove on a limestone plateau, averaging of 18 km width. Upstream Cairo and for almost 300 km, including the Minya and Asuit areas, the Nile River shows a strong tendency to hug the eastern edge of the valley floor in a way that rendered the greater part of the cultivated land found on the western bank of the river.

The River Nile Valley itself went through numerous changes after the construction of the High Dam, but as a general feature it consists of the River Nile Channel surrounded by a flood plain of alluvium material that gradually increases in width from Aswan till it reaches its maximum at Beni- Suef (+ 12 km). The flood plain is elaborately cultivated through a well established irrigation system and a slowly developing drainage system.

4.2.1 SIESMICITY

Egypt is considered one of few regions of the world where evidence of historical earthquake activity has been documented during the past 4,800 years.

Information on historical earthquakes is documented in the annals of ancient Egyptian history and Arabic literature. According to Sieberg (1932), Ambraseys (1961), Maamoun (1970), Ibrahim and Marzouk (1984), Poirier & Taher (1980) and Savage (1984), about 83 events were reported to have occured in and around Egypt and to have caused damage of variable degrees in different localities. The earthquake occurred in Egypt on 1995, felt strongly in port Said. It has a magnitude of about 5.2. Its epicenter was at Nuweiba. It resulted in the damage of Nuweiba docks, however, it did not cause damage in the eastern Delta regain.

Kebeasy (1990) suggested that the level of earthquake activity in Egypt is generally low. Abdel Kader (1982) Stated that northern Egypt has been inactive, except for minor trenons and earthquakes since Oligocene and early Miocene times. No major tectonic environments seem have occurred since the early Miocene (Said 1962, 1981).

Distribution of earthquake epicenters in Egypt suggests three major seismic active tones, which extend along the following trends.

- Northern Red Sea - Gulf of Suez - Alexandria

- The Levant - Aqaba
- East Meditteranean (Pallusiac) - Fayum

Occurrence of an earthquake may represent a potential risk. Thus, precautions will be taken, mainly raising the awareness of the working staff in the field, in case of occurring an earthquake. Any way, and as described before, Egypt is not an earthquake active zone, so the threat of occurrence of an earthquake, although it is difficult to be predicted, is minor.

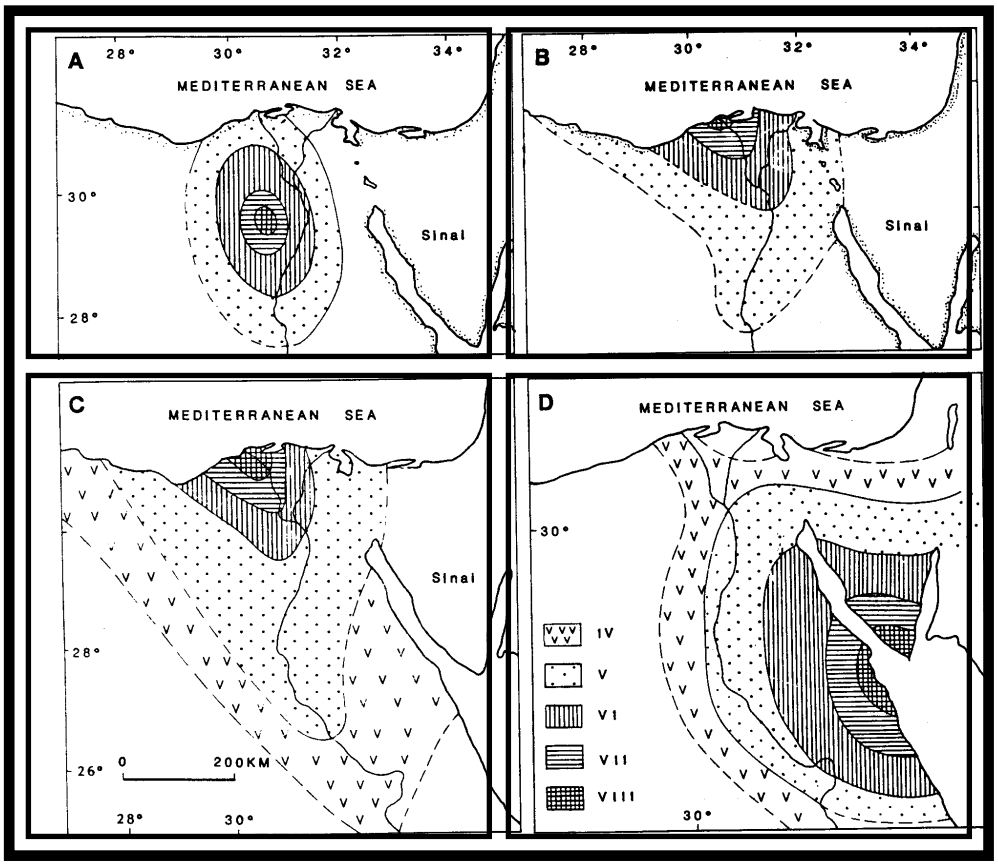


Figure (4.1) - **Intensity distribution of earthquakes of: A. August 1847; B. 24 June 1870; C. 12 September 1955 and D. 31 March IV-VIII = Earthquake intensity.**

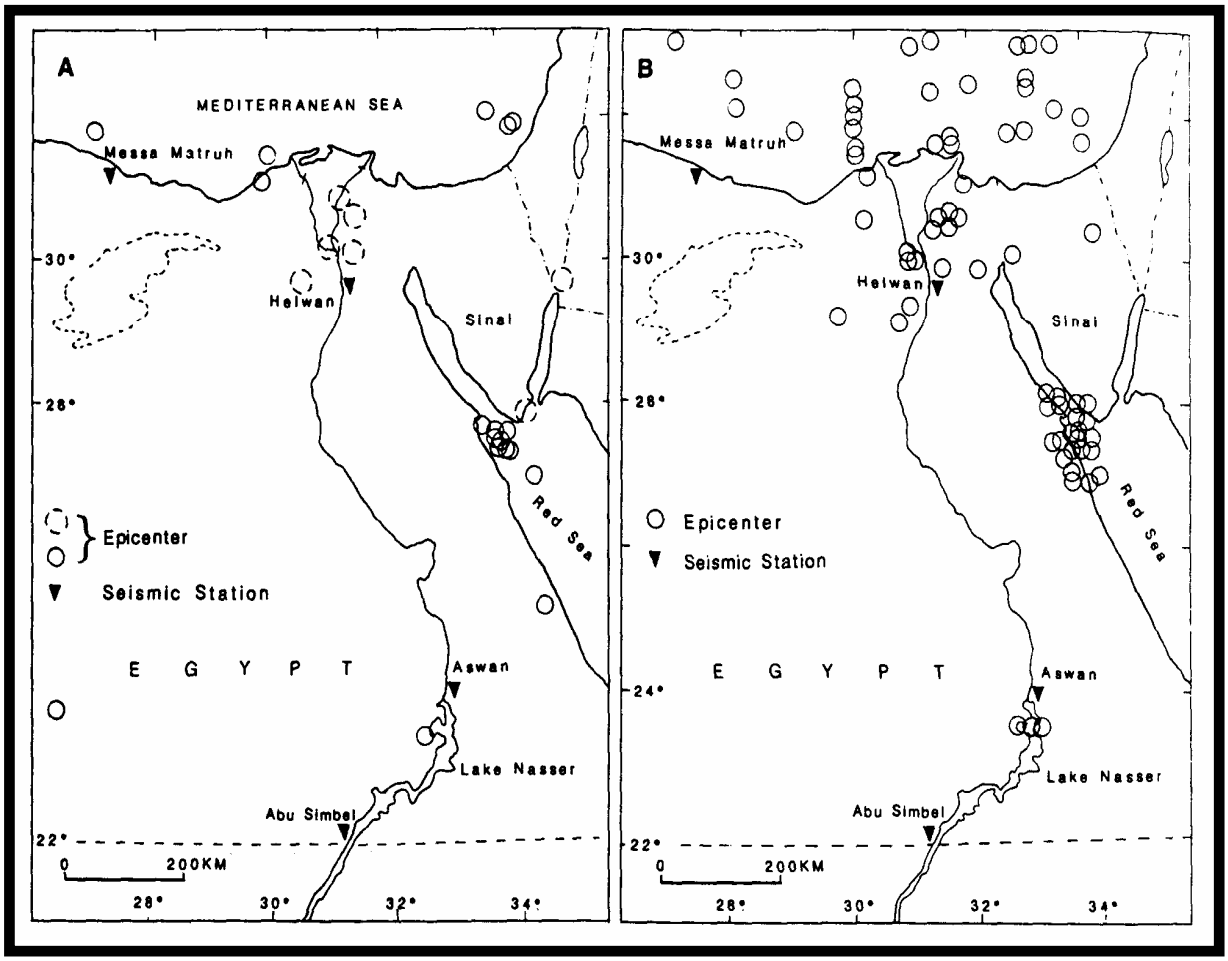


Figure (4.2) - **A location of permanent seismic stations and epicenters of historical and recent medium to large earthquakes; B. epicenters of small earthquakes.**

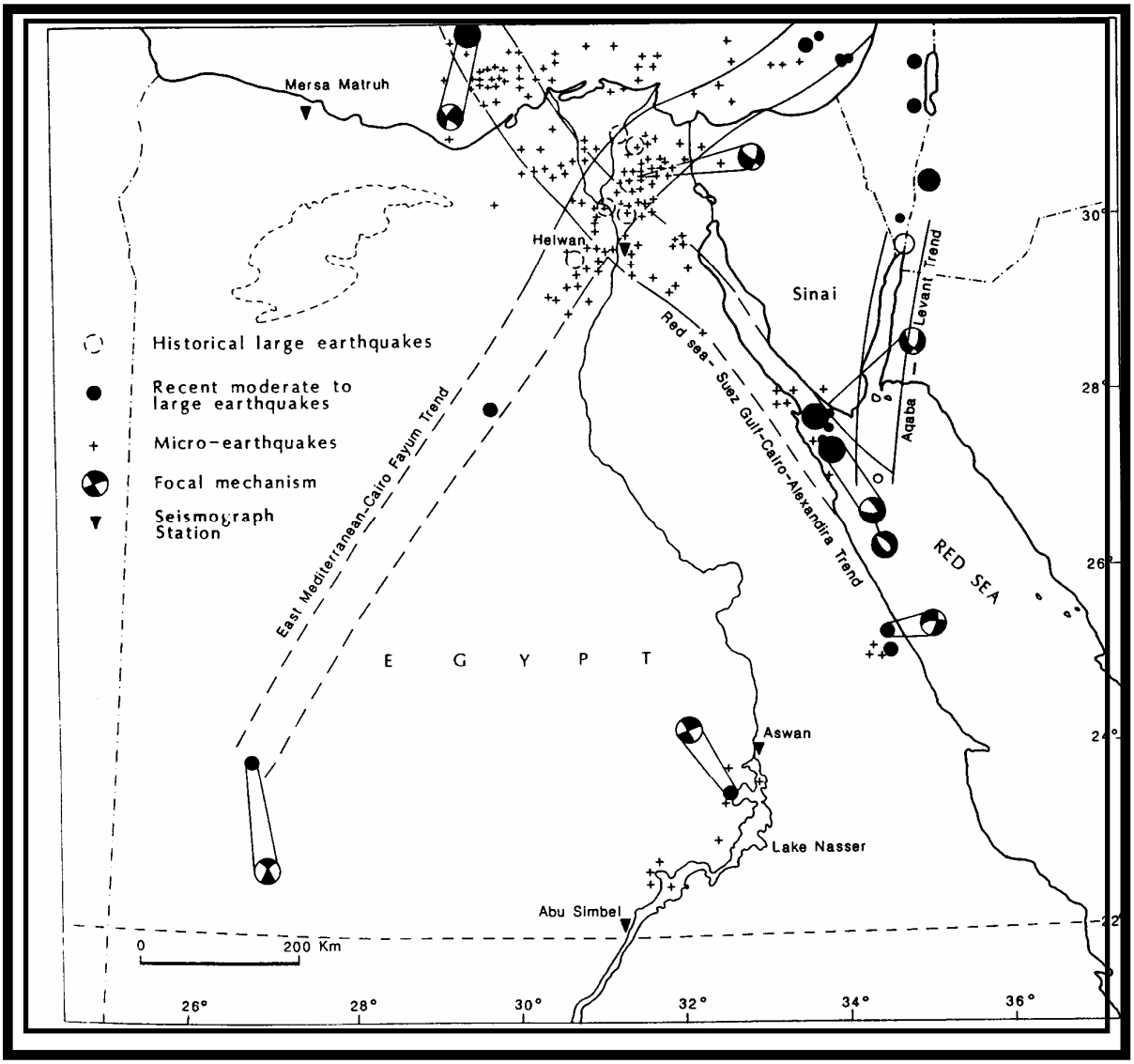


Figure (5.3) - **Epicentral distribution of all earthquakes, focal mechanisms of principal earthquakes and active seismic trends.**

4.3 GEOMORPHOLOGY

The Nile Valley and the Delta occupy the alluvial tract along the terminal 1,350 km of the River Nile. After entering Egypt at Wadi Halfa it passes for more than 300 km

through a narrow valley surrounded by cliffs of sandstone and granite on both its east and west sides until it reaches the First Cataract which commences about 7 km south of Aswan. The construction of Aswan Dam at the beginning of this century inundated the strips of cultivable land along this stretch, while the construction of the Aswan High Dam rendered large tracts of the Nubian desert into a vast reservoir of water. The average width of the alluvial floor of the Nile valley between Aswan and Cairo is about 10 km and that of the river itself about three-quarters of a kilometer. Throughout its entire course, the Nile tends to occupy the eastern side of its valley so that the cultivable lands to the west of the river are generally much wider than those to the east. In fact, in some places, the stream almost washes the eastern boundary cliffs. After passing Cairo, the Nile pursues a northwesterly direction for about 20 km and then divides into two branches, each of which meanders separately through the delta to the sea. The western branch (239 km in length) debouches into the Mediterranean at Rosetta, and the eastern branch, which is about 6 km longer, at Damietta.

The ground surface of the study area is characterized by three geomorphic units including:

- The Nile Delta Alluvial Plains.
- Mediterranean Foreshore Plains.
- Suez Isthmus Plains.

Each unit displays different characteristics in terms of topography and surface features, such as soil types, drainage lines, depressions, lakes, salt flats and gypsum flats.

4.4 CLIMATE

Monthly averages show wide seasonal variation of temperature. In summer, it fluctuates from 46°C, during mid-day, to 15°C at night. In winter, it fluctuates from 37°C, during mid-day, to 0°C at night. On an average monthly basis, the maximum temperatures occur

in July, while the minimum temperatures occur during December, January and February (about 11°C). The climate is relatively dry, with small monthly variation in relative humidity.

The bioclimatic provinces in Egypt are defined by Ayyad and Gaddour (1986) with some modification according to the system applied in UNESCO map of the world distribution of arid regions (UNESCO, 1979). This system is based on the aridity index P/ETP (potential evapotranspiration) is calculated according to Penman's formula. Two classes are recognized: hyperarid (P/ETP< 0.03), and arid (P/ETP= from 0.03 to 0.20). These classes are, in turn, subdivided according to the mean temperature of the coldest month and that of the year. Consideration is also given to the time of the rainy period relative to the temperature regime.

The area is located within the arid province, generally characterized by the Mediterranean coastal climate of arid to semi arid conditions. This section is distinguished into two provinces by the UNESCO/FAO map of 1963: the coastal belt province under the maritime influence of the Mediterranean, with a shorter dry period (attenuated), and the more inland province with a longer dry period (accentuated), and an annual rainfall from 20 to 100 mm. Both provinces are characterized by mild winter and hot summer.

4.4.1 AIR TEMPERATURE

The air temperature obeys, more or less, the general pattern of Cairo rather to that of the Upper Egypt. Based on 30 years measurements, Table (4.1) and Figure (4.4) represent the average air temperature indicatives of the study area. It is quite apparent that the high temperature values are reached during May – August and the lowest ones during winter period (January - February).

Table (4.1) – Maximum, Mean, and Minimum Air Temperature

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec

Maximum ^{o} C	**30.0**	**32.2**	**37.8**	**42.2**	**46.1**	**46.1**	**42.8**	**42.2**	**41.1**	**37.2**	**35.0**	**30.0**
Mean ^{o} C	**12.8**	**14.4**	**18.1**	**21.7**	**26.1**	**28.3**	**28.9**	**28.6**	**26.4**	**24.2**	**19.7**	**15.0**
Minimum ^{o} C	**0.0**	**0.0**	**3.9**	**7.2**	**11.1**	**15.0**	**17.2**	**17.8**	**16.1**	**12.2**	**6.1**	**0.0**

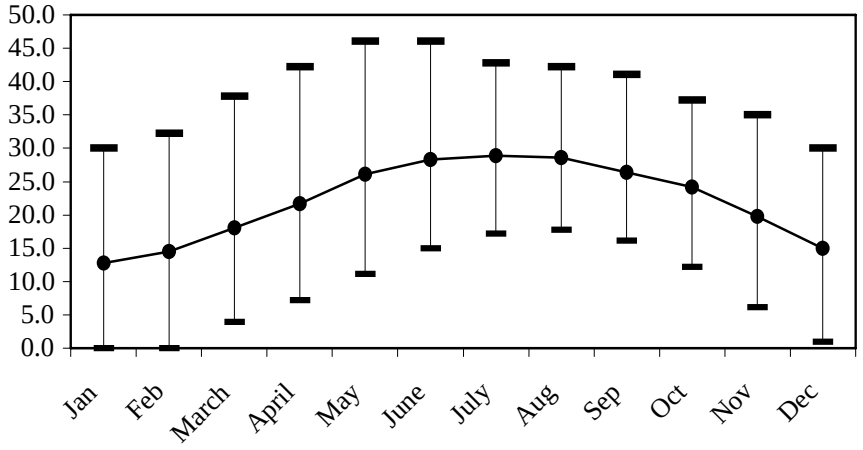


Figure (4.4) - ***Maximum, Minimum and Average Air temperature ^{o} C***

4.4.2 RELATIVE HUMIDITY

Relative Humidity, Figure (4.5), fluctuates between 48.5 % during May and 64.0 % during December. Values as high as 90 % were recorded occasionally during early summer during dawn.

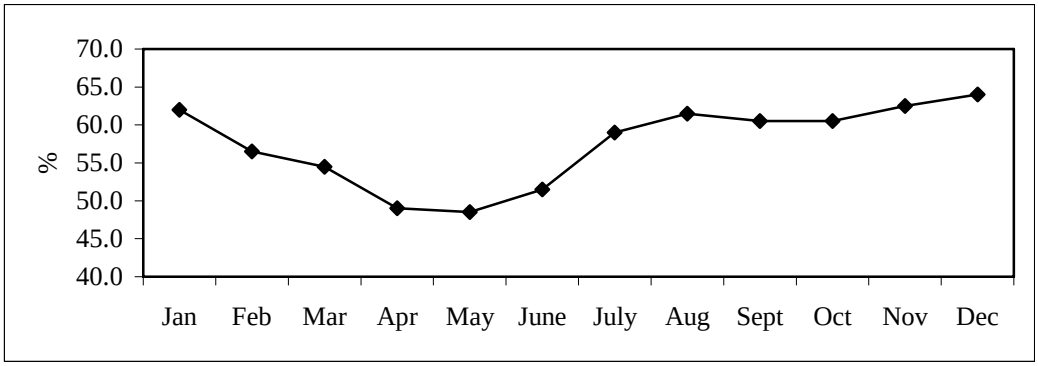


*Figure (4.5) – M**onthly Relative Humidity***

4.4.3 RAINFALL

In general three rainfall belts may be characterized in Egypt:

1) The Mediterranean Coastal Belt;
2) Middle Egypt, with latitude 29^{o} N as its southern boundary; and
3) Upper Egypt

The first and second belts have a winter rainfall (Mediterranean regime), the rainy season extends from November to April, though mainly concentrated in December and January. These belts correspond roughly to the attenuated and accentuated arid provinces of northern Egypt, where the average annual rainfall ranges from 100 to 150 mm in the attenuated arid province; and from 20 to 100 mm in the accentuated arid province. One of the major features of rainfall in arid and semiarid regions, other than being scanty, is its great temporal variability. The area is within the Mediterranean coastal belt. The rainfall is exceedingly irregular in space and duration.

4.4.4 WIND

Table (4.2) and Figure (4.6), (4.7) and (4.8) clearly show that, the wind galling from Northern directions are the prevailing winds. The strongest winds are coming from the Southern directions especially during March to June. Though the wind speed is highly variable, at study area, but the wind blows mainly from Northern Areas

Table (4.2) - ***Mean Monthly Wind Direction & Speed Nearby Study Area***

	Jan		Feb		Mar		Apr		May		June		July		Aug		S ep		Oct		Nov		Dec	
	%	K	%	K	%	K	%	K	%	K	%	K	%	K	%	K	%	K	%	K	%	K	%	K
N	7.5	5.6	8.2	6	11.4	7.4	14.8	7.8	19.9	8.1	25.6	8	28.7	7.1	31	6.8	30.5	7.3	20.7	6.9	13.1	6.2	8	5.7
NNE	5.5	7	5.7	7.9	10.8	8.2	13.6	8.8	16.2	9.5	13.5	8.6	7.7	7.2	8.8	6.5	16.9	7.4	18.7	7.9	10.6	7.4	6.4	6.8
NE	5	7.8	5.7	8	10.3	8.6	11.1	9.3	13	9.2	9.3	7.9	4	6.2	4.5	5.7	9.1	6.6	11.7	7.3	6.8	7	5.5	7.1
ENE	4.9	6.3	5.9	7.1	8.9	8.3	8.4	8.8	8.9	8.4	4.8	7	2.1	5.6	2.4	5.2	4.8	5.8	8.7	6.6	6.5	5.8	5.4	6.2
E	5.7	5.7	7.1	6.3	7.4	7.8	6.3	8	6.9	8.6	3.6	7.6	1.2	5.3	1.6	6.1	2.6	6	4.7	5.8	6.1	5.4	6.5	5.3
ESE	2.3	4.7	2.4	6	2	7.2	2.1	9.3	1.8	9.5	1.1	7.6	0.2	5.9	0.4	5.7	0.6	6.7	1.7	5.3	2.6	4.5	2.8	4.5
SE	2.3	5.4	1.8	6.1	1.2	7.5	1.4	9.4	0.7	8.6	0.4	7.3	0.2	7.1	0.2	5.1	0.2	7.3	0.9	6.1	1.8	4.3	2	4.6
SSE	3.8	7.2	2.9	7.7	1.7	8.3	1.2	9.4	0.6	9.1	0.4	6.3	0.1	6	0.1	6	0.2	8.4	0.8	6.2	2.9	5.1	4	6.4
S	12.1	8.4	9.5	8.5	3.8	9.5	2.6	12.8	1	10.6	0.4	6.2		3	0.1	14.8	0.1	5	1.5	6.5	4.9	6.5	11.2	7.4
SSW	9.2	9.4	7.8	10.7	3.7	10.1	2.2	11.3	0.7	12	0.3	6.4	0.2	6.4	0.2	4.8	0.3	7.9	1.4	8.7	3.7	7.7	9	9
SW	6.1	9.6	6.2	10.5	3.5	10.2	2	9.9	0.8	11.1	0.4	9.5	0.2	8.6	0.2	3.9	0.3	9.5	1.3	7.4	3.3	8.1	5.9	9.5
WSW	6.5	9.1	5.8	9.4	4.7	10.5	3	9.9	1.6	8.1	0.7	6.1	0.7	5.6	0.4	3.8	0.8	5.3	1.4	6.4	3.5	7.5	5.5	9
W	8.9	8.2	10.3	9.2	10.2	9.7	7.4	8.4	5.8	8.1	5.7	6.2	7	5.4	6.3	5.3	3.1	4.8	4.7	6.8	6.8	6.6	7.1	7.7
WNW	4.5	6.1	5.3	6.9	5.9	7.5	6.2	7.6	5	7.8	6.4	6.8	10.6	6.3	9.1	5.7	4.6	6	3.4	5.7	4.8	6	3.9	5.2
NW	3.5	6	4.4	6.2	4.2	7.5	5	7.7	5.4	7	8.7	7.6	12	6.8	10.5	6.4	5.6	6.5	3.9	6.4	4.4	5.3	3.5	4.6
NNW	4.2	5.1	5.1	6.2	6	6.6	8.5	7.2	8.9	7.6	15.9	7.7	21.4	7.1	19.8	6.6	13.7	6.8	7.4	6.2	7.5	5.5	4.2	4.9
Calm	7.8		6		4.6		4.2		2.9		2.9		3.9		4.5		6.6		7.2		10.8		9.2	

K = Speed in Knots

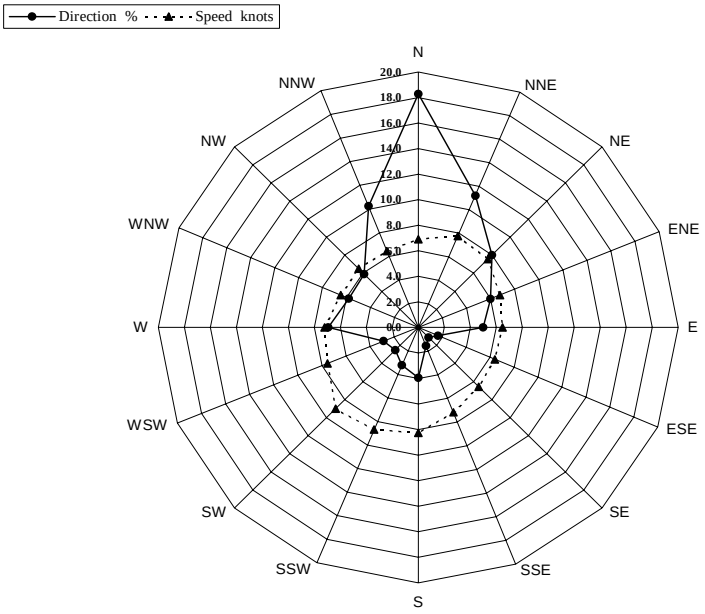


Figure (4.6) - ***Annual Computation of the Mean Wind Speed & Direction***

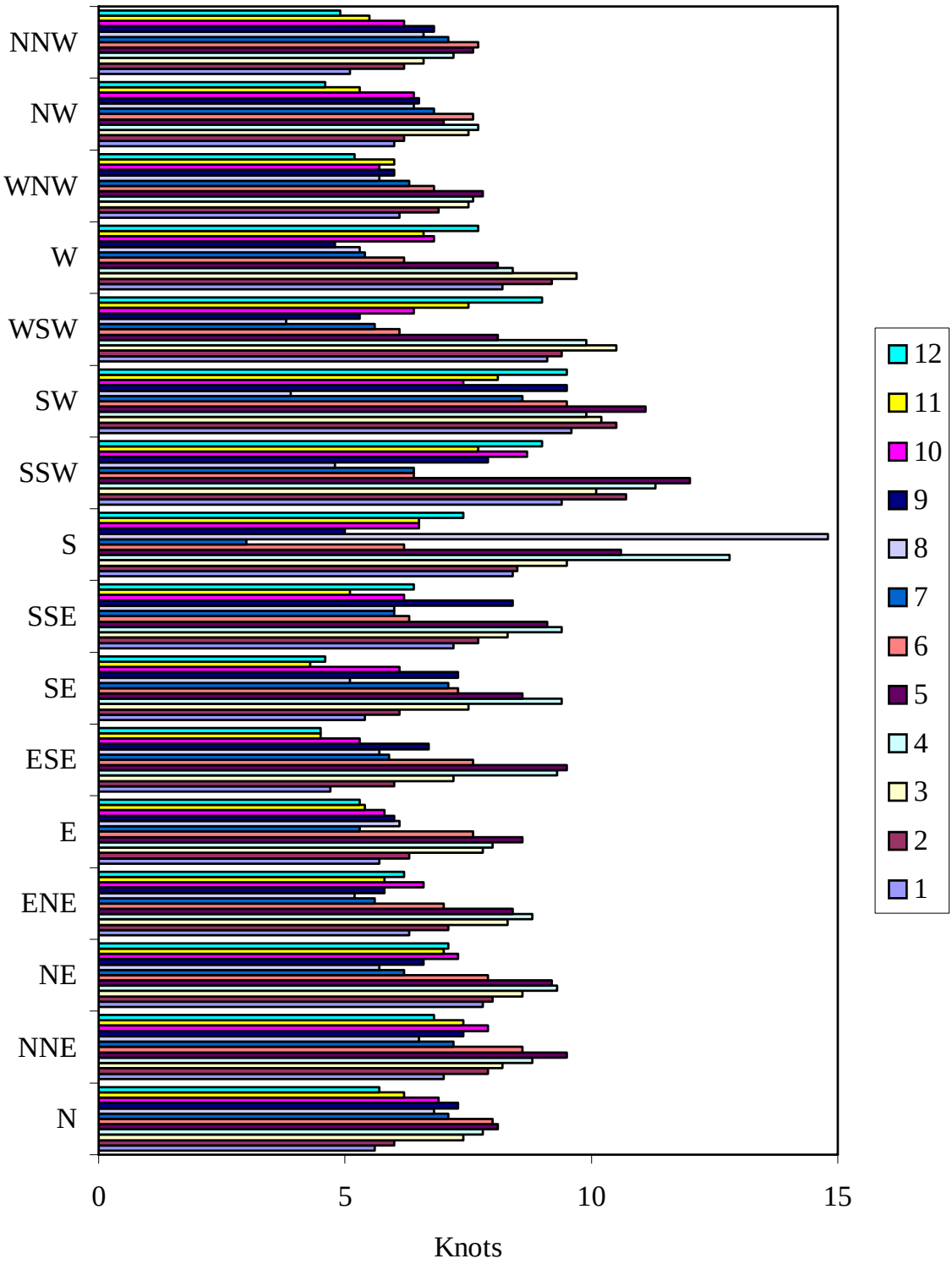

NNW
NW
WNW
W
WSW
SW
SSW
S
SSE
SE
ESE
E
ENE
NE
NNE
N
0
5
10
15
Knots
12
11
10
9
8
7
6
5
4
3
2
1

Figure (4.7) - ***Monthly Wind Speed at the study area***

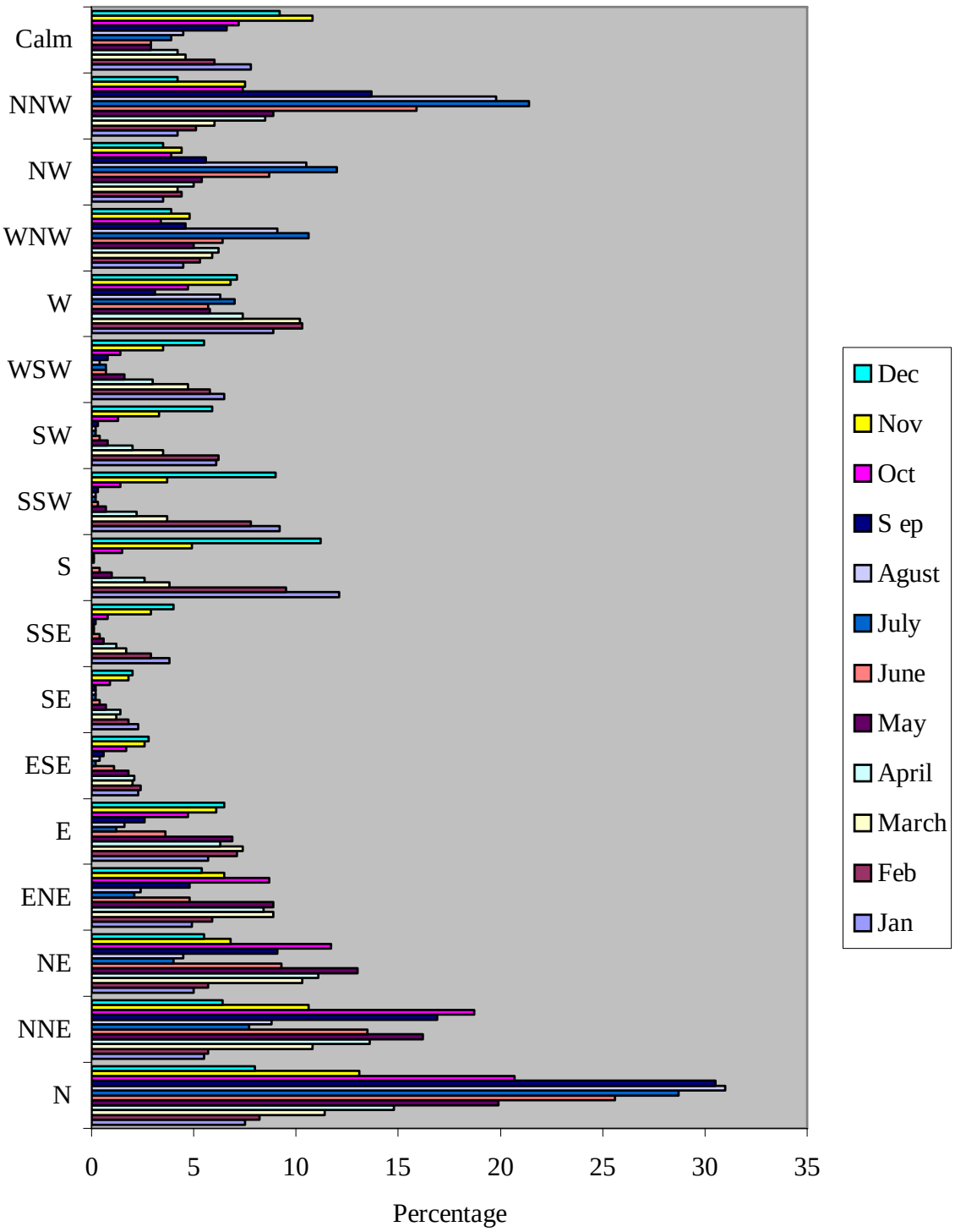

Calm
NNW
NW
WNW
W
WSW
SW
SSW
S
SSE
SE
ESE
E
ENE
NE
NNE
N
0
5
10
15
20
25
30
35
Percentage
Dec
Nov
Oct
S ep
Agust
July
June
May
April
March
Feb
Jan

Figure (4.8) - ***Wind Direction (%) and Calmness Periods at the study area***

4.5 TERRESTRIAL FEATURES

4.5.1 SOIL

The majority of the soil through which the pipeline pass is sandy. However, the cultivated areas are characterized by typical clayish fertile agriculture soil. Its compactness and carrying strength is rather weak and installation of heavy weight rigs and movement of heavy equipment will need a special soil preparation and supportive actions.

4.5.2 VEGETATION

The cultivated crops are the typical cash crops grown in the Egyptian agriculture areas. Cotton, Maize, Rice, Wheat, Clover, Corn and Beans are the common crops grown at different seasons in the close agriculture land to the studied site. The land is fertile and of high yields characteristics. The bio-diversity of the plants stems from the different crops grown during the different agriculture cycles. The impacts of the project activities to the soil are represented mainly by the probability of clearing, crashing or covering of vegetation.

4.6 TERRESTRIAL HABITAT

As the project area extends on both sides of the River Nile, and because of the great variation between the habitats covered by the project (desert, new cultivated land, aquatic habitat, old cultivated land and the New and Old City of Minya). Though considerable portion of these habitats may be destroyed by Urbanization

and land reclamation, still each habitat may have portions of its original specific characteristics that need to be highlighted.

So the desert area around the Highway Cairo-Aswan, which includes the Cement Factory and the New Minya on the eastern side of the River, is originally a part of the Eastern Desert. This arid desert is mainly composed of limestone, with few and scarce population, vegetation and animal representatives. Living organisms of economic or environmental value do not exist, most probably because of the heavy traffic on the highway.

The new cultivated land in this area is bordered by the River Nile in the west side and by the Highway Cairo-Aswan from the east. The area is covered with clay silt and mud. Farmers in this area produce some sugarcane, corn and wheat and other field crops. The area is characterized by a very gentle slope to the River. The bank of the River in this site is about 1.5 m above the water surface. New residential areas are scattered within the cultivated lands. Apparently, only domestic and farm animals exist.

On the western bank of the River Nile, surrounding the old Minya city, their is the old cultivated land. It is 3 to 4 m above the present water level of the River Nile. This area represents a typical Egyptian countryside, in which traditional crops are produced. The farmers are very keen to get the most and the best from their piece of land, but the production is still poor because of the existing poor drainage system.

The old Minya city is a relatively small town with moderate population, most of the paved roads are with narrow footpath. The eastern part of the town is less crowded than the western part which lies on both sides of the Ibrahimiya canal. But the part of the old Minya city lying to the west of the Ibrahimiya canal is undergoing a sporadic and fast growing phase.

4.6.1 FLORA

A well adapted wildlife flora exists on the lowland and valleys. Mixture of xerophytes and halophytes exists such as *Zygophyllum spp. And Lmonium spp*.

Systematic botanical survey data is not yet made for the flora of the cultivated lands and the new reclaimed land, but the assumption may be made that this flora is largely introduced as a result of man's activities, and equivalent to that of the adjacent areas of the Nile valley where the vegetation can still be considered natural. A review of the Flora's of Egypt (Tackholm, 1974; Tackholm and Drar, 1973. and Boulos and Hadidi, 1967), leads to compilation of a list of plant species that are reported to occur in the region with a classification in plants of cultivated lands, plants of waste lands and roadsides and plants of verges of canals and drains.

Table (4.3) - ***Flora of the Cultivated Land***

Family/*species*	**L**	**W**	**C**	**Family**/*species*	**L**	**W**	**C**
Family Amaranthaceae				**Family Cyperaceae**			
Alternanthera sessilis	+		+	*Cyperus alopecuroides*	+		+
Amaranthus graccizans	+	+		*C. articulatus*			+
A. hybridus	+	+		*C. difformis*	+		+
A. lividus	+	+		*C. lacvigatus*			+
				C. rotundus	+		
Family Asclepiadaceae				*Scirptis tuberosus*	+		+
Oxystelma alpini			+				
				Family Euphorbia			
Family Boraginaceae				*Euphorbia arguta*	+		
Heliotropium europaeum	+	+		*E. forsskalii*	+	+	
H. supinurn			+	*E. geniculata*	+	+	
				E. granulata	+		
Family Caryophyllacea				*E. helioscopia*	+		
Silene conoidea	+			*E. peplis*	+		
Family/*species*	**L**	**W**	**C**	**Family**/*species*	**L**	**W**	**C**
Family Caryophyllacea							
S. nocturna	+						
S. rubella	+		+	**Family Gramineae**			
Stellaria pallida	+			*Agrostis viridis*	+		+
Vaccaria pyramidata	+			*Avena sp*	+		
				Brachiaria eruciformis	+		

Family Chenopodiaceae				*Bromus wildenowii*	+	+	
Beta vulgaris	+	+		*Cynodon dactylon*	+	+	+
Chenopodium album	+	+		*Dactyloctenium aegyptium*	+	+	
				Desmostachya bipinnata		+	+
Family Compositae				*Digitaria sanguinalis*	+	+	
Ageraturm conyzoides			+	*Dinebra retroflexa*	+		
Ambrosia maritima			+	*Echinochloa colonum*	+		+
Anthemis pseudocotula	+	+		*E. crus-galli*	+		+
Aster squamatus	+	+	+	*Eleusine indica*	+		
Calendula arvensis	+	+		*Imperata cylindrica*	+	+	+
Chamomilla recutila	+	+		*Lolium sp.*	+		+
Cichorium endivia	+	+		*Lolium temulentum*	+		
Conyza aegyptiaca	+	+		*Panicum repens*	+		+
Erigeron bonariensis		+		*Papspalidium geminatum*			+
Eclipta prostrata		+	+	*Paspalum paspaloides*	+		+
Family Compositae (cont)				**Family Gramineae (cont.)**			
Lactuca serriola		+		*Phalaris minor*	+	+	
Senecio aegyptius	+			*Poa annua*	+		+
S. flavus	+	+	+	*Setaria glauca*	+	+	+
Silybuin mariarum		+		*S. verticillata*	+		+
Sonchus sp.	+	+	+	*S. viridis*	+		
Xanthium sp.	+		+	*Phragmites australis*		+	+
				Sorghum virgatum	+		+
Family Convolvulaceae							
Convolvulus arvensis	+	+		**Family Juncacaceae**			
Cuscuta arabica	+			*Juncus rigidus*			+
Family Cruciferae				**Family Labiatae**			
Brassica nigra	+			*Mentha longifolia*	+		+
Capsella bursa-pastoris	+	+					
Lepidium sativum	+	+		**Family Leguminosae**			
Sisymbrium irio	+	+	+	*Alhagi maurorum*		+	+
Medicago polymorpha	+	+	+	*Lathyrus hirsutus*	+		
Melilotus indicia	+	+	+	*Lotus arabicus*	+		+
Trifolium resupinatum	+		+				
Family/*species*	**L**	**W**	**C**	**Family**/*species*	**L**	**W**	**C**
Family Cruciferae							
Trigonella hamosa	+		+	**Family Poligonaceae**			
Vicia monantha	+			*Emex spinosus*	+	+	+
				Polygonum salicifolium			+
Family Malvaceae				*P. senegalense*			+
Hibiscus trionum	+		+	*Rumex dentatus*	+		+
Malva parviflora	+	+	+				
				Family Portulacaceae			
Family Onagraceae				*Portulaca oleracea*	+	+	
Jussiaea repens		+	+				
Family Orobanchaceae				**Family Primulaceae**			
Orobanche crenata	+			*Anagallis arvensi*	+		
O. ramosa L	+	+		**Family Solanaceae**			
O. muteli v. spissa	+			*Datura sp.*	+	+	
Family Oxalidaceae				*Solanum nigrum*	+	+	+
Oxalis corniculata	+		+				
				Family Tiliaceae			

Family Plantaginaceae				Corchorus olitorius			
Plantago sp.	+		+		+	+	
				Family Umbelliferae			
Family Utricaceae				Ammi majus	+	+	+
Utrica utens		+	+	A. visnaga	+		+

L = cultivated lands; W = waste lands and road sides; C = verges of canals and drains.

In general, cultivated crops in the area are oriented to the needs of the surrounding population especially those in the Beni-Suef, Minya, Asuit, etc. Vegetables (legumes), Cotton, Corn, Sun-flower, Palm dates, Lime and Lemon, etc. are major crops found in the cultivated part.

4.6.2 FAUNA

Generally speaking, the fauna of the Northern part of the Eastern Dessert, where originally the Minya and Asuit cities is a part of, is related to that of Sinai, Palestine, the Arabian Peninsula and Western Asia.

The mammals known to exist in this part of the dessert are Cape Hare (*Lepus capensis*), *Gerbillus gerbillus, Dpodillus henleyi, Mus musculus, Jaculus jaculus*, Ruppel's Fox (*Vulpes rueppelli*). Camels, sheeps, wild donkeys and goats are frequent mammals observed in the region.

Reptiles are spread over the area, five genera of lizards and three different genera of snakes were reported, they include the small spotted lizard, the gecko lizard and the shockari sand snake.

Birds are also seen within the area. They include the sand partridge, the Egyptian vulture, the Egyptian eagle, the Raven, the Ranner Falcon, etc.

Apparently, nowaday and after the Man Made Alteration to the natural habitat, only domestic and farm animals can be observed. But original population may exist in undisturbed areas surrounding the Minya and Asuit Area.

4.6.2.1 REPTILES

About 34 species of reptiles are known from this area (Habitat Diversity, EEAA-NBU, 1993). However, not all of them are known to occur in the project area. They are *Ptyodactylus guttatus, Mesalina guttulata guttulata, Mabuya quinquetaenita quinqueniata, Acanthodactylus boskiantus asper, Leptotyphlos Cairi, Eryx Jaculus Jaculus, Coluber Florulentus, Psammophis schokari schokari, Naja haje haje*

4.6.2.2 BIRDS

Common breeding birds of the Nile Valley and Delta include 66 species. At least 14 of these are known to breed outside that habitat (Habitat Diversity, EEAA-NBU, 1993).

It is worth mentioning, however, that the only noticed birds species in the project area are the domestic birds (hens, ducks, turkies, chicks, etc.) rared usually by the inhabitants.

4.6.2.3 MAMMALS

Rodents are the most common in the project areas inhabiting the cultivated fields. Among the most characteristic mammalian species are *Hmiechinus auritus, Crocidura flavescens, Herpestes ichneumon* and *Felis sylvestris*. Wild carnivores have suffered a great deal of decline in the recent years as a result of secondary poisoning with pesticides widely used to control *Arvicanthis niloticus* and other rodent pests.

4.7 AQUATIC HABITAT

The aquatic habitats in the project area exist in 4 different locations, namely; the two banks of The River Nile, the submerged Island in the middle of the River, and The Ibrahimiya Canal.

4.7.1 WATER REGIME

The nature of the inflow of the River Nile entering Egypt differs greatly before and after the High Dam. Before the High Dam Table (4.5), the amount of water entering Egypt was 83.9 X 10^9 m^3 / year reaching its maximum during August/September and its minimal values during January/February.

After the High Dam, and due to the water requirements policy and International Convention regulating the use of the water of the River Nile, the water released to the Egyptian channel of the River Nile was almost fixed to be around 57.2 X 10^9 m^3 . Its minimal value was during January and its maximal one during July. This year (1998) and due to exceptional successive high floods, the inflow of the river was greatly altered to lower the water level upstream the dam for safety reasons. The magnitude of discharge is not yet known.

Table (4.4) - ***Average Inflow*of the River Nile Before and after the High Dam***

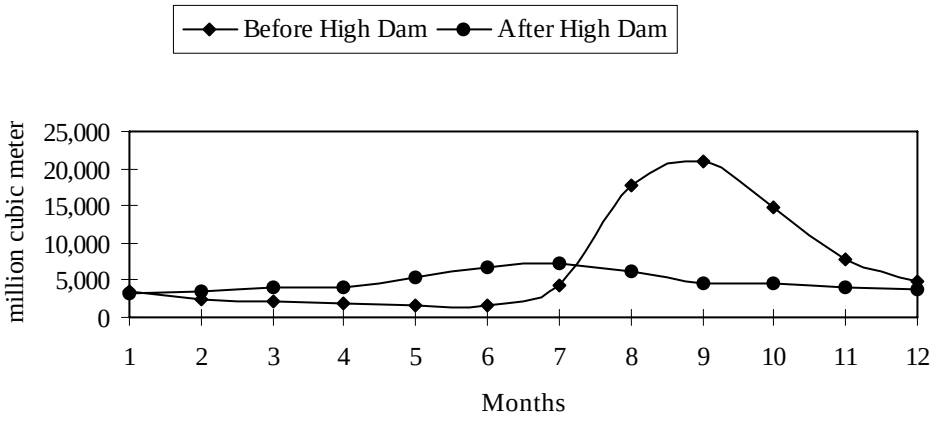
(Data adopted from official statistics)

Month	**Before High Dam 1912 - 1957**	**After High Dam 1970 - 1990**
January	3,620	3,140
February	2,500	3,430

March	2,170	4,075
April	1,800	3,950
May	1,670	5,445
June	1,740	6,700
July	4,300	7,180
August	17,700	6,285
September	21,000	4,650
October	14,800	4,440
November	7,720	4,150
December	4,900	3,730
Total	83,920	57,175

- Million meter cube.

Figure (4.9) - ***Discharge of the River Nile***



The indices of water quality within Minya area indicate a high quality water with a water temperature ranging between 4.7 and 36.2 ^{o} C, a pH around 8, a dissolved oxygen over 7 ppm, a total phosphorus of 0.08 mg-P/l and a nitrate-Nof 0.21 mg-N/l.

4.7.2 PHYTOPLANKTON

The phytoplankton community prevails a healthy community at Beni-Suef with Bacillariophayta (Diatoms) being the dominant group with an average biomass of 6.0 mg/l, followed by Chlorophyta (green Algae) 1.08 mg/l as an average biomass and finally Cyanophyta (Blue-Green Algae) with an average biomass of 0.44 mg/l.

4.7.3 ZOOPLANKTON

Zooplankton has Rotifers as a dominant group (47.5 organism/l) followed by Copepoda (10.5 org/l) and Cladocera (water flees) 5.5 org./l.

4.7.4 BENTHOS

Benthic organisms are vital environmental indicators for pollution and any alteration of the existing environmental conditions. Though references indicate larger communities than those seen during the field trip, but due to the winter season and the extraordinary increase in the water regime during this year, Table (4.5) shows the population densities of benthic organisms found in the project area.

Table (4.5) - ***Benthic organisms (expressed as No / m^2) in the Project Area***

Species	East Bank	Island	West Bank	I. canal
Aquatic Insets				
Chironomus larvae	42	120	60	13
Nymph of Ischnura sp.	20	--	--	23
Micronecta plicuta	153	--	40	--
Total	**215**	**120**	**100**	**36**
Annelida				
Limnodrilus hoffmeisteri	--	112	176	56
Limnodrilus udekemianus	--	45	96	05
Branhiora sowerbyi	--	--	40	53
Total	--	**157**	**312**	**114**
Mullusca				
Lanistes carinatus	30	8	--	27
Cleoptra bulimoides	55	--	--	15
Lymnea sp.	47	--	24	03
Valvata nilotca	--	--	60	--
Bulinus trancatus	40	--	02	11
Corbicula fluminals	--	100	20	--
Total	**172**	**108**	**106**	**56**

4.7.5 HYDROPHYTES

Hydrophyte of the study area is a mixture of floating, submerged and emerged plants. The following genera is known to exist within the project area; *Lemna, Eichornia, Spyrogyra, Potamogaton, Ceratophyllum, Myrophylum, Phragmites, Carex* and *Typha*.

During the field investigation, only few of the above mentioned genera were identified. Table (4.6) shows the densities of the hydrophytes in the project area. It is clear that the western bank has more organisms than other sites.

Table (4.6) - The hydrophytes observed in the different sites of the Project Area

Species	East Bank	Island	West Bank	I.canal
Floating				
Eichhornia crassipes	+++	++	-	-
Submerged				
Nymphaea lotus	++	++	-	+
Potamogeton pectinatus	++	+	+	+
Emerged				
Phragmites australis	+++	++	+	-
Ceratophyllum demersum	+	-	-	++

4.7.6 FISH AND FISHERIES

Beni-Suef, Minya, Asuit, and its vicinity provide the Egyptian Nile River and its canal by almost 7 % of the total catch said to be around 20,000 tons/year.

The fish community within the project area has the tilapias as the major fish caught from the River Nile in Beni-Sweif with 52 % as a percentage composition. Cat-fishes compose 29.2 % of the catch, while other fish groups compose 18.7 %.

The fishing gears usually used in the area are the gill net, the trammel net, the seine net, the small bottom trawling, the long line and the bate line. All fishing methods involve netting are used either active or passive depending on the season and the water level.

The CPE (Catch Per unit Effort) expressed as kg/boat/day was approaching 10.8 kg. This results were experimentally derived throughout different projects and can be taken as indicative values only.

4.8 SOCIO-ECONOMIC FEATURES

4.8.1 HUMAN ACTIVITIES

Farming is the main human activity of the inhabitants of the Minya and Asuit Governorates. These agricultural areas are producing considerable quantities of vegetables beside the common Egyptian crops (Cotton, Maize, Rice, Corn, etc.). Raising cattle is also considered an important activity. The majority of people there, as usual habits of all Egyptian countryside inhabitants, undergo raising of the domesticated animals for their own food staff. Few, if none, industries represented in small workshops and small clay-stone factories are present but not in vicinity to the project site.

4.8.2 HOUSING

No modern developed building and houses are established in this area. The dominant houses are simple houses that characterize all the villages of the Egyptian country side. Not a lot of them are present in the project sites or adjacent to them. The estimated numbers of houses along the vicinity of pipeline's route as follows:-

Section No.	KM Points	Estimated No. of houses
1	0+000 to 15+000	3-5
2	15+000 to 26+000	3

3	26+00 to 36+780	5
4	36+780 to 50+400	10-15
5	50+400 to End of pipeline	4-6

4.8.3 POPULATION

The sites of the project are close to a typical primitive agrarian society living on their production of cash crops. However, the population there is low and the area is calm not crowded. Living facilities are poor and no lodging accommodation facility for foreigners is available.

4.8.4 EDUCATION

The communities living near the wells sites are simple religious rural people who stick to their social reserved norms of living. The largest percentage of the people inhabiting those areas is none - to moderate educated people.

5.0

Alternatives

5.0 Alternatives

As passed in the "Guidelines for the Egyptian Environmental Impact Assessment" issued by EEAA, the concept of alternatives to a proposed project extends to sitting, design, fuels, raw materials and technology selection, construction techniques and phasing and operating and maintenance procedures. The "no action" alternative –not constructing the project- is also considered in order to demonstrate environmental conditions without it.

For the concerned project activities, we can talk about the method that shall be used in crossing the water ways, roads and railways; which is the horizontal directional drilling. An alternative that one may talk about also is the "no action" alternative.

5.1 HORIZONTAL DIRECTIONAL DRILLING (HDD)

HDD is a trenchless construction technique, which uses guided drilling for creating an arc profile. This technique is used for long distances such as under rivers, lagoons, or highly urbanized areas. The process involves three main stages: drilling of a pilot hole, pilot hole enlargement, and pullback installation of the carrier pipe.

HDD is offers several advantages when compared to other trenchless or open-cut construction methods:

- Complicated crossings can be quickly and economically accomplished with a great degree of accuracy since it is possible to monitor and control the drilling operation.
- Sufficient depth can be accomplished to avoid other utilities.
- In river crossing applications, danger of river bed erosion and possible damage from river traffic is eliminated.
- Requires only a small construction footprint.

5.2 THE "NO ACTION" ALTERNATIVE

This alternative expresses the environmental gain if not implementing the proposed exploration activities compared with the project existence.

In order to effectively protect the current environment of the location, it would be better that no activities might be carried out. But when evaluating the concerned process that would be used, it can be concluded that no severe change would take place in the time or after implementing the project activities.

Thus, implementing pipeline project is recommended as long as their impacts are identified, analyzed and the mitigation measures of them are determined and executed.

6.0
Environmental Impacts

6.0 Environmental Impacts

6.1 INTRODUCTION

The previous sections have established the project and its various components, detailed the existing environmental settings and identified the legal and regulatory framework for the proposed pipeline. This section identifies and, where appropriate, quantifies the primary biophysical and socio-economic effects expected to result from construction and operation of

the onshore gas pipeline " Abu Qurqas – Asuit / 120km, 32"". This section identifies specific project activities requiring environmental management and provides an outline of associated control measures.

The maximum project impacts will be during the construction phase, and the operational phase carries very little of concern with respect to generating impacts. A key conclusion of the study is a majority of the impacts identified are amenable to mitigation. The impacts are evaluated against the site specific characteristics to identify the level of residual impact.

6.2 METHODOLOGY

For this EIA, five categories of significance have been adopted. The criteria take into account the degree to which impacts could be quantified and compared with accepted limits and standards or a combination of the magnitude of change caused by the project in combination with the value/sensitivity of the receptor/resource (at the 'qualitative' end of the spectrum). The definitions presented apply throughout the EIA.

The significance of an impact is indentified by:

- Determining the environmental consequence of the activity.
- Determining the likelihood of occurrence of the activity.
- Subsequently, calculating the product of these two parameters.

Consequence

The level of consequence for each identified impact is determined by examining a number of factors relating to the activity as shown in table 6.1.

Table 6.1. Consequence Ranking of identified impact

Category	Ranking	Definition
Catastrophic	**5**	Transboundary and/or national scale impact.
Major	**4**	Regional to national scale
Moderate	**3**	Local to regional scale impact.
Minor	**2**	Local scale impact.
Negligible	**1**	Impact largely not discernable on a local scale being absorbed by natural environmental.
None	**0**	Impact absorbed by local natural environment with no discernable effects.
Positive	**+**	Activity has net positive and beneficial affect resulting in environmental improvement.

Likelihood

Likelihood in this assessment is the likelihood of an activity occuring, table 6.2 shows the critieria for the level of likelihood of the occurrence of an activity.

Table 6.2. Likelihood Ranking Of Activity Occurring

Category	Ranking	Definition
Certain	**5**	The activity will occur under normal operating conditions
Very Likely	**4**	The activity is very likely to occur at some time under normal operating conditions
Likely	**3**	The activity is likely to occur at some time under normal operating conditions
Unlikely	**2**	The activity is unlikely to but may occur at some time under normal operating conditions
Very Unlikely	**1**	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances

Significance

The significance of an impact is determined by calculating the product of an environmental aspect's consequence and likelihood of occurrence. The possible significant rankings are presented in table 6.3.

Table 6.3. Significance Ranking of identified impact

Ranking (Consequence X Likelihood)	Significance
> 16	Critical
9-16	High
6-8	Medium
2-5	Low
< 2	Negligible

6.3. AIR EMISSIONS

Construction and Operation

Emissions of CO_2, CO, SO_2, NO_x and PM_{10} will result from the operation of the proposed project and road vehicles during construction of the pipeline and associated facilities.

Table 6.4. Environmental impact of the proposed air emissions

Emission	Environmental Impact
Carbon dioxide (CO_2)	A green house gas that contribute to climate change
Methane (CH_4)	Contributes directly to climate change by enhancing low level ozone production. Poisonous at high concentrations and can potentially enhance photochemical smog formation
Carbon Monoxide (CO)	Contributes indirectly to climate change by enhancing low level ozone production. Highly toxic to human health at concentrations of several percent and can augment photochemical smog formation.
Oxides of nitrogen (NO_X)	NO_2 is a toxic gas, even at relatively low concentrations. NO_x also contributes to the

Emission	Environmental Impact
	formation of acidic species which can be deposited by wet and dry processes. Acidic species may impact both freshwater and terrestrial ecosystems. NO_x augment the formation of ozone at ground level when mixed with VOCs in the sunlight atmosphere. NO is a relatively innocuous species, but is of interest as a pre-cursor of NO_2.
Sulphur dioxide (SO_2)	SO_2 is a toxic gas, and is known to contribute to acid deposition (wet and dry) which may impact both freshwater and terrestrial ecosystems. Direct health effects potentially causing respiratory illness.
Volatile organic compounds (VOC_S)	Non-methane VOCs associated with the proposed development are anticipated to be predominately hydrocarbons, which play an important role in the formation of photochemical oxidants, such troposhperic ozone. Many are also known or suspected carcinogens.

There is no significant air emission sources expected to be associated with the various pipeline activities included in the scope of the proposed project and the only air emission sources will be associated with the following sources:

- Fugitive emissions from pipeline valves (i.e. mainline and isolation valves), flanges, etc.
- Potential intermittent venting from sectionalising valves provided along with the pipeline which will be short term and intermittent in nature.

The engineering design approach shall avoid or minimize emissions to the atmosphere from fugitive emission sources by applying good engineering practice in the choice of methods and equipment specification to minimize fugitive emissions to be As Low as Possible (ALAP).

More specifically, fugitive emissions from valves will be avoided or minimized through the following:

- Valve design shall be as per the requirements of the ASME B 31.4 to minimize fugitive emissions.
- Selecting of suitable valve packing, seals, etc.

In addition, emissions will arise over a large geographical area and, over the entire construction period, hence any worsening in air quality at any location is unlikely to be significant, and is expected to be transient.

Impact Significance

Based on the above emission control measures, the air emission impacts associated with the proposed pipeline will be of "low" significance.

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.4. DUST

Construction

Dust generated during construction will result from clearing and earthworks, including trenching, levelling, bund construction and reinstatement operations. The major dust sources will be from the movement of vehicles over the cleared work area within the pipeline easement and from vehicles transporting pipes and equipment to the work areas.

The occurrence and significance of the dust generation will depend upon meteorological and ground conditions at the time and location of activities. However, under normal meteorological conditions, dust impacts will be limited to within several hundred meters of the construction area/s.

Dust generation can affect the ability of nearby vegetation to survive and maintain effective evapotranspiration especially at agricultural areas.

Potential nuisance impacts on residential areas in close vicinity of the pipeline construction activities, especially from KM point 100+00 to the end point, whereas the proposed route approaching Asuit's outskirts from desert side as shown in figure 6.1.

It may also pose health risks and irritation to humans, but typically where working in uncontaminated soils, wind-blown dust is normally only considered a nuisance to these exposed.

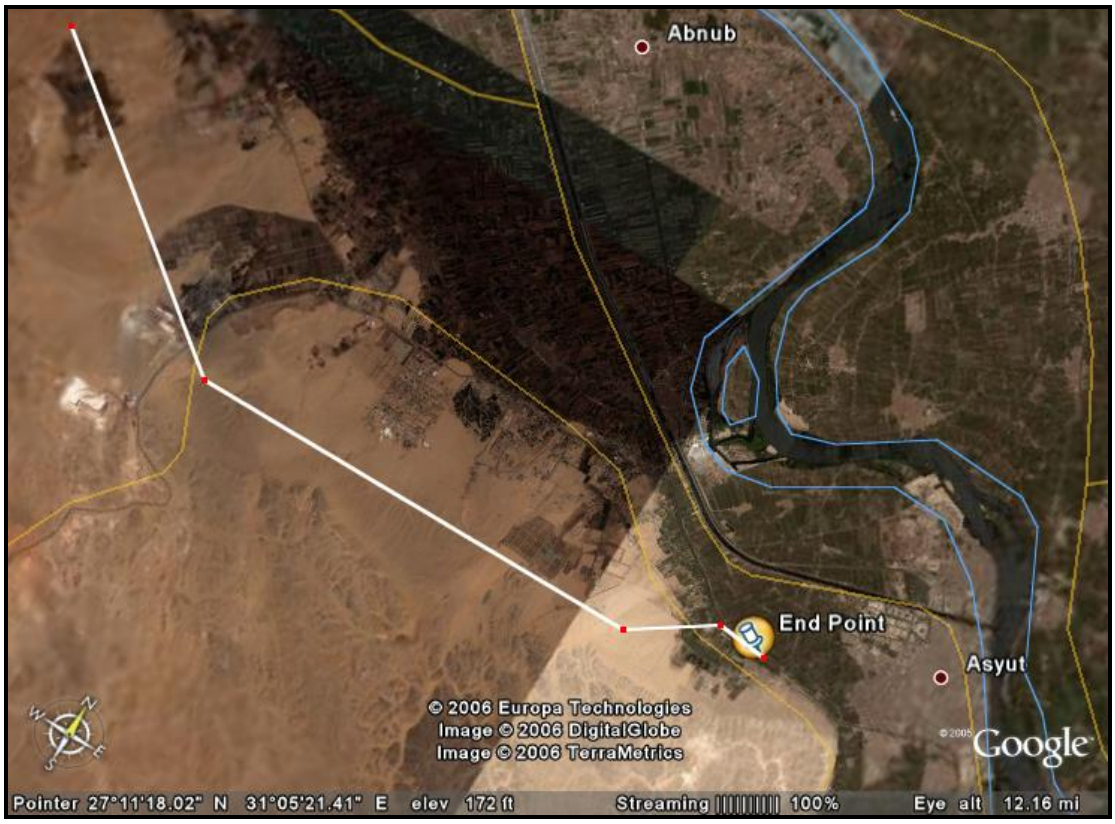


Figure 6.1. "KM point 100+00 to KM point 120+00 shows the proposed route approaching Asyut's outskirts from desert side.

Impact Significance

Quantities of dust generating over the period of construction phase from construction machinery is relatively low as shown in table 6.5.

Table 6.5 Estimated Quantities of dust and PM10 generating from construction equipment/Vehicles.

Equipment	Number	PM	PM10
		(kg)	(kg)
Bore/Drill Rigs	2	5.76	4.08
Excavators	12	43.56	24.48

Crane	3	8.64	6.12
Graders	1	2	1.42
Off-Highway Trucks	29	46.4	33.06
Rubber Tired Dozers	8	10.56	7.52
Skid Steer Loaders	2	5.76	4.08
Dumpers/ Tenders	1	2.88	2.04
Grenerator < 50 hp (37 kw)	4	8	5.68
Air Compressors < 50 hp	7	14	9.94
Welders < 50hp	40	80	56.8
4 X 4 Deisel Vehicles	10	170	120.7
Bus	12	244.8	167.28
TOTAL		**642.36**	**443.2**

Based on the NENES EPA – AP-42

Quantity of Emission = (Emission Factor x Working Hours x number of Equipment) / 1000 = kg Emission Factor :- See annex….
Working Hours = 2000 hr over the construction period for each equipment.
number of equipment :- given for each equipment

There will be relatively high quantities of fugitive dust generated as shown in table 6.6. due to construction activities such as earthmoving, levelling, grading, excavation,…etc.

Table 6.6 Estimated Quantities of dust emission and PM10 generating over the construction period.

Dust	PM10
1976788 kg	**1400225 kg**

Based on NENES EPA – AP-42
Area = pipeline length X Work Area Width = 120 X 0.02 = 2.4 sq km = 593.03188 Acre
Where : Acre = 0.004047 sq km
Working Period = 2000 hr = 2000 / (24 x 30) = 2.7778 month
Dust Emission factor = 1200 kg/Acre-month
PM10 Emission factor= 850 kg/Acre-month

The pipeline route avoided major settlements areas, so it is not anticipated that dust levels will impact greatly on existing settlements, the emissions of dust from construction activities impacts will be localized and the dust is likely to settle in close proximity to the area where clearance activity or other earth work are being carried out.

Many control cost-effectiveness estimates were reviewed some of these estimates contain assumptions different fugitive dust control measures. Table 6.7 is showing different fugitive dust control options based on current cost data and caveats that are applicable to the particular situation.

Table 6.7 Fugitive Dust Control Measures

Source Category	Control Measure	Published PM10 Control Efficiency
Agricultural Tilling	Reduce tilling during high winds	1 – 5%
	Roughen surface	15 – 64%
	Modify equipment	50%
	Employ sequential cropping	50%
	Increase soil moisture	90%
	Use other conservation management practices	25 - 100%
Construction/Demolition	Water unpaved surfaces	10 – 74%
	Limit on-site vehicle speed to 15 mph	57%
	Apply dust suppressant to unpaved areas	84%
	Prohibit activities during high winds	98%
Materials Handling	Implement wet suppression	50 – 70%
Paved Roads	Sweep streets	4 – 26%
	Minimize trackout	40 – 80%
	Remove deposits on road ASAP	>90%
Unpaved Roads	Limit vehicle speed to 25 mph	44%
	Apply water	10 – 74%
	Apply dust suppressant	84%
	Pave the surface	>90%
Wind Erosion (agricultural, open area, and storage piles)	Plant trees or shrubs as a windbreak	25%
	Create cross-wind ridges	24 – 93%
	Erect artificial wind barriers	4 – 88%
	Apply dust suppressant or gravel	84%
	Revegetate; apply cover crop	90%
	Water exposed area before high winds	90%

Consequently, it was concluded that the air quality impacts associated with dust generation will be of "low" significance (subject to provision of applicable dust control measures as shown in table 6.7) as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Operation

Minimal dust will be generated resulting from vehicles that will be used for regular patrolling survey during operation of the pipeline.

Impact Significance

Based on the above emission control measures, the air emission impacts associated with the proposed pipeline will be of "negligible" significance.

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.5. NOISE and VIBRATION

Construction

Noise

Noise will be generated by equipment associated with the construction activities including clearing, ditch digging, drilling, blasting, pipe handling, vehicle movements, etc.

The main sources of noise associated with the proposed construction activities include the following:

- Construction activities.
- Pipe delivery.

Noise impacts on sensitive receptors (hospitals, schools, residential areas…etc) will depend on where they are located relative to the proposed project activities. The pipeline route will avoid as practical as possible the residential areas.

The following activities are expected to be the most significant noise sources during the construction phase of the proposed project:

- Clearing and grading of the ROW.
- Collection and transportation of sand padding.
- Trenching.
- Transport and delivery of pipes.

- Backfilling and reinstatement.

The above noisy activities would be similar to those associated with typical construction sites and it will have temporary impacts at each section of the pipeline. Construction noise levels associated with typical machinery based on "BS 5228: 1997 Noise Control on Construction and Operation Sites" are summarized in table 6.8.

Table 6.8. Sound Pressure Levels of Construction Machinery

Construction Type	Machine/s	Noise Level d (BA)
Earth Moving	Compactors	78
	Front loaders/bull dozers	88
	Back hoes	76
	Tractors	71
	Scrapers	82
	Caterpillar grader	84
	Pavers	74
	Dump truck	74
	Excavators	78
Material Handling	Concrete mixer	76
	Concrete pumps	81
	Cranes	81
Stationary	Pumps	82
	Generators	82

Construction Type	Machine/s	Noise Level d (BA)
	Compressors	85
Others	Vibrators	74
	Vibratory roller	78
	Internal electric vibrator	78

Construction activities are likely to be confined to daytime and noise and the noise levels will only affect the above-specified areas for a relatively short time, while the spread passes through.

A large number of heavy vehicles will be needed to transport the pipes from the supply base to work site.

Because the most of the proposed pipeline segments avoiding the noise sensitive receptors, noise impacts from pipe delivery are unlikely to be a matter of concern. However, if lorry routes are not carefully selected there could be some disturbance to the populated areas and sensitive receptors such as Itlidim, Hour and Gahdem villages along the pipeline route at sections start point to KM point 15+00 approx. and KM point 100+00 to the end point..

The main routing of these vehicles will be along the public roads and temporary access roads may have to be constructed to allow the vehicles access to the pipeline route, except local roads .

Impact Significance

The generation of construction noise is not expected to represent a significant issue to local residents for the following reasons:

- With the exception of start and end sections of pipeline route (start point to KM point 15+00 approx. and KM point 100+00 to the end point), there is no major noise sensitive receptor along the route.

- It is anticipated that the "spread" will progress at an average rate of 1000 m per day and may reach 4-5 km at desert areas , and hence any associated disturbance due to noise at a location would be only short term.
- The construction noise is expected to be of a short duration and dispersion of the noise is likely to be about 100-150 meters from the construction area
- Transportation and materials delivery will be limited to daylight.

Subsequently, the impacts of the noise will be only as much as the duration of the construction activities, and therefore, the impact is "low".

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Vibration

Construction activities have the potential to produce vibration levels that may be annoying or disturbing to humans and may cause damage to structures and architectural if appropriate precautions are not taken.

Construction activities would result in varying degrees of ground-borne vibration, depending on the stage of construction, the equipment and construction methods employed, the distance from the construction locations to vibration-sensitive receptors and soil conditions. The following activities could induce the highest vibration levels:

- Raise boring from trenches upwards.
- Soil compaction with a compactor.
- Rock drilling with crawlers or pneumatic hammers.
- Delivery of materials and heavy trucks movement.

Controlled blasting, soil compaction, excavation, moving of heavy trucks...etc. would produce high vibration levels. Table 6.9. showing typical vibration levels for some construction equipment.

Table 6.9. Vibration Levels of Some Construction Machinery

Construction Activity	PPV at 23 Meter (ips)	PPV at 15 Meter (ips)	PPV at 8 Meter (ips)
Large Bulldozer	0.0	0.03	0.089
Loaded Trucks	0.0	0.027	0.076
Excavation	0.0	0.015	0.035

Source: Federal Transit Adminstration (FTA), Transit Noise and Vibration Impact Assessment, April 1995.
PPV at 25 feet based on FTA 1995, the other distances the following equation was used:
PPV at distance D=PPV (at 25ft) x [(25/D) ^1.5]

Impact Significance

The closest sensitive structures to the site are residential areas at agricultural areas such as Itlidim and Hour villages (i.e. start point to KM point 15+00 approx.) and Asuit's outskirts such as Gahdem (i.e. KM point 100+00 to the end point). There is the potential that, at times, vibration effects would reach levels that would be annoying to residents in nearby buildings. Many of these buildings contain ground and second floors only, vibration levels are likely to be lower on the second floor and above depending the building construction. However, the distance from the closest sensitive receptor and proposed pipeline route will no be less than 50m, in additions many of the vibration causing construction equipment would be used on an intermittent basis (i.e. short-term and temporary in nature) during the construction period. Consequently, no potential significant adverse vibration impacts would be anticipated to occur and therefore, the impact is "low".

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Opera

The pipeline itself is inherently quiet under normal operation.

6.6. SOILS

Construction

Soils can be thought of as a living entity, usually comprising a layered habitat with the thickness varying from place to place. Pipeline construction and subsequent reinstatement simplifies these structures with a knock on effect on the organisms they contain. Reinstatement has the objective of helping nature preserve as much of its integrity as possible.

Potential impacts on the soil will start during construction and how long they endure will depend on the success of reinstatement. The expected quantity of excavated topsoil along the route as follows:

- Desert sandy soil 112500m^3.
- Agricultural top soil 67500m^3**.**

The most significant impact will be the changes in the soil structure and degradation of soil quality as a result of erosion and compaction. However, most of pipeline route is sandy soil area with low fertility; the potential impacts will be from start point to KM point 15+00 approx. as shown in figure 6.2. where extensive agricultural areas existed.

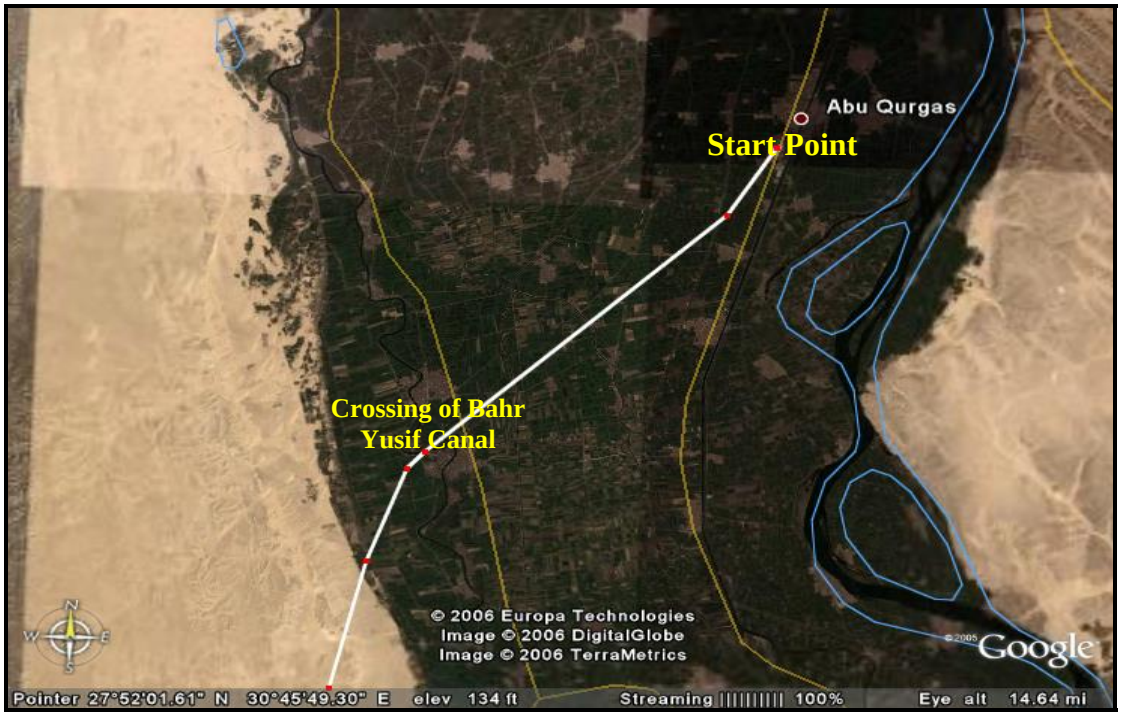


Figure 6.2. "KM point 00+00 to KM point 15+00 shows the proposed route penetrating extensive agricultural area and crossing main water body (i.e. Bahr Yusif canal)"

The main impacts on soil quality associated with pipeline construction activities will be associated with the following impact sources:

- Excavation of the trench and associated pipe-laying activities.
- Potential wind erosion.
- Impacts associated with waste generation/management.
- Fuel spills or leaks.
- Damage to important geological resources.
- Impacts associated with discharge of water generated from dewatering activities.

The entire pipeline shall be buried/laid on prepared ROW of the minimum cover of the pipeline based on the design specifications.

Excavation of the trench and associated pipe-laying activities would require that a width of approximately 20 meters along the proposed pipeline corridor to be utilized.

The overall distance of various segments of the proposed pipeline is about 120 km. Assuming the above working area width of 20 meters, the agricultural area that would be impacted as a result of pipeline construction and installation activities would be approximately $0.3km^2$ apart from total $2.4km^2$ area of pipeline route.

Construction activities will generate additional solid wastes as well, including food refuse, trash, scrap wood and metals, oily rags and empty product drums. Additionally, spills and leaks may also occur from vehicles and heavy equipment used during the construction operations, which may result in soil contamination.

The principal direct environmental impact of soil quality associated with the pipelines is the potential soil contamination from the following sources:

- Spills or leaks from construction machinery.
- Waste generation/management.
- Accidental leaks.

Although the above impact (i.e. soil contamination) will be localized within the spillage zone/area, but potential migration of such contamination to groundwater aquifer may represent significant environmental risk.

Impact Significance

The pipeline construction and laying activities would result localized alteration of the soil profile within the trench footprint, soil compaction in the immediate vicinity as a result of vehicle and construction equipment operations. Disturbed soil could be more susceptible to erosion.

Potential soil contamination may also be associated with waste handling/disposal practices and potential spillage and/or leaks during the course of the construction

activities. However, with proper waste management procedures being followed such impacts could be controlled and/or minimized.

Spill contingency plan will be implemented in case of accidental spills or leaks during the construction phase.

EGAS / GASCO have a comprehensive emergency plan ***(Appendix 3)*** in case of any emergency situation like pipeline rupture.

Consequently, it was concluded that the soil impacts associated with the proposed activities generation will be of "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.7. GROUNDWATER SOURCES

Groundwater along the proposed pipeline corridor occurs at a range of groundwater depths along the pipeline route. The main impacts on groundwater quality associated with pipeline construction activities will be associated with the following impact sources:

- Impacts associated with waste generation/management.
- Potential chemicals/fuel spills or leaks.

The potential impacts on groundwater quality associated with the construction activity may include potential spills/leaks to groundwater from fuel storage, waste handling, etc. However, with proper waste management and spill prevention/control measures, these impacts could be controlled/minimized during the construction phase of the pipeline.

Impact Significance

As excavation of the trenches of the pipeline would only be a depth of approximately 2-3 meters, it is unlikely that any significant groundwater resources would be

impacted except agricultural areas in the first 15km and the last section 20km at Asuit's outskirts (i.e. 45km approx.).

The pipeline trenches will be back-filled following pipeline installation, the effect would be short-term in nature. In the longer term, the physical presence of the pipelines underground is not considered to represent an obstruction to surface or near-surface water flow for the pipeline route.

Also, other potential impacts (i.e. those associated with potential spillages, leaks, etc) are not expected to be of major significance especially with implementation of proper environmental management procedures during the construction phase of the proposed project.

The impact significance of pipeline construction on groundwater is therefore, considered to be "Low" as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.8. SURFACEWATER

The potential of impact to surface water will largely be confined to the area of the pipeline corridor and associated access roads. The route of pipeline will cross numbers of surface water bodies ranging from small canals with width less than 1m to main irrigation canal with width more than 30m. The proposed pipeline will cross one main water body (i.e. Bahr Yusif).

Disturbances due to the pipeline construction on the water bodies could be in the form of increased pollution load by way of airborne particulates generated out of the construction/ vehicle movement activities. The trenching activities may generate trench water, having high suspended solids concentration due to turbidity.

The main water body is Bahr Yusif canal. However, ***EGAS/GASCO*** will use the horizontal directional drilling (HDD) technique in crossing the main water bodies.

This technique is considered the best available technology (BAT) due to being a trenchless methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut. HDD can be implemented with a very limited disruption to surface activities, requires less working space, and performed more quickly than open-cut methods.

For small canals, open-cut technique will be used. This method can be regarded as the standard, and the method is used worldwide in the majority of watercourse crossings. In the wet crossing method, a trench is dug, a pre-welded and hydro-tested pipe section is lowered into the trench, and the trench is backfilled while the stream continues flowing in the channel. Sediment disturbance and transport may be severe, depending upon the water velocity and the nature of the substrate that is being excavated. However, the crossing will be taken quickly and this method will be used for small watercourses only.

The hydro-test water source is planned to be Bahr Yusif canal. Samples will be taken and analyzed before discharging the wastewater to the nearest drainage canals.

Impact Significance

Proper arrangements are being made for the main water bodies crossing will give minimal environmental impacts.

In the unlikely event, the environmental impacts associated with the discharge of water used in hydro-test to be of major significance, especially with proper sampling and analysis to assure that the quality of wastewater meets the requirements of Egyptian law number 48/1982 for Nile protection and its branches, before final disposal to the nearest drainage canals.

The impact significance of pipeline construction on Surface water is therefore, considered to be “Low” as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.9. ECOLOGICAL IMPACTS

The pipeline route crossing patches of medium to dense vegetation, which could be impacted due to the pipeline construction for a short and medium period.

At sections from start point to KM point 15+00 approx. and KM point 100+00 to the end point extensive agricultural areas of domestic farms.

Clearance and grading of the ROW will obviously result in some damage to the desert habitat. However, this will be contained within the 20-25 meters corridor.

Of more concern is the wider potential impact caused by construction activities extending outside the working width. Activities such as collection of sand padding and gatch, as well as stockpiling of materials or waste, and uncontrolled off-road driving, all have the potential to extend the zone of impact considerably.

A large number of lorry movements will also be required for delivery of pipe to the work site. Provision of temporary access roads for these vehicles, if required, will impact upon the environment.

The corridor will be stripped during the construction of the pipeline and associated infrastructure, and as such some habitat loss will occur. In addition, human activity, such as earthmoving procedures and other vehicular traffic movement during the construction phase will cause some fauna temporarily, move away from the affected areas.

The route of pipeline will penetrate extensive agricultural areas for the first 15km of domestic vegetations are characterizing this section. Less extensive agricultural, industrial and residential at the last 20km.

There will be loss of vegetation along the pipeline route due to the clearing activities. This will be constituted as a short-term impact if proper mitigation measures are taken, re-vegetation of farms will take place after cease of construction phase and development of the local ecosystem to original as possible. However, with the mitigation measures in place, the residual impacts should be

minimal, as they aim to offset the localised damages. Domestic animals at agricultural areas may be disturbed. However, the overall construction phase is short term, the disturbance will be minimal.

Impact Significance

Construction and lying of the proposed onshore pipeline is not expected to have impact upon the local ecology. Although the vegetation along the pipeline ROW will be lost during the construction activities, the existing vegetation is locally common, and it is not believed that any sensitive floral species are present along the proposed ROW.

The fauna of the surrounding area is generally mobile, and it is not believed that any species with particular territorial needs will be affected by the construction works. In addition, this impact (if any) will be short term in nature.

If proper environmental management/control measures are followed during the construction phase of the project, impact significance of pipeline construction on terrestrial habitat is expected to be "Low" as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Operation

At operation phase, the pipeline will has negligible impact to vegetation.

Impact Significance

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.10. LANDSCAPE AND VISUAL IMPACTS

Visual impact is a subjective issue, which depends on the scale of a development, the context of the surrounding land use and the presence or absence of sensitive

receptors. The proposed pipeline will be buried along its entire length and hence visual impact can be discounted.

The main land-based structures associated with the project, will be associated with the Sectionalising valves provided along the route of the pipeline.

Most of valves rooms facilities will be developed close to existing facilities, such as roads, railway, existed valve room,…etc. The development of the new facilities will therefore be entirely consistent and in keeping with the industrial character of the surrounding land use.

Impact Significance

The impact on the above receptors will be limited to the construction phase of the proposed project and this impact will be short term in nature (only during the construction phase).

Subsequently, the impacts of the visual impact will be only as much as the duration of the construction activities, and therefore, the impact is "low"

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.11. ARCHAEOLOGY AND CULTURAL HERITAGE

Archaeological, historical religious, cultural, or aesthetic value. Loss of such cultural heritage is irreversible and for that reason historical and archaeological sites are legally protected in Egypt. There is no any archaeological concern encounters the proposed pipeline route, except some monasteries in backyard desert of Nile valley away from the pipeline's ROW

Impact Significance

The distance from historical religious monasteries and the proposed pipeline's route not less than 4-5km.

In the light of the above, the impact on the archaeological features would be "Negligible" significance.

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.12. EROSION CONTROL & SITE RESTORATION

Improper restoration and control measures by the contractor could result in erosion risk predominantly due to wind and to a lesser extent, rains. This is more pronounced in the areas where linear and side slopes are encountered amidst the sand dunes. The area becomes more prone to erosion due to the clearing of trees/ vegetation which have acted as binding medium to hold the soils.

Reinstatement starts and facilitates the recovery process; better the reinstatement, more rapid the recovery. This is moreover important for desert soil environment which is fragile, and which, when disturbed, can take a long time to recover, sometimes, even decades.

Impact Significance

In the light of above management, the impact on the soil erosion will be "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.13. SOCIO-ECONOMIC IMPACTS

6.13.1. Economics & Employment

Construction

During construction of the proposed pipeline and associated infrastructure, it is expected that the local will be beneficially impacted. The local economy will benefit primarily by increased temporary employment opportunities, the project will create considerable non-technical jobs for local enterprises, such as security for the provision of goods and services. During the construction phase, local firms will be considered for contracts to provide food, building materials, earthmoving, etc.

Overall, the proposed gas pipeline is in accordance with regional development plans formulated by the Egyptian oil sector/EGAS/***GASCO***.

Operation

The provision of this gas to the Asuit cementing Co., Asuit refinery and Asuit city will positively impact areas that will increase the sources of green fuel (i.e. natural gas) to avoid using diesel as a fuel any more for better air quality. The long-term operation of the pipeline and associated infrastructure will provide specialized employment and training for a small local workforce. The project will increase the maneuver capability of national network of natural gas. Encourage the developing project in the upper Egypt.

Impact Significance

Based on the above the economics impacts associated with the proposed pipeline will be of "positive"

Consequence = Positive – Activity has net positive and beneficial affect resulting in environmental improvement.
Significance = +ve

6.13.2. Land use Effects

Construction and Operation

The route of pipeline will not require any resettlement of individuals or communities from their homes. Communities living on or near the pipeline route are bound to experience some effects from the project. There will also be unavoidable disruption to use of agricultural land.

Whilst the majority of the pipeline route passes through low population rural areas with low number of houses where agricultural activities are predominant, the project will involve impacts on land, productive assets, and livelihood through:

- *Temporary use of land for construction purposes.*
- *Permanent acquisition of land for valve rooms.*

Early notice will be provided to all landowners and tenants prior to work commencing. This will include details of the work schedule, the nature of the work, its location and access requirements. Provision will be made to incorporate the genuine concerns of the landowners into the construction program as much as possible.

All construction workers will undertake an induction course before working on the project. This will include appropriate environmental management procedures as well as the maintenance or restoration of all existing land use facilities including keeping all drains, fences and gates in an "as is" condition. Access into the pipeline route will be restricted to those authorized project personnel and subcontractors who have undergone site specific safety training and in accordance with the approved procedure including the wearing of appropriate Personal Protective Equipment (PPE)".

Impact Significance

The project will impacts privately owned land. However, ***EGAS / GASCO*** will compensate the land owners with accordance to the agreement between ***EGAS / GASCO*** and ministry of agriculture (See appendix 7)

There will be temporary disruption to communities during the laying of the pipeline and construction of associated facilities, effects from the influx of construction workers. Concern also arises around safety for local residents and their property during construction of the pipeline and in the event of accidental rupture during the operation phase of the pipeline. However, ***EGAS/GASCO*'s** emergency plan will be implemented in case of emergency *(see **EGAS/GASCO*'s** emergency response plan in appendix 3)*

In the light of above management, the impact on the soil erosion will be "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.14. WASTE

Construction & Operation

The stripped top soil will be backfilled carefully in position after the completion of the pipe laying. The top soil will be spread between the track at the side of the working width and the pipe trench and the remainder. In case of, excess excavated material to be removed and disposed of in line with regulations.

Waste oil from the servicing of vehicles and miscellaneous solid wastes, including spent welding rods, packaging waste, used drums, wood, scrap metal, and building rubble will be generated during the construction phase of the project.

The estimated daily domestic rubbish will be generated during construction is 100 kg approx. It will be transported off-site for general landfill to local authority for disposal. Septic waste and domestic wastewater generated at the control facility located at construction locations will be discharged to a septic tank or the municipal sewerage system.

During the operation of the pipeline, little waste will be generated and there will be a low potential risk for significant environmental impact.

Impact Significance

Based on the above the wastes associated with the proposed pipeline activities will be of "low" significance.

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.15. TRAFFIC

Construction of the pipeline will require a large-scale transport operation in order to deliver pipe to the work site and associated construction activities. No information is yet available on the number of vehicle movements that will be required but, based on experience of other similar projects; this number could be several thousand of vehicles trips over the construction period.

Vehicle movements will also arise from the requirement to provide sand padding for the pipeline trench. This will require lorries visiting borrow areas. The need to transport personnel to and from the work site to their base will also generate a significant number of vehicle movements.

The environmental impacts typically associated with traffic generated during pipeline construction projects include:

- Dust from vehicles traveling on un-surfaced roads.
- Noise.
- General damage to the soil surface and flora from uncontrolled off-road driving.
- Potential interference with roads/traffic during pipeline construction activities.

Vehicles traveling along temporary access roads can create large quantities of dust. The impact from this will generally not be of concern, except where it occurs close to populated areas.

The movements of personnel to and from the construction camp can also be expected to cause dust generation. The location of this impact will change as the pipeline spread moves during the construction phase. As with the HGV

movements, impacts from this source are unlikely to be significant due to the remoteness of the majority of the route.

Noise associated with vehicle movements may cause localized impacts on populated areas, depending on the selected vehicle routes. To prevent nuisance impacts arising, lorry routes should be selected to avoid residential areas as far as possible. For the majority of the route, noise from traffic is unlikely to be a concern.

Another potential area of impact is the uncontrolled use of four-wheel drive vehicles in desert areas. Off-road driving by contractors can cause widespread damage to the desert surface as well as destroy vegetation and dormant seeds. Damage could also occur to environmentally sensitive features identified close to the pipeline route.

Impact Significance

If proper control measures are being followed during the construction phase of the proposed project, the potential transport/traffic impacts are expected to be of ‘’low’’ significance as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.0 Environmental Impacts

6.1 INTRODUCTION

The previous sections have established the project and its various components, detailed the existing environmental settings and identified the legal and regulatory framework for the proposed pipeline. This section identifies and, where appropriate, quantifies the primary biophysical and socio-economic effects expected to result from construction and operation of the onshore gas pipeline " Abu Qurqas – Asuit / 120km, 32"". This section identifies specific project activities requiring environmental management and provides an outline of associated control measures.

The maximum project impacts will be during the construction phase, and the operational phase carries very little of concern with respect to generating impacts. A key conclusion of the study is a majority of the impacts identified are amenable to mitigation. The impacts are evaluated against the site specific characteristics to identify the level of residual impact.

6.3 METHODOLOGY

For this EIA, five categories of significance have been adopted. The criteria take into account the degree to which impacts could be quantified and compared with accepted limits and standards or a combination of the magnitude of change caused by the project in combination with the value/sensitivity of the receptor/resource (at

the 'qualitative' end of the spectrum). The definitions presented apply throughout the EIA.

The significance of an impact is indentified by:

- Determining the environmental consequence of the activity.
- Determining the likelihood of occurrence of the activity.
- Subsequently, calculating the product of these two parameters.

Consequence

The level of consequence for each identified impact is determined by examining a number of factors relating to the activity as shown in table 6.1.

Table 6.1. Consequence Ranking of identified impact

Category	Ranking	Definition
Catastrophic	**5**	Transboundary and/or national scale impact.
Major	**4**	Regional to national scale
Moderate	**3**	Local to regional scale impact.
Minor	**2**	Local scale impact.
Negligible	**1**	Impact largely not discernable on a local scale being absorbed by natural environmental.
None	**0**	Impact absorbed by local natural environment with no discernable effects.
Positive	**+**	Activity has net positive and beneficial affect resulting in environmental improvement.

Likelihood

Likelihood in this assessment is the likelihood of an activity occuring, table 6.2 shows the critieria for the level of likelihood of the occurrence of an activity.

Table 6.2. Likelihood Ranking Of Activity Occurring

Category	Ranking	Definition
Certain	**5**	The activity will occur under normal operating conditions
Very Likely	**4**	The activity is very likely to occur at some time under normal operating conditions
Likely	**3**	The activity is likely to occur at some time under normal operating conditions
Unlikely	**2**	The activity is unlikely to but may occur at some time under normal operating conditions
Very Unlikely	**1**	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances

Significance

The significance of an impact is determined by calculating the product of an environmental aspect's consequence and likelihood of occurrence. The possible significant rankings are presented in table 6.3.

Table 6.3. Significance Ranking of identified impact

Ranking (Consequence X Likelihood)	Significance
> 16	**Critical**
9-16	**High**
6-8	**Medium**
2-5	**Low**
< 2	**Negligible**

6.3. AIR EMISSIONS

Construction and Operation

Emissions of CO_2, CO, SO_2, NO_x and PM_{10} will result from the operation of the proposed project and road vehicles during construction of the pipeline and associated facilities.

Table 6.4. Environmental impact of the proposed air emissions

Emission	Environmental Impact
Carbon dioxide (CO_2)	A green house gas that contribute to climate change
Methane (CH_4)	Contributes directly to climate change by enhancing low level ozone production. Poisonous at high concentrations and can potentially enhance photochemical smog formation
Carbon Monoxide (CO)	Contributes indirectly to climate change by enhancing low level ozone production. Highly toxic to human health at concentrations of several percent and can augment photochemical smog formation.
Oxides of nitrogen (NO_X)	NO_2 is a toxic gas, even at relatively low concentrations. NO_x also contributes to the formation of acidic species which can be deposited by wet and dry processes. Acidic species may impact both freshwater and terrestrial ecosystems. NO_x augment the formation of ozone at ground level when mixed with VOCs in the sunlight atmosphere. NO is a relatively innocuous species, but is of interest as a pre-cursor of NO_2.
Sulphur dioxide (SO_2)	SO_2 is a toxic gas, and is known to contribute to acid deposition (wet and dry) which may impact both freshwater and terrestrial ecosystems. Direct health effects potentially causing respiratory illness.
Volatile organic compounds (VOC_S)	Non-methane VOCs associated with the proposed development are anticipated to be predominately hydrocarbons, which play an important role in the formation of photochemical oxidants, such troposhperic ozone. Many are also known or suspected carcinogens.

There is no significant air emission sources expected to be associated with the various pipeline activities included in the scope of the proposed project and the only air emission sources will be associated with the following sources:

- Fugitive emissions from pipeline valves (i.e. mainline and isolation valves), flanges, etc.
- Potential intermittent venting from sectionalising valves provided along with the pipeline which will be short term and intermittent in nature.

The engineering design approach shall avoid or minimize emissions to the atmosphere from fugitive emission sources by applying good engineering practice in the choice of methods and equipment specification to minimize fugitive emissions to be As Low as Possible (ALAP).

More specifically, fugitive emissions from valves will be avoided or minimized through the following:

- Valve design shall be as per the requirements of the ASME B 31.4 to minimize fugitive emissions.
- Selecting of suitable valve packing, seals, etc.

In addition, emissions will arise over a large geographical area and, over the entire construction period, hence any worsening in air quality at any location is unlikely to be significant, and is expected to be transient.

Impact Significance

Based on the above emission control measures, the air emission impacts associated with the proposed pipeline will be of “low” significance.

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.4. DUST

Construction

Dust generated during construction will result from clearing and earthworks, including trenching, levelling, bund construction and reinstatement operations. The major dust sources will be from the movement of vehicles over the cleared work area within the pipeline easement and from vehicles transporting pipes and equipment to the work areas.

The occurrence and significance of the dust generation will depend upon meteorological and ground conditions at the time and location of activities. However, under normal meteorological conditions, dust impacts will be limited to within several hundred meters of the construction area/s.

Dust generation can affect the ability of nearby vegetation to survive and maintain effective evapotranspiration especially at agricultural areas.

Potential nuisance impacts on residential areas in close vicinity of the pipeline construction activities, especially from KM point 100+00 to the end point, whereas the proposed route approaching Asuit's outskirts from desert side as shown in figure 6.1.

It may also pose health risks and irritation to humans, but typically where working in uncontaminated soils, wind-blown dust is normally only considered a nuisance to these exposed.

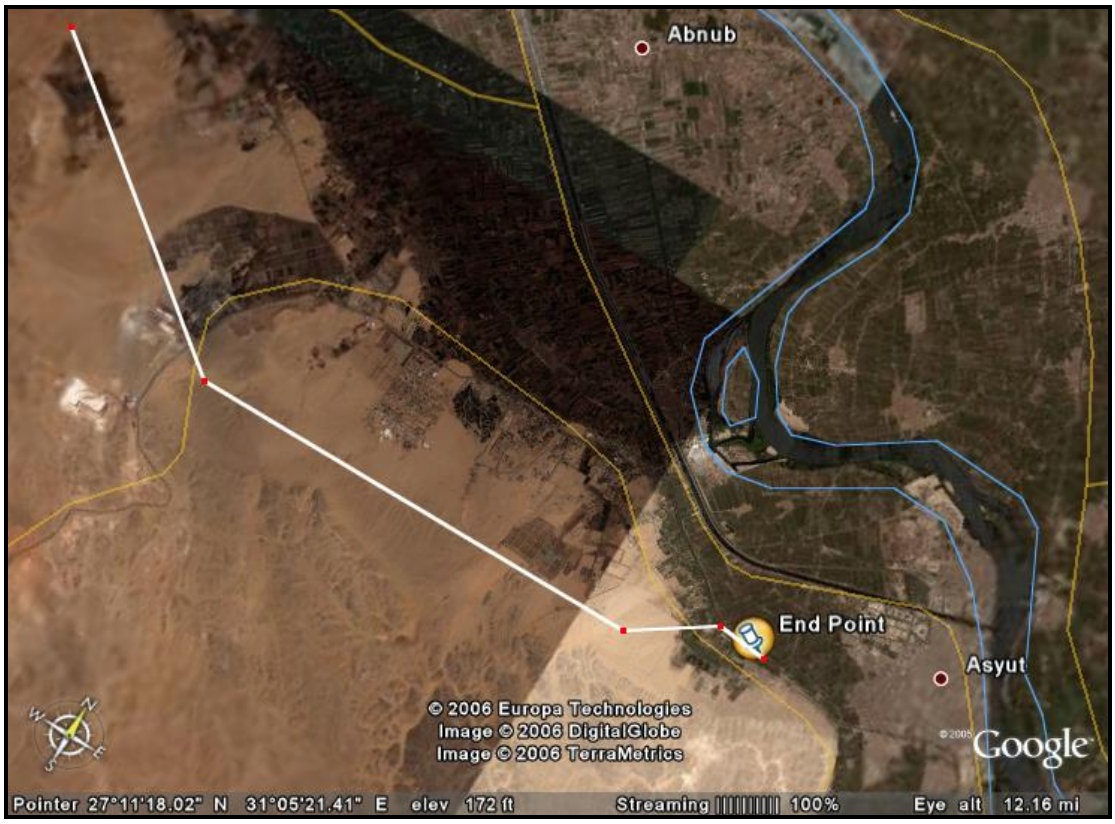


Figure 6.1. "KM point 100+00 to KM point 120+00 shows the proposed route approaching Asyut's outskirts from desert side.

Impact Significance

Quantities of dust generating over the period of construction phase from construction machinery is relatively low as shown in table 6.5.

Table 6.5 Estimated Quantities of dust and PM10 generating from construction equipment/Vehicles.

Equipment	Number	PM	PM10
		(kg)	(kg)
Bore/Drill Rigs	2	5.76	4.08
Excavators	12	43.56	24.48
Crane	3	8.64	6.12
Graders	1	2	1.42
Off-Highway Trucks	29	46.4	33.06
Rubber Tired Dozers	8	10.56	7.52
Skid Steer Loaders	2	5.76	4.08
Dumpers/ Tenders	1	2.88	2.04
Grenerator < 50 hp (37 kw)	4	8	5.68
Air Compressors < 50 hp	7	14	9.94
Welders < 50hp	40	80	56.8
4 X 4 Deisel Vehicles	10	170	120.7
Bus	12	244.8	167.28

TOTAL	**642.36**	**443.2**

Based on the NENES EPA – AP-42

Quantity of Emission = (Emission Factor x Working Hours x number of Equipment) / 1000 = kg Emission Factor :- See annex….
Working Hours = 2000 hr over the construction period for each equipment.
number of equipment :- given for each equipment

There will be relatively high quantities of fugitive dust generated as shown in table 6.6. due to construction activities such as earthmoving, levelling, grading, excavation,…etc.

Table 6.6 Estimated Quantities of dust emission and PM10 generating over the construction period.

Dust	PM10
1976788 kg	**1400225 kg**

Based on NENES EPA – AP-42
Area = pipeline length X Work Area Width = 120 X 0.02 = 2.4 sq km = 593.03188 Acre
Where : Acre = 0.004047 sq km
Working Period = 2000 hr = 2000 / (24 x 30) = 2.7778 month
Dust Emission factor = 1200 kg/Acre-month
PM10 Emission factor= 850 kg/Acre-month

The pipeline route avoided major settlements areas, so it is not anticipated that dust levels will impact greatly on existing settlements, the emissions of dust from construction activities impacts will be localized and the dust is likely to settle in close proximity to the area where clearance activity or other earth work are being carried out.

Many control cost-effectiveness estimates were reviewed some of these estimates contain assumptions different fugitive dust control measures. Table 6.7 is showing different fugitive dust control options based on current cost data and caveats that are applicable to the particular situation.

Table 6.7 Fugitive Dust Control Measures

Source Category	Control Measure	Published PM10 Control Efficiency
Agricultural Tilling	Reduce tilling during high winds	1 – 5%
	Roughen surface	15 – 64%
	Modify equipment	50%
	Employ sequential cropping	50%
	Increase soil moisture	90%

Source Category	Control Measure	Published PM10 Control Efficiency
	Use other conservation management practices	25 - 100%
Construction/Demolition	Water unpaved surfaces	10 – 74%
	Limit on-site vehicle speed to 15 mph	57%
	Apply dust suppressant to unpaved areas	84%
	Prohibit activities during high winds	98%
Materials Handling	Implement wet suppression	50 – 70%
Paved Roads	Sweep streets	4 – 26%
	Minimize trackout	40 – 80%
	Remove deposits on road ASAP	>90%
Unpaved Roads	Limit vehicle speed to 25 mph	44%
	Apply water	10 – 74%
	Apply dust suppressant	84%
	Pave the surface	>90%
Wind Erosion (agricultural, open area, and storage piles)	Plant trees or shrubs as a windbreak	25%
	Create cross-wind ridges	24 – 93%
	Erect artificial wind barriers	4 – 88%
	Apply dust suppressant or gravel	84%
	Revegetate; apply cover crop	90%
	Water exposed area before high winds	90%

Consequently, it was concluded that the air quality impacts associated with dust generation will be of "low" significance (subject to provision of applicable dust control measures as shown in table 6.7) as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Operation

Minimal dust will be generated resulting from vehicles that will be used for regular patrolling survey during operation of the pipeline.

Impact Significance

Based on the above emission control measures, the air emission impacts associated with the proposed pipeline will be of "negligible" significance.

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.5. NOISE and VIBRATION

Construction

Noise

Noise will be generated by equipment associated with the construction activities including clearing, ditch digging, drilling, blasting, pipe handling, vehicle movements, etc.

The main sources of noise associated with the proposed construction activities include the following:

- Construction activities.
- Pipe delivery.

Noise impacts on sensitive receptors (hospitals, schools, residential areas…etc) will depend on where they are located relative to the proposed project activities. The pipeline route will avoid as practical as possible the residential areas.

The following activities are expected to be the most significant noise sources during the construction phase of the proposed project:

- Clearing and grading of the ROW.
- Collection and transportation of sand padding.
- Trenching.
- Transport and delivery of pipes.
- Backfilling and reinstatement.

The above noisy activities would be similar to those associated with typical construction sites and it will have temporary impacts at each section of the pipeline. Construction noise levels associated with typical machinery based on "BS 5228:

1997 Noise Control on Construction and Operation Sites" are summarized in table 6.8.

Table 6.8. Sound Pressure Levels of Construction Machinery

Construction Type	Machine/s	Noise Level d (BA)
Earth Moving	Compactors	78
	Front loaders/bull dozers	88
	Back hoes	76
	Tractors	71
	Scrapers	82
	Caterpillar grader	84
	Pavers	74
	Dump truck	74
	Excavators	78
Material Handling	Concrete mixer	76
	Concrete pumps	81
	Cranes	81
Stationary	Pumps	82
	Generators	82
	Compressors	85
Others	Vibrators	74
	Vibratory roller	78

Construction Type	Machine/s	Noise Level d (BA)
	Internal electric vibrator	78

Construction activities are likely to be confined to daytime and noise and the noise levels will only affect the above-specified areas for a relatively short time, while the spread passes through.

A large number of heavy vehicles will be needed to transport the pipes from the supply base to work site.

Because the most of the proposed pipeline segments avoiding the noise sensitive receptors, noise impacts from pipe delivery are unlikely to be a matter of concern. However, if lorry routes are not carefully selected there could be some disturbance to the populated areas and sensitive receptors such as Itlidim, Hour and Gahdem villages along the pipeline route at sections start point to KM point 15+00 approx. and KM point 100+00 to the end point..

The main routing of these vehicles will be along the public roads and temporary access roads may have to be constructed to allow the vehicles access to the pipeline route, except local roads .

Impact Significance

The generation of construction noise is not expected to represent a significant issue to local residents for the following reasons:

- With the exception of start and end sections of pipeline route (start point to KM point 15+00 approx. and KM point 100+00 to the end point), there is no major noise sensitive receptor along the route.
- It is anticipated that the "spread" will progress at an average rate of 1000 m per day and may reach 4-5 km at desert areas , and hence any associated disturbance due to noise at a location would be only short term.

- The construction noise is expected to be of a short duration and dispersion of the noise is likely to be about 100-150 meters from the construction area
- Transportation and materials delivery will be limited to daylight.

Subsequently, the impacts of the noise will be only as much as the duration of the construction activities, and therefore, the impact is "low".

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Vibration

Construction activities have the potential to produce vibration levels that may be annoying or disturbing to humans and may cause damage to structures and architectural if appropriate precautions are not taken.

Construction activities would result in varying degrees of ground-borne vibration, depending on the stage of construction, the equipment and construction methods employed, the distance from the construction locations to vibration-sensitive receptors and soil conditions. The following activities could induce the highest vibration levels:

- Raise boring from trenches upwards.
- Soil compaction with a compactor.
- Rock drilling with crawlers or pneumatic hammers.
- Delivery of materials and heavy trucks movement.

Controlled blasting, soil compaction, excavation, moving of heavy trucks...etc. would produce high vibration levels. Table 6.9. showing typical vibration levels for some construction equipment.

Table 6.9. Vibration Levels of Some Construction Machinery

Construction	PPV at 23	PPV at 15 Meter (ips)	PPV at 8 Meter (ips)

Activity	Meter (ips)		
Large Bulldozer	0.0	0.03	0.089
Loaded Trucks	0.0	0.027	0.076
Excavation	0.0	0.015	0.035

Source: Federal Transit Adminstration (FTA), Transit Noise and Vibration Impact Assessment, April 1995.
PPV at 25 feet based on FTA 1995, the other distances the following equation was used:
PPV at distance D=PPV (at 25ft) x [(25/D) ^1.5]

Impact Significance

The closest sensitive structures to the site are residential areas at agricultural areas such as Itlidim and Hour villages (i.e. start point to KM point 15+00 approx.) and Asuit's outskirts such as Gahdem (i.e. KM point 100+00 to the end point). There is the potential that, at times, vibration effects would reach levels that would be annoying to residents in nearby buildings. Many of these buildings contain ground and second floors only, vibration levels are likely to be lower on the second floor and above depending the building construction. However, the distance from the closest sensitive receptor and proposed pipeline route will no be less than 50m, in additions many of the vibration causing construction equipment would be used on an intermittent basis (i.e. short-term and temporary in nature) during the construction period. Consequently, no potential significant adverse vibration impacts would be anticipated to occur and therefore, the impact is "low".

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Opera

The pipeline itself is inherently quiet under normal operation.

6.7. SOILS

Construction

Soils can be thought of as a living entity, usually comprising a layered habitat with the thickness varying from place to place. Pipeline construction and subsequent reinstatement simplifies these structures with a knock on effect on the organisms they contain. Reinstatement has the objective of helping nature preserve as much of its integrity as possible.

Potential impacts on the soil will start during construction and how long they endure will depend on the success of reinstatement. The expected quantity of excavated topsoil along the route as follows:

- Desert sandy soil 112500m^3.
- Agricultural top soil 67500m^3**.**

The most significant impact will be the changes in the soil structure and degradation of soil quality as a result of erosion and compaction. However, most of pipeline route is sandy soil area with low fertility; the potential impacts will be from start point to KM point 15+00 approx. as shown in figure 6.2. where extensive agricultural areas existed.

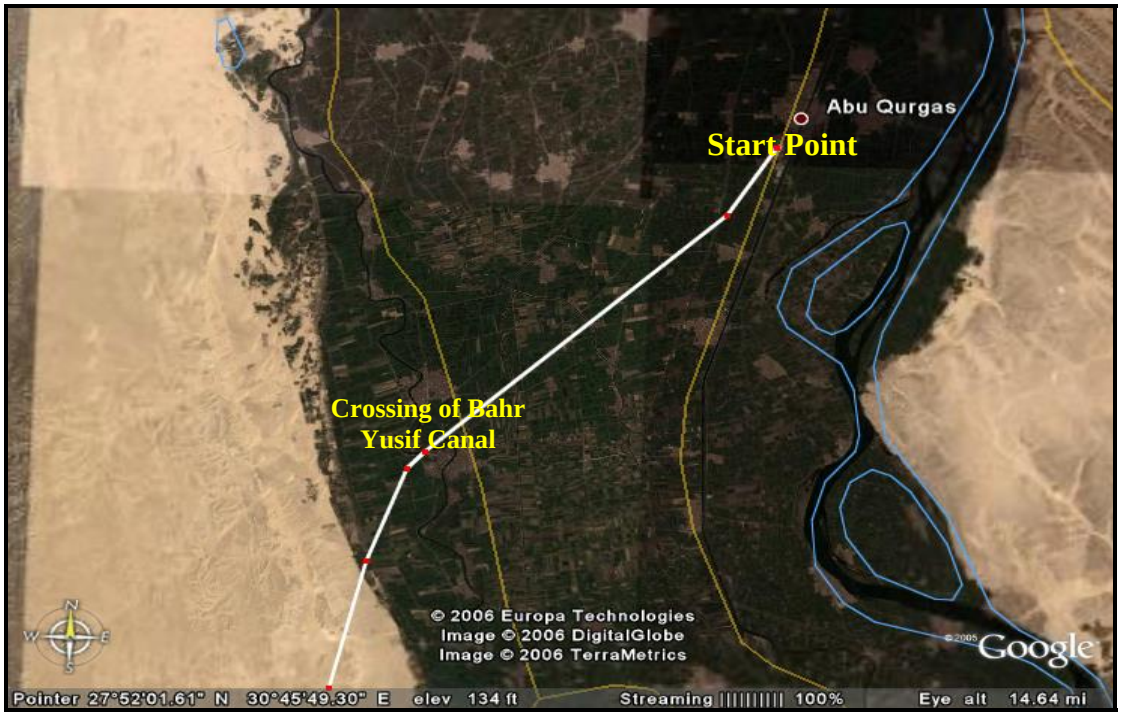


Figure 6.2. "KM point 00+00 to KM point 15+00 shows the proposed route penetrating extensive agricultural area and crossing main water body (i.e. Bahr Yusif canal)"

The main impacts on soil quality associated with pipeline construction activities will be associated with the following impact sources:

- Excavation of the trench and associated pipe-laying activities.
- Potential wind erosion.
- Impacts associated with waste generation/management.
- Fuel spills or leaks.
- Damage to important geological resources.
- Impacts associated with discharge of water generated from dewatering activities.

The entire pipeline shall be buried/laid on prepared ROW of the minimum cover of the pipeline based on the design specifications.

Excavation of the trench and associated pipe-laying activities would require that a width of approximately 20 meters along the proposed pipeline corridor to be utilized.

The overall distance of various segments of the proposed pipeline is about 120 km. Assuming the above working area width of 20 meters, the agricultural area that would be impacted as a result of pipeline construction and installation activities would be approximately $0.3km^2$ apart from total $2.4km^2$ area of pipeline route.

Construction activities will generate additional solid wastes as well, including food refuse, trash, scrap wood and metals, oily rags and empty product drums. Additionally, spills and leaks may also occur from vehicles and heavy equipment used during the construction operations, which may result in soil contamination.

The principal direct environmental impact of soil quality associated with the pipelines is the potential soil contamination from the following sources:

- Spills or leaks from construction machinery.
- Waste generation/management.
- Accidental leaks.

Although the above impact (i.e. soil contamination) will be localized within the spillage zone/area, but potential migration of such contamination to groundwater aquifer may represent significant environmental risk.

Impact Significance

The pipeline construction and laying activities would result localized alteration of the soil profile within the trench footprint, soil compaction in the immediate vicinity as a result of vehicle and construction equipment operations. Disturbed soil could be more susceptible to erosion.

Potential soil contamination may also be associated with waste handling/disposal practices and potential spillage and/or leaks during the course of the construction

activities. However, with proper waste management procedures being followed such impacts could be controlled and/or minimized.

Spill contingency plan will be implemented in case of accidental spills or leaks during the construction phase.

EGAS / GASCO have a comprehensive emergency plan ***(Appendix 3)*** in case of any emergency situation like pipeline rupture.

Consequently, it was concluded that the soil impacts associated with the proposed activities generation will be of "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.7. GROUNDWATER SOURCES

Groundwater along the proposed pipeline corridor occurs at a range of groundwater depths along the pipeline route. The main impacts on groundwater quality associated with pipeline construction activities will be associated with the following impact sources:

- Impacts associated with waste generation/management.
- Potential chemicals/fuel spills or leaks.

The potential impacts on groundwater quality associated with the construction activity may include potential spills/leaks to groundwater from fuel storage, waste handling, etc. However, with proper waste management and spill prevention/control measures, these impacts could be controlled/minimized during the construction phase of the pipeline.

Impact Significance

As excavation of the trenches of the pipeline would only be a depth of approximately 2-3 meters, it is unlikely that any significant groundwater resources would be

impacted except agricultural areas in the first 15km and the last section 20km at Asuit's outskirts (i.e. 45km approx.).

The pipeline trenches will be back-filled following pipeline installation, the effect would be short-term in nature. In the longer term, the physical presence of the pipelines underground is not considered to represent an obstruction to surface or near-surface water flow for the pipeline route.

Also, other potential impacts (i.e. those associated with potential spillages, leaks, etc) are not expected to be of major significance especially with implementation of proper environmental management procedures during the construction phase of the proposed project.

The impact significance of pipeline construction on groundwater is therefore, considered to be "Low" as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.8. SURFACEWATER

The potential of impact to surface water will largely be confined to the area of the pipeline corridor and associated access roads. The route of pipeline will cross numbers of surface water bodies ranging from small canals with width less than 1m to main irrigation canal with width more than 30m. The proposed pipeline will cross one main water body (i.e. Bahr Yusif).

Disturbances due to the pipeline construction on the water bodies could be in the form of increased pollution load by way of airborne particulates generated out of the construction/ vehicle movement activities. The trenching activities may generate trench water, having high suspended solids concentration due to turbidity.

The main water body is Bahr Yusif canal. However, ***EGAS/GASCO*** will use the horizontal directional drilling (HDD) technique in crossing the main water bodies.

This technique is considered the best available technology (BAT) due to being a trenchless methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut. HDD can be implemented with a very limited disruption to surface activities, requires less working space, and performed more quickly than open-cut methods.

For small canals, open-cut technique will be used. This method can be regarded as the standard, and the method is used worldwide in the majority of watercourse crossings. In the wet crossing method, a trench is dug, a pre-welded and hydro-tested pipe section is lowered into the trench, and the trench is backfilled while the stream continues flowing in the channel. Sediment disturbance and transport may be severe, depending upon the water velocity and the nature of the substrate that is being excavated. However, the crossing will be taken quickly and this method will be used for small watercourses only.

The hydro-test water source is planned to be Bahr Yusif canal. Samples will be taken and analyzed before discharging the wastewater to the nearest drainage canals.

Impact Significance

Proper arrangements are being made for the main water bodies crossing will give minimal environmental impacts.

In the unlikely event, the environmental impacts associated with the discharge of water used in hydro-test to be of major significance, especially with proper sampling and analysis to assure that the quality of wastewater meets the requirements of Egyptian law number 48/1982 for Nile protection and its branches, before final disposal to the nearest drainage canals.

The impact significance of pipeline construction on Surface water is therefore, considered to be “Low” as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.10. ECOLOGICAL IMPACTS

The pipeline route crossing patches of medium to dense vegetation, which could be impacted due to the pipeline construction for a short and medium period.

At sections from start point to KM point 15+00 approx. and KM point 100+00 to the end point extensive agricultural areas of domestic farms.

Clearance and grading of the ROW will obviously result in some damage to the desert habitat. However, this will be contained within the 20-25 meters corridor.

Of more concern is the wider potential impact caused by construction activities extending outside the working width. Activities such as collection of sand padding and gatch, as well as stockpiling of materials or waste, and uncontrolled off-road driving, all have the potential to extend the zone of impact considerably.

A large number of lorry movements will also be required for delivery of pipe to the work site. Provision of temporary access roads for these vehicles, if required, will impact upon the environment.

The corridor will be stripped during the construction of the pipeline and associated infrastructure, and as such some habitat loss will occur. In addition, human activity, such as earthmoving procedures and other vehicular traffic movement during the construction phase will cause some fauna temporarily, move away from the affected areas.

The route of pipeline will penetrate extensive agricultural areas for the first 15km of domestic vegetations are characterizing this section. Less extensive agricultural, industrial and residential at the last 20km.

There will be loss of vegetation along the pipeline route due to the clearing activities. This will be constituted as a short-term impact if proper mitigation measures are taken, re-vegetation of farms will take place after cease of construction phase and development of the local ecosystem to original as possible. However, with the mitigation measures in place, the residual impacts should be

minimal, as they aim to offset the localised damages. Domestic animals at agricultural areas may be disturbed. However, the overall construction phase is short term, the disturbance will be minimal.

Impact Significance

Construction and lying of the proposed onshore pipeline is not expected to have impact upon the local ecology. Although the vegetation along the pipeline ROW will be lost during the construction activities, the existing vegetation is locally common, and it is not believed that any sensitive floral species are present along the proposed ROW.

The fauna of the surrounding area is generally mobile, and it is not believed that any species with particular territorial needs will be affected by the construction works. In addition, this impact (if any) will be short term in nature.

If proper environmental management/control measures are followed during the construction phase of the project, impact significance of pipeline construction on terrestrial habitat is expected to be "Low" as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

Operation

At operation phase, the pipeline will has negligible impact to vegetation.

Impact Significance

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.10. LANDSCAPE AND VISUAL IMPACTS

Visual impact is a subjective issue, which depends on the scale of a development, the context of the surrounding land use and the presence or absence of sensitive

receptors. The proposed pipeline will be buried along its entire length and hence visual impact can be discounted.

The main land-based structures associated with the project, will be associated with the Sectionalising valves provided along the route of the pipeline.

Most of valves rooms facilities will be developed close to existing facilities, such as roads, railway, existed valve room,…etc. The development of the new facilities will therefore be entirely consistent and in keeping with the industrial character of the surrounding land use.

Impact Significance

The impact on the above receptors will be limited to the construction phase of the proposed project and this impact will be short term in nature (only during the construction phase).

Subsequently, the impacts of the visual impact will be only as much as the duration of the construction activities, and therefore, the impact is "low"

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.11. ARCHAEOLOGY AND CULTURAL HERITAGE

Archaeological, historical religious, cultural, or aesthetic value. Loss of such cultural heritage is irreversible and for that reason historical and archaeological sites are legally protected in Egypt. There is no any archaeological concern encounters the proposed pipeline route, except some monasteries in backyard desert of Nile valley away from the pipeline's ROW

Impact Significance

The distance from historical religious monasteries and the proposed pipeline's route not less than 4-5km.

In the light of the above, the impact on the archaeological features would be "Negligible" significance.

Likelihood of occurrence = 2 – Unlikely to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 2 Negligible

6.14. EROSION CONTROL & SITE RESTORATION

Improper restoration and control measures by the contractor could result in erosion risk predominantly due to wind and to a lesser extent, rains. This is more pronounced in the areas where linear and side slopes are encountered amidst the sand dunes. The area becomes more prone to erosion due to the clearing of trees/ vegetation which have acted as binding medium to hold the soils.

Reinstatement starts and facilitates the recovery process; better the reinstatement, more rapid the recovery. This is moreover important for desert soil environment which is fragile, and which, when disturbed, can take a long time to recover, sometimes, even decades.

Impact Significance

In the light of above management, the impact on the soil erosion will be "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.15. SOCIO-ECONOMIC IMPACTS

6.13.1. Economics & Employment

Construction

During construction of the proposed pipeline and associated infrastructure, it is expected that the local will be beneficially impacted. The local economy will benefit primarily by increased temporary employment opportunities, the project will create considerable non-technical jobs for local enterprises, such as security for the provision of goods and services. During the construction phase, local firms will be considered for contracts to provide food, building materials, earthmoving, etc.

Overall, the proposed gas pipeline is in accordance with regional development plans formulated by the Egyptian oil sector/EGAS/***GASCO***.

Operation

The provision of this gas to the Asuit cementing Co., Asuit refinery and Asuit city will positively impact areas that will increase the sources of green fuel (i.e. natural gas) to avoid using diesel as a fuel any more for better air quality. The long-term operation of the pipeline and associated infrastructure will provide specialized employment and training for a small local workforce. The project will increase the maneuver capability of national network of natural gas. Encourage the developing project in the upper Egypt.

Impact Significance

Based on the above the economics impacts associated with the proposed pipeline will be of "positive"

Consequence = Positive – Activity has net positive and beneficial affect resulting in environmental improvement.
Significance = +ve

6.13.2. Land use Effects

Construction and Operation

The route of pipeline will not require any resettlement of individuals or communities from their homes. Communities living on or near the pipeline route are bound to experience some effects from the project. There will also be unavoidable disruption to use of agricultural land.

Whilst the majority of the pipeline route passes through low population rural areas with low number of houses where agricultural activities are predominant, the project will involve impacts on land, productive assets, and livelihood through:

- *Temporary use of land for construction purposes.*
- *Permanent acquisition of land for valve rooms.*

Early notice will be provided to all landowners and tenants prior to work commencing. This will include details of the work schedule, the nature of the work, its location and access requirements. Provision will be made to incorporate the genuine concerns of the landowners into the construction program as much as possible.

All construction workers will undertake an induction course before working on the project. This will include appropriate environmental management procedures as well as the maintenance or restoration of all existing land use facilities including keeping all drains, fences and gates in an "as is" condition. Access into the pipeline route will be restricted to those authorized project personnel and subcontractors who have undergone site specific safety training and in accordance with the approved procedure including the wearing of appropriate Personal Protective Equipment (PPE)".

Impact Significance

The project will impacts privately owned land. However, ***EGAS / GASCO*** will compensate the land owners with accordance to the agreement between ***EGAS / GASCO*** and ministry of agriculture (See appendix 7)

There will be temporary disruption to communities during the laying of the pipeline and construction of associated facilities, effects from the influx of construction workers. Concern also arises around safety for local residents and their property during construction of the pipeline and in the event of accidental rupture during the operation phase of the pipeline. However, ***EGAS/GASCO*'s** emergency plan will be implemented in case of emergency *(see **EGAS/GASCO*'s** emergency response plan in appendix 3)*

In the light of above management, the impact on the soil erosion will be "Low" significance

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.14. WASTE

Construction & Operation

The stripped top soil will be backfilled carefully in position after the completion of the pipe laying. The top soil will be spread between the track at the side of the working width and the pipe trench and the remainder. In case of, excess excavated material to be removed and disposed of in line with regulations.

Waste oil from the servicing of vehicles and miscellaneous solid wastes, including spent welding rods, packaging waste, used drums, wood, scrap metal, and building rubble will be generated during the construction phase of the project.

The estimated daily domestic rubbish will be generated during construction is 100 kg approx. It will be transported off-site for general landfill to local authority for disposal. Septic waste and domestic wastewater generated at the control facility located at construction locations will be discharged to a septic tank or the municipal sewerage system.

During the operation of the pipeline, little waste will be generated and there will be a low potential risk for significant environmental impact.

Impact Significance

Based on the above the wastes associated with the proposed pipeline activities will be of "low" significance.

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

6.15. TRAFFIC

Construction of the pipeline will require a large-scale transport operation in order to deliver pipe to the work site and associated construction activities. No information is yet available on the number of vehicle movements that will be required but, based on experience of other similar projects; this number could be several thousand of vehicles trips over the construction period.

Vehicle movements will also arise from the requirement to provide sand padding for the pipeline trench. This will require lorries visiting borrow areas. The need to transport personnel to and from the work site to their base will also generate a significant number of vehicle movements.

The environmental impacts typically associated with traffic generated during pipeline construction projects include:

- Dust from vehicles traveling on un-surfaced roads.
- Noise.
- General damage to the soil surface and flora from uncontrolled off-road driving.
- Potential interference with roads/traffic during pipeline construction activities.

Vehicles traveling along temporary access roads can create large quantities of dust. The impact from this will generally not be of concern, except where it occurs close to populated areas.

The movements of personnel to and from the construction camp can also be expected to cause dust generation. The location of this impact will change as the pipeline spread moves during the construction phase. As with the HGV

movements, impacts from this source are unlikely to be significant due to the remoteness of the majority of the route.

Noise associated with vehicle movements may cause localized impacts on populated areas, depending on the selected vehicle routes. To prevent nuisance impacts arising, lorry routes should be selected to avoid residential areas as far as possible. For the majority of the route, noise from traffic is unlikely to be a concern.

Another potential area of impact is the uncontrolled use of four-wheel drive vehicles in desert areas. Off-road driving by contractors can cause widespread damage to the desert surface as well as destroy vegetation and dormant seeds. Damage could also occur to environmentally sensitive features identified close to the pipeline route.

Impact Significance

If proper control measures are being followed during the construction phase of the proposed project, the potential transport/traffic impacts are expected to be of ‘’low’’ significance as follows:

Likelihood of occurrence = 5 – certain to occur
Consequence = 1 – impact largely not discernible on a local scale
Significance = 5 low

7.0

Environmental Mitigation Measures

7.0 Environmental Management Plan

7.1 INTRODUCTION

The environmental management plan (EMP) will start in an early stage beginning usually with the detailed route design for the pipeline. As mentioned in the route description, the route is sometimes modified to avoid interactions with other existing facilities and consequently avoid more negative impacts from taking place. For example, deviations for the route (crosses) are sometimes applied to avoid passing by critical facility like residential areas, high-tension towers or industrial areas. During construction, solid wastes (domestic & excavated material) will be classified; excavated materials will be reburied after laying the pipes. Domestic wastes will be sent to the nearest local landfill.

During operation phase, an important part of the management plan, which is the staff training plans, will be applied on a short time interval to cover several activities such as:

- Upgrading the environmental awareness
- Understanding the rationale for the recommended mitigating measures
- Proper evacuation procedures during emergency

Also, restoration plan will be applied to reclaim and repair all damages happen to the road access and any other important land uses, construction contractors are committed to do so as well as any other reinstatements needed.

7.2. AIR EMISSIONS

There is no significant air emissions sources expected to be associated with the various pipeline's activities included in the scope of the proposed project.

Construction

Air quality impact from combustion sources during construction phase should minimized through routine inspection and maintenance of combustion emissions sources such as generators, diesel engines …etc. maintenance will ensure that equipment is operating efficiently and not producing excessive emissions.

Operation

The only emissions during operation phase are fugitive from pipeline's valves, flanges and intermittent venting from the sectionalizing valves provided along with the pipeline.

Engineering design approach shall avoid/minimize emissions to the atmosphere from fugitive emission sources by applying good engineering practice by selecting suitable valve packing, seals…etc.

Inspection and maintenance program will be implemented during the operational phase to control fugitive emissions from the above-identified sources.

7.3. DUST

Construction & Operation

Construction and operation of the pipeline will result in increased levels of dust generation. The effects of these upon local residents will be minimal as the pipeline route generally traverses land that is sparsely populated, with the exception of agricultural areas at Abu Qurqas and Asuit outskirts. Dust control measures will be considered include the following:

- Watering-down work areas.
- Efficient scheduling of sand deliveries.
- Maintain stockpiles at minimum height and keep any long-term stockpiles to the optimum shape to reduce the wind erosion.

- Any drilling and blasting activity should be restricted to daylight hours.
- Attention should given to maintaining routes, especially at extensive agricultural areas, from medium/heavy use vehicles.
- Appropriate speed limits will be established and enforced.
- Vehicles transporting materials with significant dust content to/from the site should be covered with dustsheet.

7.4. NOISE

Construction

It was concluded that the significance impact of noise is "low". However, the following measures are recommended to be considered in order to control/minimize the noise impacts associated with the various facilities construction activities:

- Air compressors (if used during the construction phase) should be of the type, which is sound reduced with properly, lined and sealed acoustic cover and to be operated with the covers closed.
- All pneumatically operated tools should be fitted with properly maintained mufflers or silencer of the type recommended by the manufacturers.
- Any machinery, which is intermittent in use, should be shut off in periods of non use or, where this is impracticable to be throttled back to a minimum.

7.5 SOILS

Construction

Measures will be employed to minimize the overall environmental impact of soil erosion. Where possible, the clearing of vegetation will be limited and roots to left in-situ if practically possible. Particularly vulnerable areas will be protected by appropriate erosion control. Re-vegetation of areas particularly to erosion will be undertaken to minimize the mobilization of soil through wind.

It is recommended that all topsoil removed during the excavation works of the pipeline trench to be stockpiled and backfilled once the pipeline has been installed. The location of the topsoil stockpiling should be defined before starting the

construction activities. Waste reduction, minimization, reuse and recycling and spill prevention measures should be incorporated into the management system of the construction phase of the project.

The main mitigation methods needed to avoid unnecessary damage to the important topographic features identified along the route are to control access to these areas by providing temporary fencing, and to prevent vehicles driving in the desert areas, except along the right of way.

The supply of gatch should be controlled and be from non-sensitive areas away from the pipeline route corridor.

7.6. GROUNDWATER SOURCES

To minimize the potential for Impact on the quality of the groundwater, the following control measures will be undertaken:

- All fuel storage will be appropriately bunded and refueling will be undertaken.
- If any leakage or spillage occurs, construction contractor will implement spill response measure to contained and clean up any contaminated soil before reaching groundwater.

Waste reduction, minimization, reuse, recycling, and spill prevention measures should be incorporated into the management system of the construction phase of the project.

7.7. SURFACEWATER

The risk of adverse environmental impacts to surface water quality during construction and operation of the pipeline will be minimized by adopting appropriate soil conservation measures, reducing the disturbed area and scheduling work, where practical, to avoid periods of high rainfall.

The slopes and slope lengths of steeper sections of the pipeline route and any areas of cut and fill will be minimized and drains installed to intercept and divert run-off

water. Road crossings and other traffic areas will be located and constructed to minimize the concentration or diversion of water in drainage lines. Where practical, surface cover will be maintained in these areas.

During backfilling, soil in the pipeline trench will be compacted and the material graded off such that surface water flow will not be impeded/diverted.

Disturbed natural drainage lines will be restored to their original level/contours and access tracks and any borrow pits will be constructed and aligned.

7.8 . ECOLOGICAL IMPACTS

The recommended mitigation approach depends on control of construction works and minimizing the 'ecological footprint'.

The principal control mechanism is to restrict all activities, as far as practicable, to the ROW corridor. Development of temporary access roads should also be limited to the minimum necessary.

Recovery of any vegetation would be improbable if it was damaged excessively by heavy vehicle movements or earthmoving activity. Particular care should be taken not to damage unnecessarily the vegetation of neighboring areas during trenching of the pipeline as identified. Only existing tracks should be used as practical as possible.

Prevention and restriction of unnecessary damage to vegetation and in fact considered in the pipeline route selection. Without vegetation, the fauna will also disappear.

In addition to the above recommendations, the following mitigation measures are recommended to be implemented during the construction of the pipelines in order to control/minimize the potential impact on the terrestrial habitats:

- Vegetation clearance should be confined to that necessary for the establishment of the pipeline.
- The establishment of 20m wide construction corridor will minimize impact on vegetation communities and disturbance of wildlife/domestic life along the route of the proposed pipeline.

- The movement of vehicles should be managed to ensure minimal loss of vegetation.
- As the retention of rootstock is an essential element of the subsequent restoration program, the root of cleared vegetation should be, where possible, left in place and cleared vegetation should be spread along the pipeline corridor to encourage re-seeding.

7.9. LANDSCAPE AND VISUAL IMPACTS

The disturbed and cleared appearance of the corridor will only be a short term visual characteristic because rehabilitation will be undertaken progressively once the pipe has been laid.

This will include stabilization and re-vegetation of the disturbed areas in agricultural areas in from start point to KM point 15+00 section. As the rehabilitation becomes established, the visual prominence of the pipeline corridor will gradually reduce.

Rock dumping or backfilling on slopes which are visible from existing roads should be minimized as much as possible.

7.10. ARCHAEOLOGY AND CULTURAL HERITAGE

In view of the pipeline route from an archaeological perspective, it is recommended that a watching brief should be maintained during construction in the event that any archeological artifacts or fossil appear.

It is worth mentioning that before determining the route of the pipeline, a consultation with the Egyptian Archeological Agency was made to identify any archeological or historical sites known along the pipeline route. An approval and permission of the route were given from the agency. Also, during the site survey, no archeological or historical sites were noticed. However, any finds of archeological materials should be reported immediately to the Egyptian Archeological Agency.

7.11. EROSION CONTROL & SITE RESTORATION

Increased erosion may occur in, or as a result of disturbed areas such as the pipeline corridor and access tracks. Where possible, the clearing of vegetation will be

limited and rootstock left in-situ. Re-vegetation of disturbed areas will be undertaken.

7.12. SOCIO-ECONOMIC IMPACTS

7.12.1. Landuse Effects

Construction and Operation

Prepare a detailed photographic and remedial management plan for significant locations and appoint appropriate specialists to monitor re-construction.

The landowners encompassed by the pipeline route will be compensated, which may temporary or permanently in case of valve room. There is has already been a formal compensation agreement to compensate the landowners along the pipeline route (see Appendix 7)

Public hearing/consultation will be held with the landowners and relevant NGOs, at areas may be impacted.

7.13. WASTE

Construction & Operation

The construction phase of the project is the one when most waste is likely to be generated. Providing these wastes are handled and disposed off in accordance with EGAS/GASCO procedures, adverse impacts are not expected and no specific mitigation measures should be needed.

Detailed waste management plan should be developed and implemented for the construction phase of the proposed project including the following:

- Waste storage, transfer and handling.
- The requirements for consignment notes.
- Inspection and auditing.

Additionally, all personnel employed for the construction phases of the proposed project should receive formal waste management awareness training, particularly regarding the correct waste segregation, storage and labeling procedures and potential recycling of wastes if possible.

Generally, in pipeline projects, the hazardous wastes that may be generated are the such as empty paints, used oil (*classified as "List S" hazardous waste*) resulting after painting and coating processes of pipelines onsite. In the case of Abu Qurqas-Asuit pipeline project, the pipelines shall be painted and coated in the factory. No painting or coating shall be done onsite. However, if any non-significant residues arisen due to sudden need of painting on site.

The Waste Management Plan specifies the types of wastes that will be generated as part of the construction process as follows:

- Aqueous waste (comprising hydrotest water, drainage water, untreated sewage water);
- Non-hazardous waste ; solid and liquid (domestic refuse, industrial refuse, sewage sludge);
- Gaseous wastes (vents, exhausts, fire-fighting agents, refrigerants).

Data relevant to the waste produced as a result of Contractor's constructional activities shall be monitored and recorded into an environmental register on an ongoing basis and will be made available for inspection.

7.14. TRAFFIC

Because of the location of the pipeline, nuisance issues such as noise and dust are unlikely to require particular mitigation due to lack of populated areas along most of the route.

However, some controls may be required in the identified sensitive receptors, particularly if access routes are to be selected close to the residential areas. Restrictions on lorry movements to prevent noise nuisance in the early morning/late evening may also need to be considered near sensitive areas.

A high degree of control will be needed over contractors' vehicles to prevent encroachment/damage to the desert surface outside the work area. There should be prohibition on uncontrolled off road driving.

It is recommended that a specific transport / journey management plan be drawn up by the contractor and approved by EGAS/GASCO prior to works commencing.

This should address the need to minimize environmental impacts from traffic and the proposed mitigation approach.

7.15. EMERGENCY RESPONSE PLAN

EGAS/GASCO have plans ***(see appendix 3)*** which can be acted on upon an emergency, elements of this are designed that proposed pipeline project will control any major environmental negative impact that may. The plan will cover both construction phase and operation phase.

7.15.1. Objectives Of The Emergency Plan

With the nature of the emergency defined it is possible to state the objectives of the intervention. These will be dependent upon the perceived nature of the emergency but will have Two main goals :

1. To eliminate the emergency at source
2. To minimize adverse effects on people, environment, and property.

7.15.2. A Fast Effective Response

An emergency may not be preventive but a speedy reaction to an accident can minimize both the scale and the effects. It means acting fast and thinking on your feet.

Rapid response to an emergency requires a site accident controller, plus the need for pre-emergency planning, good procedures, familiarization through regular practice and the strategic sitting of alarms.

The prime aim for emergency planning is to " avoid the need to manage crisis ". Safety cannot be left to chance, neither can there be absolute safety. Safety should be planned, and should form an integral part of design, operations and maintenance.

During construction phase

Health and Safety division will set contacts with competent authorities (along the whole route) to organize responses for control and repair of sudden road damages or traffic jams (especially near settlements) during equipment mobilization and pipes convey. Same thing will be applied during de-mobilization. H.S. division also will coordinate with all hospitals near the route for treatment of injuries which result from sudden accidents (welding, lifting, coating, sand blasting,…etc.). First Aid treatment will be available at the sites to deal with minor accidents. During using corrosion inhibitor for pipes pressure test all recommendations and precautions (will be received by the supplier later), for storing, handling, and using, will be followed carefully and monitored by H.S. division to avoid negative impacts.

7.15.4 During Operation Phase

Any leakage signal received by the control room will be followed by immediate separation for the relevant section and maintenance operation takes place to minimize amount of gas discharged. Coordination with all fire extinguishing stations available around the route will be made to combat any fire accidents may occur or explosions. The probability of fire and explosions occurrence is very small due to the use of "GASCO" automatic control system that covers the whole line.

Definition of A Major Emergency

The following definition provides some guidance on the severity categorization of emergencies.

There is a gradation of emergencies from small accidents to catastrophic ones. It is therefore useful to consider four categories:

Category "0" Minor Accident:
Can be handled by the resources of the unit concerned.

Category 1 Accident
Accident requiring assistance from elsewhere in the work place area.

Category 2 Accident:
Assistance required from the local fire and police services.

Category 3 Accident:
Accident of disaster proportions requiring considerable outside assistance from fire, police, medical and municipal emergency services.

7.16 REINSTATEMENT OF ROW & SITE

- This work will be carried out under a general permit to work and will be monitored and supervised at all times by a operations engineer and company site representative.
- EGAS/GASCO will reinstate and clean up the ROW.
- All creeks, water courses, wells, siphons, drains, streams, ditches and irrigation channels will be reinstated to their former condition and if necessary their former condition and if necessary their banks will be pitched with stone and/or faced with gabions to prevent washing out or erosion.
- The stripped top soil will be replaced carefully in position after the completion of the pipe laying operation. The top soil will be spread between the track at the side of the working width and the pipe trench and the remainder
- All walls, fences, tracks, roads…etc. will be reinstated to their original condition.
- Excess excavated material to be removed and disposed of in line with local regulations.
- EGAS/GASCO will pay attention to the condition of the backfilled trench to ensure that this has been properly consolidated before allowing the passage of plant or equipment across the backfilled area.
- The centre line of the pipeline will be accurately located and indicated by suitable means.

7.16. EMPLOYEE HEALTH AND SAFETY

During the construction activities of proposed pipeline, emphasis will be placed on providing a safe and healthy environment for the site workers. Antidote against reptiles and poisonous snakes will be available at site's clinic. A health and safety plan will be implemented to ensure compliance with the regulations of the Egyptian working laws. Occupational Safety & Health plans will be implemented in the following areas:

- Accident prevention and management
- Occupational Hygiene.
- Illness & Infectious disease prevention and management.
- Sewage and Waste Disposal.

Accident Prevention and Management operations accident prevention and management will be effected via the company safety program. This will commence along with the construction phase until the cessation of site activities. The program will include the following:

- Hazard identification and control.
- Monitoring and reporting of accidents.
- Training or education of employees in first aid.
- Fire Safety & Preparation.
- Hazard Identification and Control

Table 7.1 lists the potential hazards in different phases of the activities and the preventative and remedial activities necessary for their elimination and control. If this is not possible or feasible and the hazard cannot be eliminated, then the employees will be provided with the necessary safety protective gear to prevent any injuries during the work process. Hazard identification and reporting will constitute an ongoing activity in which the employees' participation will be considered an integral part of his work functions. The supervisor/manager has the obligation to:

- Inspect all machinery and equipment for the existence of potential hazards and ensure that they are in working order.

- Inform the worker if any hazards are present.
- Instruct the employee in the correct safe work procedure to prevent any injuries and ensure that those instructions are followed
- Provide the necessary safety protective gear when required.

Table (7.1) Potential Hazards during Construction Phase

Phase	Potential hazard	Protective & preventative Safety measures
Clearing of Site - removal of topsoil & overlying vegetation -Excavation of trenches & transportation along the pipeline route. Operation of Power generators Maintenance shop operations Backfilling of mined out areas	Insect Bites Snake Bites Minor Trauma to Extremities Lacerations from use of sharp tools Fugitive dust blown into yes Inhalation of fugitive dusts High noise levels from working of heave duty vehicles – trucks, tractors etc. High noise levels High noise levels Contact dermatitis skin irritation from exposure to grease High noise levels Fugitive / wind blown dust into eyes Inhalation of fugitive dust	Use of insect repellants Provision of snake bite kits Use of safety shoes & gloves Use of clear goggles Use of dust/mist respirators Use of ear plugs Use of air muffs Wearing of air plugs Use of barrier creams & detergents on hands Use of air plugs Use of clear goggles Use of dust/mist respirators

The employee on the other hand has the obligation to:

- Cease work once a hazard is perceived.
- Report the hazards to the supervisor who will in company with the safety representative inspect the condition or circumstance and determine its validity.
- Obey the instruction to perform alternative work or cease work completely as directed by the supervisor.
- Return to the site or proceed once the hazard has been adequately dealt with or eliminated.

7.17. OCCUPATIONAL HYGIENE

The main environmental occupational hazards to which employees will be exposed during the construction phase of Abu Qurqas – Asuit pipeline are:

- Dust
- Noise
- Heat

7.17.1. DUST EXPOSURE

The construction/installation activities of pipeline including: route clearing, excavation, transportation, earth levelling and may be blasting of hard rock will also occur. As a consequence the construction activities may result in the dispersion of particulate matter into the air. Particulate matter dispersed into the air will be fugitive wind blown dust from the excavation, blasting and transportation. Calculations (section 6.0) revealed that around seventy percent (70%) of dust particles are less than 10 microns (PM10) in size. ILO and WHO guidelines state that the danger from particles occur for diameters less than 10 microns and especially those with a diameter between 0.5 and 3 microns since those particles when inhaled can reach the alveoli and lead to lung impregnated disease. Development of respiratory disease due to inhalation of respirable dust has been shown to be in direct proportion to the total load of dust inhaled over a time period. This in turn is a function of:

- The dust particle size
- The concentration of particles in the atmosphere.
- The duration of exposure

The concentration of dust particles in the air is not expected to be consistently above acceptable standard since it is basically wind blown dust. The development of respiratory disease due to inhalation of dust is very low and will probably need exposure time far in excess of twenty five years to develop. Notwithstanding the abovementioned, the following measures will be

implemented in order to decrease or eliminate respirable dust inhalation and prevent any adverse effects on workers:

1. Provision of dust respirator with filters to employees exposed during the route clearing, excavation and transportation phases of the operation
2. Sitting of camps a convenient distance from the construction activities and on the upwind side.
3. Chest X-Rays of all employees once/yearly in order to detect any incipient pulmonary disease such as persistent coughing and/or shortness of breath.

These measures will assist to eliminate or reduce further the very low risk of the development of lung impregnated disease by employees exposed to dust. Workers in the excavation and transportation phases are exposed to wind blown/fugitive dust being blown into the eyes and causing eye irritation and conjunctivitis. These employees should provided with clear goggles and eye wash lotion will at all times be available for washing the affected eyes.

7.17.2. NOISE

The following measures will be implemented to address worker health and safety related to noise associated with the operation:

1. Control of noise levels at source via installation of silencers on exhaust system of power generating plant.
2. Provision of hearing protection to employees exposed to high noise levels: ear muffs for employees in the maintenance shops and generating plant areas.
3. Earplugs for employees who operate heavy duty machines.
4. Sitting of power generators and compressor in location away from the living camp of site workers.

5. Hearing conservation program for employees exposed to noise. This will consist of:
   a) Audiological examination to establish baseline hearing capacity.
   b) Yearly audiological testing of employees exposed to high noise levels.
   c) Acquisition of a portable sound level meter
   d) Measurement of sound levels in instances where it is suspected that deviations from the previous levels are occurring.

7.17.3. HEAT

Abu Quras – Asuit pipeline lays in upper Egypt areas, which is warm most of the year especially during summer season. There are number of options to help preventing temperature related incidents:

For heat exposures, rotating work schedules with adequate work/rest rotations can be used. Cooled rest areas should be provided. Workers should receive training in recognizing early signs of heat related incidents. Personal protective equipment can be used to help prevent heat related injuries. Aluminized reflective clothing has been recommended for use in hot environments. Full suits made from aluminum-coated material may hinder the evaporation of sweat from the body, thereby, increasing the overall heat burden on the body. If aluminized clothing is used, an aluminized apron can reflect radiant energy without hindering sweat evaporation.

With protective clothing in cold situations, care should be taken to prevent overdressing. Insulated clothing can minimize the body's heat loss, however overdressing can lead to excessive sweating. It should be noted that if the clothing becomes wet either from contact with water or sweat, the insulating properties of the clothing will be severely limited. Multilayer outfits with an outer layer of wind resistant fabric is recommended. The hands and feet are at particular risk due to decreased blood flow to the appendages during cold conditions. Mittens allow less surface area for heat loss and are preferred over gloves. For feet protection,

insulated boots with inner and outer vapour barriers are obviously recommended. Fur ruffs should be used around the face rather than masks. Masks may hinder early detection of frostbite.

For hot situations it is imperative that workers maintain proper fluid levels. Water intake should equal the amount of water lost through sweating. The body's thirst mechanism is not an adequate indication of water loss and should not be used to determine needed fluid intake. Workers should drink 16 ounces of water prior to beginning work. Water should be 10 to 15 degrees C. During the course of work approximately 3 to 5 liters of water are recommended, although more may be required in certain conditions and work environments. Salt supplements can be used to help replenish the body's reserves; however, use of salt supplements should be discontinued after few days. At this point, additional salt supplements may affect the body's mechanisms for regulating salt concentration.

Acclimatization should be used for all workers exposed to hot environments. In acclimatization, conditioning through daily exposures to heat helps individuals work in hot environments with lower core body temperatures, lower heart rates, and high rates of sweat production. Another advantage of acclimatization is that the sweat composition for an acclimatized worker has a lower salt content, thus conserving the body's salt reserves. NIOSH recommends six day acclimatization for workers in hot environments. Acclimatization to dry heat also improves the worker's ability to work in wet heat. Obesity, age, lack of physical fitness, and degenerative diseases all have an adverse effect on acclimatization.

8.0

Monitoring Plan

8.0 Environmental Monitoring

8.1 INTRODUCTION

The Environmental Impact Assessment broadly identifies environmental impacts, positive or negative, that are associated with the concerned project. A Monitoring Plan will be established in order to:

- Obtain, where appropriate, data for the environment during construction, commissioning and operation of the project;
- Monitor the discharges associated with all stages of the project, including the operation stage;

- Monitor any significant alteration of the physical, chemical or biological characteristics in the vicinity of the project and may be due to the project activities;
- Begin mitigation measures before these changes alter the natural processes and turn it to irreversible processes.

The following elements shall be taken into consideration throughout the different project stages.

8.2 DURING CONSTRUCTION

During the construction and mobilization phases, a strongly recommended set of procedures aiming at checking the integrity of some specific locations within the project area and insuring the compliance of different machinery and tools with environmental legislation. This can be summarized as follows.

a. Visual check of the integrity of the following locations will be maintained:

- Trench locations and its banks;
- Waste collection/storage tanks, pits, locations, etc ;
- Company Site Stores location.

b. Noise will be monitored to insure that the levels are below the permissible limits.

c. Maintain Logbooks to record all kind of incoming and outgoing chemicals, paints, fuel, welding cylinders, welding rods, etc.

d. Maintain Logbook for incidents involving environmental consequences.

e. Water sampling and analysis from water will be produced from hydrostatic test before final discharge.

8.3 DURING OPERATION

Though environmental hazards related to the operation of gas pipelines are considered minor, but because the strict environmental policy that ***Egyptian Natural Gas Company (GASCO)*** is obeying, the following environmental monitoring programme will be implemented on a yearly basis. We recommend a full Environmental Auditing will be performed each three years after the full operation of the plant.

a. The pipeline track passing within agricultural areas, with 10 width band on both sides of the track, will be monitored for the status of the crop. If a substantial drop in the crop of this area is observed and proven to be related to the gas pipeline, mitigation measures and adequate compensation for the farmers will be bared by ***GASCO.***

b. The benthic and hydrophytes communities at the crossing point of the Bahr Yusif canal shall be monitored once a year.

c. Environmental incidents shall be reported to relevant authorities, analyzed professionally by competent personnel and corrective measures shall be taken.

8.3.1 PIPELINE INTEGRITY MONITORING

The following pipeline integrity monitoring systems could be used to assure the pipeline integrity during the operational phase.

The supervisory control and data acquisition (SCADA) system, which can detect when a leak occurs through a drop in pressure. This system allow very early detection of a leak and allow the operators to shut down the pipelines , identify the location of the leak and isolate it by shutting off block valves on either sides. This is remotely controlled by Remote Terminal Units (RTU) which monitors all changes in temperature, pressure and quantity of gas transported through the 24 hours. All information is transmitted via microwave network to covering 120 locations, where it will be analyzed through a computer system, to take necessary actions. The network covers Alexandria, Cairo, Suez, the Delta connects them to the central SCADA Dispatching Center and the upper Egypt will be in future Facilities for the prevention and detection of corrosion and the detection of other defects could also be built into the proposed pipeline.

- Cathodic protection measures should be used to control pipeline corrosion.
- Regular checking using a pig should be used to check the state of the inside of the pipeline.
- Patrolling and Leakage surveys will be regularly conducted.

8.3.2. PREVENTION OF THIRD-PARTY INTERFERENCE

Third party interference is widely recognized as the single most probable cause of pipeline failure. It can arise from four major sources.

- Land owners.
- Utility companies.
- Contractors.
- Local authorities.

In order to control such risk, the following measures will be conducted:

- Awareness about the risks associated with pipelines and the continual supply of information about the pipelines to the third party.
- One-call system, which allow any one wanting to carry out an excavation to telephone a central number to register their intention.
- Surveillance techniques to detect third - party interference with the pipeline.
- Clearly marking the pipeline route with suitable marks to identify the pipeline routing.

8.3.3. RECORD KEEPING

Several basic information will be kept in order to facilitate the process of pipeline information access. Such basic information could include:

- Name, address and phone numbers of the land owners.
- Engineering data such as depth of burial and pipe wall thickness.
- Photographic documentation of the proposed pipeline route.

Additional information will also be kept to be used in the case of pipeline leak such as:

- The best access route the leaking section of the pipeline.
- Who to contact, with name and telephone number.
- Which settlements fall within the area affected by the release.

9.0

Conclusions & Recommendations

9.0 COCLUSIONS

1. The route corridors for Abu Quras - Asuit pipeline examined in this report include unavoidable sections of environmental sensitivity. All resembled in the agricultural areas that shall be penetrated by the pipelines. However, loss of these lands shall be temporary. The lands taken due to establishing the valve rooms are small areas. Good compensation for landowners shall be considered. In areas of intensive mixed agriculture, the refinement of the route location will play a very important role.

2. The pipeline route encounters crossing of main highways; such as *Asuit El Gharbi* . The technique that shall be used in crossing of main roads is HDD, which is characterised over the traditional ways by being implemented with very little disruption to surface activities, requires less working space, and performed more quickly than open-cut methods.

3. Pipeline route encounters crossing Bahr Yusif canal; and several small canals. Crossing of these water bodies is of significant impacts resulting from trenching of the water canal floor for placement of the pipe and laying the pipe on the sea bed. However, the HDD technique that ***GASCO*** adopted for crossing the main large canal to avoid these impacts.

4. The route follows as much as possible the existing corridors.

5. The major sections of the pipeline pass within featureless topography; most of the route passes through flat areas. However, some areas along the route may require flattening some topographic features and removing small hills. This must not be done drastically.

6. As for the social sensitivities, it was noted that the majority of route sections does not pass through areas of intensive population. Only few scattered houses found in the agricultural areas owned by the owners of the farms. However, the route does not require displacement of houses. It is worth mentioning that during the site visit, quick survey was conducted to find out the impression of the residents towards the project. The majority of people have good idea about such projects from their past experience with the previous pipelines works, especially about the compensation for the used cultivated lands. The overall impression of the people towards the project was positive.

7. The pipeline routes are penetrating a variety of military sites. ***GASCO*** attained approval for the pipelines from the military authority for constructing and operating pipelines.

8. No protected areas are present along the pipeline route.

<u>An overall conclusion is that the pipeline has, almost, no significant impacts to the surrounding environments. *GASCO* may commence the project taking into consideration the mitigation measures and monitoring plan mentioned in this study.</u>