EG-Giza North Power Project (P116194)
Utilization of Project Savings for the Procurement, Construction and Operation of additional pipelines to supply natural gas to additional Power Plants in Egypt

Updated Environment and Social Impact Assessment of the Nubaria-Metnama Gas Pipeline

Prepared in June 2011
Updated in January 2016

Final Report
Executive Summary

Introduction

The proposed project is an integral part of Egypt’s strategy which aims to expand the use of natural gas as a clean source of energy; this would be achieved through delivery of natural gas to houses, industrial facilities and power plants. The *EG-Giza North Power Project (the original and additional financing)* have three main components: Component 1 namely the power plant component, construction of 2250 MW Combined Cycle Gas Turbine; Component 2, The construction of transmission lines to connect power plant to national grid; Component 3 The construction of gas pipeline to strengthen the gas supply network and ensure supply of gas to power plant. The power plant is 92% completed, the transmission lines are 95% completed and the gas connections are 96% completed and all are in operation.

*Component 3: Gas Pipeline Construction* which aims to provide natural gas to North Giza power station and to strengthen the national network of gas is implemented by the Egyptian Company for Natural Gas (GASCO) with the assistance of the World Bank.

In accordance with Egypt’s energy strategy, it was agreed between Government of Egypt and The World Bank to reallocate the *EG-Giza North Power Project* savings of up to expand the scope of component 3 (Construction of Gas pipelines) to procure goods for additional set of pipelines in order to supply gas to the additional power plants. In this regard, it is planned to procure, construct and operate 10 new gas transmission pipelines to the 8 power plants as follows:

The Giza North Power Plant project development objective is to contribute to improving the security and efficiency of electricity supply by adding a new generation capacity based on the most efficient thermal power generation technology. The new gas pipelines connections to the eight existing and new power stations will improve the security and efficiency of electricity supply and therefore this additional scope is fully in line with the Giza North Power Plant project development objectives.

For all three components of the Giza North Power Project, ESIA, RPFs and RAPs were prepared, publically consulted and disclosed in-country and on The World Bank info-shop.

At this stage (project restructuring), the ESIA prepared for the pipeline feeding Giza North power station needs to be updated, publically consulted and disclosed.

According to the feasibility studies, the routes of the pipeline have been determined and therefore the Environmental and Social Impact Assessment (ESIAs) and Resettlement Action Plans (RAPs) will need to be prepared and completed before construction. Terms of Reference for preparing route/site specific ESIAs and RAPs have been prepared, consulted and disclosed.

Approach to Study

- Review the technical feasibility studies prepared for the new proposed pipelines;
- Review the original ESIA for Giza North pipeline (Nubareya-Meetnama) and update it based on the new geographical scope of the ten new proposed pipelines
- Assess the generic potential environmental and social impacts of the project and identify areas for further investigation during the specific ESIAs of each pipeline;
- Assess the generic risks and hazards associated with the project activities;
- Develop an outline for the environmental and social management plan for the mitigation of the potentially negative impacts and for monitoring compliance with the relevant environmental laws;
- Produce an updated ESIA. The Resettlement Policy Framework (RPF) is being prepared as a separate document.
Hold a public consultation session on the updated ESIA and the specific ESIAs/RAPs ToRs
Disclose the updated ESIA and RPF in-Egypt (on GASCO website) and on the World Bank’s info-shop;
Assess the capacity of the implementing agencies to implement the updated ESIA and future specific ESIAs

Project overview

It is planned to procure, construct and operate 10 new gas transmission pipelines to feed 8 power stations with natural gas as follows:

1- Six October Power Station, expected operation date: June 2017
2- Damanhour Power Station, expected operation date: February 2018
3- El-Syof Power Station, expected operation date: September 2017
4- El-Mahmodia Power Station, expected operation date: September 2017
5- El-Suez Power Station, expected operation date: June 2017
6- New Capital Power Station, expected operation date: April 2017
7- Beni Sweif Power Station, expected operation date: March 2017
8- Burullus power station, expected operation in December 2016

The gas pipelines which will be constructed to feed the above power stations are as follows:

- Abu Rawash gas pipeline 20” - feeding 6 October Power Station
- Pipeline and Power station of Damanhour 24” - feeding Damanhour Power station
- Al-Seyof gas pipeline 16” – feeding Al-Seyof Power Station (Alexandria)
- Gas Pipeline for Al-Mahmoudia Power Station 16”/30”/42”, feeding Al-Mahmoudia Power Station (Al-Behera)
- Suez pipeline 16” – feeding Suez Power Station
- Soumid gas pipeline 32” - Feeding New Capital power station (Import Pipeline from Soumid Port
- New Capital/ Dahshour gas pipeline – 32”, expected operation date: March 2017
- Dahshour/Al Wasata36” & Al-Wasata / Beni- Suef 36”- gas pipeline feeding Beni-Suef power station
- El-Wasta/Beni-Sweif gas pipeline – 36”, expected operation date: June 2017
- El-Gamel /Damietta gas pipeline 42”. Expected operation in December 2016

During project implementation, specific ESIAs with detailed ESMPs will be prepared for each pipeline. These will be reviewed, approved and disclosed before commencement of civil works/construction.

Construction Phase

The project will be carried out under the supervision and control of GASCO and will include the following activities:

- Leveling and preparing of the temporary roads leading to the work sites
- Storing of pipes
- Trenching
- Welding and checking the seams
- Tweaking the welding joints
- Visual checking of the welding joints
- Inspection
- Air tests
- Laying pipes in the trenches
- Valves installation
- Connection works with valves
- Backfill works
- Cleaning works
- Preparation for tests
- Hydrostatic test
- Additional air test
- Water discharging
- Magnetic cleaning
- Drying and delivery

**Operation Phase**

Normal operation will include routine audits on pressures and condition of the pipeline. Normal maintenance and monitoring works will also be performed, including a leakage survey and patrolling for encroachment. In case of leak detection, or damage of part of the pipeline, the damaged pipe is replaced. Standard procedures are in place for such incidents.

**Routing Alternatives**

Choosing the pipeline route involves selecting paths that, when possible, follow a logical course along existing transportation ways, cross these transportation ways at opportune locations, and avoid populated areas and other sensitive receptors. These efforts must be balanced with efficient use of resources and the desire to minimize the overall length of the pipeline.

The path selected by GASCO and proposed in this report is sufficiently short and well chosen for its navigation of the critical crossing points and populated areas. GASCO has a methodology that thoroughly avoids any construction buildings including: houses, graveyards, religious buildings and historical areas.

**Positive Environmental and Social Impacts**

Achievement of the previously mentioned project objectives represents many of the social and economic benefits, and will support the achievement of Egypt's strategy for the energy sector. The most significant positive impacts to be achieved are:
- Providing work opportunities for local untrained labor or limited trained labor in construction works, as well as opportunities for engineers, welding and coating workers, marine employment (assistance), and supervisors;
- To achieve increased commercial activities (such as restaurants and cafes) at construction sites, which exist in the rural areas;
- To stimulate the sale and rental of building materials and construction equipment at the targeted areas, where such projects provide a good marketing opportunity;
- Increased opportunities for workers in the various means of transportation in the different locations;
- Utilization of housing units for the project management at site, as well as to accommodate the workers.
- Achievement of sustainability and continuity of the energy source, which is environmentally safer and comes with less economic cost. The life span of the facilities used to generate electricity at power stations that will be supplied by gas will be extended. This will lead to improved continuity of electricity in the targeted governorates of Egypt.
- The ability to make subsidiary gas connections for the various governorates, which could result in delivery of natural gas to houses around the clock.
- Economic benefits as a result of using sustainable local source of energy at the power stations, which will work on the stability of the fuel cost price, unlike other unstable sources such as fuel oil and diesel fuel. This will also reduce the subsidiary cost of petroleum materials which overburden Egypt.

### Environmental Impact Rating Summary

<table>
<thead>
<tr>
<th>Phase</th>
<th>Impact Category</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Hazardous waste generation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Risk to infrastructure</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Construction/excavation waste generation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Water use/wastewater generation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Air emissions</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Noise production</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Soil quality degradation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Biodiversity and habitat destruction</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Stability of existing structures</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Traffic disruption</td>
<td>X</td>
</tr>
<tr>
<td>Operation</td>
<td>Accidents and emergencies</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Repairs and maintenance</td>
<td>X</td>
</tr>
</tbody>
</table>
Main Construction Impacts

Hazardous Waste Generation

The primary sources of hazardous waste are:

- Demolished asphalt
- Containers of chemicals and lubricant oils used for construction machinery

Asphalt waste will come from the open-cut road crossings, while the chemicals and lubricants will result from the use of machinery. Improper disposal of these items can potentially directly affect the health of anyone who comes in contact with them. Potential soil contamination may result from improper hazardous waste storage, handling, and disposal practices, as well as potential spillage and/or leaks during the course of the construction activities. There is a slight risk of a spilled or leaked substance spreading beyond the project site as a result of nearby ground or surface water contamination, thus becoming a more significant environmental risk, but in general the potential of this impact is local in nature.

Damage to Existing Infrastructure

Most of the underground infrastructure pipelines (such as water, sewerage and telecommunication) have been established a long time ago, without accurate documentation for its routes and depths. Therefore, the risk of breaking infrastructure lines is relatively high. Normally the contractor takes caution by applying manual excavation to avoid such situations where he is obliged to pay for the damage.

The most important environmental impact will arise in case a sewerage pipe is broken, and wastewaters accumulate in the trench and, possibly, over flood to the streets causing significant nuisance to the surrounding environment.

Breaking a water supply pipe may result in cutting the supply to a number of residential units, which may, if it takes place for a long period, direct residents to use other sources of water which may be either expensive or unsafe.

The effects of cutting telecommunication cables during excavation are mainly socioeconomic, due to cutting possible personal and business communications.

Main Operational Impacts

Accidents and Emergencies (Quantitative Risk Assessment)

In order to assess the potential impact of pipeline operation in terms of human health and safety, a Quantitative Risk Assessment (QRA) was performed to determine the threat of injury or fatality to the public in the case of an accident or emergency. The nature of the project is such that an unforeseen failure in the pipeline operation could result in the release of significant amounts of natural gas into the surrounding environment. The possibility of this gas being ignited poses an environmental risk and threatens the safety of individuals and the public. This risk is fully assessed in a separate QRA report.

Social Impacts during Construction

- Temporary negative impact on the local livelihoods of farmers due to the temporary acquisition of land and the subsequent impact of damaging crops. Farming, in most of the cases, is the sole source of income for the affected farmers. The project construction phase will necessitate temporary expropriation of agriculture land during the construction. It was very difficult to estimate the numbers of potentially affected people during this phase of the project. This will only be possible before the actual construction of the project and upon
determining the exact route. During this stage, a Resettlement Action Plan (RAP) should be prepared guided by the prepared RPF. The RAP will involve a full inventory survey for the PAPs and a valuation for the compensation that should be paid. The steps are well detailed in the RPF.

- Permanent acquisition of land for the establishment of the valve rooms. In such cases, the common rule of GASCO is to provide full replacement cost for purchasing the land as per the market price under satisfactory, agreeable and appropriate agreement. It might be roughly suggested that each of the land plots (25m x 45 m) for each of the valve rooms is owned by one farmer.

- Potential traffic congestion due to the accumulation of construction materials and dust that will result from digging. From a social prospective, this impact might affect the income of microbuses, small vehicles and taxi drivers.

- Potential temporary inconvenience as result of the construction activities. This could be in the form of accumulation of wastes (both construction and domestic waste in the construction areas, associated odor, air emissions, especially dust as a result of excavation. These impacts are of temporary nature and will be of very limited level of severity, particularly since the construction activities will be in farms and not populated areas.

- Risks of damaging existing community infrastructure, especially water pipes that are not mapped, can have detrimental social repercussions. Disruption of other utility services such as electricity and communications can also be a nuisance to those affected.

**Social Impacts during Operation**

- The possibility of a gas leakage or the occurrence of fires, which could affect the residents in the area, is a concern. The other element is the possibility of extending the residential mass to the pipeline routes, which could lead to encroachment on the line. Additional crop damage as a result of maintenance or surveillance activities is also a possibility.
Environmental and Social Management Plan (ESMP):

The following table below shows the generic ESMP for the proposed pipelines. More specific ESMPs shall be prepared within the site specific ESIAs.

**Table 1: Environmental and Social Management Plan**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation measures</th>
<th>Responsibility of mitigation</th>
<th>Responsibility of direct supervision</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste generation</td>
<td>Separation of asphalt waste, arrange for asphalt recycling</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Vehicle repairs and fuelling off site, on appropriate surfaces</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Approved storage and disposal of chemical and lubricant containers</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Risk of damaging infrastructure</td>
<td>Consult maps before excavation work</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Use of trial pits</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Analysis of accident log</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Construction/Excavitation waste</td>
<td>Identification and use of approved nearby disposal sites through local authority</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>generation</td>
<td>Designation and use of appropriate stockpiling locations on site</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Daily hauling of waste to disposal site in covered trucks</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Water use/wastewater generation</td>
<td>Acquire discharge permits from sewage/irrigation authority</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Collection of potentially contaminated streams in separate tanks</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Air emissions</td>
<td>Water spraying before excavation, filling, loading and unloading</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Spraying of stockpiles, storage in covered areas</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Implementation of regular maintenance schedule for machinery</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Impact</td>
<td>Mitigation measures</td>
<td>Responsibility of mitigation</td>
<td>Responsibility of direct supervision</td>
<td>Estimated Cost</td>
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<tr>
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</tr>
<tr>
<td>Noise Production</td>
<td>Limit exposure time of workers to elevated noise levels</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Use of earmuffs</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Effect on structures by dewatering / tunneling activities</td>
<td>Survey of buildings with damage potential</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Soil investigations</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Traffic congestion</td>
<td>Signage and markings to instruct drivers</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Use of alternative routes when roads are obstructed</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Employment of trained drivers</td>
<td>Contractor</td>
<td>GASCO HSE Site supervisor</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Loss of farmer livelihood due to temporary land acquisition</td>
<td>Applying the requirements presented on the prepared RPF. Preparation of RAP</td>
<td>GASCO Compensation Committee</td>
<td>GASCO Social Development Officer</td>
<td>Estimated amount for crop compensation To Be Determined during RAP preparation</td>
</tr>
<tr>
<td>Loss of farmer livelihood due to permanent land acquisition for valve rooms</td>
<td>Providing fair compensation to the land owners for the loss of crops.</td>
<td>GASCO Compensation Committee</td>
<td>GASCO Social Development Officer</td>
<td>GASCO has already purchased the land</td>
</tr>
</tbody>
</table>

Table 2: Environmental monitoring matrix during construction

<table>
<thead>
<tr>
<th>Impact</th>
<th>Monitoring indicators</th>
<th>Responsibility</th>
<th>Frequency/Duration</th>
<th>Location</th>
<th>Methods</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction/ excavation and hazardous waste generation</td>
<td>Use of designated stockpile locations</td>
<td>Contractor</td>
<td>Weekly</td>
<td>Construction site</td>
<td>Site observation</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Separation of hazardous waste components</td>
<td>Contractor</td>
<td>Weekly</td>
<td>Construction site</td>
<td>Site observation</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Quantity and type of waste generated</td>
<td>Contractor</td>
<td>Daily</td>
<td>Construction site</td>
<td>Recording of daily hauling statistics</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Risk of damaging infrastructure</td>
<td>Frequency and location of damage incidents</td>
<td>Contractor</td>
<td>Monthly</td>
<td>Documentation offices</td>
<td>Documentation in HSE monthly</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Impact</td>
<td>Monitoring indicators</td>
<td>Responsibility</td>
<td>Frequency/Duration</td>
<td>Location</td>
<td>Methods</td>
<td>Estimated Cost</td>
</tr>
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<td>----------------------------------------</td>
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</tr>
<tr>
<td>Water use/wastewater generation</td>
<td>Quantity of wastewater discharge from administrative camp</td>
<td>Contractor</td>
<td>Daily</td>
<td>Construction site</td>
<td>Recording of daily discharge amounts</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Quantity of water diverted for testing.</td>
<td>Contractor</td>
<td>Continuous during testing</td>
<td>Construction site</td>
<td>Flow rate measurements</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Oily appearance or smell of wastewater stream.</td>
<td>Contractor</td>
<td>Continuous during testing</td>
<td>Construction site</td>
<td>Site observation</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>Contaminant concentrations in wastewater streams</td>
<td>Contractor</td>
<td>Upon detection of oily appearance or smell</td>
<td>Approved water treatment lab</td>
<td>Chemical analysis</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Air emissions</td>
<td>Inspection of vehicle and machinery maintenance schedule.</td>
<td>Contractor</td>
<td>Quarterly</td>
<td>Documentation offices</td>
<td>Review of schedule</td>
<td>Contractor cost</td>
</tr>
<tr>
<td></td>
<td>HC, CO% and opacity</td>
<td>Contractor</td>
<td>Once before construction, once quarterly</td>
<td>Vehicle maintenance site</td>
<td>Emissions testing</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Noise production</td>
<td>Noise intensity, exposure durations and noise impacts</td>
<td>Contractor</td>
<td>Quarterly, at least one measurement per contractor</td>
<td>Construction site</td>
<td>Noise recording, reporting in monthly reports</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Complainsts from residents</td>
<td>Complaints from residents</td>
<td>Contractor</td>
<td>Quarterly</td>
<td>Construction site</td>
<td>Inspection of filed complaints</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Use of earmuffs by construction workers</td>
<td>Use of earmuffs by construction workers</td>
<td>Contractor</td>
<td>Weekly</td>
<td>Construction site</td>
<td>Site observation</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Effect on structures by dewatering/tunneling activities</td>
<td>Amount of soil present in wastewater stream</td>
<td>Contractor</td>
<td>As necessary</td>
<td>Construction site</td>
<td>Inspection of water from dewatering or tunneling</td>
<td>Contractor cost</td>
</tr>
<tr>
<td>Loss of farmer livelihood due to temporary land acquisition and crop damage</td>
<td>Complaints and grievances from PAPs about fair compensation and procedures</td>
<td>GASCO Social Developmen Officer Compensation Committee</td>
<td>Weekly</td>
<td>Project Site Documentation offices</td>
<td>Review list of PAPs, receipts, grievances, and follow up forms</td>
<td>No additional cost required</td>
</tr>
</tbody>
</table>

*No additional cost required*
<table>
<thead>
<tr>
<th>Impact</th>
<th>Monitoring indicators</th>
<th>Responsibility</th>
<th>Frequency/Duration</th>
<th>Location</th>
<th>Methods</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of farmer livelihood due to permanent land acquisition for valve rooms</td>
<td>Complaints and grievances from PAPs about fair compensation and procedures</td>
<td>GASCO Social Development Officer Compensation Committee</td>
<td>Weekly during the phase of project preparation until the purchase of land is done.</td>
<td>Project Site Documentations offices</td>
<td>Review list of PAPs, receipts, grievances, and follow up forms</td>
<td>GASCO regular management cost</td>
</tr>
</tbody>
</table>

* Since the Social Officer will be one of GASCO Staff, appointing this person on the project should not associate with additional costs

### Table 3: Environmental mitigation matrix during operation

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation measures</th>
<th>Responsibility of mitigation</th>
<th>Responsibility of direct supervision</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents and Emergencies</td>
<td>Design to recognized standards, effective inspection, testing, and maintenance plans</td>
<td>GASCO HSE Department</td>
<td>GASCO Headquarters</td>
<td>GASCO regular management cost</td>
</tr>
<tr>
<td></td>
<td>Rapid isolation of leaks to minimize potential hazards</td>
<td>GASCO HSE Department</td>
<td>GASCO Headquarters</td>
<td>GASCO regular management cost</td>
</tr>
<tr>
<td></td>
<td>Pipeline patrolling for encroachment and damage risks</td>
<td>GASCO HSE Department</td>
<td>GASCO Headquarters</td>
<td>GASCO regular management cost</td>
</tr>
<tr>
<td></td>
<td>Pipeline leakage surveys</td>
<td>GASCO HSE Department</td>
<td>GASCO Headquarters</td>
<td>GASCO regular management cost</td>
</tr>
<tr>
<td>Permanent expropriation of land entering urban zoning</td>
<td>Providing compensation to the land owners</td>
<td>GASCO Compensation Committee</td>
<td>Review list of PAPs, receipts, grievances, and follow up forms</td>
<td>Difficult to determine at this stage</td>
</tr>
<tr>
<td>Temporary loss of crops during maintenance</td>
<td>Compensation for the loss of crops</td>
<td>GASCO Compensation Committee</td>
<td>Review list of PAPs, receipts, grievances, and follow up forms</td>
<td>Estimated compensations To Be Determined during RAP preparation.</td>
</tr>
</tbody>
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Table 4: Environmental monitoring matrix during operation

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Social Management Plan

Implementation of the social management plan for the project activities is carried out through a committee of GASCO including a lawyer, an accountant, and the committee director. Members of the agricultural associations and the Local Governorate Units in the various governorates will need to cooperate with the committee. In the case of a dispute regarding the provided compensation amount and the failure of the proposed proactive and reactive grievance mechanisms proposed on the RPF in handling these disputes, it should be submitted to the Supreme Commission for Compensation, which is chaired by a consultant from the state council, and the commission is competent to hear appeals for compensation. Also there should be a field Social Development Officer who is responsible for compensation record keeping and monitoring of complaints, among other social responsibilities.

Detailed guidelines for dealing with expropriated land, displacement of people, and compensation matters are provided in the Resettlement Policy Framework.
Public Consultation

Due to the project needs for a temporary expropriation of the agricultural land, the need for supportive community participation for the various activities of the project must be greatly considered. The ESIA and RPF are/will be publicly consulted through regular sessions and community interviews along the planned routes. The field surveys involve comprehensive investigations to evaluate the environmental and social assessment of the proposed project. Interviews will be carried out with different groups, in order to include their inputs about the proper scope of the study, and what they consider the most important environmental and social impacts.

In addition to the previous consultation sessions which were undertaken during the original pipeline feeding Giza North power station, this updated ESIA has been consulted upon via public consultation session which was well attended by key stakeholders. In addition, the RPF and ToRs for route/site specific ESIA and RAPs will be disclosed and consulted upon.

Questions and comments from the public was arranged through GASCO website and during the consultation session.

Local Governorate; executive authorities The ESIA recommended strongly the need for the involvement of various stakeholders and community groups. For this purpose, GASCO conducted a public consultation session on 12th January 2016 in Cairo. 158 participants from different governmental and non-governmental organizations participated in this session and raised many issues which GASCO responded to and assured participants that these issues are properly addressed in this updated ESIA or will be considered in the site/route specific ESIA/RAPs.

The following chart shows the level of participation and percentage representation of the various stakeholder groups.

![Chart showing participation and percentage representation of stakeholders](chart.png)

Conclusion

The study concluded, after analyzing the various project activities through the phases of construction and operation, and the consequent various environmental impacts, that the basic designs were based on the latest technologies and cleaner production technologies.

The study also concluded that the project has many positive impacts on the socio-economic level, in terms of providing several employment opportunities, especially during construction.
phase, which support the national economy.

As for the negative environmental impacts during construction phase, they are considered to be limited and short-term, and can be reduced to the minimum that could be made these impacts negligible, by applying the proposed environmental monitoring and management plan during the construction phase. With regard to the negative environmental impacts during operational phase, the study concluded that they are insignificant and very limited.

Similarly, the social impacts of the project are mostly of temporary nature. The negative social impacts could be tackled through adopting a transparent and fair strategy to address resettlement and compensation for the project affected persons.

From the foregoing, the initial study concluded that the project is acceptable in terms of environmental and social aspects. However, proposed social and environmental monitoring and management plans should be followed and further route/site specific ESIAAs and RAPs should be prepared.
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<td>CAPMAS</td>
<td>Central Agency for Public Mobilization and Statistics</td>
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<td>CBO</td>
<td>Community Based Organization</td>
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<td>EDHS</td>
<td>Egyptian Demographic and Health Survey</td>
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<td>EEAA</td>
<td>Egyptian Environmental Affairs Agency</td>
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<td>EGAS</td>
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<td>EHS</td>
<td>Environmental Health and Safety</td>
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<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
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<td>MOE</td>
<td>Ministry of Environmental Affairs</td>
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<td>NGO</td>
<td>Non Governmental Organization</td>
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<td>PPM</td>
<td>Parts Per Million</td>
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<td>PPAH</td>
<td>Pollution Prevention and Abatement Handbook</td>
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<td>Pressure Reduction Station</td>
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1. Introduction

1.1 Background

The proposed project is an integral part of Egypt’s strategy which aims to expand the use of natural gas as a clean source of energy; this would be achieved through delivery of natural gas to houses, industrial facilities and power plants. The EG-Giza North Power Project (the original and additional financing) (P116194) have three main components: Component 1 namely the power plant component, construction of 2250 MW Combined Cycle Gas Turbine; Component 2, The construction of transmission lines to connect power plant to national grid; Component 3 The construction of gas pipeline to strengthen the gas supply network and ensure supply of gas to power plant. The power plant is 92% completed, the transmission lines are 95% completed and the gas connections are 96% completed and all are in operation. Component 3: Gas Pipeline Construction which aims to provide natural gas to North Giza power station and to strengthen the national network of gas is implemented by the Egyptian Company for Natural Gas (GASCO) with the assistance of the World Bank.

After completion of the procurement of all Bank financed packages has been concluded, there are still financial savings which can be utilized by the Government of Egypt.

The World Bank received formal requests from the Government of Egypt to utilize the financial savings resulting from the Giza North Power Plant project to procure pipelines required for an upgrade of the gas network to connect new and existing power plants. The Giza North Power Plant project development objective is to contribute to improving the security and efficiency of electricity supply by adding a new generation capacity based on the most efficient thermal power generation technology. The new gas pipelines connections to the existing and new power stations will improve the security and efficiency of electricity supply and therefore this additional scope is fully in line with the Giza North Power Plant project development objectives.

For all three components of the Giza North Power Project, ESIs, RPFs and RAPs were prepared, publically consulted and disclosed in-country and on The World Bank info-shop.

At this stage (project restructuring), the ESIA prepared for the pipeline feeding Giza North power station (component 3) needs to be updated, publically consulted and disclosed.

1.2 Project Overview

In accordance with Egypt’s energy strategy, it was agreed between Government of Egypt and The World Bank to reallocate the Giza North Power Plant project savings to expand the scope of component 3 (Construction of Gas pipelines) to procure goods for additional set of pipelines in order to supply gas to the additional power plants.

Terms of Reference (Annex 1) has been prepared following the Bank appraisal of the new gas pipelines project (The Project) utilizing the financial savings resulting from the Giza North Power Plant project. The ToR covers the requirements for the ESIA while a ToR for preparing RAP is included in the updated RPF study.

The feasibility studies for the Project has been finalized and approved by the Bank on August 16, 2015.

According to the feasibility studies, the routes of the pipeline have been determined and therefore the Environmental and Social Impact Assessment (ESIs) and Resettlement Action Plans (RAPs) will need to be prepared and completed before construction. However, as part of the Giza North project restructuring activities, GASCO is required by the World Bank to update the ESIA prepared for the gas pipeline feeding Giza North Power Plant to encompass the new scope of the ESIA which will cover additional ten gas pipelines which will feed eight new and existing power plants.

In this regard, it is planned to procure, construct and operate 10 new gas transmission pipelines to feed 8 power stations with natural gas as follows:
1- Six October Power Station, expected operation date: June 2017
2- Damnhour Power Station, expected operation date: February 2018
3- El-Syof Power Station, expected operation date: September 2017
4- El-Mahmodia Power Station, expected operation date: September 2017
5- El-Suez Power Station, expected operation date: June 2017
6- New Capital Power Station, expected operation date: April 2017
7- Beni Sweif Power Station, expected operation date: March 2017
8- Burullus power station, expected operation in December 2016

1.3 Objectives of the Updated ESIA
The scope of the updated ESIA is to assess the environmental and social impacts of the construction and operation of the new high-pressure natural gas pipelines, pressure reduction stations, in the various geographical locations. Impacts of NG exploration, extraction and refining, are outside the scope of the updated ESIA.

In addition to assessment of environmental and social impacts based on the available level of project details, the specific objective of the study is to develop a framework as a “road map” for addressing the following key modules during the preparation of the route specific ESIA before starting any construction activities:

- Describing project components and activities of relevance to the environmental and social impacts assessments
- Identifying and addressing relevant national and international legal and technical requirements and guidelines pertaining to project-related environmental, social, and occupational health & safety issues;
- Performing stakeholder meetings and public consultation to maximize ownership and stakeholder engagement
- Describing baseline environmental and social conditions, obtaining key data relevant to the project, and identifying relevant governmental, administrative, and civil society institutions
- Assessing the potential environmental and social impacts of the project in the project areas;
- Developing an environmental and social management and monitoring plan framework for the mitigation of negative impacts and for monitoring compliance with the relevant environmental laws

Overall, a key objective of each of the sections of this study is to provide a framework for addressing the various components of the specific ESIAs which will be prepared. Governorate-level ESIAs covering the final project components to be implemented will be prepared, cleared, and disclosed prior to commencement of construction. Annex 1 outlines the proposed ToRs for the governorate-level route/site-specific ESIA.

1.4 Approach and Methodology

1.4.1 Approach to ESIA
The ESIA adapted an interactive and participatory approach and has been prepared according to the following steps:

- Review the technical feasibility studies prepared for the new proposed pipelines;
• Review the original ESIA for Giza North pipeline (Nubareya- Meetnama) and update it based on the new geographical scope of the ten new proposed pipelines
• Assess the generic potential environmental and social impacts of the project and identify areas for further investigation during the specific ESIA s of each pipeline;
• Assess the generic risks and hazards associated with the project activities;
• Develop an outline for the environmental and social management plan for the mitigation of the potentially negative impacts and for monitoring compliance with the relevant environmental laws;
• Produce an updated ESIA and RPF (prepared separately);
• Hold a public consultation session on the updated ESIA and the specific ESIA s/RAPs ToRs.
• Disclose the updated ESIA and RPF in-Egypt (on GASCO website) and at the World Bank’s info-shop;
• Assess the capacity of the implementing agencies to implement the updated ESIA and the proposed specific ESIA s for the 10 pipelines

1.4.2 Stakeholders Consultation

Stakeholders' consultation is a core part of the preparation of this updated ESIA and the RPF for this project. The consultation session gave the key stakeholders the opportunity to contribute to the updated ESIA, the updated RPF and the ToRs for the specific ESIA s and RAPs. The stakeholders' consultation was conducted during January 2016 prior to the approval of the project restructuring.

After drafting the results of the ESIA, public consultation was organized to review the draft results of the ESIA with various stakeholders. This activity comes in line with the World Bank disclosure policy and the requirements of the EEAA as part of the EIA guidelines. This activity brought wide range of stakeholder together to review the analysis and results of the ESIA and the RPF and the proposed ESIA s/RAPs ToR. The consultation process reflected the views and interests of the various groups of stakeholders, particularly the potentially affected groups. As part of the Public Consultation phase, a draft version of the Executive Summary of the ESIA report was reviewed by a group of project stakeholders and non-technical presentation was delivered. Questions and comments session was arranged and the comments and suggestions of the stakeholders were incorporated into this final version of the ESIA.

1.5 Contributors

The original ESIA was prepared by EcoConServ Environmental Solutions (Cairo, Egypt) and updated by GASCO environmental and social team of experts.
2. Project Description

In this chapter, a brief description of the restructured project (procurement, construction and operation of 10 gas pipelines) is presented. It is expected that the route/site specific ESIs will elaborate on the description of the project to include further details which will be available by the time the ESIs will be prepared.

2.1 Description and maps of the routes of the gas pipelines

According to the feasibility studies, the routes of the pipeline have been determined and therefore the Environmental and Social Impact Assessment (ESIs) and Resettlement Action Plans (RAPs) will need to be prepared and completed before construction. In this regard, it is planned to procure, construct and operate 10 new gas transmission pipelines, PRSs to the 8 power plants as follows:

2.1.1 Abu Rawash gas pipeline 20” - feeding 6 October Power Station

The Purpose of Construction of this pipeline is to support gas delivery to 6th October Power Station.

**Route Description**

- The Route start with expansion to the valve rooms on the feed pipeline of Abo-Rawash power station constructed on Tanash/Dahshour Pipeline 20” then extend south parallel to Abo-Rawash road from the western side and also parallel to Feed Pipeline to Abo-Rawash Power station till it reaches to the Pressure reduction station inside Sbo-Rawash Power Station with a total length of 400m.

![Abu Rawash gas pipeline route](image)

*Figure 1: Abu Rawash gas pipeline route*
2.1.2 Pipeline and Power station of Damanhour 24” - feeding Damanhour Power station

The purpose of this pipeline is to support gas delivery to Damanhour Power Station. In Al-Beheira governorate.

**Route Description**

- The gas pipeline route starts from Al-Mahmoudia Sectionalizing Valve Room constructed on Abo-Homos/Shabshir 28” on AL-Mahmoudia Canal and then extend south for 300m inside agricultural land and then extend west for 1Km parallel to High voltage towers crossing AL-Khandak canal and Damanhour/ Kafr-El-Dawar and continue its route in agricultural land till the end of power station southern fence then extend to the north for 300m parallel to the power station western fence till it reaches to the pressure reduction and measuring station inside the power station with total length 4Km totally inside agricultural land.

![Figure 2: Damanhour gas pipeline route](image)

2.1.3 Al-Seyof gas pipeline 16” – feeding Al-Seyof Power Station (Alexandria)

The Purpose of Construction of this pipeline is to support gas delivery to Al-Seiouf Power Station.

**Route Description**

- The Route starts with Valve room on Al-Amreya/ Al-Maadia 24” on Damanhour/ Alexandria agricultural road before Alexandria entrance with 10Km then extend north for 500m crossing Cairo/Alexandria railway then deviated west for 200m parallel to the fence of Al-Seiyof power station till reaches the pressure reduction and measuring station inside the power station with total length of 3.5Km.
2.1.4 Gas Pipeline for Al-Mahmoudia Power Station 16”/30”/42”, feeding Al-Mahmoudia Power Station (Al-Behera)

The purpose of constructing this pipeline is to support gas delivery to Al-Mahmoudia Power Station.

**Route Description**

- The Station is fed from three pipelines of the national grid 16”,30”,42” as detailed below:

- **First Pipeline (42”):** the route starts with a diameter of 42” from Rashid Petroleum Company facilities and the east side of Edco city and aligned with angle to Edco/ Damanhour and extend south crossing the international coastal road and the railway (Alexandria/ Rashid) and Al-Bosaily drain and continue south beside village no. (8 & 6& 1) and then cross the eastern Edco drain and Abo-AlEinen and Al-Kamheen drain and the french drain till it reaches the national grid of natural gas facilities on the north of Besentoai village with total length of 30 Km.

- **Second Pipeline (30”):** the route starts from valve room on 42” pipeline on the north of Abdel-Razik and Hemsi manor and extends to the east in an agricultural land parallel with Kom –Algarak canal till it reaches Dairut power station with total length 15Km.

- **Third Pipeline (16”):** the route starts from valve room that will be constructed on pipeline feeding Dairut power station then extend south for 2.5Km parallel to the high voltage towers inside the agricultural lands and then extend in the eastern south for 2Km also parallel to the high voltage towers and then deviates east crossing Al-Mahmoudia canal till reaches the pressure reduction and measuring station inside the Power station with total length of 7Km.
Figure 4: Al-Mahmoudia gas pipeline route (1)

Figure 5: Al-Mahmoudia gas pipeline route (2)
2.1.5 Suez pipeline 16” – feeding Suez Power Station

The purpose of construction of this pipeline is to support gas delivery to Suez Power Station.

**Route Description**

- The route starts with construction of valve room on Ras-Bakr Pipeline 16” (one of the national grid pipelines) in Ataka area then extend west crossing railway for 500m then extend south for 1.2Km crossing a tarmac (Salah Neseem) and parallel to stream bed then extend east for 700m on the border of residential area of Suez oil Processing company till it reaches the pressure reduction and measuring station inside the power station with a total length of 3Km.
2.1.6 Soumid gas pipeline 32” - Feeding New Capital power station (Import Pipeline from Soumid Port)

The purpose of constructing this pipeline is to support delivering gas from Soumid port to New Capital Power Station

Route Description

- The pipeline Route extends for 2Km on the piers to receive petroleum products that expected to be constructed by Soumid south of AL-Sokhna marine Port with a length of 3Km till it reached the Suez bay ,thus the start room will be constructed and then extend north then east for 2Km till the connection with Soumid Valve room (one of the room of the National Grid) near to Al-Sokhna Power station and AL-Sokhna marine port with total length of 4Km.
2.1.7 New Capital/ Dahshour gas pipeline – 32”, expected operation date: March 2017

The purpose of constructing this pipeline is to support delivering gas to Beni-Suef Electrical Power Station & New Capital Power Station and Consumers in the South of Egypt. This line is of length 115 kilometres with diameter 32 inches. The route will be passing in agricultural lands and desert lands.

**Route Description**

- The Route starts from the valve room that will be constructed in front of new capital power station on Al-Katamyia / Al-Sokhna road, then extend to the west parallel to the same road for 5km till the crossing of this road with ring road territorial then goes south west parallel to the ring road territorial from the north for 80km crossing desert, agricultural and mountainous areas and crossing also the River Nile and the east desert road. After that it deviates to the north parallel to the western Asuit desert road from the east side for 30 km in a desert land till it reaches the valve room present on the national grid in Dahshour area with a total length of 115km.
Figure 9: New Capital/ Dahshour gas pipeline route (1)

Figure 10: New Capital/ Dahshour gas pipeline route (2)
2.1.8 Dahshour/Al Wasata36” & Al-Wasata / Beni- Suef 36”- gas pipeline feeding Beni-Suef power station

The purpose of constructing this pipeline is to support delivering gas to Beni-Suef Power Station and consumers in South Egypt.

**Route Description**

- The Route starts from Dahshour Compression Station (one of the Natural Gas National Grid stations) in Dahshour area then extend to the south parallel to Faioum/ Cairo road for 8Km then extend south east parallel to Western Asuit / Cairo Road from the east side for 62 km till it reaches Abo-Rady valve room on Dahshour/ Al-Korimat pipeline 36” (one of the pipelines of the Natural Gas National Grid) in Abo-Rady area in Wasta city with a total length of 65km.
2.1.9 El-Wasta/Beni-Sweif gas pipeline – 36”, expected operation date: June 2017

This line is of length 65 kilometres with diameter 36 inches and pressure reduction station that will feed Beni-Sweif power station.
2.1.10 El-Gamel /Damietta gas pipeline 42”. Expected operation in December 2016

The purpose of constructing this pipeline is to support delivering gas to El-Burullus Electrical Power Station. This line is of length 50 kilometres with diameter 42 inches and ends with a pressure reduction station that will feed Burullus power station.

**Route Description**

- The pipeline route starts from valve room No. (2) on gas pipeline Port Foad/Al-Tina 42” (one on the national grid pipelines) then goes north for 300m, to cut Port said/Damietta road till it reaches to the suggested place for ENI Company beside the UGDC (United gas Derivatives company) then extend in the west side for 3km parallel to Port said/Damietta road from the north side then deviates south west for 2km crossing Port said/Damietta road & the international coastal road.

- Then deviates west parallel to the international coastal road from the south side on the boarder of EL-Manzalah lake for 29km till it reaches to the end of the lake and continue extending in the west side in a planted land for 1km then deviates in the south west side parallel to the high voltage towers behind Ahmed Sholah manor till it cross EL-Salam canal then deviated north west also parallel to the high voltage towers passing beside EL-Khalifa manor from the north till it reaches EL-Horany area to cross (Farskor/ EL-Mansoura) road and the River Nile beside AL-Bostan water station(from the south side) till it reaches room no. (13) on Edco- Damietta pipeline (one of the national grid pipelines) at Kafr AL-Batikh area with a total length of 48km.

Figure 14: El-Gamel/Damietta pipeline route (1)
2.2 Pipeline design criteria
At the minimum, the pipelines will be built, operated, and maintained to the standards of ASME
B31.8, which dictates the use of good engineering practices for public safety in all conditions and local regulations as a minimum, along with any additional local regulations, as well as other relevant high standards for pipeline routing with consideration for nearby settlements.

Settled areas along the pipelines are classified by population density, which is used to determine the Location Class which are used to determine the design criteria appropriate for different sections of the pipeline. They are also used in determining the amount of surveillance activity to be conducted as shown in the following figure.

![Figure 17: Determination of Location Class](image)

<table>
<thead>
<tr>
<th>Location Class</th>
<th>Number of buildings intended for Human Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 or fewer</td>
</tr>
<tr>
<td>2</td>
<td>more than 10 but fewer than 46</td>
</tr>
<tr>
<td>3</td>
<td>more than 46</td>
</tr>
<tr>
<td>4</td>
<td>more than 46 and including multi-storey buildings and where there may be many other utilities</td>
</tr>
</tbody>
</table>

Generally a zone 200m wide is considered on either side of the route of the pipeline. To include a maximum number of buildings for human occupancy, the pipeline route is also divided lengthwise into sections of 1 mile. Within a multiple dwelling unit, each separate dwelling unit is counted as a separate building. However, ASME B31.8 does not provide restrictions on the proximity of a pipeline to a building or group of buildings, which can lead to pipelines being constructed close to buildings (and vice versa).

The following proximity limits should be applied to all pipeline design and to new buildings developed close to existing pipelines.

- No pipeline operating at a pressure greater than 7 bar must be within 3m of a building in residential areas, and 6m desert areas.
- Any pipeline closer than 25 m to a normally occupied building should operate at a pressure that is 40% of the material yield strength or less, and have a wall thickness of at least 0.375".
- Any pipeline closer than 12.5 m to a normally occupied building should operate at a pressure that is 40% of the material yield strength or less, and be laid with greater than or equal to 0.5" wall thickness.

Wall thickness is also increased at road crossings, and impact protection measures (cast in site or pre-cast concrete slab) shall be provided on all pipeline crossings. Warning tape is placed above and below such impact protection.

### 2.3 Construction Activities and Methodologies

Qualified and approved contractors under the supervisions and monitoring of GASCO personnel will carry out construction. Brief descriptions of the key activities during the pre-construction and construction phases are provided in the following sections.

#### 2.3.1 Planning and system design

Accurate maps of project areas shall be obtained in order to collect sufficient information for reaching optimum design for the system, surveying works may be carried out at few locations where maps are outdated or do not include recent developments. Routes and depths of existing
underground infrastructure shall be obtained from different authorities (water lines, sewage lines, telecommunication lines, and electric cables). However, in some cases no accurate mapping is available for underground infrastructure. In such cases a trial pit shall be manually excavated to locate underground pipes.

# 2.3.2 Mobilization of equipment, materials, and workers

According to the approved phased implementation plan, the contractor mobilizes the required construction equipment, materials, and labor. The contractor normally occupies a location for storing materials and equipment in the project area. This location should be approved by the local authority. These storage locations shall include:

- Excavation machinery, such as trenchers, backhoe excavators, jack hammers, loaders, cranes, manual tools … etc.
- Piping materials, such as pipes, valves, elbows, coating materials
- Stockpiles of sand and filling materials
- Repair machinery, such as compaction machinery, asphalt laying, concrete mixers … etc.
- Management caravan for the site engineers and staff

Unskilled labor from the nearby villages will be utilized, eliminating the need for large worker camps. Some additional technical staff will be housed in nearby apartments or hotels.

The following table shows the types of equipment which are typically used in the construction of pipelines.

<table>
<thead>
<tr>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Double Cabin Car</td>
</tr>
<tr>
<td>2 Double Cabin Car 4*4</td>
</tr>
<tr>
<td>3 Pick Up</td>
</tr>
<tr>
<td>4 Bus (26 Persons)</td>
</tr>
<tr>
<td>5 Puller</td>
</tr>
<tr>
<td>6 Generator 200-250 K.V</td>
</tr>
<tr>
<td>7 Crane 50 Ton.</td>
</tr>
<tr>
<td>8 Side Boom D8</td>
</tr>
<tr>
<td>9 Pipe Welder</td>
</tr>
<tr>
<td>10 Pipe Carrier</td>
</tr>
<tr>
<td>11 Welding Machine</td>
</tr>
<tr>
<td>12 Low Bed</td>
</tr>
<tr>
<td>13 Water Tank Car</td>
</tr>
<tr>
<td>14 Solar Tank Car</td>
</tr>
<tr>
<td>15 Agriculture Excavator</td>
</tr>
<tr>
<td>16 Truck</td>
</tr>
</tbody>
</table>
2.3.3 Site preparation and excavation

Prior to excavation works, pipeline routes shall be identified and marked in the field. Excavation works start by removing the asphalt layer using either mechanical trencher or jack hammer. The mechanical trencher also removes broken asphalt and base stones layer, in case the jack hammer is used, road layers are then removed by excavator.

The road base soil, underneath asphalt and stones, is then excavated either by a backhoe excavator or by manual excavation. The advantage of manual excavation is that it reduces the risks of breaking water, sewerage, electric or telecommunication lines which are unmapped. Typically the trench for PE pipes is 0.4-0.6 meter wide, and about 1.5-meter deep, depending on pipe diameter. For steel pipes the trench width is 0.6-0.8 meters with the same depth, also depending on diameter.

Excavated soils, broken asphalt and other wasted materials during excavation are then loaded to trucks, which transfer it to disposal areas. Loading waste trucks shall be done upon excavation, whenever possible, in order to avoid stockpiling waste on site.

In some cases, where groundwater table is shallow, the trench should be dewatered before pipe lying. Dewatering pumps discharge sucked water into a drain or sewer manhole, according to area circumstances.

2.3.4 Pipe Storage

The project management selected the needed sites for storing the pipes and other installations in an area selected carefully for such purpose. The Contractor will pay great attention in adapting appropriate procedures (approved by GASCO) during transporting, handling, and stacking pipes and installations to ensure that no damage whatsoever results to the pipe or coating.

Piping material must be stored by type, size and material specification. Materials will be supplied color marked, to differentiate types/services of materials. Care must be taken to select and utilize special material such as that manufactured to NACE Std., ASME code and alloys for their required services only. Materials must be checked for their color-coding. For protection of all piping materials, when stored outdoors they shall be supported off the ground.

2.3.5 Foundations Structural Work or Civil Work

At this stage, the site is ready for the commencement of starting the construction of the plant (valve room) structure. Through the construction of the various components of the plant structure a lot but similar activities take place which follow the pattern for the preparation for pouring concrete. The pattern is as follow:
Concrete shuttering: which involves the use of shuttering materials mainly plywood for forming the required shape and size of the component being constructed.

Reinforced steel preparation: which involves the sizing, cutting, and shaping of the reinforced steel bars to the required shapes and sizes, as well as the laying of these bars in the shuttering specified in the structural design.

Concrete pouring inside the formed shuttering (form work) so as to form the required skeleton of the structure. This is done through the use of a concrete batch plant which mixes the concrete components (cement, gravel, sand, and water) internally in batch amounts which is then transported to pouring site through the aid of concrete mixers and cranes.

The installations of the concrete works subject to exposure with the surrounding ground water table.

Aggregates with different sizes and with an estimated sum total of 10,000 m³ for the use with different types of a concrete mixes to yield different required concrete strengths.

2.3.6 Trenching Lowering and Laying

A trench will be dug from the running track to allow the pipeline to be buried. The width of the trench will be the width of the pipe plus 0.4 m. Sub-soil from the trench will be stored in loose piles on the opposite side of the working width to prevent mixing with top soil. The minimum cover on top of the pipeline will be 1.5 m. The bottom of the trench will be uniformly graded and covered with sieved sand to prevent any damage to the pipe coating. The pipeline trench will be a minimum of 2 m from any existing pipeline. The trench will be left open for as short a time as possible before the pipeline is lowered into the trench.

During the excavation works, some welding works are taking place above-ground. Once the trench is excavated, the available pipe stretch shall be laid down. The pipeline will be lowered into the trench using wide, non-abrasive belts, and care will be exercised to avoid causing damage to the pipeline coating. In marshy areas, negative buoyancy will be created using a concrete coating. Warning tapes will be installed 30 cm below ground level. Remaining welding works then take place, to connect the laid pipe with the previous stretch.

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

2.3.7 Backfilling

The trench will be backfilled with layers of the original stored sub-soil. Once the trench is filled, the reinstatement of the whole working width begins. This involves ripping the sub-soil to rectify any compaction that may have occurred during construction and grading to the original contours. Topsoil will then be replaced across the working width to its original depth, will be graded carefully, and clean up operations will need to be completed within one week of backfilling.

2.3.8 Welding and Weld Inspection

The following welding processes are acceptable:

- Shielded Metal Arc Welding (SMAW)
- Gas Tungsten Arc Welding (GTAW)
- Gas Metal Arc Welding (GMAW)
- Flux Cored Arc Welding (FCAW)
- Submerged Arc Welding (SAW) (Automatic or Semi-automatic)

All welding and tacking must be performed by welders who are currently qualified to applicable codes, and to specific variables and materials of the procedure. Welders and welding operators...
must be currently qualified as required by the applicable ANST/ASME Code. The procedure for welding must conform to the current applicable ASME Code. ASME Section IX forms QW-482 and QW-483 or their equivalent must be used.

The following weld inspection methods are applicable:

a) Non destructive tests
   - Radiographic test (R.T. 100%)  
   - Ultrasonic test (U.T. 10%)  
   - Die penetrate test for weld let, sweepolet and nippolet (½”, 1”)

b) Destructive tests (Mechanical Test)
   - 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.

2.3.9 Valves and Tie-ins

- Valves requiring frequent operation, and located more than 2 meters (6 feet - 9 inches) above the operating level require extension stems  
- Valves should not be installed with stems below the horizontal position, unless otherwise approved by Client.  
- Impact type hand wheels or handles may be installed on extended stems if the stem is independently.

2.3.10 Pipe Cleaning

- **Materials** - Cleaning solutions used shall be compatible with piping materials, valve trim, gaskets, and all other components in the piping. Chemical cleaning shall not exceed 0.2 mils metal penetration. Solutions and water used for detergent flushing of stainless steel piping shall not exceed 50-PPM chloride content.  
- **Acceptance** - The cleaning contractor shall make a record of all lines cleaned. For carbon, steel piping the record shall include the degreasing, pickling, and end of cleaning examinations and type of passivator used. For stainless steel, piping the record shall include the degreasing and end of cleaning examinations.  
- **Drying** - The cleaning contractor shall drain and dry the cleaned piping. Carbon steel shall be dried to -40 degree F dew point Stainless steel shall be blown out with dry air.  
- **Rust Prevention** - The cleaning contractor shall apply a rust preventative on the internal surface of cleaned carbon steel piping immediately after drying. Lube oil and seal oil piping shall be coated with a rust preventative approved by the equipment manufacturer

2.3.11 Horizontal Directional Drilling

Vertical excavation described in could not be practiced when the natural gas line intersects with a major waterway, railway or road. When applicable, a special crossing for such obstacles has to be
made. Such crossings will be made using a tunneling technique called Horizontal Directional Drilling (HDD), described below.

In special crossings, the line starts gradual descending below the obstacle by enough horizontal distance to avoid steep connections. This allows easier access for repairing different parts of the line.

Crossing of water bodies and main canals, as well as large roads and railways shall not be done by the traditional open-cut method. It shall be done using HDD which is a trenchless tunnel-in method 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 outlined and are illustrated below.

**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 18 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:

- Inclination relative to the vertical plane.
- Direction of hole relative to magnetic north, and.
- 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. wash pipe. The front of the wash pipe is fitted with a cutting bit, typically 300mm dia., and fitted with round 20 kenna metal 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 smooth 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 127 mm 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.

2.3.12 Pipeline Testing

After the line construction it should be tested to locate possible leaks in the line. The testing
could be done either through hydrostatic testing, or through pneumatic (air/gas) testing. The first process is normally more complicated than the second, because it needs highly efficient water drainage using the pigging process, which forcing an object through the pipe by liquid or air pressure.

**Hydrostatic Testing**

Water shall be clean fresh water and free from any substance, which may be harmful to pipe material. A 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). The lines will maintain static pressure 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 with 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.

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.

**Pneumatic Testing**

Utility air or nitrogen can be used as the test medium. The air used for blowing and testing shall be clean, dry and oil free. All instrument air system shall be service tested with its own medium when this is not available, a utility air source supplied by a non-lubricated compressor may be used. Air piping receiving a pneumatic test shall be tested at service pressure. Piping receiving a pneumatic test shall be tested at 110 percent of the design pressure, or to the maximum upset pressure, whichever is greater. The pneumatic test pressure shall be continuously maintained for a
minimum time of 10 minutes. 
Records shall be made of each system tested, which shall include:

- Date of test.
- Identification of piping tested.
- Test medium.
- Test pressure
- Approval by the Inspector

2.3.13 Water Removal
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. The 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.

2.3.14 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.

2.3.15 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.

2.3.16 Records and 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 are not limited to:

- Materials records that contain identification number, inspection certificates, test certificates, etc.
- Welding records (e.g. welder qualifications, welding procedure, etc.).
- Protective coating records that contain date, method of cleaning, material used, repairs, etc.
- Painting records (e.g. paint type, grade of paint, paint batch number, etc.)
- Mechanical installation records (e.g. testing procedure, insulation procedure, pipe alignment, etc.)
- Structural steel work records (e.g. line, level, plumbness, tightness of bolts, etc.)

In addition, the contractor shall supply all necessary maintenances manuals and training in their application.
2.4 Description of Operation Phase

2.4.1 Normal operation
Normal operation will include routine audits on pressures and condition of the pipeline. Normal maintenance and monitoring works for the pipeline include:

- Monitoring valves and some selected points on the pipeline. Gas leaks are routinely detected using gas detection sensors
- Maintenance of valve boxes and raise of its level whenever needed
- Checking cathode protection on "Flange Adaptors" by taking voltage readings and change anodes whenever needed

The Pressure Reducing Stations are also routinely tested against leaks and safety issues.

2.4.2 Repairs and replacement
In case of leak detection, or damage of part of the pipeline, the damaged pipe is replaced. The following procedures are usually followed:

- Stopping leaking line
- Excavating above the effected part (in case of distribution main or underground installation line)
- Venting the line
- Removing affected pipe
- Replacing effecting part and welding it with the two ends
- Filling and road repairs

2.4.3 Valve Room Locations
Valve room dimensions are a maximum of 25 m x 50 m, but may be smaller. A typical plot plan for a valve room is shown above in Figure 21.

2.4.4 Crossings
There are many crossing that the proposed pipeline route encounters. Some of them will be crossed using an open trench, but major crossings and waterways will be crossed using the Horizontal Directional Drilling (HDD) technique.
Figure 21: Typical valve room layout
2.5 Design Gas Composition and Flow Rate

The main stream of natural gas will come from the national network once the pipeline has been filtered. The pipeline is designed to transport the gas at a pressure of 70 bar. The compositions of the gas coming from the national network are indicated in the table below.

<table>
<thead>
<tr>
<th>Contaminants</th>
<th>Lean Gas Composition</th>
<th>Rich Gas Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>CO2</td>
<td>0.150</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N2</td>
<td>0.760</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O2</td>
<td>0.000</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>H2</td>
<td>0.000</td>
</tr>
<tr>
<td>Methane</td>
<td>CH4</td>
<td>97.313</td>
</tr>
<tr>
<td>Ethane</td>
<td>C2H6</td>
<td>1.710</td>
</tr>
<tr>
<td>Propane</td>
<td>C3H8</td>
<td>0.040</td>
</tr>
<tr>
<td>iso-Butane</td>
<td>i-C4.</td>
<td>0.020</td>
</tr>
<tr>
<td>n-Butane</td>
<td>n-C4.</td>
<td>0.000</td>
</tr>
<tr>
<td>iso-Pentane</td>
<td>i-C5</td>
<td>0.000</td>
</tr>
<tr>
<td>n-Pentane</td>
<td>n-C5</td>
<td>0.000</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>n-C6</td>
<td>0.000</td>
</tr>
<tr>
<td>n-Heptane</td>
<td>n-C7</td>
<td>0.000</td>
</tr>
<tr>
<td>n-Octane</td>
<td>n-C8</td>
<td>0.000</td>
</tr>
<tr>
<td>n-Nonane</td>
<td>n-C9</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>100.000</td>
</tr>
</tbody>
</table>

Gas delivered will be commercially free of materials and dust or other solid or liquid matter which may interfere with the operation of lines.

Reference: GASCO
3. Legal and Administrative Framework

3.1 ESIA National Administrative and Legal Framework

The following is a brief description of the different national authorities and institutions of relevance to the site-specific ESIA to be prepared once this project is detailed. The proposed Natural Gas connection project is classified as “C” under the Egyptian requirements. Class C projects require full ESIA including public consultation sessions. It will be the responsibility of the site-specific ESIA to investigate and update Egyptian legal/institutional requirements beyond those outlined in this framework.

The main legal instrument dealing with environmental issues in Egypt is Law 4/1994, amended by Law 9/2009 and Executive Regulation 1095/2011 modified by 710/2012, commonly known as the Law on Protection of the Environment. The law deals mostly with the protection of the environment against pollution. Prime Ministerial Decree 631 of 1982 established the EEAA as the competent body for environmental matters in Egypt. Law 4 also stipulates the role of the EEAA as the main regulatory agency for environmental matters.

According to Article 1 of Law 4, the legal entity responsible for a given project is required to carry out an assessment of the project's potential impact on the natural and socio-cultural environment before implementing that project. The findings of the assessment are submitted to the EEAA for review and approval before other relevant governmental authorities can issue their permits for implementing the project.

An ESIA is required to be viewed as an integrated part of the project planning process, according to EEAA requirements. The ESIA will help to ensure that environmental concerns are taken into account along with technical and economic considerations.

The Egyptian Environmental Affairs Agency (EEAA) is an authorized state body regulating environmental management issues. Egyptian laws identify three main roles of the EEAA:

- It has a regulatory and coordinating role in most activities, as well as an executive role restricted to the management of natural protectorates and pilot projects.
- The agency is responsible for formulating the environmental management (EM) policy framework, setting the required action plans to protect the environment. Following-up their execution in coordination with Competent Administrative Authorities (CAAs).
- In specific to this project, EEAA is responsible for review and approve of the environmental impact assessment studies as for new projects/expansions undertaken.

EMU (Environmental Management Unit at Governorate and District level) is responsible for the environmental performance of all projects/facilities within the governorates premises. The governorate has established environmental management units at both the governorate and city/district level. The EMU is responsible for the protection of the environment within the governorate boundaries and are mandated to undertake both environmental planning and operation-oriented activities. The environmental management unit is mandated to:

- Follow-up on the environmental performance of the projects within the governorate during both construction and operations to ensure the project abides by laws and regulations as well as mitigation measures included in its ESIA approval. Investigate any environmental complaint filed against projects within the governorate.
- The EMU are affiliated administratively to the governorate. yet technically to EEAA.
- The governorate has a solid waste management unit at the governorate and district level. The units are responsible for the supervision of solid waste management contracts.

The CAA for the natural gas pipelines project is the Egyptian Natural Gas Holding Company (EGAS). Law 4/1994 amended by Law 9/2009 stipulates that applications for a license from an individual, company, organization or authority, subject to certain conditions, require an assessment of the likely environmental impacts.
The CAAs are the entities responsible for issuing licenses for project construction and operation. The ESIA is considered one of the requirements of licensing. The CAAs are thus responsible for receiving the ESIA forms of studies, check the information included in the documents concerning the location, suitability of the location to the project activity and ensure that the activity does not contradict with the surrounding activities and that the location does not contradict with the ministerial decrees related to the activity. The CAA forwards the documents to EEAA for review. They are the main interface with the project proponents in the ESIA system. The CAA is mandated to:

- Provide technical assistance to Project Proponents
- Ensure the approval of the Project Site
- Receive ESIA Documents and forward it to EEAA
- Follow-up the implementation of the ESIA requirements during post construction field investigation (before the operation license)

After submission of an ESIA for review, the EEAA may request revisions in the ESIA report within 30 days, including additional mitigation measures, before issuing the approval of the report. EGAS will have the right to issue an appeal within 30 days from its receipt of the EEAA’s decision. It should be noted that once the ESIA has been approved, the ESMP as will be presented in the report, will be considered an integral part of the project; and the EGAS will be legally responsible for the implementation of that plan, depending on their involvement in construction or operation. It is therefore worth mentioning that the EGAS and its project implementing entity (GASCO) must ensure that all mitigation measures and environmental requirements described in the ESMP have been clearly referred to in the tender documents for the construction works, the construction contracts, and have been respected. EGAS will follow-up on the construction contractor to ensure that the ESMP is adequately implemented in the construction phase.

3.2 Applicable Environmental and Social Legislation in Egypt

3.2.1 Law 217/1980 for Natural Gas

It organizes supply and connections of natural gas in residential areas, industrial areas and power plants. The law gives the Egyptian General Petroleum Corporation, together with one of the Petroleum Public Sector companies the responsibility for making the natural gas supply. The Law stipulates the following safeguards, which should be followed, during installation of natural gas in residential areas:

- The entity responsible for natural gas connections should undertake these connections in a manner that should not affect the safety of the connected building, its occupants or other parties. If such connections resulted in any damage to the building owner or occupant he should be subject to compensation (Article 2).
- All natural gas pipelines and structures should be established on state-owned land without payment of any duties (Article 2).
- It is not allowed for the entity in charge of licensing buildings to grant license for buildings, or for amendments of existing buildings, which are connected with natural gas, without approval from the entity responsible for natural gas connections. Violation to this article may lead to a change of the ownership of the violating building to be publicly owned (Article 3 and 4).

It is not allowed to undertake excavation, building, demolition, pavement or any maintenance works in roads, squares and areas planned to be connected with natural gas, except in coordination with the entity responsible for natural gas connections. The entity responsible for natural gas connections is authorized to remove violations and claim associated removal costs from the violator (Article 5).

Ambient Air Quality and Gaseous Emissions

Articles 35 and 34 of Law 4 of its Executive Regulations amended by Decree 1741/2005 provide the maximum load of the ambient air and the permissible levels of air pollutants in emissions in Annex 5 and Annex 6 respectively. Annex 5, and Annex 6 of Law 4/1994 have been modified by ministerial decree 1095/2011 modified by 710/2012. Tables 1, 2, 3, and 4 present the maximum load of the ambient air and the permissible levels of air pollutant pertinent to the project accordingly.

Noise Pollution

Article 42 of the Law 4/1994 requires all organizations and individuals to maintain emanating sounds from different operating machinery or other sources below the permissible limits. Licensing authorities are to ensure that in a given area, the overall emanated sounds from fixed sources are within the allowable limits. In addition, licensing authorities are to ensure that machinery and equipment used by establishments fulfill the law’s requirements.

Maximum permissible limits of sound intensity according to Annex 7- Table 1 of the Executive Regulations (1095/2011 modified by 710/2012) specify that noise intensity during an eight-hour work shift shall not exceed 85 decibels.

Waste management


Article 39 of Law 4/1994 and Article 41 of its Executive Regulations requires precautions to be taken during any digging, construction, demolition activities, or transport of resulting waste, in order to avoid air pollution.

Articles 29 to 32 of Law 4/1994 provide regulations for the handling and storage of hazardous materials, including hazardous waste. Article 33 of Law 4/1994 specifies that all precautions must be taken when handling or storing hazardous material in any form (i.e.: gaseous, liquid, or solid).

Articles 34 to 36 address the responsibility of companies in ensuring safety of workers against chemical risks.

Articles 26, 31, and Decree 211/2003, specify conditions for the storage of flammable material, fuel, raw material, products and equipment.

Article 36 specifies that the workers should be made aware through written or oral instructions of the hazards related to the chemicals they are handling; they should also be trained on proper handling procedures.

Petroleum and Mineral Resource minister decree number 1352/2007 defines hazardous waste materials generated from petroleum industry. In addition ministerial decree number 1352/2007 prohibits handling of hazardous waste, except for entities authorized by EGPC.

Biodiversity

The main law concerned with natural protectorates is Law 102/1983. The Prime Ministerial Decree 1067/1983 designates the EEAA as the authorized administrative body charged with the implementation of law 102/1983.

At this stage, it is not expected that natural protectorates will come within the area of influence of the project. However, HP pipelines

The protection granted to the animal species listed in Annex 4 of Law 4 extends to:

- Other animal species determined by international conventions to be ratified by Egypt.
Any other birds or animals for which a decree shall be issued by the Minister of Agriculture with the agreement of the EEAA.

### 3.2.3 Law 38/1967 for General Cleanliness

Article 15 of the Executive Regulations stipulates that vehicles hauling construction waste should have a tight cover to prevent dispersion or falling of its contents.

### 3.2.4 Law 93/1962 for Wastewater

Law 93/1962 regulates the disposal of wastewater, and liquids in general, to the sewerage network. The Executive Regulations (Decree 44/2000) in Article 14 details the physical/chemical standards that should be complied with. The articles of this Law apply to the project in two main aspects:

- In case damage is caused to the sewerage network during excavation; and
- In case dewatered water from excavated trenches is discharged to the sewerage network.

### 3.2.5 Law 117/1983 for Protection of Antiquities

Law 117 of 1983 concerning the protection of antiquities gives the Supreme Council for Antiquities (SCA) the responsibility of management and protection and management of antiquities and archaeological sites. The law requires prior approval by that authority of plans for construction work on archaeological sites. Any legal person encountering any evidence of archaeological presence is required by law to report his finding to the General Authority for antiquities.

### 3.2.6 Traffic planning and diversions

Traffic Law 66/1973, amended by Law 121/2008 deals with traffic planning during construction of projects. Law 140/1956 on the utilization and blockage of public roads and Law 84/1968 concerning public roads govern the utilization or temporary obstruction of public roads. The Executive Regulations of Law 140 contain specifications for the management of construction and demolition debris. The law also allows the competent administrative authority to charge a fee for occupation of public ways.

### 3.2.7 Work environment and operational health and safety

Several laws and decrees tackle occupational health and safety provisions at the workplace, in addition to Articles 43 – 45 of Law 4/1994, which address air quality, noise, heat stress, and the provision of protective measures to workers. These laws and decrees apply to the work crew that will be involved in construction activities.

Law 12/2003 on Labor and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment. The law also deals with the provision of protective equipment to workers and fire-fighting/emergency response plans. Moreover, the following laws and decrees should be considered:

- Minister of Labor Decree 55/1983.
- Minister of Industry Decree 91/1985

The environmental aspects that have to be taken in consideration for the workplace are noise, ventilation, temperature, and health and safety. Noise regulations and standards for the work environment are described previously.
Table 7: Limits of heat exposure permissible in the work environment

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Low Air Speed (°C)</th>
<th>High Air Speed (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy Work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Limit of exposure to temperature permissible in work environment

<table>
<thead>
<tr>
<th>System of Work and Rest per Hour</th>
<th>Light Work (°C)</th>
<th>Moderate Work (°C)</th>
<th>Heavy Work (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Work</td>
<td>30</td>
<td>26.7</td>
<td>25</td>
</tr>
<tr>
<td>75% Work, 25% Rest</td>
<td>30.6</td>
<td>28</td>
<td>25.9</td>
</tr>
<tr>
<td>50% Work, 50% Rest</td>
<td>31.4</td>
<td>29.4</td>
<td>27.9</td>
</tr>
<tr>
<td>25% Work, 75% Rest</td>
<td>32.2</td>
<td>31.1</td>
<td>30</td>
</tr>
</tbody>
</table>

3.2.8 EEAA ESIA guidelines related to the Public Consultation

Consultation with the community and concerned parties, where all the stakeholders are invited, should clearly provide attendees with the necessary information about the project. Paragraph 6.4.3 of EEAA EIA guidelines provides detailed information about the scope of public consultation, methodology and documentation thereof

- Paragraph 6.4.3.1 Scope of Public Consultation
- Paragraph 6.4.3.2 Methodology of Public Consultation
- Paragraph 6.4.3.3 Documentation of the Consultation Results
- Paragraph 7 Requirement and Scope of the Public Disclosure

3.2.9 Land Acquisition and Involuntary Resettlement

Law No. 10 of year 1990 on Property Expropriation for Public Benefit identifies infrastructure projects as public benefit activities. It describes acquisition procedures as follows:

1. The procedures start with declaring the project for public interest pursuant to the presidential decree accompanied with a memorandum on the required project and the complete plan for the project and its structures (Law 59/1979 & Law 3/1982 provided that the Prime Minister issues the decree for Expropriation);
2. The decree and the accompanying memorandum must be published in the official newspapers; A copy for the public is placed in the main offices of the concerned local Government unit.

This law has specified, through Article 6, the members of the Compensation Assessment Commission”. This Article states that the commission is made at the Governorate level and consists of a delegate from the concerned Ministry’s Surveying Body (as President), a delegate from the Agricultural Directorate, a delegate from the Housing and Utilities Directorate, and a delegate from the Real Estate Taxes Directorate in the Governorate. The compensation shall be estimated according to the prevailing market prices at the time of the issuance of the Decree for Expropriation.

This project will not require land acquisition or involuntary resettlement given that the project land area has been allocated by the Egyptian Government and has no inhabitants.

3.2.10 Relevant international treaties to which Egypt is a signatory

Egypt has signed and ratified a number of international conventions that commit the country to conservation of environmental resources.

- International Plant Protection Convention (Rome 1951)
- African convention on the conservation of nature and natural resources (Algeria 1968)
• UNESCO Convention for the protection of the world cultural and natural heritage (Paris, 16 November 1972)
• Convention on International Trade In Endangered Species Of Wild Fauna And Flora (CITES) (Washington 1973)
• International tropical timber (Geneva 1983)
• United Nations framework convention on climate change (New York 1992). The convention covers measures to control greenhouse gas emissions from different sources including transportation.
• United Nations Framework Convention on climate change and Kyoto Protocol (Kyoto 1997)
• Convention on biological diversity (Rio de Janeiro 1992), which covers the conservation of habitats, animal and plant species, and intra specific diversity.
• Convention for the protection of the ozone layer (Vienna 1985)
• Convention for the prevention and control of occupational hazards caused by carcinogenic substances and agents (Geneva 1974)
• Convention for the protection of workers against occupational hazards in the working environment due to air pollution, noise and vibration (Geneva 1977)
• International Labour Organization: core labour standards are to be followed during the project implementation. Egypt has been a member state of the ILO since 1936, and has ratified 64 conventions which regulate the labor standards and work conditions. In 1988, Egypt ratified the Occupational Safety and Health Convention of 1979 (No 152).
• Cultural Heritage: respecting cultural heritage and not financing projects which threaten the integrity of sites that have a high level of protection for reasons of cultural heritage, e.g. UNESCO World Heritage sites
• Consultation, Participation and Public Disclosure: The Aarhus Regulation promotes transparency of environmental information and the inclusion of stakeholders in projects. Consultation serves to identify and manage public concern at an early stage. The regulations include provisions for the public disclosure of key project information such as the Non-Technical Summary and the ESIA.

3.3 World Bank Safeguard Policies

The World Bank (WB) has identified 10 environmental and social safeguard policies that should be considered in its financed projects. The proposed project is classified as Category A according to the World Bank. This mandates a full Environmental and Social Impact Assessment (ESIA).

World Bank Safeguard Operational Policies and their applicability to the proposed project:

<table>
<thead>
<tr>
<th>Safeguard Policy</th>
<th>Triggered</th>
<th>Justifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment (OP/BP 4.01)</td>
<td>Yes</td>
<td>The project is classified as Category A which requires full environmental assessment.</td>
</tr>
<tr>
<td>Natural Habitats (OP/BP 4.04)</td>
<td>No</td>
<td>Location and alignment of project components is mainly along (or close to) previously paved paths. Protected Areas, if encountered, will be avoided</td>
</tr>
<tr>
<td>Forests (OP/BP 4.36)</td>
<td>No</td>
<td>Proposed project areas contain No forests.</td>
</tr>
<tr>
<td>Pest Management (OP 4.09)</td>
<td>No</td>
<td>The proposed project will not involve purchasing or using Pesticides.</td>
</tr>
<tr>
<td>Physical Cultural Resources (OP/BP 4.11)</td>
<td>No</td>
<td>Location and alignment of project components is mainly along (or close to) previously paved paths. Sites of cultural importance, if encountered, will be avoided</td>
</tr>
</tbody>
</table>
3.3.1 OP 4.01 – Environmental Assessment

According to the World Bank Operational Policy OP 4.01, the Natural Gas Connection Project is classified among Category A projects. Projects under this Category are likely to have significant adverse environmental impacts that are sensitive\(^1\), diverse, or unprecedented.

The environmental impacts that are likely to be caused by the project shall be analyzed in this study. Mitigation measures shall be identified for all expected negative impacts, along with an Environmental Management and Monitoring Framework presenting mechanisms for implementation of these mitigation measures.

3.3.2 OP 4.12 – Involuntary Resettlement

According to the WB’s safeguard policy on Involuntary Resettlement, physical and economic dislocation resulting from WB funded developmental projects or sub-projects should be avoided or minimized as much as possible. The purpose of the RPF is to set down the principles for social impact mitigation, as well as clarify the organizational arrangements that may be needed during sub-project preparation and implementation phases. This includes compensating all project affected persons (PAPs) for the loss of lands, properties, and livelihoods resulting from displacement and resettlement, as well as assisting these people in relocation and rehabilitation.

A Resettlement Policy Framework has been prepared in order to outline a proposed approach and workplan to guide the implementation, handover, and monitoring and evaluation of the resettlement process, in case OP 4.12 is triggered at any point.

3.4 Gap analysis for key environmental concerns: Egyptian laws and WB Policies

3.4.1 Air Quality

<table>
<thead>
<tr>
<th>Requirements of Egyptian legislation</th>
<th>Requirements of WB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference</strong></td>
<td><strong>Inflections</strong></td>
</tr>
<tr>
<td>Article 34 of Law 4/1994</td>
<td>Standards of</td>
</tr>
</tbody>
</table>

\(^1\) A potential impact is considered “sensitive” if it may be irreversible (e.g., lead to loss of a major natural habitat) or raise issues covered by OP 4.10, *Indigenous Peoples; OP 4.04, Natural Habitats*; OP 4.11, *Physical Cultural Resource*; or OP 4.12, *Involuntary Resettlement.*
Requirements of Egyptian legislation

**Reference**
amended by law 9/2009 and

**Inflections**

Article 34 of its Executive Regulation (ERs), and

Decree 710/2012 Annex 5 of the ERs

**Reference**

Executive regulation and Decree 1095/2011) Annex 6

**Inflections**

Table 12

States that it is not allowed using the Asphalt mixing units at a distance less than 500 m away from a residential building.

Table 9: Max. Emission allowable limit for Asphalt mix units (mg/m³)

<table>
<thead>
<tr>
<th>Total VOCs</th>
<th>CO</th>
<th>Total particulate matters</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>500</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 10: Indicative limits for air quality

<table>
<thead>
<tr>
<th>Ambient air parameters</th>
<th>Ambient air pollutants threshold</th>
<th>IFC Ambient air pollutants threshold (based on WHO limits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure period</td>
<td>1 hr 8 hr 24 hr 1 yr</td>
<td>1 hr 8 hr 24 hr 1 yr</td>
</tr>
<tr>
<td>Carbon monoxide CO</td>
<td>30 10 N/A N/A</td>
<td>N/A N/A N/A N/A</td>
</tr>
<tr>
<td>Sulfur dioxide SO₂</td>
<td>350 N/A 150 60</td>
<td>N/A N/A 125 N/A</td>
</tr>
<tr>
<td>Nitrogen oxides NOₓ</td>
<td>300 N/A 150 60</td>
<td>200 N/A N/A 40</td>
</tr>
<tr>
<td>Particulates PM₁₀</td>
<td>N/A N/A 150 70</td>
<td>N/A N/A 150 70</td>
</tr>
<tr>
<td>Particulates PM₂,₅</td>
<td>N/A N/A 80 50</td>
<td>N/A N/A N/A N/A</td>
</tr>
<tr>
<td>TSP µg/m³</td>
<td>N/A N/A 230 125</td>
<td>N/A N/A 230 80</td>
</tr>
</tbody>
</table>
3.4.2 Water Quality (In case of dewatering during excavation)

Requirements of Egyptian legislations

<table>
<thead>
<tr>
<th>Reference</th>
<th>Inflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 60, Executive Regulations of Law 48 for the year 1982</td>
<td>Standards of Ambient water quality of this document</td>
</tr>
<tr>
<td>Article 61, The Executive Regulations of Law 48 for the year 1982</td>
<td>maximum limits for draining the processed liquid industrial wastes into freshwater bodies and groundwater reservoirs</td>
</tr>
<tr>
<td>Ministerial Decree No. 44/2000 (Decree 1095/2011) of Law 93/1962</td>
<td>Controlling the discharge of wastewater into the sewage system and public network</td>
</tr>
<tr>
<td>Law 38/1967 and its executive regulations (decree 134/1968)</td>
<td>It encompasses this statement: it must be to acquire the wastewater discharge licenses from the concerned authorities during the construction and operation phase.</td>
</tr>
</tbody>
</table>

Requirements of WB

<table>
<thead>
<tr>
<th>Reference</th>
<th>Inflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP 4.01</td>
<td>Ensure the environmental sustainability of investment projects</td>
</tr>
<tr>
<td>IFC GENERAL EHS GUIDELINES</td>
<td>Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or storm water to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria</td>
</tr>
<tr>
<td>IFC GENERAL EHS GUIDELINES (Wastewater and Ambient Water Quality Table 1.3.1)</td>
<td>Effluent pollutants threshold</td>
</tr>
</tbody>
</table>

It encompasses this statement: it must be to acquire the wastewater discharge licenses from the concerned authorities during the construction and operation phase.

Table 11: Indicative Limits for discharge of liquid effluent into sewer systems

<table>
<thead>
<tr>
<th>Parameters/pollutant</th>
<th>Effluent threshold</th>
<th>Effluent pollutants threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Egyptian 93/1962 Modified)</td>
<td>(WB requirements)</td>
<td></td>
</tr>
</tbody>
</table>
by ER 44/2000)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Egyptian</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6-9.5</td>
<td>6 – 9 pH</td>
</tr>
<tr>
<td>BOD mg/l</td>
<td>600</td>
<td>30</td>
</tr>
<tr>
<td>COD mg/l</td>
<td>1100</td>
<td>125</td>
</tr>
<tr>
<td>Total nitrogen mg/l</td>
<td>N/A</td>
<td>10</td>
</tr>
<tr>
<td>Total phosphorus mg/l</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Oil and grease mg/l</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Total suspended solids mg/l</td>
<td>800</td>
<td>50</td>
</tr>
<tr>
<td>Total coliform bacteria (Most Probable Number/100 ml)</td>
<td>N/A</td>
<td>400</td>
</tr>
</tbody>
</table>

3.4.3 Noise

(Egyptian requirements) (WB requirements)

<table>
<thead>
<tr>
<th>Article</th>
<th>Inflections</th>
<th>Reference</th>
<th>Inflections</th>
</tr>
</thead>
</table>

Table 12: Standards and Limits for Ambient Noise

<table>
<thead>
<tr>
<th>Egyptian Law 4 Requirements</th>
<th>Requirements of WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFC GENERAL GUIDELINES Table 1.7.1</td>
<td>Maximum increase in background nearest receptor location off-site.</td>
</tr>
<tr>
<td>Table 2.3.1</td>
<td>Noise limits for different working environments are provided</td>
</tr>
</tbody>
</table>
### Permissible limit for noise intensity (decibel)

<table>
<thead>
<tr>
<th>TYPE OF AREA</th>
<th>DAY</th>
<th>NIGHT</th>
<th>Receptor</th>
<th>One hour $L_{Aeq}$ (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive Areas (schools, hospitals, public parks, rural areas)</td>
<td>7 a.m. to 10 p.m.</td>
<td>10 p.m. to 7 a.m.</td>
<td>Residential</td>
<td>55 45</td>
</tr>
<tr>
<td>Residential areas in with limited traffic and public services are available</td>
<td>55 45</td>
<td>Industrial</td>
<td>70 70</td>
<td></td>
</tr>
<tr>
<td>Residential areas in the city where commercial activities are available</td>
<td>60 50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential areas located adjacent to roads which width is less than 12m, and workshops or commercial or entertainments activities are found</td>
<td>65 55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas located adjacent to roads which width is 12m or more, or light industrial areas.</td>
<td>70 60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial areas (heavy industries)</td>
<td>70 70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 13: Standards and Limits for Noise Levels in the Work Environment

<table>
<thead>
<tr>
<th>TYPE OF PLACE AND ACTIVITY</th>
<th>MAXIMUM PERMISSIBLE NOISE [level equivalent to decibel (A)]</th>
<th>Location /activity</th>
<th>Equivalent level $L_{Aeq,8h}$</th>
<th>Maximum $L_{Amax,fast}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work place with up to 8 hour shifts and aiming to limit noise hazards on sense of hearing*</td>
<td>85</td>
<td>Heavy Industry (no demand for oral communication)</td>
<td>85 dB(A)</td>
<td>110 dB(A)</td>
</tr>
<tr>
<td>Hospitals, clinics, public offices, etc.</td>
<td>80</td>
<td>Light industry (decreasing demand for oral)</td>
<td>50-65 dB(A)</td>
<td>110 dB(A)</td>
</tr>
</tbody>
</table>
### Administrative offices – control rooms

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 dB(A) N/A</td>
<td>Open offices, control rooms, service counters or similar</td>
</tr>
</tbody>
</table>

### Work rooms for computers, typewriters or similar equipment

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 dB(A) N/A</td>
<td>Individual offices (no disturbing noise)</td>
</tr>
</tbody>
</table>

### Work rooms for activities requiring routine mental concentration

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 dB(A) N/A</td>
<td>Hospitals</td>
</tr>
</tbody>
</table>

### Hotels, bedrooms, and similar residential units

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 dB(A) N/A</td>
<td></td>
</tr>
</tbody>
</table>

* At the workplace, exposure time (8 hours) is halved for every additional 3 dBA over the maximum allowable limit. Above the maximum limit (85dBA for 8-hour shifts), wearing proper ear muffs is a must.

- Noise level at any time at the workplace shall not exceed 135 dBA
- Noise shall be measured inside working environment in LAeq unit in accordance with ISO 9612/ ISO 1996 or Egyptian standards

### 3.5 Closing note

The Legal framework chapter in this updated ESIA is meant to shed some light on the most relevant environmental and social legislations and regulations which the project should adhere to and take mitigation actions to comply with. These should be revisited and updated in the route/site-specific ESIA as according to the features of the detailed project.

Overall, Egyptian legislation provides environmental compliance procedures and emission limits which are at least comparable with WB/international requirements, if not more stringent. GASCO is bound by internal policies which oblige them to comply with national legal requirements. In the case that national requirements are non-existent for specific issues or pollutants, WB requirements will be adopted.
4. Description of the Environment

4.1 Administrative Districts and introduction to the 9 governorates

The proposed pipelines shall pass through 9 governorates. Each governorate has its own specific environmental and socio-economic background. At this stage (updating of the existing ESIA for the purpose of restructuring the original Giza North Power Plant Project), only selected relevant background data will be presented. During the preparation of the site specific ESIA for the different pipelines, the consultant shall investigate and describe, in more details at the micro level, the relevant background data.

1. Cairo Governorate

Cairo Governorate (Muhafazat al Qahirah) is the political and economic capital of the Arab Republic of Egypt. It hosts all the executive government and popular institutions, as well as the offices of international institutions, the most famous media and cultural pulpits, the oldest theaters and cinemas in Africa and the Middle East. It also hosts the oldest and most prestigious hospitals (Kasr al-Aini), universities (Al-Azhar and Ain Shams universities) and the most important and famous mosques of Egypt and the world (Al-Azhar mosque). Cairo governorate also hosts the Saint Mark Cathedral, the Coptic Orthodox Church. It is home to numerous monuments of the Coptic and Islamic civilizations. Cairo governorate is a one-city governorate located on the eastern bank of the Nile, one of the most important world rivers. It is bordered by the Qalioubiya and Sharqiya governorates to the north, the Giza governorate to the south and the Suez governorate to the east. The natural urban growth of Cairo is towards the East direction. Many new urban settlements have been established to attract a significant portion of the existing population and to allow for the new generations to find appropriate housing units in new urban communities.

Traffic congestion and high levels of air pollution in addition to deteriorating infrastructure have pushed the Government of Egypt to take a major decision to re-locate not only ministries and many government authorities but also the presidential palace and the parliament to a new administrative district which will be built to the East of Cairo in between the Cairo-Suez road and Qattameya – Ain Sokhna road. It is planned that the new administrative district will be one of many other urban economic development projects which will formulate an integrated, self-sufficient and modern community which publically known as “The New Capital”.

Cairo is administratively divided into 41 divisions (qism) and has a population of 9,102,232 (estimated for year 2014).

2. Alexandria Governorate

The governorate is bordered to the north by the Mediterranean Sea, to the east by El Behera and to the west by Matrouh Governorate. Alexandria's total area comes to 2300.0 km², and is divided into one Markaz, one city, 7 districts, and 3 rural local units.

Alexandria is an industrial governorate where 40% of Egyptian industries are concentrated, especially chemicals, food, spinning and weaving as well as oil industries and fertilizers. Borg Al-Arab city was established to be an industrial, housing and agricultural city to absorb the current and future population increase.

3. Damietta Governorate

Damietta Governorate is one of the governorates of Egypt. It is located in the northeastern part of the country, and has a population of over 1 million. Its capital is the city of Damietta.

The city of Damietta is famous of its skilled carpenters and furniture. These productions are not only sold inside of Egypt, but also in the Middle East, Europe and the USA. 80% of the governorate's income is related to furniture.
Damietta (city) is famous for its guava farms, as well as the palm trees that cover the coast from Ras El Bar in the east to Gamasa in the west. The governorate exports millions of palm trees to many countries every year, including Greece and China. Damietta also produces wheat, maize, cotton, rice, potatoes, lemon, grapes and tomatoes. It is also famous for its sweet industry, sardine packing, and Domiati cheese. Ras El Bar, one of the oldest summer resorts in Egypt, is located at the point where The Nile meets the Mediterranean Sea.

4. **Beheira Governorate**

Beheira governorate enjoys an important strategic location, west of the Rosetta branch of the Nile. It comprises four important highways, namely the Cairo-Alexandria desert road, the Cairo agricultural road, the international road and the circular road. Beheira governorate is also home to a number of the most important Coptic monasteries in Wadi El Natrun (Scetes). Beheira consists of 13 centres (markaz) and 14 cities, and contains important industries such as cotton, chemicals, carpets, electricity and fishing.

The capital of Beheira governorate is Damanhour.

5. **Port Said Governorate**

Port Said Governorate is one of the governorates of Egypt. It is located in the north-eastern part of the country, directly on the Mediterranean Sea at the northern gate of the Suez Canal, making it the second most important commercial and passenger harbour in Egypt. The governorate’s capital is the city of Port Said, the home of the building of the Suez Canal Authority local headquarters and the Lighthouse of Port Said. Port Said governorate has a population of more than 653,000 inhabitants, and an area of 1,345 km².

6. **Suez Governorate**

Suez Governorate (Egyptian Arabic is one of the governorates of Egypt. It is located in the north-eastern part of the country and is coterminous with the city of Suez. It is situated north of the Gulf of Suez. There are five ports in the Suez Governorate; namely El-Sokhna port, Tewfiq port, Adabeya port, petrol basin port, and El-Atka fishing port. Natural resources in the Suez Governorate include limestone, clay, coal, petroleum, marble, and lime. Suez hosts many important industries such as oil refining, petrochemicals, cement production, steel manufacturing in addition to many industrial establishments which are located in the special economic zone of Ain Sokhna.

7. **Giza Governorate**

Giza is one of Greater Cairo region urban governorates. The governorate's total area reaches 13184 km², forming 3% of the country's total area. The governorate is divided into 9 Markaz, 11 cities, 8 districts in addition to 48 rural local units with 120 affiliated villages.

Giza is privileged with plenty of ancient Pharoanic monuments, placing it second after Luxor city in this regard. Most Important monuments include Giza pyramids, the Sphinx, Cheops Ship.

8. **Beni Soiuf Governorate**

It is one of Upper Egypt governorates which is situated in the center of the country. This governorate's capital is the city of Beni Suef, located about 120 km south of Cairo on the west bank of the Nile River. The area is well known in Egypt for its cement factories. The nearby Meidum pyramid is the prominent tourist attraction in the area.

9. **Fayoum Governorate**

Al-Fayoum is one of the Upper Egypt governorates and located in a great depression of the Western Desert about 130 km south west of Cairo. It has a population of 3,072,181. Extending about 80 km east–west and about 56 km north–south, the whole Fayoum —including Wadi Al-Ruwayān, a smaller, arid
depression—is below sea level (maximum depth 150 feet [45 metres]). The governorate also includes a triangular tract of desert to the west, bounded by Giza to the north and Beni Souif to the south. On the southeastern side of the depression is Al-Fayoum, the capital of the governorate formerly Madinat al-Fayoum (“City of the Fayoum”). The present Lake Qārūn in the depression is sustained by a partial diversion of the Nile into the Yūsf (Ibrāhīmiyyah) Canal, which follows the ancient channel of the Nile into the Fayoum, branching out to provide irrigation water. The brackish lake, occupying 85 square miles (220 square km), has been successfully stocked with saltwater fish, enabling a commercial fishing industry to develop.

With the linking of Al-Fayoum to the Nile valley by railroad, the governorate’s isolation was reduced and the way opened for development of the rich soils deposited by the Nile. Most of the area of Al-Fayoum is settled and cultivated. Cereals, rice, beans, grapes, olives, figs, dates, honey, cotton, and sugarcane are produced. Pigeons are raised for domestic commercial use. In the early 1970s about 9,900 acres (4,000 hectares) of desert were reclaimed for agricultural use. Attar of roses collected there is used in the perfume industry. Other industrial activities include manufacture of woolen and linen cloth, leather tanning, and tobacco processing. Construction of a chemical plant using solar evaporation to extract sodium chloride, sulfide, chlorate, and magnesium oxide started in 1980 near Lake Qārūn. Coal and iron ore deposits have been found in the governorate.

4.2 Environmental and social baseline

The geographical spread of the project is over 9 governorates, from the southern governorates (Al-Fayoum, Beni Souif, and Giza) to the northernmost (Alexandria), Delta governorates (Damietta and Al-Beheira), Suez Canal governorates (Suez and Port Said) in addition to Cairo (Qattameya and New Capital) yields a diverse array of baselines for the project areas.

As an integral component of the updated ESIA, this study sets the basis for describing the project physical, biological, and socioeconomic environment upon finalization of design and various project details. In the specific ESIs, the focus of the baseline descriptions of the project areas should be on aspects and components of high relevance to the environmental and social impact assessment of the natural gas pipelines project.

Data from secondary sources such as published reports, governorate information centers, and environmental profiles is important and essential. Data such as flora and fauna, rainfall, wind speeds, geology, hydrogeology, surface & groundwater, land-use, socioeconomic traits, etc. may play an important role in the environmental and social profiling of the project in the area-specific ESIs. In addition, field measurements, coordination with stakeholders/government entities, and extensive document acquisition must take place in order to provide data on baseline components.

However, the most important source of project-relevant baseline data should be the detailed outcomes of the initial field surveys which should be carried out by the environmental and social consultant.

In addition to the abovementioned sources for baseline data, the following table presents the baseline components of high relevance to the project and a non-exhaustive listing of suggestions on the best sources of relevant data.

<table>
<thead>
<tr>
<th>Component</th>
<th>Proposed data sources</th>
<th>Governorates potentially sensitive to component</th>
</tr>
</thead>
</table>

55
<table>
<thead>
<tr>
<th>Component</th>
<th>Proposed data sources</th>
<th>Governorates potentially sensitive to component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic</td>
<td>- Studies/data by the technical departments of the Ministry of Interior</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td></td>
<td>- Local police and traffic authorities in the project area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Interviews with dwellers in the project areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Main roads maps from General Authority for Roads, Bridges and Land Transport (GARBLT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Egypt National Railway Authority</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Studies and maps from the General Organization for Physical Planning (GOPP)</td>
<td></td>
</tr>
<tr>
<td>Air quality</td>
<td>- Field measurements around equipment and machinery directly prior to commencement of project activities</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Noise</td>
<td>- Field measurements at source and at sensitive receptors directly prior to commencement of project activities</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Underground utility lines and piping</td>
<td>- Data collection and acquisition of updated documents from the central and regional offices of the Potable Water and Wastewater Authority; the Electricity Holding and Transmission Companies; the Ministry of Telecommunications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Field surveys and mapping in the presence of representatives of the above entities</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td></td>
<td>- Interviews with locals and residents of the project areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Using non-destructive remote sensing technologies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Using limited/exploratory boreholes</td>
<td></td>
</tr>
<tr>
<td>Nearby weak structures</td>
<td>- Field surveys and mapping building-by-building</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Reports from the Local Authority</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Consulting structural specialists in areas with clear signs of vulnerability</td>
<td></td>
</tr>
<tr>
<td>Culturally-valuable sites and antiquities</td>
<td>- Coordination with the central and regional offices of the Supreme Council of Antiquities</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td></td>
<td>- Consultations with locals and project areas residents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Field surveys and mapping</td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>Proposed data sources</td>
<td>Governorates potentially sensitive to component</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Solid, liquid, and hazardous waste disposal sites</td>
<td>Field investigation, Acquisition of maps and data from local government units and relevant offices, Data/maps from the Egyptian Environmental Affairs Agency (EEAA), Data and maps from the GOPP, Interviews with locals and residents, Interviews with certified waste management companies and local service providers, Interviews with informal waste handlers / scavengers, Interviews with operators of the Nasreya and UNICO waste treatment facilities in Alexandria</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Geological and geotechnical history of the area</td>
<td>Field surveys and geotechnical investigations, Interviews with locals and project area residents, Data collection and map acquisition from local government units, Geotechnical Due Diligence in areas close to water bodies or zone of high underground water tables</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Government-owned land</td>
<td>Field surveys and land mapping for placement of PRSs, Obtaining documents and maps from the Property of the Country “Amalak El Dawla” office in the local government or Markaz unit</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Protected Areas and sensitive ecological systems</td>
<td>EEAA Protected Areas sector, Environmental profile of the governorate</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Cultural, social, and political traits</td>
<td>Field investigations, Interviews with locals and project area residents, Interviews with government officials and relevant stakeholders</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Restoration and Res-</td>
<td>District local authorities, Data collection from the Directorate of Roads and Bridges</td>
<td>All 9 governorates</td>
</tr>
<tr>
<td>Pavement plans</td>
<td>GOPP reports, data, and maps, Urban/physical planning offices of the Governorate</td>
<td>All 9 governorates</td>
</tr>
</tbody>
</table>

It should be noted that some of the data above may simply be unavailable or incomplete despite...
having been implemented fully by a government and/or private entity. In such cases, the site specific ESIA consultant shall generate the data using the necessary means (field investigations, measurements, stakeholder engagement, etc.). The following is a generic description of the existing environmental and social settings (which will be further described in details in the route specific ESIAs) in the project areas.

4.2.1 Land Uses

The gas pipelines project will cover areas which are located in agricultural zones of the delta governorates as well as desert areas in the rest of the governorates (Cairo, Giza, Beni-Souif and Fayoum). The pipelines may cross irrigation/drainage canals, lake Manzalah, main roads and railways. Temporary land acquisition in privately owned land is expected during construction and therefore a Resettlement Policy Framework is being prepared to determine the compensation procedures which will be utilized if land acquisition is unavoidable.

The pipelines will not encounter any protected areas, culturally or historically valuable sites.

4.2.2 Climate

The pipeline routes are in a subtropical climatic region of Northeast Africa, generally arid and characterized by a warm winter and hot summer, low rainfall and high evaporation intensity. The relative humidity is moderate and active winds of intermediate speed is recorded, rainfall range between 25 to 100 mm/year as shown in figure 3. The annual minimum and maximum air temperature in this region vary from about 13°C to about 28°C, respectively. However the temperature frequently rises to about 35°C during the summer season.

The project area is located in a subtropical climatic region. Among the outstanding weather events are the dust and sandstorms that frequently blow in transitional seasons of spring (March to May) and autumn (September to November). In winter (December to February) the general
climate of the area is cold, moist and rainy while during summer (June to August), its climate is hot, dry and rainless.

A phenomenon of Egypt’s climate is the hot spring wind that bellows across the country. The winds, known as the Khamasin, usually arrive in April but occasionally occur in March. Unobstructed by geographical features, the winds reach high velocities and carry great quantities of sand and dust from the deserts. These sandstorms, often accompanied by winds of up to 140 kilometers per hour, can cause temperatures to rise as much as 20°C in two hours. The winds blow intermittently and may continue for days. The Khamasin winds cause illness in people and animals, harm crops, and occasionally damage houses and infrastructure.

Winds are mostly northerly, with the direction ranging from NW to NE throughout the year. These directions of the wind could cause rapid transportation of pollutants and other urbanized effects from the industrial complex areas in the north.

### 4.2.3 Soil

Only one type of soil characterize the region through the pathway of the pipeline which is the Calcaric fluvisols, relatively young soils (clay to loam) developed on recently deposited colluvial, fluviatile, lacustrine, or marine sediments in the Nile Valley and Delta as shown in the figure below.(sky blue color)

![Soil map of Egypt](image)

Fluvisols still show some sedimentary stratification. Organic matter content decreases irregularly with depth (although it remains above 0.35 percent in the upper 1.25m) and the soils have sulphide-rich material within 125cm of the surface. Generally fluvisols exhibit little horizonation, except for a weakly developed A-horizon and peaty horizons. Calcaric fluvisols, however, are strongly calcareous, having significant amounts of free calcium carbonate at depths of 20-50 cm and pH 7. These are the most intensively farmed soils in Egypt and have a high development potential due to the ease of irrigation low water erosion potential, and their ability to be double-cropped. They do not, however, have very high nutrient levels, so the maintenance of fertility by traditional manuring practices or by high rates of fertilizer application is of particular importance in crop production. There are also potential wind erosion problems in silt-rich areas if the topsoil is allowed to dry out. The major management task is to control water supply and conserve soil moisture.
The Nile fluvisols are extensively irrigated and the management of irrigation scheduling and drainage is time-consuming. In addition, in areas with high clay content, poor irrigation practices often lead to subsoil compaction and pan formation, secondary salinization, and gleying.

4.2.4 Geology

The surface exposures of the area belong almost totally to the Quaternary and to the Late Tertiary and are essentially developed into clastic facies. Eocene and Upper Cretaceous carbonate rocks are locally exposed and are principally associated with fold-faulted structures. Oligo-Miocene basalt exists in the southern portion and also recorded in the subsurface. The following figures represent the geologic map of the area and legend associated and as well as the following table gives an idea about the stratigraphic correlation of the area.

- **Quaternary:**
  - Holocene: occupies the present floodplain the Nile River, composed of silty layers and act as semi-confining stratum in the Nile Delta.
  - Pleistocene: Thick succession of deposits of graded sand and gravels intercalated with clay lenses, the thickness reach about 100 m near Cairo, this unit act as the main aquifer of the area.
- **Tertiary:**
  - Miocene: occupies the southern portion of the area, composed mainly of sand and gravel and local intercalation of limestone or shale.
- **Mesozoic:**
  - Upper Cretaceous: present in southern portion of the area with a thickness up to 1000 m, and composed mainly of limestone and dolomite.
Figure 24: General geologic map of the area
(Egy.Geol.Surv., 1981), scale 1:2,000,000

Figure 25: Legend of the geologic map
4.2.4.1 Geomorphology

The pipeline route lies entirely on one main geomorphologic unit - the Young Alluvial Plain which occupies the banks of the river Nile. The surface of this flood plain consists of a top layer of clay-silt and underlain by sand and gravels which is water bearing formation of the alluvial aquifer. The Nile floodplain has an elevation of about 21m (amsl), to the east side of the flood plain, the ground surface rises towards El Mokata to reach about 150m (amsl), to the west side, the surface rises 100m (amsl) at the Pyramid plateau.

Table 14: Stratigraphic correlation or the area
(Said, 1990) a=age (millions of years) b=thickness (meters)

<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
<th>a</th>
<th>Nile phase</th>
<th>Formation</th>
<th>lithology</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaternary</td>
<td>Holocene</td>
<td>0.02</td>
<td>Neolithic</td>
<td>Balqas</td>
<td>silty clay</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Pleistocene</td>
<td>2.8</td>
<td>Prehistoric</td>
<td>Mit Ghamr</td>
<td>gravel, sand</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2</td>
<td>Paleolithic</td>
<td>El Wastani</td>
<td>sand, clay</td>
<td>300</td>
</tr>
<tr>
<td>Neogene</td>
<td>u, m</td>
<td>5.2</td>
<td>Marine Gulf</td>
<td>Kafr el Sheikh</td>
<td>clay</td>
<td>1750</td>
</tr>
<tr>
<td></td>
<td>lower</td>
<td>11.2</td>
<td>Eocene</td>
<td>Abu Mesi</td>
<td>sandy dpts.</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>upper</td>
<td>16.5</td>
<td></td>
<td>Rosetta</td>
<td>evaporites</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>middle</td>
<td></td>
<td></td>
<td>Qawasim</td>
<td>silt, sand</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>lower</td>
<td></td>
<td></td>
<td>Sidi Salem</td>
<td>clay</td>
<td>1800</td>
</tr>
<tr>
<td>Oligocene</td>
<td></td>
<td></td>
<td></td>
<td>Abu Zabel</td>
<td>basalt</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Deb`e-Sharqan</td>
<td>shale</td>
<td>150</td>
</tr>
</tbody>
</table>
4.2.4.2 Tectonic Frameworks

Structure Geology:

The selected area for the project implementation is characterized by almost featureless plain with the exception of the small folded and faulted Abu Rawash complex which offers a few prominent topographical or geologic features. The following figure shows major faults in the area, the majority of these faults are steep normal faults and most have a long history of growth.
The most famous fault in the area is the Abu Rawash fold which owes its origin to compressional movement which affected the area during the late Cretaceous-early Tertiary tectonic event, this fold have a northeast-southwest trend.

**Seismicity**

Seismicity in the area is characterized by the occurrence of small, moderate and large earthquakes which has increased in recent years but they are limited within the crust, only micro-earthquakes were frequently observed. The following figures show the intensity distribution of earthquakes in Egypt, and the epicenters of recent medium to large earthquakes (A) and the epicenter of small earthquakes.
The figure “A” below shows the locations of earthquakes recording stations in the delta area. Figure “B” shows the epicenter of Earthquakes recorded throughout the geologic history which range from large earthquakes in old geologic time to low earthquakes intensity at present time. Recently no earthquakes even of low intensity were recorded throughout the pathway of the pipeline.
The region has faced a number of earthquakes in recent geologic history. The following is a brief description of recorded major earthquakes:

- In 1847, an earthquake of magnitude 8 degree was felt, 100 dead, thousands injured and thousands of houses were destroyed.
- In 1870, very wide earthquakes, was felt all over Egypt, Greece, Turkey and Palestine, and has a magnitude of 6 degree.
- In 1955 several earthquakes occurred and were strongly felt all over Egypt of magnitude ranging between 6 and 7 degrees.
- In 1969, another earthquake of magnitude 6.3.
- In 1974, and 1984, small earthquakes of magnitude 4.5 were felt in Cairo.
- In 1992 moderate earthquake, 5.8 degree but caused large damage in greater Cairo.
4.2 Biodiversity and Habitats

Figure 30: Egyptian Protected Areas.
(Note: The pipeline does not encounter any protected areas.)
4.2.1 Flora
The following habitats can be distinguished along the pipelines route:

- Farmland
- Hydrophytic and Canal banks Habitats
- Roadsides habitats
- Desert habitats

4.2.2 Fauna
The main habitats in the majority of the areas crossed by the pipelines pathway are artificial-terrestrial habitats including arable land, plantations, rural gardens, cultivated agricultural lands and urban areas. Other habitats include desert lands and wetlands along the main two branches of the River Nile and smaller branches and irrigation canals, as well as inhabited areas, asphalt roads and railways. These habitats can be categorized under three broad ecosystems one being the artificial-terrestrial, arid desert and the aquatic (lotic) ecosystem of the River Nile.

4.3 Closing note
As outlined at the beginning of this chapter, certain baseline characteristics are of high relevance to the proposed natural gas pipelines project. These should be addressed comprehensively during the specific ESIAs in order to identify possible impacts which may vary in significance from one location to the next. It should be noted that the baseline characteristics identified are non-exhaustive and that the specific ESIAs must add other project-related characteristics to the baseline, as appropriate.
5. Analysis of Alternatives

Alternatives are explored in the following areas: construction technologies (particularly in crossing roads, railways and waterways), routing options, and locations of associated facilities. The “No Action” alternative is also considered in order to demonstrate potential environmental benefits or determinants that would occur if none of the project activities were carried out.

5.1 The “No Action” Alternative

The primary purpose of the proposed project is to supply natural gas to 8 Power Stations, which will generate electricity for end user consumption. Without the project activities, the existing and planned new power plants will operate using fuel oil as its primary and only fuel.

There are two major impacts if this project is not implemented:

a) In addition, the overall environmental conditions will be worse off should fuel oil be used as the primary, or sole fuel due to the increased levels of

b) The power plants operation will violate the Egyptian environmental regulations which only approve fuel oil to be used as back-up fuel and for maximum of 2% of the annual operation while natural gas should be used as the primary fuel.

In addition to the environmental degradation, operation of the power plants using imported fuel oil will not be as economically feasible compared to operation while using locally produced natural gas. Moreover, the lifetime of the power plants which operate using natural gas has a longer life time and require less maintenance than that which operate using fuel oil.

Therefore, for the above reasons, not implementing this project is not considered an environmentally favored alternative.

5.2 Construction Alternatives

5.2.1 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 offers several advantages when compared to other trench-less 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 such as power and telephone cables.
- In river crossing applications, danger of river bed erosion and possible damage from river traffic is eliminated.
- Requires only a small construction footprint.
- The volume of drilled fluids will be estimated only during the start of HDD by a short time.
5.2.2 Open-Cut Method

If a trenchless technology were not employed, the pipeline would have to be laid using open-cut excavation along the entire route. This would have a number of major negative impacts at points where the pipeline crosses roads, railways, and waterways. Main roads would have to be partially or completely obstructed for a significant period of time to allow for excavation and laying of the pipeline, amplifying any negative impacts on traffic discussed in Section 6.2.2. Furthermore, obstruction of main roads and railways would disrupt the flow of people and goods along those routes, which would have a negative effect socially and economically, not only in the project area, but in the larger region linked with the transport routes that were disrupted. This technique would also require partial dismantling/destruction and then reconstruction of the existing infrastructure of roads and railways, thus complicating and expanding the required construction activities of the project.

Crossing waterways without using a trenchless technology would require construction activities that directly affected important sources of water, increasing the risk of contamination during both the construction and operation phases. These activities would also disrupt the natural marine environment. It is likely that the pipeline would not be buried in these situations, so it would also be at an increased risk of damage. These impacts could affect the entire downstream portion of the respective waterways.

5.3 Routing Alternatives

Choosing the pipeline route involves selecting paths that, when possible, follow a logical course along existing transportation ways, cross these transportation ways at opportune locations, and avoid populated areas and other sensitive receptors. These efforts must be balanced with efficient use of resources and the desire to minimize the overall length of the pipeline.

The path selected by GASCO and proposed in this report is sufficiently short and well chosen for its navigation of the critical crossing points and populated areas. GASCO has an unwritten strategy that thoroughly avoids any construction buildings including: houses, graveyards, religious buildings and historical areas.

The route/site specific ESIAs will investigate the different alternative routes which are studies for each pipeline.

5.4 Sequence of work progress (in various areas) Alternatives

As mentioned previously, there will be 10 lines to be constructed to feed 8 existing and new power stations. The pipeline routes will cross 9 governorates. Therefore progressing with constructing the high pressure transmission networks in the various project areas could be practiced through two alternatives:

- Alternative 1: Complete the construction of the networks in more than one area simultaneously.
- Alternative 2: Complete networks in sequence area by area.

Advantages of Alternative 1 over Alternative 2 are:

- Shorter implementation schedule
- Utilization of economies of scale in lower cost for the additional equipment and components procured to cover multiple areas simultaneously

Advantages of Alternative 2 over Alternative 1 are:

- Less resources and capital investments required
- Less management and coordination resources required

Overall, the key contrast between the two alternatives is related to CAPEX and OPEX of the available
assets and human resources. If sufficiently distant from each other, it may be favorable to expand the work progress over many areas (within the available resources) while paying special attention to coordination of sequential work outputs of the parallel teams. The main advantage of working in parallel would be to minimize project implementation time.

The environmental benefits and negative impacts of the two alternatives are similar if the areas being implemented are distant from each other (in different governorates or areas with large distances between them). However, working in parallel in areas which are close to each other may lead to heavier environmental and social impacts (such as traffic congestions, as well as more air and noise emissions).

### 5.5 Closing note

Specific ESIAs which will be carried out in the 9 governorates should consider and analyze additional (site-specific) alternatives, as needed.
6. Assessment of Main Environmental and Social Impacts

The impacts of various activities are evaluated based on their effect on sensitive aspects of the surroundings in which GASCO operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation. The following sections will describe the potential positive impacts of the project, and describe and evaluate the potential negative impacts resulting from construction and operation activities.

Impacts are rated qualitatively based on their influence on the aforementioned aspects. Impact significance is judged based on four criteria:

- ecological importance
- social importance
- environmental standards
- statistical significance

6.1 Positive Impacts

Achieving the project objectives shall yield many social and economic benefits, and will help meeting the targets of the overall Energy Strategy for the country and national development plans formulated by the Egyptian oil/gas sector.

Job opportunities will be provided for both skilled and unskilled laborers in the selected governorates. These job opportunities can be divided into two main categories:

- The first category encompasses the direct jobs related to the project construction and operation. This involves both permanent and temporary jobs for both high and low skilled labor (e.g. support staff for the welders, coaters, measurement workers).
- The second category encompasses indirect job opportunities that will be created as a result of the project and will be useful to various community groups:
  - Restaurant and cafes workers in the different areas,
  - People who work in construction materials business in the area,
  - Owners of small markets and supermarkets in the area,
  - Drivers of large vehicles and small vehicles that can transport the workers around the area.

These jobs are likely to directly benefit several poor community members. If the project is successful in reaching these poor families, this could be a positive impact of major importance to them as it could represent a main source of income during the construction phase.

The indirect job opportunities will involve socioeconomic benefits including:

- Benefit owners of cafés and small restaurants in the project areas through providing services to the construction workers.
- Increase the need for local buses and vehicles to transfer the workers and the equipment to and from the construction sites.
- Rent apartments near the pipeline sites for the housing of the technical workers from outside the governorates.
- Provide jobs primarily for community members, simultaneously saving on the cost of employing people from outside the governorates and encouraging community acceptance of the project.
- Diversification of skill base within the existing workforce.

The project shall also result on some environmental benefits, such as:

- Natural gas offers substantial environmental benefits over oil and coal as a source of fuel:
- Natural gas contains less carbon and more hydrogen than oil and coal and so results in the generation of lower amounts of carbon dioxide per unit of energy output. Compared to other fossil fuels, it also produces lower emissions of nitrogen oxides when burned.
- Natural gas contains no solid particulates or inorganic compounds that may give rise to particulate emissions or ash production.
- Natural gas produced from indigenous sources can be made available at costs, which are significantly lower than the cost of importing oil or gas and, in many cases, lower than costs of importing coal.
- Whilst some of the natural gas will substitute or replace other less environmentally friendly fuel sources, some will represent new or additional consumption. The balance between replacement and new consumption is beyond the scope of this EIA and has therefore not been considered.

6.2 Negative Environmental Impacts during Construction

By analyzing project activities during the construction phase, the negative impacts that may be encountered are:

- Hazardous waste generation
- Risk to infrastructure from excavation
- Construction/excavation waste generation
- Water use/wastewater generation
- Air emissions
- Noise production
- Soil quality degradation
- Biodiversity and habitat destruction
- Risk to stability of existing structures from dewatering/tunneling
- Traffic disruption

Impacts in each area are evaluated qualitatively, and an environmental and social management and monitoring plan has been formulated to mitigate the most significant impacts. The plan is detailed in Section 7.

6.2.1 Hazardous Waste Generation

The primary sources of hazardous waste are:

- Demolished asphalt
- Containers of chemicals and lubricant oils used for construction machinery

Asphalt waste will come from the open-cut road crossings described, while the chemicals and lubricants will result from the use of machinery. The asphalt waste could have some hazardous components, such as tar, lubricating oils, some heavy metals, etc. However, its solid nature minimizes transport of such components to the environment. Disposal of asphalt waste to a normal construction waste disposal site is the common practice in Egypt, which is normally not
associated with significant environmental risks because of the dry weather nature of the country. However, it would be a more acceptable environmental practice is to transport asphalt waste to one of asphalt mixing stations for recycling.

Empty containers of chemicals and lubricating oils are considered hazardous waste. Improper disposal of these items can potentially directly affect the health of anyone who comes in contact with them. Potential soil contamination may result from improper hazardous waste storage, handling, and disposal practices, as well as potential spillage and/or leaks during the course of the construction activities. There is a slight risk of a spilled or leaked substance spreading beyond the project site as a result of nearby ground or surface water contamination, thus becoming a more significant environmental risk, but in general the potential of this impact is local in nature.

Due to the proximity of agricultural lands and numerous waterways, the impact level is considered “medium”.

6.2.2 Damage to Existing Infrastructure

Most of the underground infrastructure pipelines (such as water, sewerage and telecommunication) have been established a long time ago, without accurate documentation for its routes and depths. Therefore, the risk of breaking infrastructure lines is relatively high. Normally the contractor takes caution by applying manual excavation to avoid such situations where he is obliged to pay for the damage.

The most important environmental impact will arise in case a sewerage pipe is broken, and wastewaters accumulate in the trench and, possibly, over flood to the streets causing significant nuisance to the surrounding environment.

Breaking a water supply pipe may result in cutting the supply to a number of residential units, which may, if it takes place for a long period, direct residents to use other sources of water which may be either expensive or unsafe.

The effects of cutting telecommunication cables during excavation are mainly socioeconomic, due to cutting possible personal and business communications.

Due to the extensive excavation required for this project, and the relative uncertainty in the location of existing infrastructure, the impact level is considered “medium”.

6.2.3 Construction/Excavation Waste Generation

The primary forms of solid wastes that are generated during the construction phase include:

- Excavated soil and excess sand
- Concrete and bricks waste

For the most part, excavated soil will be backfilled into the trench. Otherwise, it will be transported off-site with the construction waste by trucks to the general authorized landfill. Excavated soil and concrete/bricks waste are inert materials. Improper disposal of such wastes will only have aesthetic effects in the disposal site. The legal standards of Law 9/2009 for the Environment and Law 38/1967, discussed in Section 3, stipulate that these wastes should be disposed in licensed sites by the local authority, which minimizes any aesthetic effects of such waste.

Due to the inert nature of the waste, and the practice of backfilling excavated soil, the impact level is considered “low”.

6.2.4 Water Use/Wastewater Generation

The water used for hydrostatic testing will be drawn from different water bodies canal, and will be discharged in nearby drains after being examined to be sure no harmful materials are present. Proper approval must be granted for the discharge of this waste.
Improper drainage of dewatering water may result in forming stagnant water ponds around construction site, which can develop, if not drained, infiltrated or evaporated, to form a nuisance and an environment for breeding of insects.

Normally dewatered water is relatively clean, and could be drained to a public sewer or even discharged at a watercourse. This course of action may be applied during tunneling a special crossing under a water course. However, there can be exceptions to that, when dewatering is performed from a contaminated trench or near source of pollution seepage to groundwater. This could apply during trenching besides, or under, fuel service station, any UST or AST system, where groundwater could contain hydrocarbons or chemicals. Although such cases could be rare, its occurrence would require collection of contaminated water and special treatment/disposal. Discharging contaminated water with significant amounts of chemicals and hydrocarbons is not legally acceptable neither to sewers nor to fresh watercourses according to Laws 93/1962 and 48/1982 respectively.

The amount of water used for project activities is not expected to have a significant or sustained effect on irrigation or other water use in the area.

Due to the relatively small amount of water that will be used over the entire course of the project, the impact level is considered “low”.

6.2.5 Air Emissions

Air emissions during construction shall arise primarily from exhaust from excavation vehicles (excavators, trenchers, loaders, trucks) containing SO\textsubscript{x}, NO\textsubscript{x}, CO, VOCs, etc. In general, concentrations will be low, but if the machinery is stationary for an extended period, or the engine is not operating properly due to poor maintenance, potentially harmful quantities may be released. However, rapid dispersion is likely in the open areas of the project site, and a low number of people are potentially affected.

Dust generated during construction of the new pipeline will result from clearing and earthworks, including excavation, trenching, levelling, and reinstatement operations. Another major dust sources will be from the movement of vehicles transporting pipes and equipment to the work areas. The effects of such impacts are expected to be local and short term. 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 meters of the construction area(s). Dust generation can affect the ability of nearby vegetation to survive and maintain effective evapo-transpiration. It is also a potential nuisance to workers and employees in the area during the construction activities.

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 those exposed. The proposed route for the pipeline is away from residential areas, public gardens and other social activities and there are no sensitive receptors like schools, hospitals, natural protectorates, etc. along the pipeline route.

Law 9/2009 has very strict standards to preserve the air quality. As previously indicated in Section 2, the law has identified certain measures to control excavation, soil stockpiling, soil haulage and exhaust from vehicles. These measures have been considered in the recommended environmental management practices in Section 7.

Another indirect source of air emissions is the traffic congestions that may happen. Air emissions from vehicles usually are effected by different modes of traffic, including traffic congestions.

Due to the point-source emissions from vehicles and relative distance from populated areas, the impact level in considered “low”.

6.2.6 Noise Production

Construction activities shall increase noise levels caused by excavation machinery. The noise levels would be similar to those associated with typical construction sites, with activities such as
clearing, ditch digging, drilling, sand blasting, facilities handling, and vehicle movements. Construction noise in a particular location will be temporary, and the levels will vary from increase of noise intensity due to engine operation, and intermittent impacts which may take place during demolition of asphalt, either by a trencher or by a jack hammer.

Law 9/2009 has defined certain standards for noise intensity and exposure period in work place, in addition to certain limits for ambient noise levels for different types of urban and rural areas.

The effects on construction labor are considered more significant, because they are exposed to high levels of noise for relatively longer periods. Residents of nearby settled areas are the second level recipients of elevated noise levels, as the noise intensity will be relatively dissipated at their locations, and they will only be affected at certain locations along the pipeline route. When construction nears settled areas, it is not likely that the general public will suffer from hearing damage as a result of environmental noise; it is more a nuisance or disturbance. However, it can make life uncomfortable or stressful for those who may be affected, and when it exceeds the standards, can even cause psychological effects among exposed persons.

Traffic congestions, which could be caused by excavation works, may increase ambient average noise intensity levels, but this will not be an issue for most of the smaller roads in the area.

Due to the fact that noise generation is mostly a nuisance to the general public and activities are not in heavily populated areas, the impact level is considered “low”.

6.2.7 Soil Quality Degradation

The construction and laying activities will result in direct disturbance of soil and specific geological features. This disturbance includes localized alteration of the soil profile within the trench footprint, and soil compaction in the immediate vicinity because of vehicle and construction equipment operations. However, excavation will only occur to a depth of 1-2 meters along the path of the pipeline, with most of the excavated material being replaced, so the impact of these activities on soil profile will be relatively minor. Compaction is not considered to pose a serious environmental risk. Most of the affected land is expected to return to full agricultural productivity once construction is finished.

As mentioned before, potential soil contamination may result from improper waste storage, handling, and disposal practices, as well as and potential spillage and/or leaks during the course of the construction activities.

Due to temporary nature of disturbance, the impact level is considered “low”.

6.2.8 Biodiversity and Habitat Destruction

Flora

Although the number of plant species observed and recorded at the project site appears large, almost all of these species are characteristic of agricultural or cultivated lands (weeds of cultivation) in the region and therefore the risk of disrupting them is not considered important.

Fauna

According to the pipeline trenches dimensions as well as the exact trench-line route, there is a very low impact on the fauna as most of pipeline pathway occurs in insensitive areas, represented by artificial-terrestrial habitats including plantations, rural gardens, cultivated agricultural lands and urban areas as well as asphalt roads and railways. No important species or nesting sites were recorded of species from the exact trench-line route and few records around. The depth of the pipeline underground leaves an adequate amount of soil (the same soil that resulted from the digging process, not from another different habitat) on the pipeline to be used by fauna and that helps to mitigate the impact of changing habitat for most of recorded or potentially occurring species in these ecosystems. Finally, all previously mentioned reasons indicate that in general the pipeline pathway has no passive effect on the fauna which may potentially occur in these ecosystems.
Due to the low occurrence of species and the lack of sensitive areas, the impact level is considered “low”.

**6.2.9 Stability of Existing Structures**

Although the pipeline RoW will not directly encounter any structures, the larger project working areas may contain various muddy and vulnerable old buildings in terms of construction. Any weak and old structures will be very sensitive to differential settlements, which could be caused by different factors. Among the construction activities that could have impacts on structures are:

- Dewatering from regular trenches
- Tunneling and horizontal drilling

Excavation for natural gas pipelines is usually shallow and does not exceed a depth of 2.0 meter. In the project region, there are very few areas which have groundwater depth less than that. If groundwater was not encountered during excavation of normal trenches there shall be no effects. In case if groundwater is encountered and dewatering is applied, there might be effects if the dewatering occurs for a long duration. Dewatering in silty and sandy soils can move fine soil particles and wash them away through the surface pump, which creates voids and spaces in the soil surrounding the excavation and the nearby buildings.

The effect of the tunneling process has several folds, but mainly settlement, which can be due to:

- Excavation of jacking and receiving shafts in case of micro-tunneling
- Dewatering if needed for the shafts and/or the tunnel in case of open face machine
- The tunneling process itself

Due to the complications that will arise if any structures are damaged, the impact level is considered “low”.

**6.2.10 Traffic Congestion**

Construction of the pipeline and facilities will require a large-scale transport operation in order to deliver equipment to the work site. In addition, the pipeline route runs alongside and at times crosses multiple roadways, which potentially entails narrowing major roads, lateral excavation, and temporary blockage of the road.

**Impact on Main Roads**

The primary road network carries the highest traffic volume, and vehicles generally move at higher speed. While complete obstruction of main roads will be avoided by the use of the HDD technique described above, traffic on these roads will still be affected by temporary restructuring/narrowing of the lanes as a result of construction activities taking place nearby.

The narrowing of the road will reduce the number of traffic lanes available for traffic movement and will also entail the prohibition of on-street parking along the length of the road works. The narrowing may reduce the right-lane either partially or totally. In either case, traffic will shy away from the construction side and encroach with traffic in the adjacent lanes. A direct result of the construction works would be the reduction in the average travel speed on these roads. Although it is difficult to quantify such an effect without a detailed study, the general conclusion is that the level of service would be reduced one level as a minimum.

Lateral excavation is bound to produce similar effect as other roadside work in terms of flow reduction, however this will only occur at one section of the road. This method of construction entails the closure of a lane or more at a point along the road. As such, this type of work can take place during off peak periods, preferably during night-time when traffic volumes are the lowest. The road cross section at the site can then be reinstated during daytimes to resume normal traffic conditions. Therefore, the reduction in the number of lanes will have its minimum effect.
In addition, as drivers approach such a construction site, they would tend to change their lanes prior to site and adjust their speed to that of the traffic in the adjacent lanes. These maneuvers will be easier to carry out when traffic volumes are low during night time. The selected times could be from midnight to 6:00 am.

**Impact on Secondary Roads**

The network of rural roads carries the lowest traffic volume. Disruptions to traffic due to the construction would be different from those for main roads. The local streets are narrower in width, so lateral excavation would mean almost blocking a direction. Therefore, traffic in both directions would be using one lane only. Opposing traffic (although little) can block the street if they reach at the same time. Therefore, the level of service in this case will depend primarily on the judgment of each driver on the best way to avoid blocking the street.

In order to traverse the smaller secondary roads that pass into private farms, the pipeline will be laid using the open cut method. This will require temporary blocking of all or part of the roads. This may result in an inconvenience for regular users of the road.

In any case, lesser impact is envisaged on the local road network since they are considered low volume roads that are expected to use these streets with low speed.

Due to the low traffic volumes and the use of HDD, the impact level is considered “low”.

### 6.3 Negative Environmental Impacts during Operation

The following categories will have negligible negative impact during normal operation of the pipeline:

- Construction/Excavation Waste Generation
- Hazardous Waste Generation
- Water Use/Wastewater Generation
- Noise Production
- Soil Quality Degradation
- Biodiversity and Habitat Destruction
- Damage to Existing Infrastructure
- Stability of Existing Structures
- Traffic Congestion

#### 6.3.1 Accidents and Emergencies (Quantitative Risk Assessment)

In order to assess the potential impact of pipeline operation in terms of human health and safety, a Quantitative Risk Assessment (QRA) was performed to determine the threat of injury or fatality to the public in the case of an accident or emergency. The nature of the project is such that an unforeseen failure in the pipeline operation could result in the release of significant amounts of natural gas into the surrounding environment. The possibility of this gas being ignited poses an environmental risk and threatens the safety of individuals and the public. This risk is fully assessed in the accompanying QRA report.

Due to the potential for harm to individuals, the impact level is considered “medium”.

#### 6.3.2 Repairs and Maintenance

Emission sources during operation will be associated with fugitive emissions from pipeline relief valves, flanges, etc. Such events may happen during planned preventive maintenance, repairs, or unplanned venting of the pipeline. *The impact level is considered “low”.*
The negative impacts of excavation discussed earlier in the construction phase, will also apply to the operational phase, but to lesser extent, in case of repairs and maintenance of the pipeline. The impact level is considered “low”.

### 6.4 Environmental Impact Rating Summary

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<tr>
<th>Phase</th>
<th>Impact Category</th>
<th>Impact Rating</th>
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<tr>
<td>Construction</td>
<td>Hazardous waste generation</td>
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<td></td>
<td>Risk to infrastructure</td>
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<td></td>
<td>Construction/excavation waste generation</td>
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<td></td>
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<td></td>
<td>Repairs and maintenance</td>
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### 6.5 Potential Social Impacts

As noted above, the project is likely to result in several positive social impacts, particularly related to the creation of job opportunities. The project will contribute to the improvement of the electricity provision by feeding Giza North Power Plant and this, in turn, will be reflected on the quality and regularity of the electricity provision in various places, not limited to the project site.

The project will not result in negative social changes like involuntary resettlement or change the demographical or the traditional lifestyle of area communities. The only potential negative impact of relevance to resettlement is the potential temporary land acquisition during construction and the potential negative temporarily impacts on livelihoods. The RPF has been prepared as a safeguard document that should be enforced during the project execution. The RPF has defined methods for valuation and compensation of affected people. The asset valuation will depend on market value of the asset and replacement costs. For intangible losses that cannot easily be valued in monetary terms (i.e. access to employment opportunities, public services, natural resources, social capital), access to equivalent resources and earning opportunities would be established. Compensation will be provided to all individuals whose assets or access to assets is severely affected or damaged, as a consequence of land acquisition or any other activities undertaken by the project.

The purpose of the RPF is to establish resettlement objectives, organizational arrangements and funding mechanisms for any resettlement operation that may be necessary. When during
implementation the exact extent of land acquisition becomes known, a Resettlement Action Plan (RAP) or abbreviated RAP - depending on the scale and severity of impacts - will be prepared. The various steps in preparing a RAP have been outlined in this document. It should also be emphasized that the resettlement process should be completed prior to the start of physical works.

6.5.1 Negative Social Impacts during Construction

During construction phase, there are a number of impacts with possible negative social implications that need to be considered, namely:

- Temporary negative impact on the local livelihoods of farmers due to the temporary acquisition of land and the subsequent impact of damaging crops. Farming, in most of the cases, is the sole source of income for the affected farmers.

- It was very difficult to estimate the numbers of potentially affected people during this phase of the project. This will only be possible before the actual construction of the project and upon determining the exact route. During this stage a Resettlement Action Plan (RAP) should be prepared guided by the prepared RPF. The RAP will involve a full inventory survey for the PAPs and a valuation for the compensation that should be paid.

- Permanent acquisition of land for the establishment of the valve rooms. In such cases, the common rule of GASCO is to provide full replacement cost for purchasing the land as per the market price under satisfactory, agreeable and appropriate agreement. It might be roughly suggested that each of the land plots (25m x 45 m) for each of the valve rooms is owned by one farmer. Based on this assumption, 11 farmers are expected to sell their land to GASCO for establishing the valve rooms.

- Potential traffic congestion due to the accumulation of construction materials and dust that will result from digging. From a social perspective, this impact might affect the income of microbuses, small vehicles and taxi drivers.

- Potential temporary inconvenience as result of the construction activities. This could be in the form of accumulation of wastes (both construction and domestic waste in the construction areas, associated odor, air emissions, especially dust as a result of excavation. These impacts are of temporary nature and will be of very limited level of severity, particularly since the construction activities will be in farms and not populated areas.

- Risks of damaging existing community infrastructure, especially water pipes that are not mapped, can have detrimental social repercussions. Disruption of other utility services such as electricity and communications can also be a nuisance to those affected.

6.5.2 Negative Social Impacts during Operation

It is unlikely that the normal operation of the pipeline will create any significant negative social impacts. However, fears were expressed about the possibility that some leakage in the sites might affect the agricultural lands in the area or cause fires, and the potential damage to crops due to any needed work on the pipeline during operation phase.

6.5.3 Affected parties

The affected parties or people affected by the project should be discussed in order to try to minimize any hardships they face due to project implementation.

- It is foreseen that the affected parties will be mainly among farmers who will either be losing their income due to the temporarily expropriation of crop land or permanently due to selling it to GASCO for the valve rooms.

- Moreover, there is the risk of work accidents and injuries to the construction workers.
during the construction phase. However, the probability of this risk is very low, since GASCO is very strict about the health and safety measures and they have their HSE guidelines which they follow strictly.

6.5.4 Key Issues for Consideration

**Transparency in the Valuation of Compensations**

The valuation of the damaged crops and ensuring satisfaction with the compensation are key issues that should be considered during planning for the project. It following, however, should be noted:

- The Egyptian Government has a very efficient and fair system for crop compensation that goes in line with the World Bank Safeguard Policy.
- GASCO also has a clear valuation system that was primarily based on the Ministerial Decree 347/2007 that declared the necessity of valuing the vegetation is the responsibility of each governorate and the previous experience of GASCO revealed that the majority of farmers who were compensated believe that they were offered fair compensations.
- Transparency in the process of the damaged crops valuation is crucial as a proactive mechanism to eliminate any opportunities for disputes. This is elaborated in more details in the RPF.

**Sensitivity to the Local Communities' Interests**

The interviews with GASCO staff and local farmers with previous experience for similar projects implemented by GASCO revealed that a socially sensitive approach is usually adapted by the company when it comes to the actual execution of the project. An instance on that is the flexibility that both GASCO and the contractor show with farmers during the actual execution of the project. Although GASCO does have a decree for temporary acquisition of lands which is issued prior to the implementation of the project, the contractor in several cases allow additional days for the farmers in order for them to harvest their crops.

"When we notice that a crop will be harvested in days, the contractor does his best to avoid working in the plot before the harvest of the crops unless it will affect the time plan," reported an engineer at GASCO.

**The Importance of Community Participation**

The preparation of the ESIA and the RPF involves a several consultative activities. Local communities were approached, consulted and encouraged to spell out their views and concerns about the project. According to the various groups of the interviewed stakeholders, community participation in developmental projects is quite limited in Egypt and in particular, within this type of projects where the “public interest” prevail over the interests of the poorer groups.

GASCO staff reported that the following measures are usually considered in order to ensure adopting a participatory and transparent approach with the local hosting communities:

- Providing information about the project to the community in a timely manner
- Provision of a clear valuation strategy in order to settle any potential disputes with the project affected people
- Provision of information about the owners of the crops in areas
- Working to mediate between the owners of crops and the Compensation Committee from GASCO in order to facilitate their work
- Monitoring of any unfavorable attitudes during the implementation and report the complaints to the monitoring department of the project
- GASCO also encourages the involvement of natural leaders like mayors of the villages
and their deputies, religious leaders, youth center managers, etc. The Agriculture Association is also a crucial party that they engage in the process of valuation, paying compensations and channeling complaints. GASCO also showed willingness to involve further grassroots organizations like local CBOs/NGOs located within the project localities. This level of involvement for the local stakeholders will play a role in eliminating the chance of disputes and grievance. This has been elaborated on the RPF as one of the proactive grievance redress mechanisms.
7. Environmental and Social Management Plan

7.1 Objectives of the ESMP

The objective of the Environmental Management Plan (EMP) is to propose mitigation measures for expected negative impacts and to monitor the efficiency of these mitigation measures on relevant environmental indicators. Similarly, the goal of the Social Management Plan (SMP) is to construct guidelines for the avoidance of expected negative social impacts, and initiate a mechanism for implementing these guidelines when issue arise. As discussed before, the primary social impacts are those related to land expropriation and compensation, so the SMP is presented as the accompanying RPF report. The respective plans identify certain roles and responsibilities for different stakeholders for implementation, supervision and monitoring.

7.2 Institutional Framework for Implementation

The project shall be implemented by the Egyptian Natural Gas Company (GASCO), an affiliate of the Egyptian Natural Gas Holding Company (EGAS), which owns a majority share. EGAS was established in 2001 as an entity focusing on developing Natural Gas business including upstream and downstream operations. EGAS has number of affiliate companies with different specialties in natural gas business chain.

The organizational chart, Figure 7-1, of EGAS indicates that the responsibility of environmental management falls under the responsibility of Assistant Chairman for Safety and Environment, who supervise the General Manager for Environmental Protection and five environmental specialists.

![Organizational chart for Environmental Protection Department in EGAS](image)

Being certified for ISO 14001:2004, EGAS has a well defined Environmental Management System in place and running. The Environmental Policy of EGAS mentions that the company and its affiliates are committed to:

- Comply with legislation relevant to their nature of activity
- Provide training and awareness for their staff in order to carry out their work safely
• Achieve continual improvement in the fields of safety, health and environment
• Investigate and analyze incidents to prevent its recurrence
• Follow-up companies and contractors compliance and implementation of health, safety and environment rules, regulations and provisions
• Provide necessary information and data on health, safety and environment
• Ensure execution of the policy through setting objectives, targets and an action plan. The policy shall be reviewed whenever needed
• Staff members of EGAS carry out audits and inspections on affiliate companies, of which GASCO is one, to make sure the EMS is being implemented according to set objectives and targets. As part of the EMS procedures, GASCO presents monthly and quarterly reports about its environmental performance. EGAS reviews these reports, and makes occasional site inspections to compare these reports with field conditions.

7.2.1 Environmental Management Structure of Implementing Agency
GASCO is also certified for ISO:14001 and OHSAS:18001, and has direct involvement in the environmental management and monitoring of the natural gas pipeline. One of the standard tasks of the HSE Department of GASCO, which is followed up by EGAS, is establishing Environmental Registers for facilities, and frequent auditing of this register. The Environmental Register is audited by the Environmental Department head of GASCO. The HSE Department performs audits twice annually on the average, in addition to infrequent and emergency inspections. The routine monitoring activities performed include:
• Visual inspection of solid waste and scrap, and disposal methods
• Visual inspection of existence of liquid waste such as leaked condensate hydrocarbons or chemicals used in the heaters
• Checking that handling of hazardous waste is according to the approved procedures, which are described below
• Use gas analyzers to measure SO₂, CO, CH₄ and O₂ in ambient air, and detect possible leaks
• Noise measurements
GASCO HSE personnel have received training on environmental auditing, environmental impact assessments for industrial establishments, and environmental legislation.

The Environmental Department of GASCO has been less involved on design, planning, tendering and construction procedures of natural gas connection projects. Their role has been more effective in the operational phase according to the described procedures above. However, the Safety Department in GASCO usually reviews designs, and assigns full time staff member to supervise the construction contractor, making sure that adequate safety measures are considered during design and implemented during construction.

The current positions and person-power of the HSE Department of GASCO is shown in Table 16Figure 7-2. These positions are divided over three sectors of the HSE Department, namely Environmental Protection, Safety and Fire Fighting, and Technical Consultancy and Inspection. Furthermore, representatives from each sector are present at the Site HSE department, as well as the HSE headquarters. The organizational structure is shown in Figure 32 below.
Table 16: OHSE Department positions and person-power

<table>
<thead>
<tr>
<th>Position</th>
<th>Number of Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>General manager</td>
<td>1</td>
</tr>
<tr>
<td>Executive manager</td>
<td>3</td>
</tr>
<tr>
<td>Assistant manager</td>
<td>6</td>
</tr>
<tr>
<td>Director</td>
<td>7</td>
</tr>
<tr>
<td>Department head</td>
<td>9</td>
</tr>
<tr>
<td>Engineer</td>
<td>8</td>
</tr>
<tr>
<td>Chemist</td>
<td>10</td>
</tr>
<tr>
<td>Specialist</td>
<td>13</td>
</tr>
<tr>
<td>Secretary</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
</tr>
</tbody>
</table>

The ESMP will suggest mitigation and monitoring responsibilities for the contractor and GASCO’s HSE Department. The assignment of these responsibilities among the various sectors of the department is the decision of GASCO HSE Management.
Figure 32: GASCO OHSE organizational chart
7.2.2 Social Management Structure of Implementing Agency

The analysis conducted during the preparation of the ESIA and the RPF showed clearly that the main impacts that should be carefully mitigated and addressed is the impact related to temporary and permanent land acquisition and the accompanying process of crops valuation and paying compensation. Currently, this process is done by GASCO through the Compensation Department, which participated in the formation of a Compensation Committee for the project.

The ESIA team noted that although this department is fully aware of the acquisition and compensation issues and is adapting an approach which is very close to the Bank's requirements, certain specific considerations related to OP 4.12 are still not very clear for GASCO staff. The ESIA team suggests appointing a "Social Development Officer" who should be working on full time basis during the project construction to ensure the social management plan is sufficiently addressed. The Social Development Officer might be a GASCO staff with relevant background (e.g. a background in social development or social science). It is required that the "Social Officer" be aware of the World Bank safeguard policy on involuntary resettlement and the associated procedures. Training courses on participatory approaches and the aspects of OP 4.12 might be needed in order to build his/her capacity to efficiently follow up the implementation of the social management plan. The Social Development Officer will be working closely with the Consultant who will be preparing the RAP.

Social Development Officer

The main roles and responsibilities of the Social Development Officer are as follows:

- He/She is the primary person in charge of ensuring that the proposed social management plan is sufficiently considered and applied.
- Develop detailed list of the local stakeholders and the NGOs representatives and maintain communication channels with them and ensure that they are engaged and consulted
- Developing all the required techniques and formats to monitor the implantation of the social management plan
- Report to the WB on the progress related to the ESMP and the safeguard policies including the fair compensation to PAPs
- Assure transparent and timely sharing of information
- Review PAPs grievance and conduct regular feedbacks and meetings as a proactive and early measure to eliminate disputes
- Follow up the progress to respond to the concerns of PAPs
- Work closely with local NGOs and other stakeholders to raise the awareness of local communities on the safety of line and other related issues.

This social management plan involves a monitoring process that will be the main responsibility of the Social Development Officer. The monitoring of the compensation process and the adherence to the safeguard policy OP 4.12 necessitates the development of some forms/templates in order to be able to process the management and monitoring system appropriately. This includes a Registration Form for affected plots, containing specific information to identify the owner and the approximate value of the crops. Also, a grievance form should be used to record any complaints and ensure that action will be taken. Draft model for these forms are provided in Annex 2. It should be noted that these forms should be updated by the Social Development Officer based on the actual needs.

The results of the monitoring and management system should be reported quarterly to the Headquarter of GASCO. The monitoring and management will be implemented by the branches of GASCO in each governorate under the supervision of the Social Development Officer.

In addition to appointing the Social Development Officer other local-based mechanisms are also
suggested, mainly the establishment Compensation Committee with main objective of working as a safeguard mechanism to ensure that the interests of the poor and most vulnerable are protected and to ensure that the valuation and compensation process is as transparent as possible.

**Compensation Committee**

The main roles and responsibilities of the Compensation Committee are as follows:

- Supervise the inventory survey for the project affected persons (PAPs) that will be prepared as part of the RAP
- Valuate the affected assets
- Estimate the amount of compensations to PAPs based on the collected information and on the light of the prepared RPF (Egyptian legislations and the World Bank safeguard policy OP 4.12)
- Prepare and disseminate lists of PAPs
- Obtaining approvals from GASCO on the planned compensation
- Apply proactive mechanism for grievance redress including transparent sharing of information, carrying out consultative activities with the local communities and ensuring involvement of local leaders in resolving disputes.
- Ensure that grievances are addressed

Normally, this Committee (currently is formed under GASCO projects) is composed of a manager, an accountant and a lawyer. In order to ensure a more participatory role for this Committee, the following composition indicted on Box 7.2 is suggested

The committee will be composed of the following members:

- A representative from the GASCO (namely the Social Development Officer and the staff of the Compensation Department including the lawyer,
- A representative from the Local Governorate Unit
- A representative from the contractor
- A representative from the Agriculture Association
- A representative from a local CBO or NGO
- Natural leader from the villages where the line is crossing

In cases of acceleration of disputes, a Supreme Compensation Committee with the responsibly of settling disputes could involve the same composition above headed by councilor from the Supreme Court. It should be stressed here that all possible mitigation actions and procedures should be considered in order to prevent the in necessity of involving the Supreme Committee.

### 7.3 Management and Monitoring Activities during Construction Phase

#### 7.3.1 Management of Hazardous Waste Generation

**Mitigation Measures**

- It is recommended as a best environmental practice to segregate asphalt waste and to send it to an asphalt mixing plant for recycling. Because recycling of asphalt is not a common practice in Egypt, there are doubts that an asphalt plant will accept the waste. For such circumstances this recommendation should not be compulsory. In this case, asphalt waste could be disposed with construction waste according the previous procedures.
As an important pollution prevention measure, fueling, lubricating or adding chemicals for excavation should not take place at the construction site except in necessary situations. In such situations, repairs and fueling of machinery should occur over impervious surface such as plastic sheeting, and empty containers of chemicals and lubricating oils should be collected and disposed in an approved hazardous waste facility. The contractor is required, according to the stipulations of Law 9/2009, to keep records and manifests for his management practices of such waste.

**Monitoring Activities**

- Monitoring activities for ensuring sound waste management practices shall depend mainly upon observation of hazardous waste stockpiles to ensure how often they are removed from the site, and whether normal construction waste stockpiles contain hazardous components.

**7.3.2 Management of Excavation Activities Posing Risk on Infrastructure**

If a line break occurs, the site manager gives immediate notification to the Police Department and the correspondent authority (according to the type of broken pipe). The authority then starts repairing the line as soon as possible, they claim repair costs back from the contractor later.

**Mitigation Measures**

- Collecting most accurate maps for infrastructure routes, whenever available and making such data available to the contractor prior to commencing the works
- Excavating manual trial pits in each street to allocated the pipes before using mechanical excavation
- In case an infrastructure pipe is damaged, a documentation report shall be prepared for the accident, including:
  - Time and place of accident
  - Name of contractor
  - Type of infrastructure line
  - Description of accident circumstances and causes
  - Actions taken and responses of different parties, such as infrastructure company
  - Duration of fixing the damage
  - Damage caused (description shall be according to observation, expertise judgment, reports of infrastructure company)

- Analysis and statistics should be undertaken periodically for the accidents taken place, with recommendations to reduce such risks in consequent excavation activities

**Monitoring Activities**

Monitoring activities for such risk, is basically documenting, analyzing reasons that led to the accident and updating procedures to avoid future accidents. Monitoring environmental consequences of such accident, such as depth of effected soils, volumes of effected groundwater, and other social effects are believed to be unnecessary action, though it might be recommended for the authority owning the infrastructure line (Water and Sewage Authority or Telecommunication Authority) for their research activities.
7.3.3 Management of Construction/Excavation Waste Generation

**Mitigation Measures**

- The contractor should communicate with the local authorities for officially assigning locations for the disposal of construction waste. Agreement on these sites should be reached prior to commencing construction works.

- A certain location in the construction site should be assigned for temporary storage or stockpiling of construction waste, in a convenient location close to the stretch of the pipeline that is being constructed. These areas should be agreed between the contractor and the HSE supervisor prior to starting construction works, and should be selected so as not to cause significant obstruction to traffic. The waste should be covered to prevent dust dispersion. No stockpiling is allowed on banks of waterways.

- Waste should be hauled at the end of each working day to the allocated disposal site. Waste transportation should be undertaken by adequately equipped trucks. The HSE supervisor should make sure that the trucks are not overloaded and that the waste is adequately contained inside the rear box to prevent dust or particle movements from the truck. The supervisor should also occasionally inspect that the truck drivers are disposing the waste in the approved location, and not through practicing open dumping in the midway, through irregular visits and inquiries in the disposal site.

**Monitoring Activities**

- Monitoring activities for ensuring sound waste management practices shall depend mainly upon observation of waste stockpiles of soil and construction waste to ensure how often they are removed from the site, and whether they contain hazardous components.

7.3.4 Management of Water Use/Wastewater Generation

**Mitigation Measures**

- Drainage of dewatering water should be pre-planned, and the necessary permits acquired from the local sewage or irrigation authority.

- If dewatering is taking place from a contaminated trench, or contains hydrocarbons that could be observed or smelled, it should be collected in barrels and transported to a wastewater treatment facility for special treatment.

- All chemical streams, rinses and drains shall be contained or shall be collected in suitable vats or tanks. No streams shall be allowed to drain upon the ground. Approval must be obtained prior to start draining any material to an existing sewer system.

**Monitoring Activities**

- Field observation of oily appearance and possibly smell would indicate whether to classify this water as hazardous waste, and determine whether it should be sent to an appropriate treatment plant.

7.3.5 Management of Air Emissions

**Mitigation Measures**

- In areas of loose sandy soils the contractor should provide a source of water for spraying soil before excavation, filling, loading and unloading. If the site supervisor notices a visual/sensible increase of dust emissions, he should ask for additional spraying of water in the spot generating high emissions.

- Excavated soil stockpiles and stored sand should be located in sheltered areas, sprayed with water and covered with appropriate covering material, such as polyethylene or
textile sheets to avoid soil dispersion

- Transportation of excavation/construction waste should be through licensed and sufficiently equipped vehicles with suitable special box or an air-tight cover to prevent loose particles of waste and debris from escaping into the air or dropping on the road.

- Air emissions of excavation machinery should be within the standards of the executive regulations of Law 9/2009, which are presented in Table 2-5. This can be ensured with a regular check-up and maintenance schedule.

- Avoid or minimize traffic congestion on main roads during periods of air quality crises, such as during autumn (the black cloud) and during spring (Khamasin winds).

- It is recommended that GASCO consider implementing a Mobile Health Care Unit in potentially affected areas in order to provide the needed treatment to the people in those communities which may experience some negative health impacts due to the dispersion of air emissions and fugitive dust.

**Monitoring Activities**

- Monitoring of air emissions impacts can be done through periodic inspection of vehicle maintenance schedules, and on-site observation of black smoke being produced from any machinery.

### 7.3.6 Management of Noise Production

**Mitigation Measures**

- Working hours for workers exposed to noise equipment should be designed so that noise exposure periods do not exceed the safe limits as described by the legal standards in Tables 2-1 and 2-2 in Section 2.

- Workers that operate noisy machines or worker near them should be supplied with earmuffs and should be instructed to put them on when they get into noisy zones. Contractors should be responsible to instruct their workers to abide to this role, and the site supervisor should make sure the contractor is compliant with this role.

- Minimize construction through nighttime whenever possible, while working in populated areas. Implementing this measure should be balanced with avoiding peak hours of heavy traffic. If construction works are to take place in important traffic roads, avoiding traffic disturbance in day time may outweigh reducing noise levels in afternoon or night times and vice versa.

**Monitoring Activities**

- Monitoring of noise impacts consists of periodic observation of the extent of implementation of the above mitigation measures.

### 7.3.7 Management of Soil Quality Degradation

**Mitigation Measures**

- Proper handling of hazardous liquids to avoid spilling or leaks is critical to reducing the chances of soil contamination. Appropriate measures should be taken as described in Section 7.3.2.

**Monitoring Activities**

- Recording incidents of spills or leaks and periodically analyzing the data.
Once construction has finished, the pipeline route should be revisited to ensure that the land has returned to normal agricultural production. These observations can be performed as part of the pipeline patrolling and leakage surveying, described in Section 7.7.1.

7.3.8 Management of Biodiversity and Habitat Destruction

Mitigation Measures

- Refilling the dug trench-line to the same original level of the surface will help to mitigate the impact of making barriers which affect both habitat utilization and distribution of the fauna, and will allow plant species to resume growing on the disturbed land.

Monitoring Activities

- Because of the low significance of this impact, monitoring in construction sites will not be required.

7.3.9 Management of Dewatering and Tunneling Activities Posing Risk to Structural Stability

Mitigation Measures

- For areas screened as including buildings with potential structural problems, in which dewatering (in case groundwater table is high) or tunneling works (in special crossings) will take place, a survey of building status should be undertaken. A list of structures with damage potential should be prepared.

- Undertake soil investigation program using representative bore holes for soil classification and identification of groundwater depth.

- For tunneling process, choosing the location of the jacking and receiving shafts as well as the path of the tunnel, the type of support and the type of tunneling machine should consider the status of surrounding buildings and soil type. Precautions for launching the tunneling machine and recovering it should be clearly stated and submitted showing the steps taken to prevent soil from entering the shaft.

Monitoring Activities

- Continuous monitoring of the tunneling process by observing the amount of soil excavated versus the advance of the tunneling machine and continuous monitoring of the line and level of the tunneling machine.

- If necessary, surveys of structural status of buildings and performing soil investigations shall be undertaken under the supervision of a structural consultancy firm.

7.3.10 Management of Traffic Congestion

Mitigation Measures

- Whenever road obstruction is necessary due to lateral excavation or otherwise, informational and directional signs should be posted prior to the construction zone so that drivers can react in due time and maintain safe driving. The Egyptian Road Code of Practice (Ministry of Housing, 1998) provides standard arrangements of construction zones. Markings, in the form of lane lines and directional arrows are also needed to guide the drivers to the proper lane changes and turning. Pedestrian crossings can be also provided at proper locations as dictated by each site.

- An agreement between contractors and the site supervisor should be reached about the
suitable location for temporary storage of construction materials, equipment, tools and machinery prior to starting construction of each reach of the power lines. No storage of construction materials or electric tools should be allowed in traffic lanes

- When crossing a road via the open-cut method, alternative roads for entrance to the farms should be developed, and the crossing should be done after arrangement with the owners of these farms. Work should be conducted when there is not high traffic movement on the road.
- In case a narrow road needs to be occupied for limited period (for example by loading/unloading trucks or loaders) the occupation time should be minimized and alternative routes should be facilitated for villagers.
- The contractors should make sure that the employed drivers of construction machinery (such as trucks and loaders) have received sensitization/training on safety utilization of their machines in order to minimize accidents risks.

**Monitoring Activities**

- All above mitigation measures should be implemented in coordination with Traffic Departments of the appropriate governorate.

### 7.3.11 Management of Social Impacts

**Mitigation Measures**

- Open consultation with the public during the assessment and design stages will help ensure that concerns are met, and future disputes/disagreements are avoided.
- A fair compensation plan and grievance mechanism has been set forth in the accompanying RPF report, which is meant to compensate for any temporary or permanent negative impacts that might be experienced by the PAPs.
- Registration of affected parties, and prompt recording and response to complaints is essential to minimizing social discontent.

**Monitoring Activities**

- Inspection of compensation documentation, including lists of affected parties, compensation receipts, and grievance forms.

### 7.4 Mitigation and Monitoring Tables

A matrix illustrating management and monitoring activities during construction, proposed responsibilities of different stakeholders and approximate costs are given in Tables 7-1 and 7-2. Compliance with the roles and responsibilities set forth in these tables should be incorporated into any agreements made with contractors that will be working on site. Whenever the responsibility of mitigation or monitoring falls on the contractor, the cost will be included in the normal bid price of the contract.