*6.0 Environmental Impacts & Mitigation Measures*

## 6.1 INTRODUCTION

The previous sections have established the project and its various components, detailed the existing environmental settings and identified the legal and regulatory framework for the proposed pipeline.

This section identifies and, where appropriate, quantifies the primary biophysical and socio-economic effects expected to result from construction and operation of the onshore gas pipeline " Abr Sinai 111 km, 36” ". This section identifies specific project activities requiring environmental management and provides an outline of associated control measures.

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

## 6.2 METHODOLOGY

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

*The significance of an impact is indentified by:*

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

***Consequence***

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

***Table 6.1. Consequence Ranking of identified impact***

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

***Likelihood***

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

***Table 6.2. Likelihood Ranking Of Activity Occurring***

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

***Significance***

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

***Table 6.3. Significance Ranking of identified impact***

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

## 6.3. AIR EMISSIONS

### Construction and Operation

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

***Table 6.4. Environmental impact of the proposed air emissions***

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

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

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

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

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

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

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

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

**Impact Significance**

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

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

## 6.4. DUST

### Construction

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

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

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

Potential nuisance impacts on residential areas in close vicinity of the pipeline construction activities, especially from KM point 102+00 to KM point 103+00, whereas the proposed route approaching El-Midan Village's outskirts from desert side as shown in figure 6.1.

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


***Figure 6.1. "KM point 00+00 to KM point 111+00 shows the proposed route LOOP#1 and LOOP#2 approaching from desert side.***

**Impact Significance**

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

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

| Equipment | Number | PM | PM10 |
|---|---|---|---|
| | | (kg) | (kg) |
| **Bore/Drill Rigs** | 2 | 2.88 | 2.04 |
| **Excavators** | 13 | 18.72 | 13.26 |
| **Crane** | 8.64 | 6.12 | 6.12 |
| **Graders** | 2 | 1.42 | 1.42 |
| **Off-Highway Trucks** | 43 | 34.4 | 24.51 |
| **Rubber Tired Dozers** | 10 | 6.6 | 4.7 |
| **Skid Steer Loaders** | 4 | 5.76 | 4.08 |
| **Dumpers/ Tenders** | 1 | 1.44 | 1.02 |
| **Grenerator < 50 hp (37 kw)** | 10 | 10 | 7.1 |
| **Air Compressors < 50 hp** | 13 | 13 | 9.23 |
| **Welders < 50hp** | 60 | 60 | 42.6 |
| **4 X 4 Deisel Vehicles** | 17 | 1.7 | 1.207 |
| **Bus** | 6 | 0.72 | 0.51 |
| **TOTAL** | | **165.86** | **117.797** |

***Based on the NENES EPA – AP-42***

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

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

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

| Dust | PM10 |
|---|---|
| **1,976,788.75 kg** | **1,400,225.36 kg** |

***Based on NENES EPA – AP-42***
***Area = pipeline length X Work Area Width = 111 X 0.02 = 2.22 sq km = 548.554485 Acre***
***Where : Acre = 0.004047 sq km***
***Working Period = 2000 hr = 2000 / (24 x 30) = 2.7778 month***
***Dust Emission factor = 1200 kg/Acre-month***
***PM10 Emission factor= 850 kg/Acre-month***

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

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

***Table 6.7 Fugitive Dust Control Measures***

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

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

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

**Operation**

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

**Impact Significance**

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

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

## 6.5. NOISE and VIBRATION

### Construction

***Noise***

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

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

- Construction activities.
- Pipe delivery.

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

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

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

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

***Table 6.8. Sound Pressure Levels of Construction Machinery***

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

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

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

Because the most of the proposed pipeline segments avoiding the noise sensitive receptors, noise impacts from pipe delivery are unlikely to be a matter of concern. However, if lorry routes are not carefully selected there could be some disturbance to the populated areas and sensitive receptors such as Romana villages along the pipeline route at the end of LOOP#1 KM point 32+00 approx. to KM point 33+00 end point of LOOP#1., and El-Midan Village from KM point 102+00 to KM point 103+00k through LOOP#2.

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

**Impact Significance**

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

- With the exception of start and end sections of pipeline route (LOOP#1 and LOOP#2), there is no major noise sensitive receptor along the route except the last one KM from LOOP#1 where the pipeline near from Romana villages distance equal 500m., and El-Midan Village from KM point 102+00 to KM point 103+00k through LOOP#2.
- It is anticipated that the "spread" will progress at an average rate of 1000 m per day and may reach 4-5 km at desert areas, and hence any associated disturbance due to noise at a location would be only short term.
- The construction noise is expected to be of a short duration and dispersion of the noise is likely to be about 100-150 meters from the construction area
- Transportation and materials delivery will be limited to daylight.

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

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

**Vibration**

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

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

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

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

***Table 6.9. Vibration Levels of Some Construction Machinery***

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

***Source: Federal Transit Administration (FTA), Transit Noise and Vibration Impact Assessment, April 1995.***
***PPV at 25 feet based on FTA 1995, the other distances the following equation was used:***
***PPV at distance D=PPV (at 25ft) x [(25/D) ^1.5]***
***N.B. It should be noted that there is a considerable variation in reported ground vibration levels from construction activities. The data provide a reasonable estimate for a wide range of soil conditions.***

**Impact Significance**

The closest sensitive structures to the site are residential areas at Roman visages areas, KM point 32+00 to KM point 33+00 from LOOP#1 (i.e. 1+00 KM approx.) and El-Midan Village along LOOP#2 (i.e. KM point 102+00 to KM point 103+00). There is the potential that, at times, vibration effects would reach levels that would be annoying to residents in nearby buildings. Many of these buildings contain ground and second floors only, vibration levels are likely to be lower on the second floor and above depending the building construction. However, the distance from the closest sensitive receptor and proposed pipeline route will no be less than 50m, in additions many of the vibration causing construction equipment would be used on an intermittent basis (i.e. short-term and temporary in nature) during the construction period. Consequently, no potential significant adverse vibration impacts would be anticipated to occur and therefore, the impact is "low".

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

**Operation**

The pipeline itself is inherently quiet under normal operation.

## 6.6. SOILS

### Construction

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

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

- Desert sandy soil 330,000 m3.
- Agricultural top soil 6,000 m3.

The most significant impact will be the changes in the soil structure and degradation of soil quality as a result of erosion and compaction. However, most of pipeline route is sandy soil area.

The potential impacts will be from start point to KM point 23+00 approx. as shown in figure 6.2. where extensive agricultural areas existed. And KM pint 108+00 to KM point 110+00. as shown in figure 6.3, and 6.4


***Figure 6.2. "KM point 00+00 to KM point 23+00 shows the proposed route penetrating extensive reclaimed agricultural area (in the vicinity of El -Sheikh Gaber Canal) and crossing four branch irrigation canals No. 1,3,5,7***

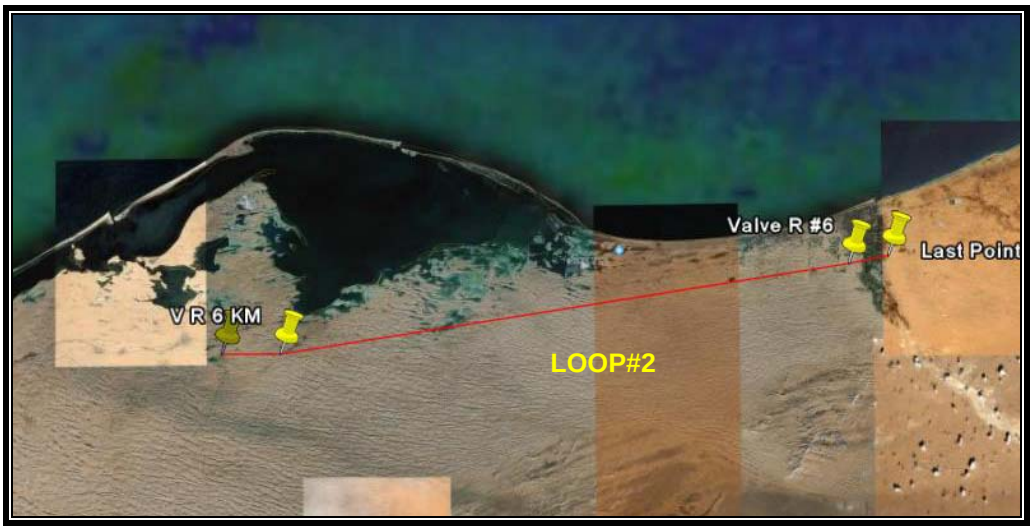


*Figure 6.3. LOOP#2 shows the proposed route penetrating extensive agricultural farms are.*

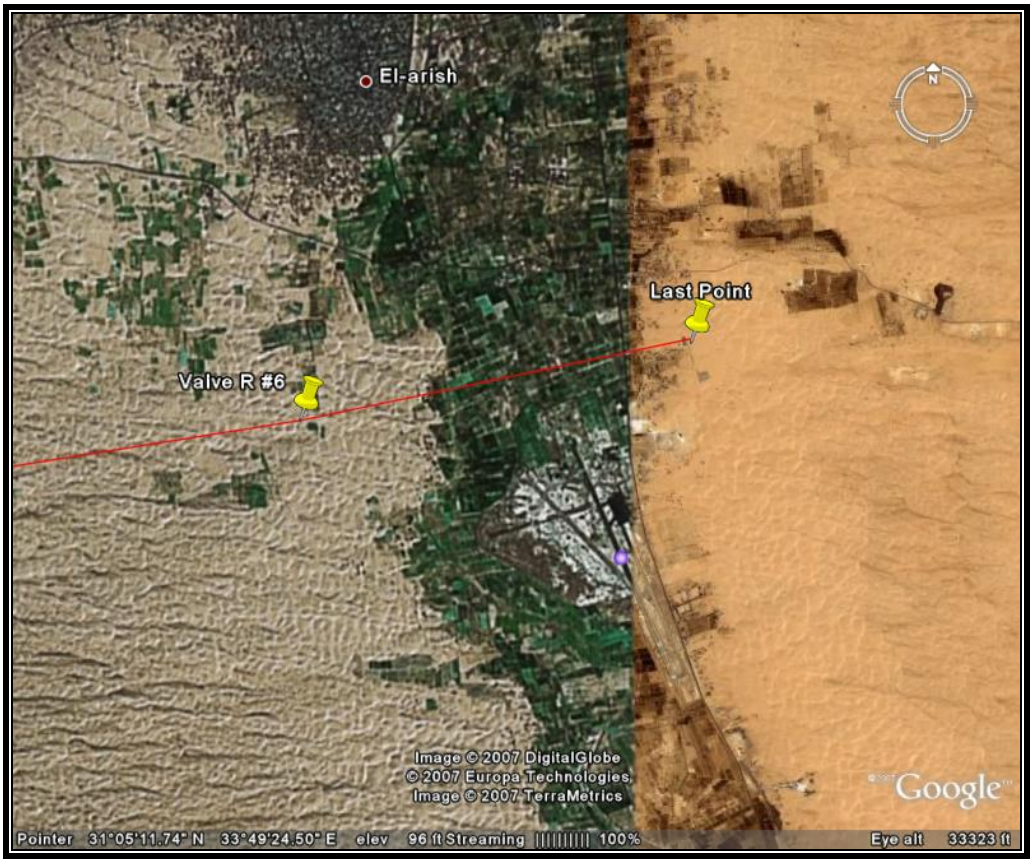


***Figure 6.4. "KM point 108+00 to KM point 110+00 shows the proposed route penetrating extensive agricultural farms are.***

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

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

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

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

The overall distance of various segments of the proposed pipeline is about 111 km. Assuming the above working area width of 20 meters, the agricultural area that would be impacted as a result of pipeline construction and installation activities would be approximately 0.5km$^2$ apart from total 2.2km$^2$ area of pipeline route.

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

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

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

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

**Impact Significance**

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

Potential soil contamination may also be associated with waste handling/disposal practices and potential spillage and/or leaks during the course of the construction activities. However, with proper waste management procedures being followed such impacts could be controlled and/or minimized.

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

***EGAS / GASCO*** have a comprehensive emergency plan ***(Appendix 2)*** in case of any emergency situation like pipeline rupture.

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

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

## 6.7. GROUNDWATER SOURCES

Groundwater along the proposed pipeline corridor occurs at a range of groundwater depths along the first 23 KM from the pipeline route "LOOP#!". But in the rest of the pipeline the ground water is very low, (i.e. there is no water in the pipeline trench). The main impacts on groundwater quality associated with pipeline construction activities will be associated with the following impact sources:

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

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

**Impact Significance**

As excavation of the trenches of the pipeline would only be a depth of approximately 2-3 meters, it is unlikely that any significant groundwater resources would be impacted except reclaimed agricultural areas in the first 23 km (i.e. 23km approx.).

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

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

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

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

## 6.8. SURFACEWATER

The potential of impact to surface water will largely be confined to the area of the pipeline corridor and associated access roads. The route of pipeline will cross numbers of surface water bodies ranging from small canals with width less than 1m to main irrigation canal with width About 7m. The proposed pipeline

will cross one main drainage canal (i.e. Kilopatra drainage canal) in addition to four branch irrigation canals branched from El-Sheikh Gaber Canal. Where the pipeline route will pass parallel to EL-Sheikh Gaber canal for a distance of 18 KM.

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

The main water body is El-Sheikh Gaber canal. ***EGAS/GASCO*** will use the horizontal directional drilling (HDD) technique in crossing Kilopatra drainage canal, and the main water bodies. This technique is considered the best available technology (BAT) due to being a trenchless methodology that provides an installation alternative that can offer a number of benefits over traditional open-cut. HDD can be implemented with a very limited disruption to surface activities, requires less working space, and performed more quickly than open-cut methods.

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

The hydro-test water source is planned to be El-Salam canal for LOOP#1 and Mediterranean sea water from EL-Aresh area for LOOP#2. Samples will be taken and analyzed before discharging the wastewater to the same location.

**Impact Significance**

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

In the unlikely event, the environmental impacts associated with the discharge of water used in hydro-test to be of major significance, especially with proper sampling and analysis to assure that the quality of wastewater meets the requirements of Egyptian law number 4/1994, before final disposal to the marine water, and law 48/1963 for discharge into El-Salam canal.

During the hydro testing phase the pipeline will be divided into two sections, the former " Loop 1"; about 27635 $m^3$ of El-Salam canal water will be used and disposed off gradually into same location after cease of hydro testing, and the latter " Loop 2"; about 65320 $m^3$ of Mediterranean sea water from El-Areish area, will be used and disposed off gradually into same locations after cease of hydro testing. No discharge to soil or ground water shall take place.

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

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

## 6.9. ECOLOGICAL IMPACTS

The pipeline route crossing patches of pour to low vegetation, which could be impacted due to the pipeline construction for a short and medium period.
Clearance and grading of the ROW will obviously result in some damage to the desert habitat. However, this will be contained within the 20-25 meters corridor.
Of more concern is the wider potential impact caused by construction activities extending outside the working width. Activities such as collection of sand

padding and gatch, as well as stockpiling of materials or waste, and uncontrolled off-road driving, all have the potential to extend the zone of impact considerably.

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

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

At sections from start point to KM point 23+00 approx. (LOOP#1) (the pipeline will pass in the north bank of El-Sheikh Gaber canal for, 18 KM and to point 23+00 KM in reclaimed agriculture land) and KM point 108+00 to 110+00 KM point extensive agricultural areas of domestic farms. (LOOP#2)

There will be loss of vegetation along the pipeline route due to the clearing activities. This will be constituted as a short-term impact if proper mitigation measures are taken, GASCO will compensate all agriculture land owners along the pipeline route according to the Rules and Regulation of Land Owner Compensations Appendix-5. Also the re-vegetation of farms will take place after cease of construction phase and development of the local ecosystem to original as possible through land owners normal efforts

However, with the mitigation measures in place, the residual impacts should be minimal, as they aim to offset the localised damages. Domestic animals at reclaimed agricultural areas may be disturbed. However, the overall construction phase is short term, the disturbance will be minimal.

**Impact Significance**

Construction and lying of the proposed onshore pipeline is not expected to have impact upon the local ecology. Although the vegetation along the pipeline ROW will be lost during the construction activities, the existing vegetation is locally

common, and it is not believed that any sensitive floral species are present along the proposed ROW.

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

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

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

**Operation**

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

**Impact Significance**

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

## 6.10. LANDSCAPE AND VISUAL IMPACTS

Visual impact is a subjective issue, which depends on the scale of a development, the context of the surrounding land use and the presence or absence of sensitive receptors. The proposed pipeline will be buried along its entire length and hence visual impact can be discounted.

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

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

**Impact Significance**

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

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

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

## 6.11. ARCHAEOLOGY AND CULTURAL HERITAGE

Archaeological, historical religious, cultural, or aesthetic value. Loss of such cultural heritage is irreversible and for that reason historical and archaeological sites are legally protected in Egypt. There is no any archaeological concern encounters the proposed pipeline route.

**Impact Significance**

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

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

## 6.12. EROSION CONTROL & SITE RESTORATION

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

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

**Impact Significance**

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

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

## 6.13. SOCIO-ECONOMIC IMPACTS

### 6.13.1. Economics & Employment

**Construction**

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

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

**Operation**

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

**Impact Significance**

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

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

### 6.13.2. Land use Effects

**Construction and Operation**

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

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

- *Temporary use of land for construction purposes.*

- *Permanent acquisition of land for valve rooms.*

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

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

**Impact Significance**

The project will impacts privately owned land. However, ***EGAS / GASCO*** will compensate the land owners with accordance to the agreement between ***EGAS / GASCO*** and ministry of agriculture (See appendix 5)

There will be temporary disruption to communities during the laying of the pipeline and construction of associated facilities, effects from the influx of construction workers. Concern also arises around safety for local residents and their property during construction of the pipeline and in the event of accidental rupture during the operation phase of the pipeline. However, ***EGAS/GASCO*'s** emergency plan will be implemented in case of emergency *(see **EGAS/GASCO**'s emergency response plan in appendix 2)*

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

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

## 6.14. WASTE

### Construction & Operation

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

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

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

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

### Impact Significance

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

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

## 6.15. TRAFFIC

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

Vehicle movements will also arise from the requirement to provide sand padding for the pipeline trench for LOOP#1, where LOOP#2 are existed in sandy desert area. This will require lorries visiting borrow areas. The need to transport personnel to and from the work site to their base will also generate a significant number of vehicle movements.

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

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

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

The movements of personnel to and from the construction camp can also be expected to cause dust generation. The location of this impact will change as the pipeline spread moves during the construction phase. As with the HGV movements, impacts from this source are unlikely to be significant due to the remoteness of the majority of the route.

Noise associated with vehicle movements may cause localized impacts on populated areas, depending on the selected vehicle routes. To prevent nuisance impacts arising, lorry routes should be selected to avoid residential areas as far

as possible. For the majority of the route, noise from traffic is unlikely to be a concern.

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

**Impact Significance**

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

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