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SHEBERGHAN GAS GENERATION ACTIVITY (SGGA)

Contract No. EPP-I-00-03-00004-00, Task Order No. AID-306-TO-12-00002

Environmental Scoping Study

(Final Environmental Terms of Reference for
Environmental Assessment/Evaluation)
(Deliverable 2-8)

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Acronyms and Abbreviations

ADB	Asian Development Bank
AEAI	Advanced Engineering Associates Inc.
AGS	Afghan Geological Survey
BCM	Billion Cubic Meters
BTU	British Thermal Unit
COTR	Contracting Officers Technical Representative
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DABs	Da Afghanistan Breshna Sherkat
EA	Environmental Assessment
EMP	Environmental Management Plan
GIRoA	Government the Islamic Republic of Afghanistan
GSA	Gas Supply Agreement
H_2S	Hydrogen Sulfide
km	Kilometer
kV	Kilovolt
kWH	Kilowatt Hours
M^3	Cubic Meter
MMCM	Million Metric Cubic Meters
mg	Milligram
MoM	Ministry of Mines
m/s	Meters per second
MW	Megawatt
NEPA	National Environmental Protection Agency
NEPS	North East Power System
NFPP	Northern Fertilizer Power Plant
Nm^3	Standard cubic meters
NOx	Nitrogen Oxide
OPIC	Overseas Private Investment Corporation
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFI	International Financial Institutions
IPP	Independent Power Producer
PPA	Power Purchase Agreement
P50	Probability 50%
PID	Project Identification Document
PM	Particulate Matter
PPM	Parts Per Million
REA	Regional Environmental Advisor
SCF	standard cubic foot (SCF)
SCR	Selective Catalyst Reduction (SCR)
SGFDP	Sheberghan Gas Field Development Project
SGGA	Sheberghan Gas Generation Activity
SOBM	Synthetic Oil Based Mud
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxide
SOW	Scope of Work
TBD	To be Determined

TOR	Terms of Reference
USAID	United Stated Agency for International Development
USD/US$	United States Dollar
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds
WB	World Bank
WBM	Water Based Mud

1 Introduction

1.1 Need for the Project

Afghanistan is one of the least electrified countries in the world. The lack of electricity restricts economic development and the advantages of a modern lifestyle. The power sector infrastructure deteriorated steadily during the series of wars and Taliban government. Since 2001, the Government of Afghanistan (GIRoA) and international donors have agreed that restoring and increasing the electric power supply is a top national priority. This is needed to support improved economic growth with resulting improvement in the standard of living. All parts of the power sector in Afghanistan are in need of capital investment, training, and capacity building in areas such as power generation, transmission, distribution, operations, maintenance, management, and electric system regulation.

The Sheberghan Gas Generation Activity (SGGA) has been developed to support a 200MW power plant fueled by gas from the natural gas fields in the Sheberghan, Jawjzan Province, northern Afghanistan. Exhibit 1-1 is a map of the general project area.

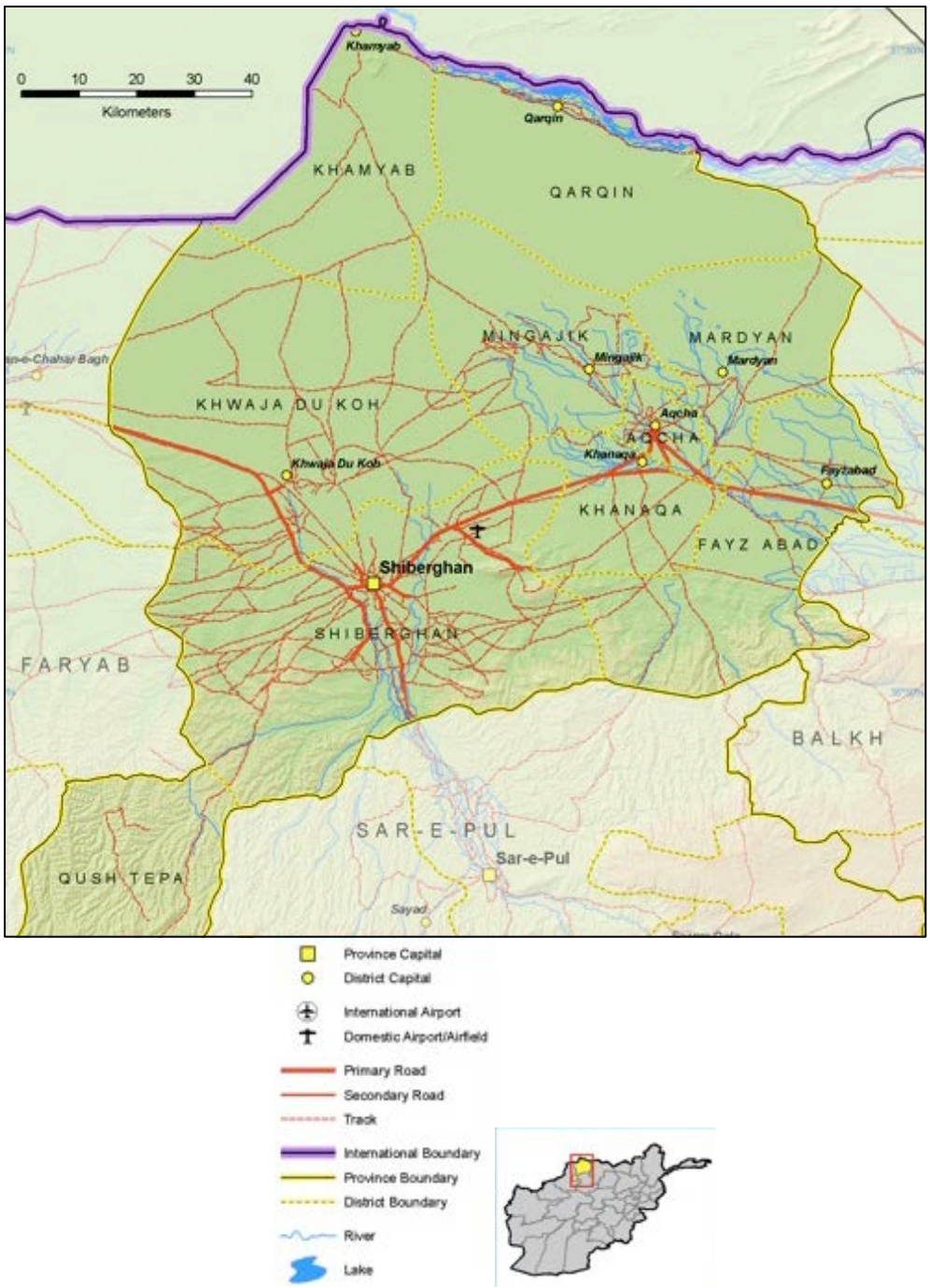
The Sheberghan Gas Generation Activity involves the Afghan Ministries of Mines and Energy and Water, the national power company DABS, the Afghan environmental agency NEPA, ADB, USAID, OPIC, private investors. Both international participants and the GIRoA all require some form of environmental assessment of the SGGA to ensure that all potential environmental impacts associated with the project are appropriately managed and mitigated. It has been determined that the best course of action to meet the environmental requirements of these parties is the preparation of an Environmental Assessment, the first stage of which is the preparation of this Environmental Assessment Scoping Study.

1.2 Project Summary

Civil war and limited funding since the Soviet withdrawal in 1989, together with limited donor support and lack of foreign investment, resulted in an almost complete halt to the development of natural gas resources in Afghanistan. However, the Ministry of Mines, through its Afghan Gas State Owned Enterprise division has continued to produce gas from the existing fields and conduct minimal well rehabilitation. This activity is presently being conducted at Yatimtaq, Gerquduq, Shakarak II, and Khoja Gogerdak gas fields in near Sheberghan.

Recent site visits to these locations show inefficient operations pieced together with antiquated equipment and little attention to personal safety considerations, generally run by staff and engineers with experience, but minimal training in modern operations. Total current production from the producing thirty seven wells is about 420,000 m^3 per day. Most of this gas is being piped to the MoM owned Northern Fertilizer Factory and Power Plant (NFPP) at Mazar-e-Sharif. Some is piped to Sheberghan for residential consumption.

Exhibit 1-1: Jawjzan Province, Afghanistan



In March 2006, under a previous project, AEAI submitted a series of reports to USAID on the technical and economic feasibility of development of a gas-fired thermal power facility in Sheberghan. Based on historic gas exploration data and previous gas related studies, the conclusion has been that significant gas reserves do exist in the Sheberghan area – as much as 28 BCM (P50) in the Juma and Bashikurd field alone. Therefore, MoM has requested USAID and other donor agencies to fund gas exploration and development activities with the GIRoA of supplying treated natural gas to a new 200 MW power plant to be located near Sheberghan.

There are several infrastructure components required to be developed in order to generate and transmit power from the natural gas supplies, they include:

1. Gas Field Development – (USAID Funding);
2. Field Infrastructure, including water supply & knockout separator – (MoM Funding);
3. Gas Processing Plant – (USAID Funding);
4. 200MW Gas Fired Power Plant – (Private Investor / OPIC Funding);
5. Transmission Lines – (ADB Funding).

A combination of donor and IFI funding, private investment and financial support from the GIRoA will provide the estimated $ (financial information omitted) in capital construction costs needed to realize the project. The United States (through USAID) is planning to provide up to US $ (financial information omitted) to develop the Bashikurd/Juma Field. Other donors and organizations, such as the Overseas Private Investment Corporation (OPIC) and the World Bank, will play important roles in financing and supporting the projects and transactions.

1.3 Scoping Objectives

The main objective of this report is to review all components of the project and assess the potential significant impacts that require further study at the EA stage and those impacts that are less than significant or that with adequate mitigation measures can be screened out from further study. The document will then outline the scope of works for any further environmental assessment.

It is noted above that the various project components will be funded by different sources. These different sources have their own EA procedures. This report aims to provide the scoping for all project components, and then identify which components require further assessment regardless of funding source. However, this report only describes a limited scope of works for further assessment actions for those activities funded by USAID.

1.4 Relevant Legislation and Guidelines

In the current configuration for the Project there are potentially four sets of environmental laws and regulations that should be considered as the individual components of the Project are implemented:

- The Environment Law of Afghanistan;
- Title 22, United States Code of Federal Regulations, Section 216;
- The World Bank Regulations and Guidelines; and
- IFC Performance Standards

1.4.1 Environmental Law of Afghanistan

Consultations were undertaken with NEPA in Kabul in May, 2012 to discuss what environmental regulations were pertinent to the development of the Project. NEPA indicated that an environmental assessment would be required for the Project as specified by Annex 1 of the National Environmental Impact Assessment Policy (2007) which indicates that a 200MW power plant falls within Category 1 – Projects likely to have significant adverse impacts. Also included within Category 1 are transmission lines, and water supply schemes with a total cost of (financial information omitted) USD and above (current estimate for the water supply component of the project is greater than two million USD). There is no direct classification of other aspects of the project including the gas processing plant or the gas gathering pipelines.

However, as part of the National EIA Policy all project components must follow the following procedures:

- Step 1: Screening – Similar to a normal scoping study, whereby the proponent prepares a review of the project similar to an IEE, or scoping study. The document contains information relating to project description, Identification of Significant Impacts and a summary of mitigation measures (See Appendix A for a full description of requirements). This document is then submitted to NEPA for review by its Board of Experts.
- Step 2: Scoping – The Board of Experts then undertake scoping of the project by reviewing the screening report. They then make a judgment as to the required level of environmental assessment at the next phase, i.e. if a full EA is required or not, and if so they will prepare an outline Scope of Work for the EA.
- Step 3: EA – The final phase is the preparation of an EA including all of the elements specified in the Scope of Works by the Board of Experts. The final document is sent by the project proponent to NEPA for review and approval.

Given the above, in order to comply with the environmental laws of Afghanistan the project must fulfill at least Steps 1 and 2 above. Accordingly, this document provides the required documentation for Step 1.

Several permits will be required for portions of the project, including:
1. Pollution Control Permit – relating to emissions control.
2. Waste Management Permit.
3. Hazardous Waste Permit.

NEPA indicates that these permits will be issued in conjunction with the EA Permit, and that no additional permit applications are required other than successful completion of the EIA procedure.

1.4.2 United States Regulations

Chapter 22 of the United States Code of Federal Regulations § 216, hereafter 22 CFR 216, implements United States Environmental Protection Agency requirements as they apply to activities of USAID.[1] 22 CFR 216 applies to "all new projects, programs or activities authorized or approved" by USAID. 22 CFR 216 requires an initial environmental examination as the first review of a proposed USAID action or project.[2] The initial environmental examination should be prepared with the Project Identification Document (PID).[3] On the basis of that initial environmental examination and the information in the PID, USAID will make the threshold decision as to whether an Environmental Assessment or Environmental Impact Statement will be required for the proposed action.

An IEE (Initial Environmental Examination) was prepared by USAID Afghanistan in 2010 for the predecessor project. The approved IEEs components differed slightly from the current project and recommended the following actions:
1. Drilling test wells – Positive Determination
2. Proving reserves – Positive Determination
3. Well Development – Positive Determination
4. Gas transmission infrastructure to a 200MW power plant (location TBD) – Positive Determination
5. Sheberghan to Mazar 90 km gas pipeline upgrade – Negative Determination with Conditions (removed from the current program)
6. 48MW gas fired power plant rehabilitation at the Northern Fertilizer Power Plant – Negative Determination with Conditions (not included in the current program).

[1] 22 CFR 216.1(a).
[2] 22 CFR 216.1(c)(2).
[3] 22 CFR 216.3(a)(1).

Another separate IEE was prepared for Gas Well Drilling and Rehabilitation Activities in the Juma and Bashikurd Fields. The report was prepared by Gustavson Associates on behalf of USAID and was submitted to USAID for approval in March 2011. The IEE recommended a Negative Determination with Conditions for all components of the Program. This recommendation conflicts with the recommendations of the 2010 IEE. However, the 2011 IEE has yet to be approved by USAID and may now require amendment due to project changes and additions over the past year.

In addition, an Environmental Assessment was prepared for USAID in 2006 as a part of a proposal for a 100MW power plant and skid mounted gas processing plant.

This study provides the scoping statement pursuant to current USAID requirements (see, Exhibit 1-B) taking into account the recommendations of the 2010 IEE and the EA prepared for a smaller power plant in 2006.

1.4.3 World Bank Regulations and Guidelines

There is a possibility that the World Bank may provide a partial risk guarantee for DABS' obligations under the power purchase agreement. If WB were to issue such a guarantee for any component of the SGGA, an EA must be done for the ***entire*** program, including the pipelines, natural gas wells, gathering lines, power plant and power transmission lines. WB guidelines do not specify a scoping study per se, but they do indicate that a type of scoping study is required to establish the TOR for the full EIA. See, Exhibit 1-2 for more details.

1.4.4 IFC Performance Standards

OPIC may invest in the 200MW Power Plant as a partner with the IPP, triggering application of the IFC Performance Standards, which, in Guidance Note 1 refer briefly to an "initial screening of the project and scoping of the assessment process" but do not give any more details about contents, approval processes, or other requirements. USAID is not involved in the funding of the proposed power plant. The IPP investors will be responsible for the preparation of the EA and other environmental compliance requirements for the power plant, including any EIA required under Afghan law.

1.4.5 Asian Development Bank (ADB) Safeguard Policies

The ADB intends to fund the transmission line components of the project. The ADB's separate environmental assessment guidelines ("safeguard policies") will be applied to this component of the SGGA. The Safeguard Policies will most likely indicate that an IEE[4] is required for the transmission lines and that this IEE should also follow Afghan NEPA EA policies.

1.5 Scoping Requirements

This document has been prepared to provide the necessary scoping for all project components in compliance with the requirements described above. It includes the following sections required for all Afghan agency and donor scoping statements, other than those for ADB:

1. Introduction to the Project
2. Project Description
    a. Identification and description of all potential elements and processes of the project;
    b. Relationship of the project to other existing or planned activities;

[4] ADBs Initial Environmental Examination (IEE) differs from the USAID IEE in that it is a summary EIA prepared for projects that are not classified as having significant impacts on the environment, but still require a summary form of assessment.

   c. Other activities which may be required or may occur as a consequence of the project;
   d. Planned future developments on or around the site;
   e. Additional demand for services such as sewage treatment or waste collection and disposal generated by the project; and
3. Consideration of Alternatives - including alternatives sites, technologies, and a 'do nothing' scenario.
4. Environmental Setting - including description of the environmental and social characteristics of the project Area and maps to illustrate the project area.
5. Preliminary Impact Assessment - including:
   a. Identification and elimination from detailed study of the issues that are not significant or have been covered by earlier environmental review. This section will also include actions to mitigate these less than significant issues.
   b. A determination of the scope and significance of issues to be analyzed further in the Environmental Assessment.
   c. A rapid environmental assessment checklist will also be completed as part of this section.
6. Consultations – a summary of the consultations undertake to date.
7. Scope of Work and Schedule for the EA – including:
   a. A description of the timing of the preparation of environmental analyses;
   b. Variations required in the format of the Environmental Assessment;
   c. The tentative planning and decision-making schedule; and
   d. A description of how the analysis will be conducted and the disciplines that will participate in the analysis.

Exhibit 1-2: Scoping Requirements by Donor

USAID (As required by 22 CFR 216.3(a)(4))	NEPA	World Bank & OPIC
• A determination of the scope and significance of issues to be analyzed in the Environmental Assessment or Impact Statement, including direct and indirect effects of the project on the environment. • Identification and elimination from detailed study of the issues that are not significant or have been covered by earlier environmental review, or approved design considerations, narrowing the discussion of these issues to a brief presentation of why they will not have a significant effect on the environment. • A description of: o the timing of the preparation of environmental analyses, including phasing as appropriate o variations required in the format of the Environmental Assessment o the tentative planning and decision-making schedule • A description of how the analysis will be conducted and the disciplines that will participate in the analysis. These written statements shall be reviewed and approved by the USAID Bureau Environmental Officer.	• The Proponent: Name, address, telephone, email and contact point for further queries, for the individual or organization proposing the project • The Project: Brief description of the nature and purpose of the project. Outline plans or drawings. Size of the project in terms of, for example, site area, size of structures, throughput, input and output, cost, duration. Program for implementation including construction, commissioning, operation, decommissioning, restoration, after-use. Scale of construction activities required. • The Location: A map and brief description of the site and its surrounding area showing physical, natural and man-made features such as topography, land cover and land use (including sensitive areas such as housing, schools, recreation areas); physical/spatial planning policies or zoning; areas or features designated for their nature conservation, landscape, historic, cultural or agricultural importance; water features including groundwater and flood protection zones; planned future developments. • Potential Sources of Impact: Completion of a Rapid Environmental Assessment should provide insight into the potential sources of impact. Any further information which provides detail on the following factors would be useful; emissions to air land or water or any residues that may arise from construction and operation activities and the proposed methods of discharge or disposal, any noise, vibration or heat generated from the project, hazardous or raw materials to be used or stored at the site and procedures for safe management and requirements for raw materials and energy and their likely sources. • Mitigation: Brief description of any measures the developer proposes to use to reduce, avoid or offset significant adverse effects would be useful. • Other information which may be useful: o identification of other permits required for the project; o relationship of the project to other existing or planned activities;	• OPIC follows IFC Performance Standard 1, which in Guidance Note 1 refers briefly to an “initial screening of the project and scoping of the assessment process” although it gives no guidelines for the process. • World Bank has indicated that a form of scoping study is required to establish the TOR for the full EIA. However, there are no specific guidelines for the contents of a scoping study, rather some loose guidance relating to consultation ‘shortly after environmental screening and before the terms of reference for the EA are finalized’ (OP4.01).

	o other activities which may be required or may occur as a consequence of the project (e.g. extraction of minerals, new water supply, generation or transmission of power, road construction, housing, economic development) o planned future developments on or around the site; o additional demand for services such as sewage treatment or waste collection and disposal generated by the project; o photographs of the site and its surroundings. o alternative sites, processes or environmental mitigation measures considered by the developer.	

2 Project Description

2.1 General

The Project comprises the following key elements:

- Gas field development;
- Field infrastructure, including water supply and knockout separator;
- Gas processing plant;
- Associated pipelines;
- 200MW gas fired power plant;
- Substations; and
- Transmission lines.

The following section provides a summary of these components of the project.

2.2 Summary Project Actions

2.2.1 Gas Well Drilling and Rehabilitation (USAID funded - US$ (financial information omitted))

The data concerning the wells and reservoirs in the Juma and Bashikurd fields in the Sheberghan area was developed by the Soviets and is twenty to thirty years old. While the data appears sound, it must be independently verified to confirm the estimated gas reserves as sufficient to support the proposed power plant for its designed thirty year life. USAID expects to finance the rehabilitation of two existing wells in the Bashikurd and/Juma Field and to finance the drilling of one or two new wells to replace previously drilled wells. These wells will be tested and the test results used to determine producible reserves. If economically and technically feasible, the wells will be completed as producing wells.

Development of the gas fields is expected to have four distinct phases: (i) well design and procurement of services; (ii) site preparation and rig mobilization; (iii) drilling and completion operations; and (iv) well testing. These phases are described as follows:

1. Well Design and Procurement – Well design consists of engineering studies of wells drilled within the targeted field and regionally. Well construction details will be determined at this phase and generally includes civil work, rig specifications, casing and cementing program, mud program, logging program, and well completion and testing. Detailed cost estimates are also prepared at this stage.

During design of the rehabilitation of Bashikurd wells #9 and #3, the existing wells will be carefully assessed and the data will be updated, if necessary, to account for the presence of H_2S during well testing. The Bashikurd well #9 was drilled and cased with corrosion resistant production casing through the target reservoir, but was not perforated. The work remaining on this well in order to prepare for production is to re-enter the well, confirm that there are no obstructions in the well bore, and then perforate and test the Jurassic interval.

In addition to Bashikurd well #9, Bashikurd well #3 appears to be another candidate for rehabilitation. This well was drilled to a total depth of 3,345 meters, but the second technical casing string ends beneath the Jurassic Anhydrite at approximately 3,000 meters. Remaining work, in order to prepare Bashikurd well #3 for production, involves drilling and casing of the well to approximately 3,500 meters to be followed by perforation and production tests.

After reentry of the Bashikurd #9 and #3 wells, one or two new wells will be drilled as twin wells

contingent on the budget remaining.

2. Site Preparation and Rig Mobilization – In order to transport the drilling rig and associated equipment to the drilling location, construction of an access road or improvements to existing access roads will have to be completed. Construction activities are likely to be minor, given the topography and probable existence of roadways used to access the drilling of exploration wells in the Bashikurd and Juma fields by the Soviets in the 1970 – 1988 time period. The truck loads transporting the rig will be large, and infrastructure along the paved thoroughfares leading to the access road will require inspection for adequacy and possible upgrading.

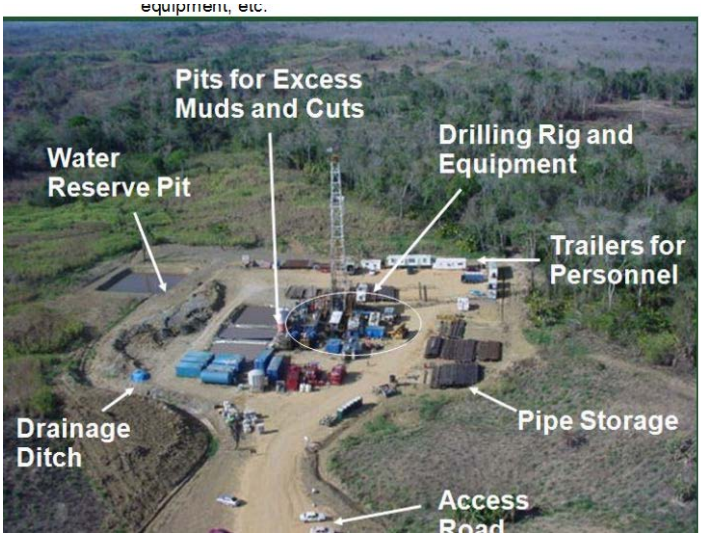
At each location proposed for drilling, an engineered surface will be constructed to support the drilling rig and equipment. Drilling locations will be approximately 3.5 acres (1.5 hectares) in size consisting of a compacted surface and placement of a gravel top layer around the rig for safety. Three or four pits will be excavated to a depth of 3 – 4 meters. In general, pits containing drilling muds or cuttings will be plastic-lined and pits containing water will be unlined. Road and location construction is estimated to take several weeks to complete. Equipment necessary to complete the work will be the following, or similar: one bulldozer, two front end loaders, one grader, and six dump trucks.

Following completion of the access road and drilling location, the rig will be mobilized to the well site and assembled. The principal equipment on a drilling rig and their functions are shown in Exhibit 2-1 and a photograph of a typical rig operation is shown in Exhibit 2-2. A rig capable of drilling to the objective depths will be mobilized in 40-60 truckloads, with an initial transport and rig assembly timeline of approximately 1-2 months. Rig moves to wells in the same field can be completed in approximately 3-4 weeks.

Exhibit 2-1: Principal Equipment

Item	Description
Draw Works	Rotating drum for lifting travelling block. Powered by diesel engine or electric motors.
Engines	Provide power or electricity for draw works.
Mast	Steel structure for lifting and supporting weight of drill string.
Substructure	Steel structure supporting mast and drill floor.
Rotary System	Rotary drive to turn drilling tubulars.
Mud Pumps	Used for pumping drilling mud down drill pipe, through the drill bit and up the annular space to cool and lubricate drill bit, and transport drill cuttings.
Mud System	Tanks or pits for storing drilling mud and cuttings. Includes drilling mud conditioning equipment such as shale shakers, desander, and centrifugal separator.
Blowout Preventers	A series of stacked, remotely or manually operated valves for controlling subsurface pressure in the event of a loss of well control.
Electrical System	Diesel engines for generating electricity and related equipment to deliver power.
Fuel Tank	Tanks for diesel fuel storage.
Other Equipment	Various offices for technical specialists and crew such as: doghouse, mud engineer's trailer, geologist's trailer, mud logger's trailer. Structures will include storage areas for parts, drilling materials, pipe, drilling recording equipment, etc.

Exhibit 2- 2: Typical Rig Operation
equipment, etc.



3. Rehabilitation, Drilling and Completion Operations – Drilling and completion of each well will be a multi-stage process, consisting of the following principal elements. The proposed re-entry wells will not require drilling but will only be logged, completed and tested.

Drilling Operations – Drilling is accomplished by rotating a drilling bit at the bottom of the hole. Weight is applied to the bit by drill collars and drill pipe. Rock cuttings are circulated to the top of the hole using drilling mud. Cuttings are removed from the mud and placed in a lined pit at the surface. Various bit sizes and types of bits are used depending upon the depth and rock formations penetrated. Cuttings will be mixed with native soil, tested for environmental contaminants and buried at the site.

Drilling Mud – While drilling, drilling fluid ("mud") is pumped down the drill pipe. This mud then exits through the bit, and circulates up the annular space between drill pipe and the wellbore to the surface. The mud serves several purposes, including transport of cuttings to the surface, lubricating and cooling the bit, stabilizing the wellbore, and providing hydrostatic control over subsurface pressure. The mud is reconditioned and then reused by removing solids and adjusting the chemical and physical properties as necessary.

Water-based muds (WBM) are most likely to be used during drilling. WBM consists of a mixture of solids, liquids, and chemicals, with water being the principal component. A typical listing of WBM additives are shown in Exhibit 2-3. With few exceptions, WBM is prepared with naturally-occurring materials. In some situations where borehole stability is a problem, a synthetic oil-based mud (SOBM) may be used. The supplier of the SOBM will recycle and reuse the synthetic oil at the conclusion of each well.

Mud additives are delivered to the drilling site in bags or bulk containers for use as the drilling progresses. Specialized chemical and solid additives may be used for specific well conditions. Mud additives will be stored at the rig location with protection from the elements. The rig is powered by diesel engines. One or more engines totaling up to 5,000 horsepower will be used on the rig. These engines will provide electricity to the rig and the mud pumps.

Exhibit 2- 3: Typical Water Based Mud Components

Item	Description
Barium Sulfate	Mineral weighting agent
Caustic soda (NaOH)	pH adjustment
Calcium oxide Bentonite	Improve shale control Increase mud viscosity
Lignite	Deflocculant
Sodium bicarbonate Polymers	Mud chemistry control Mud rheological properties
Cellulose	Fluid loss control
Surface active agents Soda ash	Improve penetration rate Mud chemistry control
Biocide	Biological control
Calcium chloride	Salt

Casing and Cementing – At certain depths during drilling, casing will be lowered into the hole and cemented in place. The casing maintains the integrity of the hole and isolates any formations requiring protection from the wellbore. A typical casing program would be:

- Surface casing to protect shallow fresh water horizons
- Intermediate casing set above the productive interval for pressure control
- Production casing set through the productive zone. The cement slurry will contain Portland cement and various additives. Common cement additives are shown in Exhibit 2-4.

Exhibit 2- 4: Common Cement Additives

Item	Description
Bentonite	Clay added to reduce cement slurry density
Barium Sulfate Diatomaceous earth	Mineral added to increase cement slurry density Used to reduce cement slurry density
Perlite	Volcanic glass used to reduce cement slurry density
Pozzolan Sand	Mineral used to reduce cement slurry density Used to increase slurry density
Calcium chloride	Salt used to decrease cement-hardening time
Sodium chloride Calcium lignosulfonate Lost circulation materials	Salt used to improve cement bond to specific formations Chemical used to increase cement-hardening time Wood chips, paper and other inert materials used to plug high permeability formations
Organic Polymers	Used to reduce cement water loss to permeable formations and control cement viscosity

Well Logging – Prior to cementing the casing in place at intermediate depths, and through the potentially productive gas-producing formations or to the objective depth, each well will be logged using various tools run on an electric wireline to determine if oil or natural gas is present and to determine the properties of the reservoir such as hydrocarbon saturation, porosity, and thickness. All logging tools are handled by a contractor using some equipment on the drilling rig. Radioactive sources are permitted, transported and managed by the contractor.

Completion – The proposed wells will be completed and tested to confirm gas deliverability. Completion operations involve installing production equipment in the well consisting of tubing and a packer to isolate the hydrocarbon bearing zone, then perforating the casing and cement at depths corresponding to the productive zones to be tested.

During drilling operations, a camp will be set up at the drilling location or in Sheberghan to house the

drilling crew. The total crew will number approximately 50 persons. The primary resource inputs during drilling are water and fuel. Water is used for drilling mud and for various rig activities. Approximately 1,500 m^3 of water will be required for drilling. Diesel fuel will be stored in a steel tank at the rig site and will be delivered by tank truck. The drilling rig engines and generators will use about 15,000 liters of diesel daily. All electricity needs will be generated by the drilling rig.

4. Well Testing - Testing will generally consist of flowing the well at various rates and measuring the well's performance characteristics. Gas will be produced into surface production equipment for measurement and separation, and the excess gas will be flared. Testing will be conducted over a 2-3 week period following the completion of the well.

The following best practice measures are proposed for gas well drilling:

- *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (commonly referred to as The Gold Book), prepared by the United States Department of the Interior, Bureau of Land Management, United States Department of Agriculture and Forest Service
- *IFC Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development.*

2.2.2 Field Infrastructure (USAID / MoM Funded - US$ (financial information omitted))

Field infrastructure includes gathering lines, a manifold, and separator. The following describes the processes for the gathering lines, gathering manifold, and separator.

Gathering Lines - The gas supply from the wells to be rehabilitated and new well(s) to be drilled needs to be transported through gathering lines in the fields to a gathering manifold and separator and then by pipeline to the natural gas processing plant. Gathering lines are medium size steel pipes (usually under 18" diameter) that carry un-odorized, raw gas at a pressure of approximately 715 psi. Typically, gathering lines are buried three to four feet underground. There is no exact timeline for installation of these gas gathering and pipeline facilities, but they must be completed before commissioning of the gas processing plant. The exact location of the gathering lines has not been determined at this stage.

Natural Gas Gathering Manifold & Knockout Separator - The natural gas gathering lines will collect the gas from the individual wells and transport it to a gathering manifold which will include a separator to remove free liquids from the gas. After the free liquids and heavier hydrocarbons are removed, the sour gas (gas containing H_2S) and/or acid gas (gas containing CO_2) will be fed into the pipeline for transportation to the gas processing plant for the removal of remaining contaminants. Based on the anticipated production, the gathering manifold and separator must be able to handle a minimum of 1.5 MMCM/day in order to provide sufficient gas supplies to the processing plant. The gathering manifold and separator will also need to be internally coated to resist the corrosive properties of sour gas.

2.2.3 Pipeline from Bashikurd/Juma Gathering Manifold to Gas Processing Plant (Funding to be determined - US$ (financial information omitted))

A ten kilometer pipeline from the southeastern edge of the Bashikurd/Juma Field to the anticipated site of the gas processing plant on the northwestern edge of the Gerquduq Gas Field. The pipeline will be internally coated, seamless pipe, probably twelve inch diameter pipe. The precise routing of the pipeline is not currently known although it is assumed that it will traverse unpopulated semi-desert. Generally, the steps of laying natural gas pipeline are as follows:

- Site preparation – A construction area approximately twelve to twenty-three meters wide is required for the transportation of pipe equipment depending on the condition of the location and

pipeline size. The ground is leveled to be equally flat. The surface or the topsoil will be stripped and separated from the excavated subsoil and will be returned after the backfill in order to allow plants to grow as normal.

- Pipe transportation - Trailers are used to move pipes from stockpile sites to laying sites.
- Ditching - A special excavator or specially designed excavator is used. The depth of a ditch depends on the pipe size and construction specifications which are normally one meter at the minimum. The top soil will be separated and will be covered afterwards.
- Pipe bending - As the pipeline route has to be curved according to the location and the elevation of the ditch, thus the pipe must be bent to follow the ditch and conform to the typography. Pipe bending by a specialized pipe-bending machine which makes minimum effect on coating, takes place along the trench or at pipeline sites.
- Pipe welding and X-ray - Normally, each section of pipe is twelve meters long for ease of transportation. During construction, welding joins each section of pipeline together into one continuous length. The welds are 100 percent x-ray checked and the pipe which does not pass the criteria will be cut and welded again.
- External coating - Typically, the external pipe coating to prevent corrosion is undertaken at the factory. There are a number of coating materials and techniques according to ASBM B 31.8 standard, such as coating of epoxy and high density polyethylene. After welding at the construction site, the pipes will be re-coated to prevent rust and rupture at the weld and checked before lowering into the ditch.
- Lowering in - Tractors are used to lower the pipe into the trench. If there is rock, the bottom must be bedded with soil or sand prior to lowering-in to protect the pipe and coating from damage.
- Backfilling - Backfilling is carried out in such a way that ensures sufficient padding and bedding to prevent damage tithe pipes already coated. If there is rock, the bottom must be bedded with rough soil and sand and the excavated soil is put back to fill the trench and backfilled to normal ground level. The topsoil is returned to allow any vegetation to grow.
- Land restoration - After the backfill, the soil and environment of the pipeline will be restored. Seeding may be done to reduce erosion. Any replacement of deep rooted plants along the lines will be avoided in order to prevent their roots from causing damages to the coating or interfering with future access to the pipe.

2.2.4 Gas Processing Plant (USAID Funded - US$ (financial information omited))

Available data indicate that the gas produced from Bashikurd/Juma Fields will be “sour gas,” meaning it will have a concentration of hydrogen sulfide (H_2S) greater than 5.7 milligrams per cubic meter, and Jurassic reserves contain concentrations of carbon dioxide in excess of eight percent. (The combination of high hydrogen sulfide and carbon dioxide in natural gas is sometimes referred to as “acid gas.”) While it may be possible to have fuel gas containing carbon dioxide, the hydrogen sulfide and other impurities must be removed. This is generally accomplished through the use of an amine sweetening plant, where a liquid desiccant (monoethanolamine or diethanolamine) is circulated through the raw natural gas to remove the “acid gas,” or the compounds of hydrogen sulfide and carbon dioxide. The resulting natural gas stream is then dehydrated and cleaned of further impurities before being compressed and fed into the pipeline for the power plant. The “acid gas” stream can be further treated to recover the elemental sulfur or disposed of through reinjection into underground formations for long-term storage.

The gas processing plant that will supply pipeline quality gas to the power plant will require a significant capital investment. The existing gas processing plant at Gerquduq has not been operational since 1989 and twenty years of idleness has resulted in significant deterioration of the facility. In several reports

written by different consultants, there was unanimous agreement that rehabilitation of the existing gas processing facility would not be economically feasible.

The power plant is expected to need 1.2 million cubic meters of gas per day, or 13.1 billion cubic meters over its anticipated thirty year operational life. AEAI's 2006 Feasibility Study found that the capital cost for the gas processing plant for a 100MW, twenty year life power plant, would be US$ (financial information omitted).

The expected nameplate capacity of the power plant has since been increased to 200MW, doubling the amount of gas that would be required. Further, the capital cost estimated by AEAI in the 2006 Feasibility Study relied on a blend of sweet gas from Yatimtaq Cretaceous reservoirs and sour gas from Gerquduq and Khoja Gogerdak Jurassic reservoirs. Gas processing plants are designed to process a specific blend of natural gas, so with the change in fields and reliance on Juma and Bashikurd Jurassic reservoirs, the estimated cost may increase to cover the additional processing requirements including the increased quantity of gas, extended operating life, waste disposal options, and different composition of the raw gas being processed. While the capital costs for gas processing do not increase linearly with the amount of gas processed, the changed circumstances from the 2006 Feasibility Study suggest that a rough 40% increase in cost would be reasonable. Based on that assumption, the capital cost for the gas processing facility would increase to approximately US$ (financial information omitted).

2.2.5 Water Supply (USAID Funded -US $ (financial information omitted))

In order to provide the estimated 12.34 liters per second of water for the power plant, it will be necessary to complete the following infrastructure:

- Drill and complete two new groundwater wells in the Qarakent well field
- Procure and construct a new water pumping station
- Procure and construct a twelve kilometer water pipeline from Qarakent well field to the power plant site.

In addition, approximately 3,600 m^3 of water per year will be required for the gas processing plant. Small volumes of water will be required for the gas well field drilling operations. This water will have to be obtained from local boreholes, although non-potable water from existing gas fields may supply most of the drilling operations water.

2.2.6 200MW Gas Fired Power Plant (Private / OPIC Funding-US$ (financial information omitted))

At present, it is expected that the builder, owner, and operator of the proposed 200 MW gas-fired power plant, including the step up substation to connect the power plant to the power purchaser's transmission system, will be a privately owned entity operating under a concession given by the GIRoA. In the case of Sheberghan project, the private investor / Independent Power Producer (IPP) will make its own decision on the type of technology used for this project. Typically, the price of the fuel (in this case gas), the capital costs, the follow up of the electricity demand, and availability of water play a major role in technology selection.

2.2.7 Power Substations (USAID Funded - US$ (financial information omitted))

A 110 kV transmission line (TL) from Turkmenistan transmits electricity to the northern provinces of Faryab, Sar-e-pul and Sheberghan. For the short term, DABS is planning to re-string a 110kV TL between Sheberghan and Mazar-e-Sharif Substation which will facilitate the 200 MW IPP to supply the power not only to the mentioned provinces but also to Mazar-e-Sharif. For the medium term, Asian

Development Bank (ABB) has committed to fund a new 220 kV substation in Sheberghan site and the corresponding transmission lines to interconnect this substation to a new substation in Andkhoy to the west, and to the existing substation in Mazar-e-Sharif to the east. This infrastructure could receive and transmit electricity from the 200 MW IPP by adding a step up transformer (power plant generation voltage to 220kV). The construction of the power plant substation to connect the IPP power plant to Sheberghan substation will initially consist of survey work, geotechnical sample drillings and soil resistivity measurements that will be used in the final design phases of the station. Once the near final design of the substation has been completed a civil contractor will mobilize to perform site development work including grubbing and then reshaping the general grade to form a relatively (1 percent slope) flat working surface. This effort also will include the all-weather access roads. A fence will be erected around the perimeter of the substation to prevent unauthorized personnel from accessing the construction and staging areas. The perimeter fence will be permanent feature to protect the general public from accessing the substation. The excavated and fill areas will be compacted to the required densities to allow structural foundation installations.

Following the foundation installation, underground electrical raceways and copper ground grid installation will take place, followed by steel structure erection and area lighting. The steel structure erection will overlap with the installation of the insulators and bus bar, as well as the installation of the various high-voltage apparatus typical of an electrical substation. The installation of the high-voltage transformers will require special high-capacity cranes and crews (as recommended by the manufacturer) to be mobilized for the unloading, setting into place, and final assembly of the transformers. While the above mentioned activities are taking place the enclosure that contains the control and protection equipment for the substation, will be constructed, equipped, and wired. A final crushed rock surfacing will be placed on the subgrade to make for a stable driving and access platform for the maintenance of the equipment. After the equipment has been installed, testing of the various systems will take place, followed by electrical energizing of the facility. The energizing of the facility generally is timed to take place with the completion of the transmission line work and other required facilities.

2.2.8 Transmission Lines (ADB Funded - US$ (financial information omitted))

For the medium term, the 200MW IPP could be connected to new 220kV substation in Sheberghan, and transmit its power through the new transmission lines. ADB has committed to fund this infrastructure. ADB is also planning to upgrade the existing distribution system and provide approximately 25,000 new domestic connections in the towns of Sheberghan and Sar-e-Pul. Further, there are opportunities to engage domestic anchor customers, such as industrial zones and military bases, in the northern provinces that could provide a ready market for the power.

2.3 Other activities which may be required or may occur as a consequence of the project

The project encompasses all of the components required to begin full development of the gas fields of Sheberghan, from extraction, through processing, power generation and to power transmission. As such no further activities will be required as part of this project. However, development of the project will undoubtedly lead to considerable economic expansion, and this could accelerate growth in the region. Such increase may require additional actions to support the growing population, such as

increased social services (healthcare, schools) and better infrastructure links. The issue of growth is discussed further in Section 5.

2.4 Planned future developments on or around the site

No further activities are currently planned in the vicinity of the power plant and the gas processing plant, although MoM has begun to consider construction of an oil refinery in the area. However, development of the Bashikurd/Juma Field could lead to additional drilling activities in these and other adjacent fields as demand increases. It is likely that additional power plants will be built within the vicinity of Sheberghan, and it is likely that additional pipelines and gas processing plants will be established. However, at this early stage of the project, these are just theoretical possibilities, but they will be discussed further at the EA stage.

2.5 Additional demand for services such as sewage treatment or waste collection and disposal generated by the project

Project works, both during construction and operational phases of the project, will require waste water treatment (at the power plant and the gas processing plant) and waste management activities (at all sites). Waste water treatment facilities will be constructed at these facilities. Management of waste at all sites will require the preparation of waste management plans for each operational site. These activities and the required management plans will be developed during the EA stage of the project.

3 Environmental Setting

3.1 General Setting

The project is located within the Sar-e-Pul Valley, with the majority of its components located to the west side of the valley approximately two to three kilometers from the Darya-I Safid (See Exhibit 3-1). All of the project components are located in semi-desert locations within Government owned lands. The proposed 200MW power plant and the gas processing plant are located five kilometers downwind from the nearest village and 15 kilometers downwind of Sheberghan. Water will be supplied to the facilities from the Qarakent aquifer which reportedly has at least 2,000 m^3/ day of available water supply.

3.2 Project Components Location and Setting

The following section provides a summary of the locations of the various project components and a description of their environmental setting. A table summarizing the rationale for the project component locations is also presented.

3.2.1 Site Selection Screening, Selection and Eligibility Criteria

Many of the project components locations are predetermined, for example the locations of the well sites have been determined by economic factors, i.e. the availability of gas within the well. All project components are located in uninhabited semi-desert and impacts to sensitive receptors, urban areas, agricultural and surface water courses will not occur. Siting of components is also predetermined by the fact that the gas power plant and processing plant will be located adjacent to the former gas processing plant, and the pipelines will follow a direct route through the semi-desert to these facilities. The transmission line routing has yet to be determined, and therefore the Scoping Study does make recommendations regarding the site selection for this infrastructure. Exhibit 3-2 summarizes the site selection process.

3.2.2 Gas Fields

Bashikurd well field is located approximately fifteen kilometers west of Sheberghan and measures approximately 43 square kilometers. Juma well field lies adjacent to the west side of the Bashikurd field and is located approximately twenty five kilometers west of Sheberghan. The fields are separated by a fault whose location is not known precisely.

Land utilization within and near the project site consists of residences along National Highway A76 (Sheberghan to Sar-e-Pul) three kilometers to the east, and small agricultural plots at the western edge of the gas fields. Since the targeted gas fields have never been produced, there are wells but no pipelines, or processing facilities. No existing or proposed cultural or environmental protected areas are found in or near the gas fields. The natural vegetation around the project site is semi-desert. Ground cover is sparse, consisting of drought resistant grasses including needle grass, sheep fescue, blue grass, and sedge. Grasses usually die back by mid-summer and the landscape takes on a desert appearance. Arable land in the Sar-e-Pul valley is located at the western edge of the productive gas fields is planted with grain including wheat, barley, and corn. Winds are primarily northwesterly and southeasterly. East winds are also common in winter and fall. Prevailing wind speeds are two to three m/s. Rare strong winds (up to 20 m/s) occur in late spring or early summer and usually result in dust storms, reducing visibility to a few meters.

Exhibit 3-1: Approximate Locations of Project Components

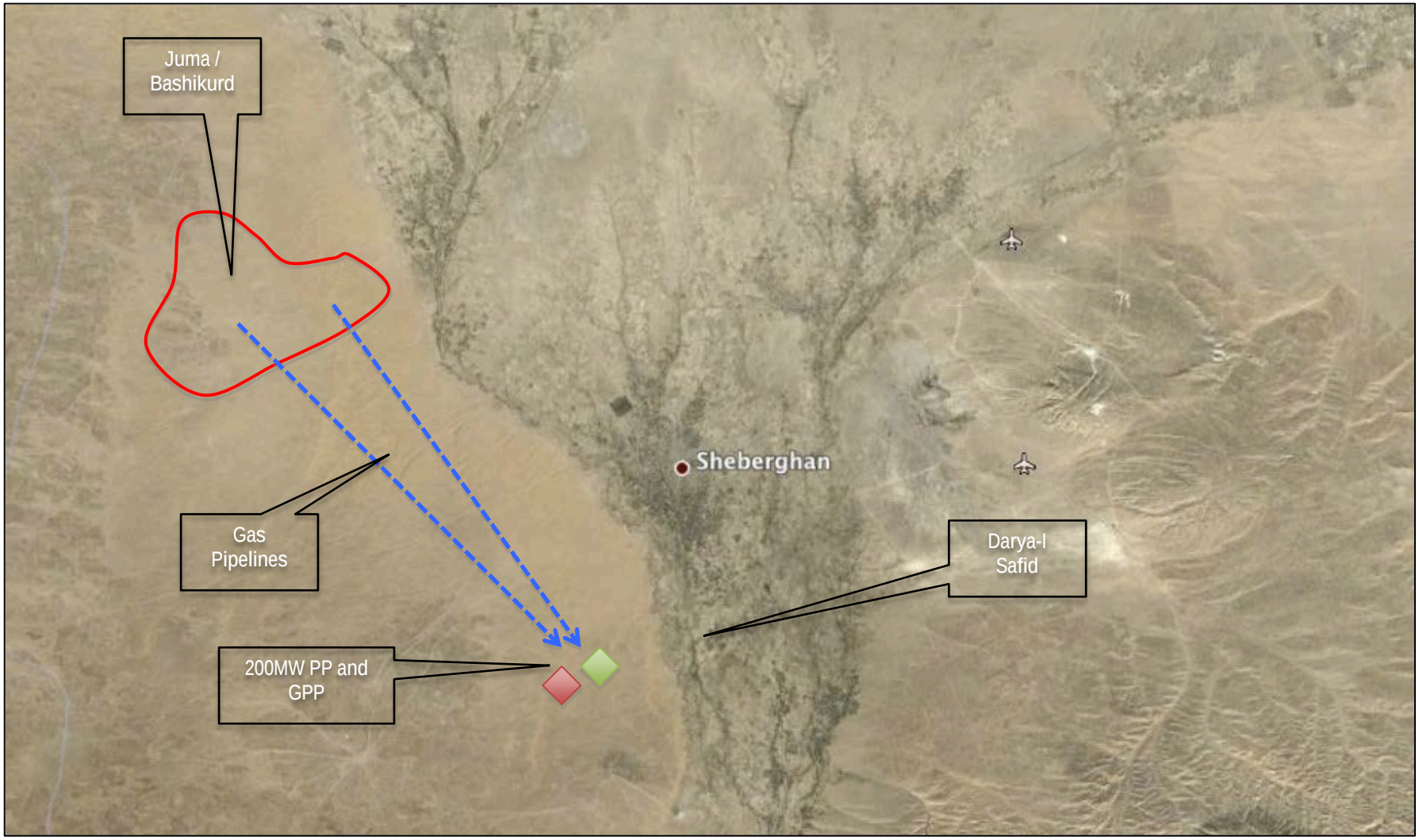


Exhibit 3-2: Site Selection Screening

#	Project Component	Existing Infrastructure	Brownfield	Greenfield	Sensitive Habitat	Proximity to Urban Areas	Comment & Potential Alternatives
1	Gas Fields	✓	✓	✗	✗	✗	The gas fields are located in semi-desert uninhabited land. The locations of well-fields are pre-determined by the availability of gas. No alternatives are available.
2	Field Infrastructure	✗	✗	✓	✗	✗	As above, the field infrastructure will be located within semi-desert uninhabited land within the proximity of the well fields. No alternative locations are available and are not considered warranted.
3	Gathering system pipelines	✗	✗	✓	✗	✗	The pipelines will run directly from the gas fields south through uninhabited semi-desert to the gas processing plant (GPP). No other routes are considered feasible or necessary.
4	Gas Processing Plant	✗	✓	✓	✗	✗	The location of the GPP has been pre-determined by the MoM at a site close to a former gas processing plant. The location is considered appropriate due to its distance from urban areas, its proximity to the well-fields and an absence of agricultural activity, or sensitive flora and fauna.
5	200MW Power Plant	✗	✓	✓	✗	✗	The power plant will be located adjacent to the GPP. Alternative locations for the plant are discussed under Section 4.3.4.
6	Substations	✓	✓	✓	✗	✓	The existing and new substations will be located on government owned lands. The decision to site the substations at these locations is determined by the necessity to be close to urban areas.
7	Transmission Lines	✗	✗	✓	✗	✓	Transmission line routing will be determined by DABS and the ADB. This document includes recommendations for appropriate siting of transmission lines to reduce potential impacts to land users and habitat.

3.2.3 Field Infrastructure

Gathering lines will be required to move the sour gas from the wellheads to a collection point to be fed into a pipeline. This collection system will include internally-coated gathering lines, a knockout separator, a gathering manifold and an internally-coated pipeline to deliver gas to the processing plant. These gathering lines will be located predominantly in the well field area, a description of which is provided above under Gas Fields. The precise location of the separator is not currently known although it is likely to be within, or very close to the gas fields.

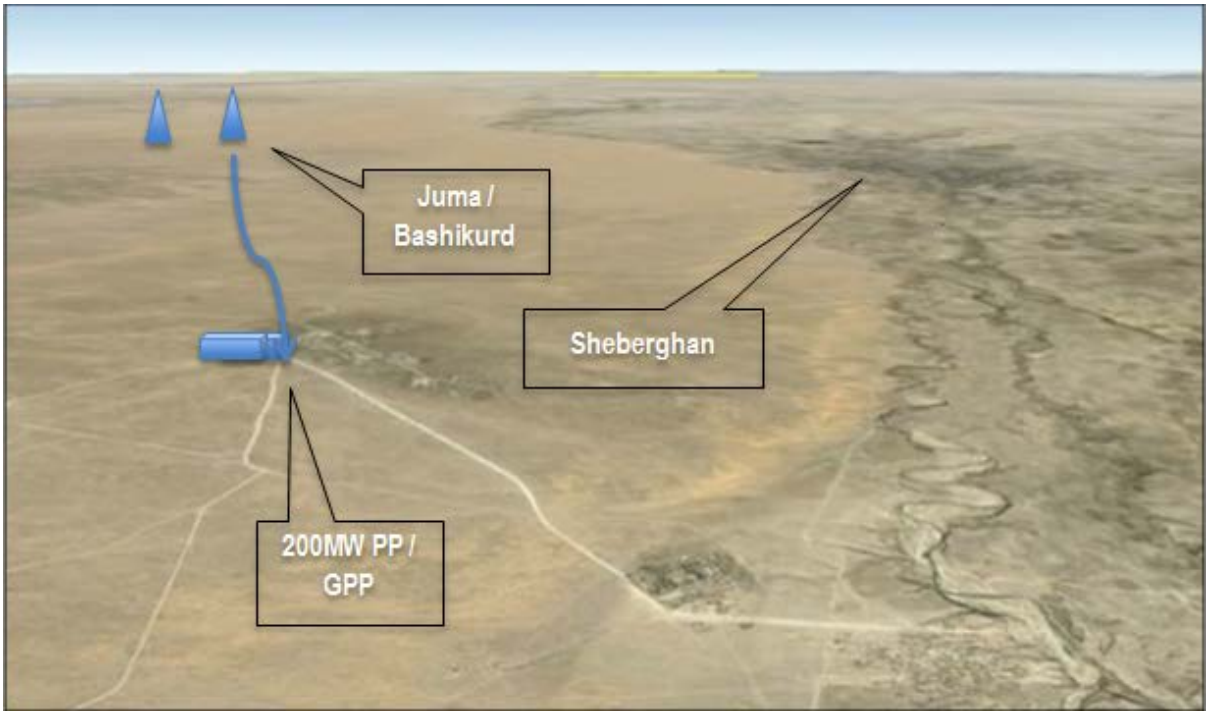
3.2.4 Pipelines

A ten kilometer pipeline from the southeastern edge of the Bashikurd Field to the anticipated site of the gas processing plant will be required. The precise routing of the pipeline is not currently known. However, it is assumed that the pipeline will follow the most direct route, notwithstanding any topographical constraints (the well fields are located at around 350 meters above sea level with the Gas Processing Plant located around 450 meters above sea level). Exhibit 3-1 indicates that the pipeline would be constructed through an area of unoccupied semi-desert, which according to the MoM, is owned by the Government.

3.2.5 Gas Processing Plant and 200 MW Power Plant

The proposed gas processing plant and 200 MW power plant will be located adjacent to the existing inoperable Gerquduq gas processing facility approximately 15 kilometers southwest of Sheberghan. A 110/35/6 kV substation and an abandoned gas fired generation station are also situated adjacent to the site. Exhibit 3-3 illustrates the location of the proposed gas processing plant. The site is located on the edge of a semi-desert area and is located on the gently sloping west side of the Sar-e-Pul River valley approximately 450 meters above sea level. To the east of the site, approximately two kilometers away the fertile valley is fed by the Darya-I Safid (west side) and the Darya-I Sya (east side) which both stem from the Sar-e-Pul river. The entire proposed site is the property of the Afghan Government.

Exhibit 3-3: Location of Gas Processing Plant and 200MW Power Plant



3.2.6 Water Supply

Two water supply wells will be developed to extract water from the Qarakent aquifer which previously supplied up to 1,500 cubic meters of groundwater per day from 12 wells to the Gerquduq and Khoja Gogerdak Gas Treatment Plants. These treatment plants have not been operational for many years and now only two water wells are operational. Consultations with the Hydrogeological Department at the Afghan Geological Survey revealed that there could be anywhere between 2,000 m^3/day and 14,000 m^3/day of water available from the Qarakent Aquifer. A pipeline will be constructed from the new, but as yet unknown, well locations to the gas processing plant and power plant. The route of the pipeline is not currently known.

3.2.7 Substations

The existing and proposed substations are both located on Government owned lands. No PCBs will be used in these substations, but it is possible that PCBs exist in the existing substation.

3.2.8 Transmission Lines

The locations of the proposed transmission lines are not known at the current time, and as stated

above, this portion of the project will be funded separately by the ADB and subject to a separate environmental assessment process following ADB safeguard policies.

3.3 Environmental Conditions

Soils - The project is located in the Northern Plain of Afghanistan in Jawjzan Province. The main soil type at the project site is loessy loam. Loess soils generally have excellent permeability and can absorb large quantities of water. Soils in the Northern Plain are prime agricultural soils and the Mazar-e-Sharif region is one of the major food-producing areas in Afghanistan. However, all of the project components, with the exception of sub-stations and transmission lines, are located outside of the irrigated zones fed by the Darya-I Sya and Darya-I Safid.

Topography – The main components of the project, the gas wells, pipelines, and plants, are located on the gently sloping valley side. The 200MW power plant and gas processing plant are located at approximately 450 meters above sea level. The Bashikurd/Juma Fields lie at approximately 400 meters above sea level. Appendix E illustrates the topographical conditions of the site. No impacts to topography are anticipated to result from the project.

Geology and Seismicity - The geology of the area comprises Neogene and Quaternary (Pleistocene) sediments consisting of loess beds tens of meters thick, overlying alternating layers of pebbles/gravels, sands, silts and clays. The sediments represent the products of erosion of the mountains. Modem alluvial deposits occur along the river valleys. The Quaternary sediments overlie Mesozoic limestones, conglomerates, sandstones, siltstones, and shales extending to several kilometers depth. The Mesozoic rocks are gently folded and faulted forming the reservoir strata and structures for the region's natural gas resources. The Mesozoic rocks are exposed to the south in the foothills of the Hindu Kush. The area is seismically active being adjacent to the northern edge of the Hindu Kush where orogenic processes are active. The region has a history of strong earthquakes, over 5.8 on the Richter scale.

Hydrology - The project sites are situated within the Sar-e-Pul watershed of the Northern River Basin, one of five river basins in Afghanistan. The Northern River Basin has the smallest annual flow contribution of all the basins, contributing a mean volume of 1,880 m^3, which is two percent of the total annual river discharge in Afghanistan. The Sar-e-Pul source is in the high mountains of the central highlands and its watershed has an area of 16,743 km^2, comprising 2.6% of Afghanistan's total area. The watershed is drained by two main rivers: the Ab-I Sya River and the Sar-e-Pul River which join two kilometers south of the town of Sar-e-Pul. Further downstream, a diversion structure splits the river into the Darya-I Sya (east side channel) and Darya-I Safid (west side channel, see Exhibit 3-4). The channels dry up in the irrigation canals or desert sands north of Sheberghan City well before reaching the Amu Darya River. Peak discharge from the Sar-e-Pul is in April and May, illustrating the strong influence of snowmelt on river flow. Minimum discharge is in August. Annual average flow rate is approximately six m^3/second.

Exhibit 3-4: Darya-I Safid

The Qarakent aquifer is the principal fresh water source in the area of the Bashikurd/Juma Field, and is the main water supply for the town of Sheberghan. According to Afghan Geological Survey (AGS) Fresh Water Resources Section personnel, the Qarakent recharge zone and catchment area is located upstream and several kilometers distant from the Bashikurd/Juma Field and the locations of the four wells to be worked over/drilled. It is also the opinion of the AGS personnel that the aquifer does not extend into the Bashikurd/Juma Field, and that there should little, if any, likelihood of encountering it or a connected formation during operations. Some shallow aquifers are reported to exist in the Bashikurd/Juma Field that are recharged from surface precipitation, but these are also reported to be non-potable and not suited for irrigation or livestock. The only fresh water zone reported in the wells to be re-entered or the replacement wells is the Cenoman horizon with fresh water intervals at 1712 to 2085 meters below surface. Depth reports and casing information for the Cenoman is summarized below.

Bashikurd #2 - Cenoman horizon: fresh water interval 1722 to 1927 meters (205 meters). Cased to 1852 meters (+/- 5 to 10 meters) with 299mm diameter casing.

Bashikurd #3 - Cenoman horizon: fresh water interval 1712 to 1918 meters (206 meters). Cased to 1821 meters (+/- 5 to 10 meters) with 324mm diameter casing.

Bashikurd #9 - Cenoman horizon: fresh water interval 1891-2085 meters (194 meters). Cased to 2049 meters (+/- 5 to 10 meters) with 245mm diameter casing.

Juma #2 - Cenoman horizon: fresh water interval 1765 - 1976 meters (211 meters). Cased to 1527 meters with 249mm diameter cashing; then to 2806 meters with 219mm diameter casing.

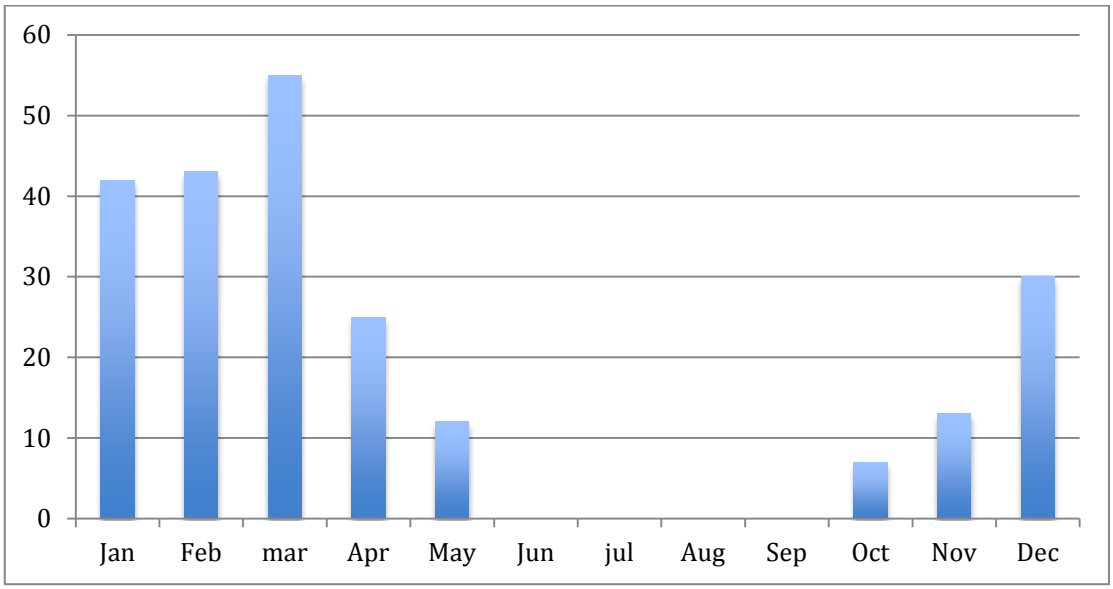
The Qarakent groundwater pumping station, located in the lower Sar-e-Pul River valley about ten kilometers south of Sheberghan, and previously provided water for the Gerquduq and Khoja Gerquduq gas treatment plants, as well as for domestic supply, from twelve wells. Currently only two water wells at Qarakent are operational.

Generally, groundwater in the area is ultimately recharged by precipitation, and direct recharge of precipitation in the project areas is likely to be small. Groundwater resources, where present, are likely

Quaternary aquifers recharged in the foothills by rivers and streams descending from the high mountains and infiltrating into coarse grained alluvial fans. In addition, there may be infiltration of water into the aquifers through the bed of the Sar-e-Pul River and from irrigation channels along the Sar-e-Pul valley. Based on this interpretation, groundwater resources are likely limited to areas immediately surrounding the Sar-e-Pul River.

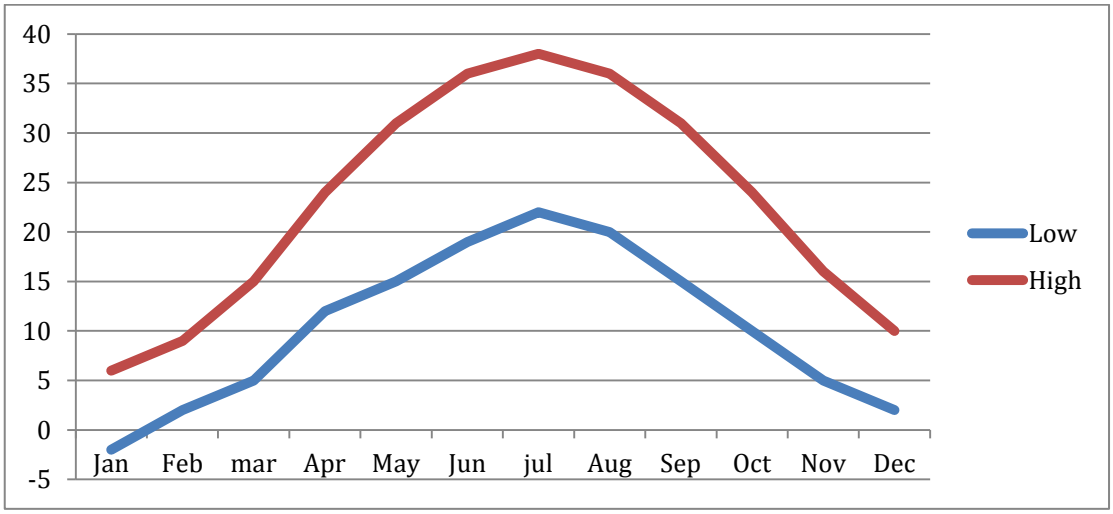
Air Quality and Climate - The climate of the Sheberghan region is dry subtropical with wide annual daily temperature variations. Winter (December to February) is mild, mostly cloudy, and has mean monthly minimum and maximum temperatures of -1.5 to 1.5°C and 7 to 10°C, respectively. Cold winter winds and clear weather can cause temperatures to fall to as low as -22°C for short periods. Precipitation falls 4 to 6 days per month as rain and occasionally snow; however, fallen snow melts quickly. Spring (March and April) is characterized by rapid daytime warming and precipitation is brief afternoon downpours. Rainfall is highest during March averaging 56.4 mm per month See Exhibit 3-5[5]). Average annual rainfall is 231 mm in Summer (May to September) is hot and dry with mean monthly maximum and minimum temperatures of 30 to 39°C and 14 to 22°C, respectively. Daytime temperatures of 45 °C can occur. Daytime relative humidity during summer does not exceed twenty five to thirty percent and rain is very rare. Fall (October and November) begins clear and dry then turns cloudy and rainy. Days in fall are warm and nights are cool. Winds are primarily northwesterly and southeasterly. East winds are also common in winter and fall. Prevailing wind speeds are two to three m/s. Rare strong winds (up to 20 m/s) occur in late spring or early summer and usually result in dust storms, reducing visibility to a few meters. Ambient air quality at the project sites is likely to be good based on the following characteristics: (1) sites are in a semi-desert area approximately 15 – 20 kilometers from Sheberghan City, where industries are the nearest potential sources of air pollution; and (2) the sites are relatively exposed topographically and not prone to atmospheric inversion. However, particulate material concentrations are likely to be high throughout the region given the prevailing winds and soil transport characteristics.

Exhibit 3-5: Precipitation (mm), Sheberghan



[5] http://www.eldoradocountyweather.com/climate/afghanistan/Sheberghan.html

Exhibit 3-6: Temperature (°C), Sheberghan



Air quality in Sheberghan City is likely negatively impacted by vehicular emissions and the burning of oil refinery residues. Vehicular density is increasing throughout Afghanistan where most vehicles run on low-grade diesel fuel. In testing performed by UNEP, dust and polyaromatic hydrocarbons were detected in Mazar-e-Sharif and other cities in Afghanistan. UNEP also found that a coal-like residue from small private oil refineries was being used for domestic heating and brick factories, which produces a thick black smoke when burned. The refinery residue results in the emissions of sulfur dioxide and hydrocarbons which are noted by UNEP to pose a threat to human health.

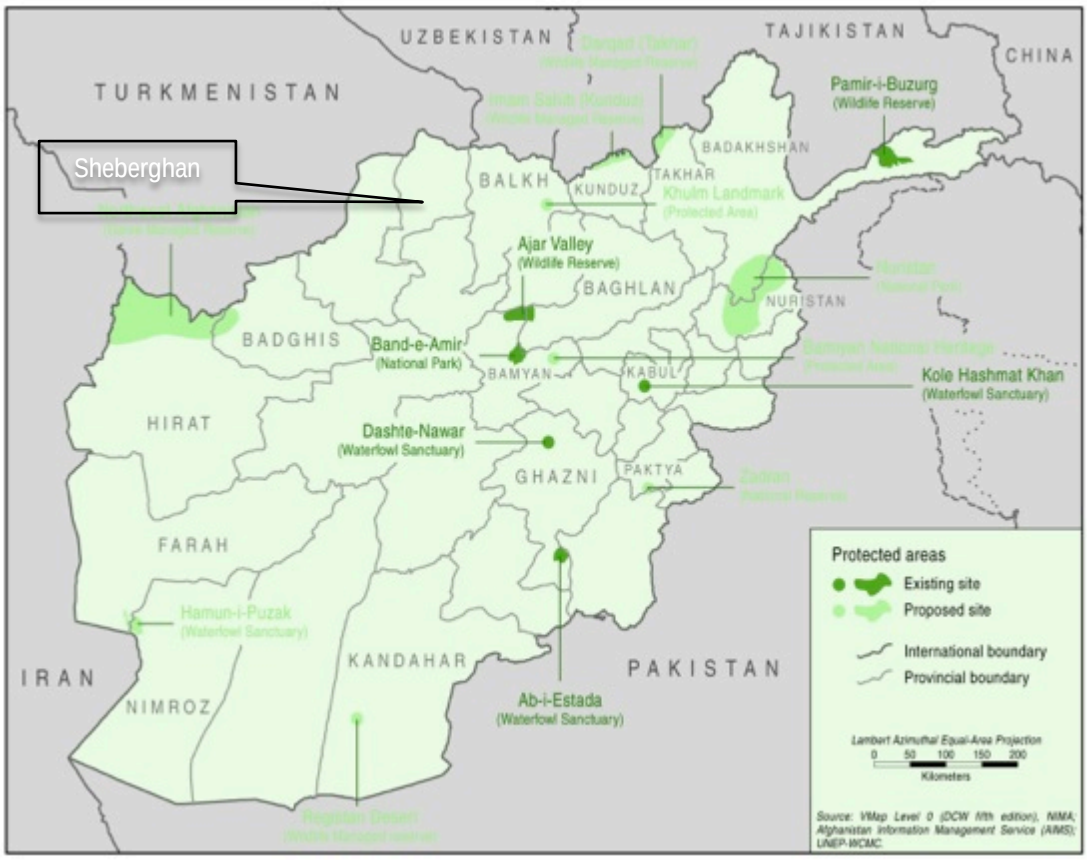
Flora and Fauna - The natural vegetation around the project site is semi-desert. Ground cover is sparse, consisting of drought resistant grasses including needle grass, sheep fescue, blue grass, and sedge. Grasses usually die back by mid-summer and the landscape takes on a desert appearance. Arable land in the Sar-e-Pul valley located at the western edge of the productive gas fields is planted with grain including wheat, barley, and corn. The region is known to provide habitat for various vertebrate species including a species of ground squirrel (Spermophilopsis leptodactylus), falcons (Falco spp.), Jerboas (Allactaga spp.), Caracal Cats (Caracal caracal), and Striped Hyenas (Hyaena hyaena). There are no known rare or endangered species within the project area.

Protected Areas – Three designated and three proposed protected areas (see Protected Areas Map, Exhibit 3-7) have been identified in the country none of which are located within 100 kilometers of the Project Area:

- Ab-I-Estada Waterfowl Sanctuary. Ab-I Istada is a large saline lake located at about 2,000 m elevation in the south corner of Ghazni province (Nawa district). Ab-I Istada drains the water from the Ghazni, Sardeh and Nahara Rod and it overflows into the Arghistan River – itself a tributary of the Arghandab River – in years with good rainfall.
- Dashte-Nawar Waterfowl Sanctuary. The Dashte-Nawur Waterfowl Sanctuary is located in Ghazni Province in eastern Afghanistan. Dasht-I Nawur is an extensive high-altitude plain in southeast Afghanistan. Some 600 km^2 in area, the plain lies at about 3,350 m elevation, with surrounding peaks, holding ibex and urial, rising to 4,800 m. A narrow brackish lake, more than 10 km long, occurs in the plain. Dasht-I Nawur serves as an important breeding and staging ground for a large number of migratory waterfowl.
- Pamir Buzurg (Proposed) Wildlife Sanctuary. The proposed Pamir Buzurg Wildlife Sanctuary is located in the extreme northeastern part of the country.

- Kole Hashmat Khan (Proposed) Waterfowl Sanctuary. The proposed Kole Hashmat Khan Waterfowl Sanctuary is a former royal hunting ground located far south of Kabul.
- Ajar Valley (Proposed) Wildlife Reserve. The proposed Ajar Valley Wildlife Reserve is a former royal hunting ground located in Bamyan Province in the central part of the country.
- Bande Amir National Park. Bande Amir National Park is also located in Bamyan Province near the proposed Ajar Valley Wildlife Reserve in the central part of the country.

Exhibit 3-7: Protected Areas of Afghanistan



Waste Management and Hazardous Materials – There is little in the way of waste management facilities within the project area, and certainly no facilities with the ability to dispose of hazardous waste. As such, it will be the responsibility of the contractors and operators to implement waste management plans which will be prepared at the EA stage of the project. It is assumed that there are few personnel within the project area that are suitably qualified to manage hazardous materials, as such, it will also be the responsibility of the contractors and operators to train site personnel in the management of hazardous materials, including storage, use and disposal. Hazardous materials management plans will form part of the EA stage of the project.

Land Use - The gas fields are located within approximately twenty km of Sheberghan (see Exhibit 3-8). Land utilization within and near the project site consists of residences along the A76 highway three kilometers to the east, and small agricultural plots at the western edge of the gas fields. Since the targeted gas fields have never been produced, there are no existing producing wells, pipelines, or processing facilities. No existing or proposed cultural or environmental protected areas are found in or near the gas fields. Within the vicinity of the proposed gas processing plant and the power plant the only land used is that of the old gas processing plant and some small related infrastructure. There are no agricultural or urban land uses within three kilometers of these facilities. In addition, it should be

noted that according to the MoM the gas fields, the gas processing plant, the power plant and the pipelines will be located on Government property.

Infrastructure – Most of the project components are located in remote areas. Highway A76 is located within three kilometers of the well fields and the gas processing and power plants. During the construction phase of the project these roads will be used to deliver equipment from neighboring countries and potentially from Kabul. These roads have been rehabilitated within the last five years and as such the increased traffic movements on these roads should not result in impacts to the road surface itself. There is a small airstrip at Sheberghan which may be used to transport staff to and from Kabul by light airplane or helicopter, but not for the transport of equipment. Helicopter transportation could be made directly to the project area. Numerous irrigation systems are located in the agricultural areas between the Darya-I Sya and Darya-I Safid, fed by the waters of these two rivers.

Exhibit 3-8: Sheberghan

Social Conditions - On the whole, the population of the Sheberghan area is poor. Over 80 percent earn less than US $1 a day per capita. The population of Sheberghan is around 200,000, the majority of them in the Uzbek ethnic group. Sheberghan is an important regional center for the surrounding hinterland, providing a regional market for goods (including agricultural products and crafts), a service center providing health and education facilities, and a transportation hub between the traffic moving on the ring road (which sees international traffic to and from Iran, Turkmenistan, Kazakhstan and Pakistan) to the central province of Sar-e-Pul. Sheberghan also has a small but serviceable regional airport 10 km to the east of the city. Water supply for most of the city population consists of in-house supply from protected tube-wells for the better-off residents, and street-side hand-pumped wells shared by a number of neighbors for poorer communities.

Sheberghan does not have a city-wide sewer system. Larger residences and guest houses have septic tanks. Most residences have a rudimentary system whereby waste is channeled to an alcove street-side, where it is collected by a dirt-cart operator for use as fertilizer. Many government facilities simply have a lidded bucket. Most people urinate and defecate in the lee of the buildings and at the roadside, with negative environmental and health consequences.

The prominent industry in the Sheberghan area is natural gas production. Operations in the field are on-going at a rudimentary level due to lack of funding for equipment and supplies as well as skilled

labor force. Rehabilitation of the existing gas infrastructure will (i) increase natural gas production contribute to energy security and self-reliance; (ii) improve the environment through replacing combustion of fuel wood and diesel oil; (iii) deliver stable supply of safe, treated gas to domestic and commercial users; and (iv) enable development of gas-fired thermal power plant that will reduce reliance on imported power and diesel generation. The output of the proposed 200MW Sheberghan gas power plant will also widely benefit the population as power will not only serve the local population, but will be supplied to other major cities through the North East Power System (NEPS). A detailed assessment of the socio-economic conditions of the Region is provided by Appendix D.

Resettlement and Compensation - No resettlement or compensation will be required as part of the project as all facilities are located on government owned lands. An exception may be any routing of transmission lines outside of Government lands or existing easements. This portion of the project will be funded by ADB and as such will follow ADB Safeguards for Resettlement and Compensation.

Noise and Vibration – All of the projects components, with the exception of the transmission lines, are located in remote areas, more than three kilometers from the nearest urban areas. As such, it is considered unlikely that the project Activities will impact significantly on sensitive receptors such as hospitals, schools, and religious/cultural facilities. Notwithstanding the above, some elements of the project may result in excessive noise that could have health impacts to workers, in particular the power plant and possibly the gas processing plant. There are no noise standards in Afghanistan, and as such, the project will adopt those used by the World Bank/IFC for thermal power plants and the IFC EHS Guidelines for Noise.

Historical and Cultural Heritage – Previous studies undertaken in the project area have not identified any historic or cultural resources that may be impacted by the project. However, potential chance finds of items of archeological importance cannot be ruled out.

4 Scoping Activities

4.1 Stakeholder Consultations

Consultations have been undertaken during May 2012 with a range of stakeholders in Kabul and the results are presented below. Consultations were planned for the project area. However, due to the recent security changes in country it has not been possible to arrange stakeholder consultations in the area at this time without compromising the safety of those visiting the sites. However, it is hoped that site based consultations will be undertaken at the EA stage when the security services changes have had time to take effect and safe journeys can be made to the site.

NEPA

- Eng. Ghulam Mohammad Malikyar – Deputy Director General / Technical
- Dr, Mohammad Khalid Naseemi – Chief of Staff and Spokesperson
- Eng. Noor Mohammed Fazli – Director of Environmental Assessment and Sustainability
- Mostapha Zaher – Director General, NEPA

AEAI asked Eng. Malikyar what the exact process for screening and scoping was. Eng. Malikyar responded, stating that firstly the project owner would submit a screening report, or a kind of scoping report, to the NEPA for review. NEPA would then undertake review of the report with their Board of Experts and make a determination if a full EA or a limited EA, or no further EA, would be required. He noted that the document must be prepared in Dari as well as English. The Board review would take approximately twenty one days, although this period is flexible, i.e., it may be completed faster. Malikyar commented that AEAI should follow Annex 3 of the EIA guidelines to develop the format for the screening/scoping report. AEAI asked if the EA document required consultations. Malikyar responded that the documents had to be 'disclosed' at NEPA HQ in Kabul and also with the local NEPA office in Sheberghan. AEAI asked if any additional permits would be required, such as waste permits, or pollution control permits. Malikyar replied that no additional permits would be required. This was confirmed by Malikyar via email a few days later. Regarding actual impacts, NEPA indicated that social impacts should also be considered and that biodiversity and protected areas should be considered during the project works. They also noted that soils maybe contaminated in the Sheberghan area by former industrial activities. NEPA did not think that the local population would be negatively impacted by the project.

<u>Ministry of Mines – Hydrological Department</u>

Eng. Muhammad Maim Tookhi – President of Geo-engineering and Hydrological Department

AEAI asked the President if permits will be required for the extraction of groundwater. The President replied that permits are required according to Article 38 of the Water Law. AEAI asked if there was a fee for the permit and if any payments should be made for water extracted. The President replied that there is no fee for the permits as this is a MoM project; he also indicated that there will be no fee for water use. However, it was unclear if a private operator of the power plant would have to pay for borehole permits and for the water the facility used. This is important considering the power plant may use upwards of 1,000 m^3 of ground water per day. AEAI asked if groundwater figures quoted in the AEAI Sheberghan Infrastructure Assessment were correct, specifically he asked if there was 2000 m^3 of water available in the Qarakent Aquifer. The President replied that he had written to AEAI to confirm that this was the case. AEAI asked if there were any other water users from the Qarakent Aquifer, the

President replied that they may be a few, but the water use is minor. AEAI asked that if the Power Plant used 1000 m^3 of water per day, and the aquifer could supply 2000 m^3, would there be adequate recharge of the aquifer annually to keep up with the water demand. The President noted that the quoted 2000 m^3 was an estimate on the low side. His assistant showed figures that indicated the yield from Qarakent could be as much as 14,000 m^3 per day. The President indicated that further tests of the Qarakent Aquifer should be undertaken to provide up to date data on the size of the Qarakent Aquifer and its recharge rates. AEAI asked the President if he knew of any specific environmental issues that may arise as a result of the project. The President noted that it was important to undertake tests on the aquifer and ensure that any ground water extractions did not have a negative impact on other water users in terms of water availability. He also noted that we should meet with the Water Survey Department at the Ministry of Urban Development in Sheberghan at the EA stage to discuss the issues of water use and availability in the Sheberghan area.

Ministry of Mines

Dep. Eng. M. Ali Behsoodi – Head of Mining Inspection

AEAI asked Eng. Behsoodi if, as stated in the Draft Hydrocarbon Law, there is an environmental department within the MoM. Eng. Behsoodi commented that twenty members of his department had recently been sent to South Africa for two weeks of environmental training, so they had some knowledge of environmental issues, but this was generally dealt with under the umbrella of Health Safety and Environment (HSE). He noted that his department dealt with monitoring of HSE on projects. Eng. Behsoodi also commented that the Ministry implemented ISO14001, but primarily on mineral mining projects and had not tried to implement such a management procedure on any hydrocarbon project. AEAI asked if any environmental related permits would be required from MoM. Eng. Behsoodi stated that all environmental related permits are the responsibility of NEPA, not the MoM. AEAI asked Eng. Behsoodi if he knew of any specific environmental issues that may impact upon the project. Eng. Behsoodi could not think of any specific environmental impacts.

Ministry of Mines - General Directorate of the Oil and Gas Survey

Dr. Qutbuddin Qaeym - General Director

AEAI asked about operational water sources for the proposed wells in Bashikurd and Juma. Dr Qaeym responded that there were existing water wells is the vicinity of the well-field that would be used for water supply. AEAI asked if there was an adequate water supply in the wells for operational activities. Dr. Qaeym responded that during the operational period of the project minimal water extraction would be required from the wells, approximately 2-3 cubic meters per day. AEAI asked where the waste water and waste materials, the drilling mud, would be disposed of. Dr. Qaeym responded that there were existing settling ponds in the area that would be used for the drilling mud, and that the water from the ponds would be re-used in the drilling process. Dr. Qaeym advised that we should undertake a site visit so he could show the condition of the well fields, the groundwater wells and the settling ponds.

Asian Development Bank

Asad Aleem - Energy Specialist

AEAI asked what projects the ADB were currently funding in the Sheberghan area. Mr. Aleem commented that the ADB were going to fund the transmission line project associated with the SGGA,

but it was still at the planning stage and consultancy services were now being procured to manage the process. He noted that an IEE had been prepared for another gas field development project in the Sheberghan region (Gerquduq Gas Field Rehabilitation Works and Gas Processing Plant) and recommended a review of this document. Mr. Aleem knew of no specific environmental or social issues relating to the gas well drilling in the Sheberghan area that may affect the SGGA.

USAID

M. Roseann Casey – Division Chief, Energy and Water, USAID,

Mr. John Stich – COTR, USAID

AEAI provided USAID with a brief overview of the environmental needs of the project from a donor and NEPA perspective, and then discussed the existing environmental documentation that USAID had produced for the project. Ms. Casey replied that she was glad that AEAI was now in a position to start the environmental assessment process. AEAI explained that the first step was to prepare an environmental scoping statement for the project, and that he had discussed this issue briefly with Andrei Barannik, USAID Regional Environmental Advisor (REA). Ms. Casey responded that she was happy for us to follow this process. Ms. Casey added that she wanted to ensure that all environmental processes were completed in a thorough manner compliant with all national and donor requirements.

4.2 Desktop Review

Several environmental documents have already been prepared as part of the process to assess the feasibility of gas power production in Sheberghan. These documents include:

- Environmental Impact Assessment – Feasibility of Development of a Gas-fired Thermal Power facility in Sheberghan, Afghanistan. USAID. 2006
- Initial Environmental Examination, Sheberghan Gas Development Program. USAID. 2009
- Initial Environmental Examination - Rehabilitation of Sheberghan Gas Fields. ADB. 2009
- Initial Environmental Examination for Gas Well Drilling and Rehabilitation Activities in the Juma/Bashikurd Fields. Gustavson Associates. March 30, 2011
- SGGA Environmental Issues Brief. USAID. 2012.

In addition to these items numerous other project related documents have been reviewed, including:

- Hydrocarbon Law. Government of Afghanistan. Draft, 2011
- Hydrocarbon Regulations. Government of Afghanistan. Draft, 2009
- Water Law of Afghanistan. Government of Afghanistan. 2005
- National Environmental Impact Assessment Policy. Government of Afghanistan. 2007
- SGFDP Gas/Power and Related Infrastructure Assessment. USAID. 2011
- SGFDP Legal and Regulatory Analysis Report. USAID. 2011
- SGFDP Roadmap for Sheberghan Gas Field Development. USAID. 2011
- SGFDP Stakeholder Consultation Report. USAID. 2011
- SGFDP Ranking of Potential Wells for Twinning and Cost Estimates. USAID. 2011
- SGFDP Critical Path for Sheberghan Gas Field Development. USAID. 2011.

4.3 Consideration of Alternatives

Consideration of alternatives at this stage of the project includes the following:

1. The ‘do nothing’ scenario
2. Alternative Waste Stream Options at the Gas Processing Plant
3. Alternative Technology at the Gas Power Plant

4. Alternative Locations

4.3.1 Do Nothing

Within the context of Afghanistan's plans to expand the availability of electric power in the Northern Region the alternative to utilizing the indigenous power resources is to continue to rely on imported power from Uzbekistan and Turkmenistan. Such an alternative could be unnecessarily expensive and risky compared to indigenous resource development and also potentially unreliable in respect of cross-border issues. Where economically feasible, developing indigenous power resources is preferable to relying on imports. For Afghanistan to achieve its development aspirations, harnessing its potential indigenous power resources is essential, particularly when such resources can be developed in an environmentally sustainable manner.

The gas fields around Sheberghan represent a significant resource for potential use in the energy sector. This was recognized in the 2004 Power Sector Master Plan which identified the feasibility of developing thermal power facilities at Sheberghan as a high priority. Furthermore, from an environmental point of view, natural gas is recognized as a ''cleaner'' fuel when considering available fuel options for thermal power plants. On the basis of national power demands, prudent use of available natural resources, self-determination and environmental considerations, the proposed development of a gas-fired thermal power plant at Sheberghan can be said to be preferable to a 'no project' option.

4.3.2 Alternative Gas Processing Plant Waste Stream Options

One of the major concerns with a 1.5 MMCM/day gas processing plant is the disposal of the impurities removed from the gas stream. The amine process will remove the carbon dioxide and hydrogen sulfide from the natural gas, creating pipeline quality natural gas that can be utilized by the power plant. However, the waste stream of carbon dioxide and hydrogen sulfide presents a significant disposal problem for the processing plant. Hydrogen sulfide is a toxic and highly flammable gas associated with hydrocarbon production. Hydrogen sulfide can be deadly in concentrations above 100 ppm and, when burned, combines with oxygen to produce sulfur dioxide, a poisonous gas known to cause acid rain when combined with moisture. Hydrogen sulfide is also corrosive to pipelines, well equipment and gathering systems and sour gas requires special handling and equipment. There are several ways of disposing of the "acid gas" stream (containing hydrogen sulfide and carbon dioxide), including flaring, reinjection and sulfur recovery. The following provides an overview of these potential alternatives.

Flaring - Gustavson Associates did an analysis of the concentration of SO_2 that would be present in the exhaust gas from a sweetening plant if the acid gas stream was burned or flared. The heat content of the stream to be disposed would have to be at least 300 BTU per standard cubic foot (SCF) in order to burn. The estimated acid gas stream from a plant processing Bashikurd gas would consist of about five percent H_2S and 95 percent CO_2, with a heat content of only about 28 BTU/SCF. Further, the estimated acid gas stream could be blended with methane from the sweetening plant in a proportion of 28 percent methane to 72 percent acid gas stream (5% H_2S/95% CO_2) to get the heat content up to 300 BTU/SCF. If the blended stream was burned with air, the concentration of SO_2 in the exhaust gas would be about 25 grams per normal cubic meter (Nm^3). This would far exceed the World Bank standard of 1g/Nm^3.[6]

[6] World Bank, Pollution Prevention and Abatement Handbook, p. 361. 1998

Reinjection of Acid Gas Stream – As an alternative to flaring, the acid gas stream can be re-injected into an underground formation for either temporary or permanent disposal. The waste gas stream from the gas processing plant, composed primarily of carbon dioxide and hydrogen sulfide separated during the amine process is re-injected into a depleted well or other suitable underground formation at high pressure for long term storage. There are several examples of this practice in the United States, and it is an alternative to expensive elemental sulfur recovery or flaring. There are several key issues that must be resolved before reinjection of the waste stream is considered as an acceptable alternative.

Initially, Afghan Gas and the processing plant engineers will need to find a suitable site and geological structure for reinjection. Identification of a suitable geological structure will require a detailed seismic study of candidate sites. It is anticipated by the parties that the gas processing plant will be located in or near the Gerquduq gas field. While some seismic work was done by Afghan and Soviet engineers prior to the Soviet withdrawal in 1989, the seismic work was focused on finding and exploiting natural gas reserves. The type of study required to identify suitable reinjection sites is much more detailed and will require more specialized equipment. One of the key concerns is leaking or migration of the injected waste stream, which can result in contamination of the entire field if the wells are communicating. A suitable structure should be an isolated depleted gas well and should be able to handle the pressures and have the capacity to store a substantial amount of waste over the operating life of the processing plant. By locating the proposed gas processing plant in the Gerquduq gas field, there is a possibility that one or more of the depleted gas wells could serve as viable candidates for the reinjection. However, even if a suitable structure and well can be identified, the well equipment will likely need to be redesigned or replaced to handle the extremely corrosive and toxic waste stream from the processing plant.

Reinjection could be an expensive proposition, particularly if multiple wells are needed to handle the volume of waste coming from the gas processing plant. Gustavson Associates estimated that for another processing plant being built in the area, an injection well will cost approximately $ (financial information omitted). Each well will have to be engineered to handle the waste stream, and each structure will have to be carefully analyzed and monitored to prevent contamination of the other reservoirs in the gas field or the water tables. The cost of reinjection could be moderated through a combination of flaring and reinjection. Such a system would flare part of the acid gas stream up to the World Bank and ADB environmental limits, then inject the remainder of the waste stream. The advantage of a split system is that it may require fewer wells for the reinjection of the waste stream and the flaring option is by far the cheapest means of disposing of the carbon dioxide and hydrogen sulfide.

Sulfur Recovery - In addition to flaring and reinjection, another method of processing the waste gas stream from the gas processing plant is to recover elemental sulfur using the Claus process. After the raw natural gas is treated using the amine solution, the amine is regenerated for reuse in the processing plant. During the regeneration process, heat and steam are used to reverse the amine reaction with carbon dioxide and sulfur dioxide. The two gasses are then recovered from the steam and sent on for further processing or incineration in a flare stack. The regenerated amine is processed further and ultimately sent back through the gas stream to begin the process again. In this way, the amine is recycled through the plant in a closed loop system. The carbon dioxide from the stream is vented to the atmosphere or recovered for a variety of industrial purposes, including secondary recovery efforts. The hydrogen sulfide can be recovered using the Claus process.

The Claus process recovers elemental sulfur from the acid gas stream after the hydrogen sulfide is removed from the rich amine solution. In order to utilize the Claus process, the gas stream can have no more than 15 percent hydrogen sulfide. In the Claus process, the hydrogen sulfide is burned in a reaction furnace with air from the outside to form sulfur dioxide and water vapor. The second part of the process, also called the catalytic stage(s), uses a catalyst to convert sulfur dioxide and additional hydrogen sulfide into elemental sulfur and water vapor. Naturally, more catalytic stages result in an increase in the efficiency of the process. A two stage catalytic conversion process results in efficiencies of 90 to 96 percent, while a three stage catalytic conversion process results in efficiencies of 95 to 98 percent. It is important to note that this process does not completely convert hydrogen sulfide and sulfur dioxide, and some emissions of these compounds must still be incinerated in a flare stack at the conclusion of the process. A tail gas clean up unit may be installed to convert the remainder of the hydrogen sulfide and sulfur dioxide and prevent any release of the compounds, but these units can cost as much as a Claus process plant.

According to one estimate, a two stage catalyst Claus process sulfur recovery unit would cost approximately US$ (financial information omitted) for 100 tons/day of processing capacity. After reviewing the Soviet data on the wells in Juma and Bashikurd, and doing some rough calculations, it would appear that a single unit with a 100 tons/day processing capacity would be sufficient to extract elemental sulfur from the waste gas stream. The Claus process unit would add approximately US$ (financial information omitted) to the capital cost of the processing plant. The market price in China for elemental sulfur as of March 7, 2011 was about $230 per ton, though the price has been subject to substantial volatility in the past few years. Analysts predict that the world price for elemental sulfur will remain low for the foreseeable future, based on development of sour oil and gas reserves in the Middle East and other factors. There are a large number of industrial applications for elemental sulfur, including sulfuric acid production, match factories and production of industrial chemicals and solvents. The prospects for the development of these industries in Afghanistan are uncertain, but the elemental sulfur produced from the process could be exported to other countries in Central and Southeast Asia. At present, market conditions in the region and the volatility of elemental sulfur prices make any realistic calculation of the financial benefits of the Claus process unit extremely difficult.

4.3.3 Alternative Power Plant Technology

This section explores different technology options for the 200MW gas-fired power plant. Although technology will not be dictated to the IPP, the technology options lets the Afghan Government as well as the investors explore the range of variables available, as input fuel and other resources such as water, for the generation of 200 MW of electricity. Power plant technologies that could be used are:

- Simple cycle gas turbines
- Combined cycle gas turbines
- Gas fired steam turbines
- Gas fired generators

Exhibit 4-1 provides a summary of the information below.

Simple Cycle Gas Turbines - This type of power plant is fueled with natural gas, which is injected at front of the unit, compressed, and, mixed with fuel, and ignited at high pressure. When released, the hot gas expands through turbine blades connected to a shaft. The turning shaft drives the generator, creating electrical energy. Simple cycle gas turbines are used primarily in locations where water is

scarce. The process water consumption in simple cycle power plants is negligible. This technology has been in operation for four decades and there are several reputable U.S. and non- U.S. manufacturers of such technology.

Combined Cycle Gas Turbines - In combined cycle power generation the gas turbine generates electric power, and the steam produced by the waste heat of the gas turbine rotates the steam turbine to generate additional electric power. The reasons or characteristics that make the combined cycle a leading generation technology for newly installed thermal power plants are;

- High thermal efficiency – about 43 percent as compared to a steam turbine and 40 percent as compared to a gas turbine giving an overall efficiency of about 50 percent for the combined cycle.
- Technology is environment friendly - by emitting less carbon dioxide (CO_2) to the atmosphere, less nitrogen oxides (NOX) and sulfur dioxide (SO_2) to the atmosphere and reducing fuel consumption leading to conservation and saving of resources. In addition the hot gasses from the gas turbine are directed to a heat recovery steam generator where steam is generated and fed into a steam turbine to generate more power and thereby increasing the efficiency of the power plant.

Gas Fired Steam Turbines - In the case of a gas-fired steam turbine, steam is generated in a boiler, where water passes through a series of tubes to capture heat from the firebox and then boils under high pressure to become superheated steam. The heat in the firebox can be provided by combustion of any fossil fuel, including coal, gas, or oil. The superheated steam leaving the boiler is fed to a steam turbine throttle, where it powers the turbine and connected generator to supply electricity. After the steam expands through the turbine, it exits the back end of the turbine, where it is cooled and condensed back to water in the surface condenser. This condensate is then returned to the boiler through high-pressure feed pumps for reuse. Steam turbine plants are reliable and have a history of achieving up to 95 percent availability and can operate for more than a year between shutdowns for maintenance and inspections. However, overall efficiency of a steam turbine power plant is close to 30 percent, meaning the fuel consumption per kWh is relatively high compared to other systems. Historically, this technology has been commonly utilized for power plants and the combustion chamber can be designed to accommodate multiple types of fuel.

Reciprocating Engines/ Gas Fired Generators - Gas fired generators operate on the reciprocating or piston-driven concept--a widespread and well-known technology. Also called internal combustion engines, reciprocating engines require fuel, air, compression, and a combustion source to function. Depending on the ignition source, they generally fall into two categories: (1) spark-ignited engines, typically fueled by gasoline or natural gas, and (2) compression-ignited engines, typically fueled by diesel oil. The four-stroke, spark-ignited reciprocating engine has intake, compression, power, and exhaust cycles. In the intake phase, as the piston moves down in its cylinder, the intake valve opens, and the upper portion of the cylinder fills with fuel and air. When the piston returns upward in the compression cycle, the spark plug emits a spark to ignite the fuel-air mixture. This controlled reaction, or "burn," forces the piston down, thereby turning the crank shaft and producing power. The compression-ignition engine operates in the same manner, except the introduction of diesel fuel at an exact instant ignites in an area of highly compressed air-fuel mixture at the top of the piston. In the exhaust phase, the piston moves back up to its original position, and the spent mixture is expelled through the open exhaust valve.

Commercially available reciprocating engines for power generation range from 0.5 kilowatt (kW) to 6.5 megawatt (MW). Reciprocating engines can be used in a variety of smaller applications because of their small size, low unit cost, and useful thermal output. They offer low capital cost, easy start-up and proven reliability. Plant emissions from such technology are low because of the modern natural gas reciprocating engine technology utilizing pre-combustion chambers, individual cylinder temperature control, and lean burn technology, carbon dioxide (CO_2) and volatile organic compounds (VOCs) are further controlled with an oxidation catalyst. Sulfur oxides (SOx) emissions are controlled to nine parts per million (ppm) with Selective Catalyst Reduction (SCR) technology using urea as the reagent. The ability of the technology to operate without use of process water is of significant social and environmental benefit.

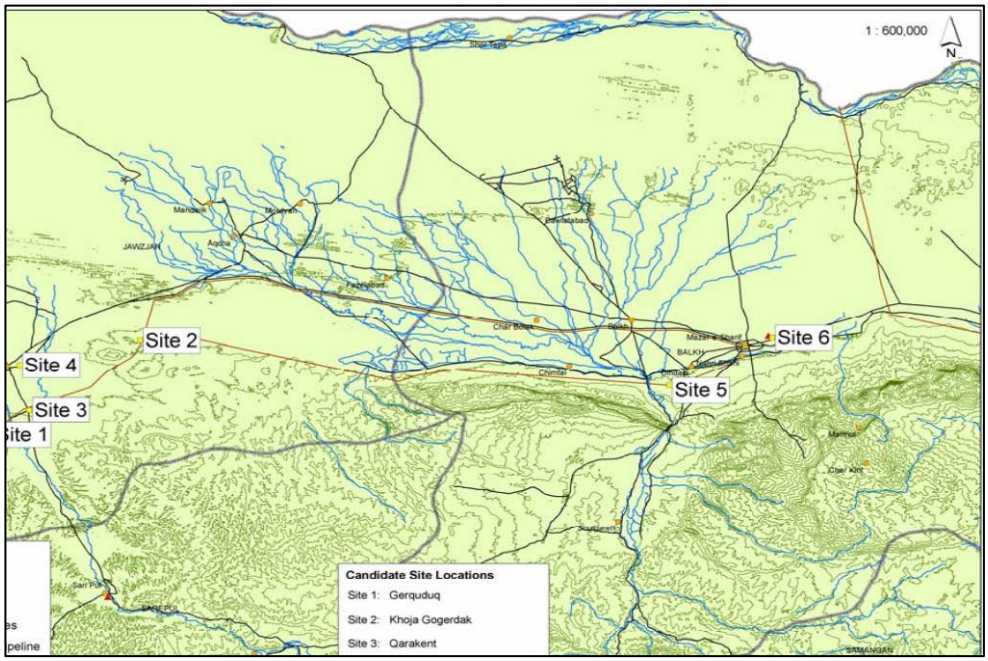
Exhibit 4-1: Summary of Technologies

	Simple Cycle Gas Turbine	Combined Cycle Gas Turbine	Gas Fired Steam Turbine	Gas Fired Generator/Reciprocating Engines
Estimated Capital Costs [1]	$450/KW-$700/KW	$700/KW-$1000/KW	$1200/KW	$1000/KW
Operating Efficiency [2]	35% - 40%	~ 50%	~30%	25% - 45%
Heat Rate (Btu/KWh) [3]	~ 13,000 btu/kWh	~10,000 btu/kWh	~13,000 btu/kWh	~10,000 btu/kWh
Process Water Requirements [4]	Negligible	250-350 galls/MWh	300-500 galls/MWh	Negligible
Estimated Procurement Lead Time [5]	1 year	1 year	1 year	0.5 years
Construction Schedule [6]	2-3 years	2-3 years	2-3 years	0.5 years
Estimated Operating & Maintenance Costs [7] (fuel cost not included)	2 cents/kWh	2 cents/kWh	3 cents/kWh	3 cents/kWh
Plant Service Life [8]	30 years	30 years	30 years	5-10 years (generator replacement)
Estimated Capital Costs for a 200 MW plant (USD) [9]	$140 million	$200 million	$240 million	$200 million
Estimated annual O&M costs. ($/year) [10]	$28.0 million/year	$28.0 million/year	$42.0 million/year	$42.0 million/year
Estimated annual Gas Fuel Usage [11]	560 million m^3/year	435 million m^3/year	560 million m^3/year	435 million m^3/year
Estimated annual kWh generation (kWh/year) [12]	1402 million kWh	1402 million kWh	1402 million kWh	1402 million kWh

4.3.4 Alternative Power Plant Locations

Assessments of potential site locations in 2006 considered six alternative locations for the 200MW Power Plant. Exhibit 4-2 illustrated the considered locations in relation to Sheberghan.

Exhibit 4-2: Potential Power Plant Locations



The following provides an overview of each location and the positive and negative issues relating to each site.

Site #	Name	Description
Site 1	Gerquduq	In the vicinity of the existing DABS substation and the Afghan Gas Company well field and processing facility.
• Close to existing gas transmission and collection infrastructure, conveniently located with respect to undeveloped fields • Close to existing transmission grid infrastructure • Highly secure water supply from Qarakent • Government owned land • No new easement requirements for gas or water supplies • No land use conflict • Land has little economic or environmental opportunity cost • Impact of emissions on community and ecology expected to be minimal		

Site #	Name	Description
Site 2	Khoja Gogerdak	Adjacent to the Afghan Gas Company well field and processing facility
• Land suitable but slightly more valuable for agriculture • Longer supply lines for water and power transmission • Gas supply situation similar, but further for transmission of Gerquduq gas • Construction and site development costs slightly higher • Environmental and social outcomes similar • Slightly inferior safety and security situation due to greater remoteness from population center • Identical operations and maintenance situation • Risk situation similar • Economic outcomes similar if gas treatment for power plant is co-located with power plant		

Site #	Name	Description
Site 3	Qarakent	In the vicinity of the existing water pumping station, which supplies potable water to Sheberghan City and the Afghan Gas Company assets at Gerquduq and Khoja Gogerdak

- Significant utilization of surrounding land, land ownership to be resolved
- Slightly longer supply line for power transmission
- Closest to water pumping station
- Less favorable site for co-location of gas treatment
- Slightly less favorable construction cost and site development situation
- Less favorable environmental situation due to proximity of plant to existing activities
- Unfavorable social impacts associated with conflicting land use
- Similar safety and security situation
- Identical operations and maintenance situation
- Unfavorable schedule risk arising from land procurement issues
- Similar economic situation excluding compensation costs for displacement of existing land users

Site #	Name	Description
Site 4	Sheberghan	On the Eastern outskirts of Sheberghan City, on land identified as a potential industrial zone

- Suitable land identified but availability not certain, new easements required for gas and water
- Transmission connection will come close to existing built up areas
- Potential conflicting use if ground water drawn from site for station use
- Similar construction cost and site development situation
- Less favorable environmental situation due to proximity of plant to populated area
- Similar social situation, land procurement issues excepted
- Slightly more favorable security situation due to proximity of plant to populated area
- Slightly more favorable operations and maintenance situation due to proximity of plant to populated area
- Unfavorable schedule risk due to land procurement and easement issues
- Slightly less favorable economics, especially if gas treatment plant is remote from power plant

Site #	Name	Description
Site 5	Mazar-i-Sharif Fertilizer Plant	Adjacent to the Ministry of Mines and Industry fertilizer plant at Qala Jangi, near Mazar-e-Sharif

- Less favorable land availability and suitability
- Longer supply line required for power transmission
- Slightly less favorable water supply security situation, potential surface water source
- Unfavorable gas supply situation, 90 km of pipeline refurbishment required
- Similar construction cost and site development situation
- Slightly less favorable environmental situation due to plant proximity to
- a populated area
- Similar social impact situation
- Similar security situation
- Slightly more favorable operations and maintenance situation due to plant proximity to populated area
- Unfavorable schedule risk due to length of gas pipeline refurbishment

Site #	Name	Description
Site 6	Mazar-i-Sharif Substation	Adjacent to the existing DABs substation at Mazar-e-Sharif

- Less favorable land suitability due to proximity of populated area
- Identical power transmission situation
- Unfavorable water supply security and potential usage conflicts
- Unfavorable gas supply situation, approximately 120 km of pipeline refurbishment and new pipeline required
- Similar construction cost and site development situation

- Unfavorable environmental situation due to proximity of plant to
- populated areas
- Less favorable social situation due to potential land use conflicts
- Less favorable security situation due to gas line vulnerability
- Similar operations and maintenance situation
- Unfavorable schedule risk due to extent of pipeline work and potential land ownership delays
- Unfavorable economics due to cost of pipeline works, lost efficiency with gas treatment remote from power plant

4.3.5 Summary of Alternatives

The “do nothing” option is not viable given Afghanistan’s energy needs and its development aims. The location for the power plant has been determined and given the conclusions of the assessment above, it appears that the proposed option is the best in terms of socio-environmental criteria. Regarding technology for the power plant, this will be determined by the IPP, and as such, at the various impacts of the alternative technologies, e.g. air emissions, water use, etc., will be assessed further at the EA stage by the IPP. Several options exist for the disposal of waste hydrogen sulfide and the final disposal method has not yet been determined. This issue will be discussed further at the EA stage of the project.

5 Significant Issues to be addressed in the EA

5.1 Scope of Impacts

The following section of this report focuses on identification of the key significant issues that should be assessed further at the EA stage. The less than significant impacts will also be identified and mitigation measures proposed for these items, thereby eliminating them from further study at the EA stage of the project.

5.2 The Project Area

At the current stage of the project Scoping Study the project area is quite difficult to define as the project encompasses several components spread over a wide geographic location. In addition, the exact locations of some of the project components, such as the transmission lines, are not currently finalized. However, the actions proposed within the context of the project will be largely (but not entirely) confined to designated, government owned areas and the immediately adjacent areas. Notwithstanding the above impacts could occur over a considerably larger area, such as air emissions and impacts to groundwater, and the conceptual limits of the project must be expanded in accordance with the circumstances of the particular environmental characteristic under discussion.

5.3 Notion of Significance

Two key characteristics of possible impacts that should be considered in determining significance are "magnitude" and "importance". Magnitude assesses factors such as severity, size or extent of an impact. Importance relates to how many people are going to be impacted or affected by the project; the geographic scope of the project; duration and probability of occurrence of each impact; and any additional social or environmental consequences if the project proceeds (or doesn't proceed). Each impact of an action must be judged by these two characteristics. Generally, bigger impact (larger "magnitude") projects are more likely to need more detailed analysis. The characteristic of "importance" requires us to look at an impact in relation to the whole action. The short or long term or cumulative nature of the impacts also needs to be considered.

Physical Resources - Soils					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Soil Erosion	✔	The gas well drilling activities will occur at two existing relatively flat sites and two new sites. Soil erosion is therefore unlikely at the already degraded existing sites. In addition, the soils around the well drilling areas are not currently productive, nor are they likely to be used for any other purpose than that for gas extraction purposes in the future. As such soil erosion impacts are considered negligible.		None
	Spills / Leaks of hazardous liquids	✔	Spills and leaks of chemicals and oils could contaminate soils, which could in turn lead to contamination of groundwater. Contract provisions shall be included within gas well drilling Contracts to ensure that: • All fuel and chemical storage (if any) shall be sited on an impervious base within a berm and secured by fencing. The storage area shall be located away from any watercourse. The base and bund walls shall be impermeable and of sufficient capacity to contain 110 percent of the volume of tanks. • Any maintenance area shall be constructed on impervious hard standing with adequate drainage to collect spills; there shall be no maintenance activities on open ground. • Filling shall be strictly controlled and subject to formal procedures. Drip pans shall be placed under all filling areas. Waste oils shall be stored and disposed of by a licensed contractor. • All valves and trigger guns shall be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum shall be clearly marked. Measures shall be taken to ensure that no		None

			contaminated discharges enter any soils.		
Pipelines	Use of Productive soils		The precise location of the pipelines is not currently known, although it is most likely to avoid any productive agricultural or grazing lands.	✔	The location of the pipelines should be confirmed at the EA stage.
Field Infrastructure	Use of Productive soils		The precise location of the field infrastructure is not currently known, although it is most likely to avoid any productive agricultural or grazing lands.	✔	The location of the field infrastructure should be confirmed at the EA stage.
	Hazardous waste discharge	✔	The removal of natural gas liquids and water condensate will be achieved through passing the gas through a simple knockout separator. In a knockout separator, the expansion of gas into a larger vessel causes the condensate to drop out of the gas. The condensate then drains into a drying pan. Water will be the main component of the condensate and it will harmlessly evaporate in the dry site conditions. The likely volumes of undifferentiated NGLs will be negligible, and will have insignificant environmental impact.		None
Water Supply	None anticipated	✔	No impacts anticipated to soils from the Water Supply activity.		None
Gas Processing Plant	Spills / Leaks of hazardous liquids		Various chemicals and oils will be used at the Plant. The exact nature and volume of these materials is not currently known. Appropriate management of these chemicals, used and un-used should prevent spills and leaks to soils, however accidental spills may occur.	✔	Hazardous management plans and spill management plans should be drawn up at the EA stage of the project to manage this issue.
	Soil Erosion	✔	See Gas Well Drilling above.		None
	Use of Productive soils	✔	The Plant is located on existing unproductive Government owned land. No impacts are anticipated.		None
	Existing contaminated land		The Plant is located adjacent to the old gas processing plant. Given that there are no formal waste management practices in the area, it is possible that waste materials from this site, including oils and hazardous liquids, were dumped in and around the Plant, i.e. in the area to be occupied by the new facility.	✔	The issue of potential soil contamination at the site should be investigated further at the EA stage. This should include a limited soil sampling investigation.
Power Plant	Spills / Leaks of		See Gas Processing Plant above.	✔	See Gas Processing Plant above.

	hazardous liquids				
	Soil Erosion	✔	See Gas Well Drilling above.		None
	Use of Productive soils	✔	See Gas Processing Plant above.	✔	See Gas Processing Plant above.
	Existing contaminated land		See Gas Processing Plant above.	✔	See Gas Processing Plant above.
Substations	Leaks / Spills of Oil		Transformers and certain types of breakers contain mineral oil, which is essential for both insulation and cooling. This oil is relatively inert, indeed quite similar in many ways to clear motor oil. However, the quantity of oil at a substation is very large -– a single transformer with its associated equipment can contain up to 40,000 liters of oil. A major oil release would be a significant environmental incident.	✔	Hazardous management plans and spill management plans should be drawn up at the EA stage of the project to manage this issue.
Transmission Lines	Use of productive lands		The exact locations of the transmission lines are not currently known, however, it is likely that there will be some impacts to productive lands as the lines will cross the agricultural land to the east of the site and head towards Mazar-e-Sharif.	✔	The impacts of transmission lines to productive land should be assessed further at the EA stage as part of the cumulative impacts assessment.
	Soil Erosion	✔	Soil erosion around the construction areas for the transmission line towers could occur. These impacts can be mitigated by ensuring that contract documents include the following clauses: • During construction, the contractor will be responsible for ensuing material that is less susceptible to erosion will be selected for placement around embankments. • In addition he shall ensure re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local grasses and shrubs; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The engineer and the contractor will both be responsible for ensuring that embankments are		None

			monitored during continuously during construction for signs of erosion.		

Physical Resources – Geology and Seismicity					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Contamination of aquifers	✔	See Water Resources below.		See Water Resources below.
Pipelines	Gas Leaks		Ruptures of pipelines can be a significant health and safety risk.	✔	The location of the pipelines away from populated areas reduces the potential risk. However, an assessment of the potential health and safety risks associated with gas leaks should be prepared along with a management plan to mitigate any risks. This plan should include an assessment of earthquakes upon infrastructure.
Field Infrastructure	Gas Leaks	✔	See pipelines above.		None
Water Supply	None identified	✔	No mitigation actions required.		None
Gas Processing Plant	Re-injection		One of the potential options for disposal of waste H_2S and CO_2 from gas processing is re-injection. The impacts to geological formations may be significant depending on the volumes of gas, technologies used and the geology of the area.	✔	The impacts of re-injection should be studied further at the EA stage if this technology is to be used.
Power Plant	Gas Leaks		See pipelines above.	✔	See pipelines above.
Substations	None identified	✔	No mitigation actions required.		None
Transmission Lines	None identified	✔	No mitigation actions required.		None

Physical Resources – Water Resources					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Contamination of Aquifers	✔	There are multiple ways in which groundwater aquifers can be contaminated by gas well drilling, mainly during the initial drilling process. The drilling process can also impact upon ground water volumes. As such, the project could impact negatively upon aquifers. Aquifers can also be contaminated by seepage/migration of water in improperly cased or cemented well bores. However, as stated in the section of Hydrology above (Section 3.3) the Qarakent, the major aquifer in the region, does not extend to the Juma/Bashikurd Field. There are some shallow, but saline, shallow aquifers within the field. There are two main steps for groundwater protection during drilling: (1) Protecting fresh water zones by casing, properly cemented ("surface casing"). (2) Using a mud (drilling fluids) program that maintains sufficient pressure on water-bearing formations to keep water from coming into the well and prevent drilling fluids from being pushed into the water-bearing zone. The draft environmental contract terms prepared for the MoM (Appendix F) has a clause (Clause 8) on water protection. Casing and cementing are addressed in clauses 2.4.3., and 2.6.		None required.

	Other Groundwater contamination	✔	The rig may generate effluent from storm water run-on and run-off. This potential impact can be eliminated by collecting rain water in a perimeter drain(s) and treating prior to release. In addition, ground and surface water can be impacted by accidental spills and releases of fuel, oil, or chemicals. Mitigation measures for spills and leaks of liquids are discussed above under Soils.		None required.
	Produced Water	✔	In addition to drilling mud, produced water (water that is produced along with the gas) will result from drilling actions. The water will be discharged to a settling pond where evaporation will take place. The amounts of produced water are likely to be low however. The Contractor shall be responsible for following the mitigation measures and guidelines for produced water outlined within Clause 6.4 of the draft environmental terms (Appendix F).		None required.
Pipelines	None identified	✔	No mitigation required.		None
Field Infrastructure	None identified	✔	No mitigation required.		None
Water Supply	Impacts to aquifer		Consultations with the MoM revealed that the exact status of the Qarakent Aquifer is not known. Water demands from the power plant could impact upon the aquifer and its users if the aquifer supply and recharge rates are insufficient to meet demands.	✔	Studies of the Qarakent Aquifer should be undertaken by a Hydrologist in conjunction with the MoM to assess volumes, extent and current water use from the aquifer.
	Impacts to surface water courses		According to existing environmental document, the Qarakent Aquifer is recharged through snow melt and rainfall, via leakage from irrigation channels and from surface water courses. Depletion of aquifers through overuse by project activities may lead to a drop in the water table, which in turn can lead to seepage from surface water courses to the aquifer. This may lead to a change in the volume and flow of surface water courses that supply the irrigation system in the Sheberghan area. This will impact upon the ecology of the rivers and the water users.	✔	The relationship between the Qarakent Aquifer and surface water courses should be studied by a Hydrological specialist in conjunction with the MoM.

Gas Processing Plant	Water use	✔	It has been estimated that approximately 3,600 M^3 of water per annum will be required for the Gas Processing Plant, this volume is insignificant given that the Qarakent Aquifer reportedly can supply at least 2,000 m^3 per day.		None
	Liquid waste disposal		See the section on Waste Management below.	✔	See the section on Waste Management below.
	Surface water run-off	✔	See Gas Processing Plant above.		None
Power Plant	Water use		Estimates of water use at the power plant range from negligible to more than 2,000 m^3 per day depending upon the technology employed. Indications from the MoM suggest that there is sufficient water to supply with power plant at the highest rates from the Qarakent Aquifer, but the recharge rates of the Qarakent Aquifer are not known, and as such the aquifer could deplete over time.	✔	The status of the Qarakent Aquifer should be studied by a Hydrologist in conjunction with the MoM to determine the recharge rates of the Aquifer and the availability of water over a 20-30 year period.
	Liquid waste disposal		See the section on Waste Management below.	✔	See the section on Waste Management below.
	Surface water run-off	✔	See Gas Processing Plant above.		None
Substations	None identified	✔	No mitigation required.		None
Transmission Lines	Crossing of surface water courses	✔	The exact locations of the transmission lines are not yet know, however, in order to reach Mazar-e-Sharif to the east the lines will most likely cross surface water courses including the Darya-I Sya and Darya-I Safid, this could lead to construction related impacts to the water course, however such impacts are likely to be minimal as works will not occur in the rivers, but may potentially occur close to the river banks. To mitigate this potential impact it is recommended that transmission line towers be located at least 50 meters from the river.		None

Physical Resources – Air Quality and Climate					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Vehicle and Equipment emissions & Dust	✔	Drilling activities require a variety of equipment that that run directly on diesel fuel or are powered by diesel generators. This will give rise to air emissions, including SOx, NOx and PM. However, given the location of the well fields away from sensitive receptors (more than 3km) no mitigation actions are deemed necessary.		None
	Odor	✔	During windless conditions (especially in areas of thermal inversion), project-related odors may be detectable at more than a mile from the source. However, the wells are located more than three kilometers from urban settlements and as such no odor impacts to these areas are anticipated.		None
	Flaring	✔	The wells will be flared during testing and well work, but not otherwise. Gas will be flared through a choke that will restrict the flow; potential open flow volume is calculated from that flow rate and pressures. The probable flow testing will be done over two days, the first day to flow the wells, then a day to allow pressure to rebuild and measured. Clause 9 of the draft environmental contract provisions (Appendix F) and Clause 4.3 of the draft safety and health contract terms (Appendix G) provide guidelines for flaring activities.		None required.
Pipelines	Construction impacts	✔	Short term construction related air quality impacts may occur, but due to distances involved, they will not impact significantly on the local population.		None
Field Infrastructure	Knockout Separator		Potential air emissions from the knockout separator.	✔	Emissions from the knockout separator should be studied further at the EA stage.
	Construction	✔	See Pipelines above.		See Pipelines above.

	impacts				
Water Supply	Pump Station emissions	✔	A diesel powered generator will be required at the pumping station. This will result in emissions to air. These impacts are likely to be minimal, and once the power station comes on line a connection to the pumping station will be made and the diesel generator will be used for standby purposes only.		None
Gas Processing Plant	Flaring		Flaring is one of the options on the table for the removal of H_2S and CO_2 at the Gas Processing Plant. Although this is not considered the most suitable option at this stage, it is still under consideration. Flaring of H_2S will result in significant levels of SO_2 being emitted.	✔	The levels of SO_2 emissions should comply with World Bank standards, and as such the emissions levels and impacts should be assessed further at the EA stage.
	Construction impacts	✔	Short term construction related air quality impacts may occur, but due to distances involved, they will not impact significantly on the local population.		None
Power Plant	Air emissions		Emissions to air from the operation of the power plant will occur; pollutants include NOx, CO_2, CO, VOCs and PM (although PM levels will be insignificant). The emissions levels will depend upon the type of technology employed at the power plant by the IPP. The distance to sensitive receptors reduces the significance of the air emissions from the power plant, but levels of NOx should comply with World Bank guideline levels and as such this issue should be looked at in greater detail.	✔	The EA prepared by the IPP should assess the emissions levels for all power plant technologies. In addition, it may be prudent to undertake atmospheric dispersion modeling to further assess potential impacts.
	Construction Impacts	✔	Short term construction related air quality impacts may occur, but due to distances involved, they will not impact significantly on the local population.		None
Substations	None identified	✔	No mitigation required.		None
Transmission Lines	Construction impacts	✔	Air quality impacts may occur in, or close to populated areas, these impacts will be short term and localized and are not anticipated to result in significant impacts.		None

Biological Resources – Flora and Fauna					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Impacts to desert fauna	✔	There is little in the way of flora and fauna within the project Area which is heavily disturbed by human activity.		None
Pipelines	Impacts to desert fauna		Recent reports indicate that there is little in the way of flora and fauna within the project area. However, it would be prudent to ensure that there are no unique fauna in the area before the project commences.	✔	Further assessment of the flora and fauna in the project area should be undertaken by a biologist at the EA stage of the project.
Field Infrastructure	Impacts to desert fauna				
Water Supply	Impacts to ecology of surface water courses		As mentioned above, over extraction of groundwater may impact upon the flow of surface water courses. This in turn could lead to impacts to the ecology of the Darya-I Sya and Darya-I Safid.	✔	The suitability of the Qarakent Aquifer should be studied further to ensure that there will be no impacts to surface water volumes.
Gas Processing Plant	No impacts identified	✔	The proposed location is already heavily disturbed by human activity. No mitigation required.		None
Power Plant	No impacts identified	✔	The proposed location is already heavily disturbed by human activity. No mitigation required.		None
Substations	No impacts identified	✔	Both Substations will be located on existing substation sites. No mitigation required.		None
Transmission Lines	Impacts to desert fauna		See Gas Well Drilling above.	✔	See Gas Well Drilling above.
	Impacts to aquatic flora and fauna	✔	The exact locations of the transmission lines are not yet know, however, in order to reach Mazar-e-Sharif to the east the lines will most likely cross surface water courses including the Darya-I Sya and Darya-I Safid, this could lead to construction related impacts to aquatic flora and fauna, however such impacts are likely to be minimal as works will not occur in the river itself, but may potentially occur close to the river banks. To mitigate this potential impact it is recommended that transmission line towers be located at least 50 meters from the river.		None

Biological Resources – Protected Areas					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling Pipelines Field Infrastructure Water Supply Gas Processing Plant Power Plant Substations Transmission Lines	None identified	✔	No protected areas identified within 100 kilometers of the project area.		None

Waste Management & Hazardous materials					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Waste water (Drilling Mud)	✔	Drilling mud, a fluid used to aid the drilling of boreholes into the ground, in varying degrees can be toxic. Wastes associated with drilling fluids include oil derivatives (e.g., such as polycyclic aromatic hydrocarbons (PAHs), spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel, and drilling mud additives (including potentially harmful contaminants such as chromate and barite). Disposal of the mud can also be problematic if there are no adequate disposal options. As a general practice, Afghan Gas/Northern Hydrocarbons collects and reconditions as much of the drilling fluids as possible. Procedures for this process, see Clauses 7.5 (Reserve, Storage, Settling, and Other Pits) and 12.5		None required other than ensuring compliance with draft environmental policy.

			(Surface Reclamation) of the draft environmental protection contract terms (Appendix F).		
	Radioactive materials	✔	Radioactive-tracer logs are used to determine injection-flow profiles and detect channels or leaks. They may also be used in production wells, but care must be taken to isolate the fluids on surface until the tracer has decayed to safe levels. The tracer is a radioactive isotope that is soluble in water, oil or gas. Afghanistan has now designated a representative under the IAEA treaties for licensing import/export of radioactive sources, the Ministry of Interior and Ministry of Mines is working on defining the procedure. China National Oil Company, which is doing exploration work in Afghanistan, has a radioactive source license, and the MoM has suggested that the contractor could arrange to have them provide the source for logging.		None other than ensuring appropriate licenses are in place prior to drilling.
	General Inert Construction and Operational Waste	✔	Small quantities of inert construction and operation waste will be generated at the sites. Guidelines for the disposal of waste, both hazardous and inert are described by the draft environmental contract terms (Appendix F).		
Pipelines	General Inert Construction Waste		Small quantities of inert construction and operation waste will be generated at the sites. This waste, although inert, cannot simply be burnt or buried on site without adequate controls. In addition, there is no formal waste disposal sector in the region.	✔	A waste management program should be established at the EA stage to manage the issue of wastes arising on site. This plan could be part of a project wide plan whereby wastes from all sites are sent to one central project location for disposal.
Field Infrastructure	Hazardous wastes		According to previous environmental studies, there will be no hazardous waste generated at the site of the knockout separator.	✔	This issue should be examined further at the EA stage to ensure that this is still the case.
	General Inert Construction and Operational Waste		See Pipelines Above.	✔	See Pipelines Above.
Water Supply	None identified	✔	No mitigation actions required.		None
Gas Processing	Liquid waste		Liquid waste will be generated at the site, both in terms of	✔	Treatment and disposal methods

Plant			waste from the gas processing itself and also sewage water. The treatment and disposal methods for these wastes are currently unknown.		should be assessed.
	General Inert Construction and Operational Waste		See Pipelines Above.	✔	See Pipelines Above.
	Hazardous wastes		Hazardous wastes will be generated at the site. The types and volumes of waste have yet to be determined, although as much as 280 tons per annum of waste lube oil could be generated according to previous studies. There is no formal waste disposal service for hazardous waste in the region.	✔	A hazardous waste management plan should form part of the Waste Management Plan prepared during the EA stage of the project.
	Hazardous Materials		Quantities of hazardous materials will be stored on site. The types and volumes of the materials have yet to be determined, but will include lube oils, glycol, solvents, amine solution, etc. Poor management of these materials can result in significant impacts to the health and safety of workers and also presents a threat to soils and groundwater,	✔	Hazardous materials management plans should be established at the EA stage.
Power Plant	Liquid waste		See Gas Processing Plant above.	✔	See Gas Processing Plant above.
	General Inert Construction and Operational Waste		See Pipelines Above.	✔	See Pipelines Above.
	Hazardous wastes		See Gas Processing Plant above.	✔	See Gas Processing Plant above.
	Hazardous materials		See Gas Well Drilling Above.	✔	See Gas Well Drilling Above.
Substations	General Inert Construction Waste		See Pipelines Above.	✔	See Pipelines Above.
	Waste oil		Spills of oils could occur at the substations.	✔	Recommendations should be made for the design of the Substations to ensure that waste oils do not leach from the site.
	Herbicides and Pesticides		Buried beneath the gravel in a substation yard is a grid of wires that functions as the grounding for the high voltage equipment. It is important to prevent this ground grid from	✔	The storage and management of herbicides should be included within the hazardous materials management

			being compromised by vegetation growth, in order to ensure safety for our employees and the public. For this reason substation yards are regularly maintained by using a variety of herbicides		plan.
	PCBs		PCBs, originally used as chemical stabilizers in electrical equipment insulating oils, were common in equipment manufactured until the late 1970's. It is possible that they could still be present in the substation proposed for rehabilitation.	✔	A survey of the existing substation should be undertaken to assess the PCB status of this facility.
	Hazardous Materials		See Gas Processing Plant above.	✔	See Gas Processing Plant above.
Transmission Lines	General Inert Construction and Operational Waste		See Pipelines Above.	✔	See Pipelines Above.

Land Use					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	None identified	✔	The gas well sites are located on government owned lands, no impacts identified.		None
Pipelines	Impacts to productive land		The precise location of the pipelines is not currently known, although it is most likely to avoid any productive agricultural or grazing lands.	✔	The location of the pipelines should be confirmed at the EA stage.
Field Infrastructure	Impacts to productive land		The precise location of the field infrastructure is not currently known, although it is most likely to avoid any productive agricultural or grazing lands.	✔	The location of the field infrastructure should be confirmed at the EA stage.
Water Supply	Depletion of water resources		Depletion of water from the Qarakent Aquifer could have negative impacts to agriculture and water users in the area.	✔	Studies to confirm the suitability of the Qarakent Aquifer should be undertaken in conjunction with MoM.
Gas Processing Plant	Depletion of water resources	✔	Water use for the gas processing plant will be approximately 3,600 m^3 a year annum; existing estimates indicate that the Qarakent Aquifer can supply at least 2,000 m^3 per day. As such no significant impacts to the aquifer are anticipated from the groundwater requirements		None

			of the Gas Processing Plant.		
Power Plant	Depletion of water resources		See water supply above.	✔	See water supply above.
Substations	None identified	✔	Both substations are located on existing government owned sites. No impacts identified.		None
Transmission Lines	Impacts to productive land		The exact locations of the transmission lines are not currently known, however, it is likely that there will be some impacts to productive lands as the lines will cross the agricultural land to the east of the site and head towards Mazar-i-Sharif.	✔	The impacts of transmission lines to productive land should be assessed further at the EA stage
	Impacts to property		Unlike all of the above project components, it is unlikely that all of the land required for the transmission lines will be government owned property. Accordingly, land acquisition may be required.	✔	The location of the transmission lines should be established during the EA process and any land acquisition issues identified.

Infrastructure					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Impacts to local roads, e.g. dust, noise, safety.	✔	Due to the limited size of the airport at Sheberghan (a dirt airstrip with no control tower) equipment will be transported to the site, probably through Tajikistan, Uzbekistan or Turkmenistan on local roads. Mitigation actions to prevent and reduce impacts include: • Direct Routes – The most direct route shall be used to the sites whilst at the same time avoiding any sensitive areas where possible, such as schools, hospitals, etc. • Watering and cleaning of roads – any local roads used within the vicinity of the project works shall be regularly cleaned of excessive mud during wet weather and shall be watered during periods of dry weather to prevent dust impacts.		None

Pipelines	None identified	✔	Pipelines will traverse semi-desert, no impacts are anticipated to infrastructure and no mitigation is required.		None
Field Infrastructure	None identified	✔	Field infrastructure is located in semi-desert, no impacts are anticipated to infrastructure and no mitigation is required.		None
Water Supply	Impacts to irrigation networks		The relationship between the Qarakent Aquifer and the Darya-I-Sya and Darya-I-Safid is not known. It is possible that over- extraction from the aquifer may result in increased seepage from the rivers to the aquifer and consequently affect the water availability for irrigation systems within the Sheberghan region.	✔	Further studies of the relationship between the rivers and the Qarakent aquifer should be undertaken at the EA stage.
Gas Processing Plant	Impacts to local roads, e.g. dust, noise, safety.	✔	See mitigation for Gas Well Drilling above.		None
Power Plant					
Substations					
Transmission Lines					

Social Impacts					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Incorporated in the Project			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Job creation & Imported Labor	✔	The project will require skilled and un-skilled labor for the construction and operation of the facilities. It is likely that the majority of un-skilled labor can be sourced from the local population, and this will have significant beneficial economic impacts to the area, especially Sheberghan and to a lesser extent Sar-I Pul. Contract provisions should ensure quotas of local workers for un-skilled labor, and this should include provisions for employment of women. Skilled labor may include engineers, construction equipment operators and plant operators. It is unlikely that many of these skilled positions can be filled with local residents. As such, the facility operators will need to import labor, including expatriates, to fill these positions. Programs should be established by DABs and other agencies to train Afghan workers to eventually take over these positions.		None
	Health and Safety Issues	✔	During drilling, subsurface pressure is controlled by the hydrostatic pressure exerted by the drilling mud on the formation. Rarely, through human error, mechanical failure, or both, a loss of well control can occur. This can result in the escape of gas to the atmosphere at the maximum rate attainable. One of two events will occur when this happens: (1) the gas will find an ignition source at the rig site and create a jet fire; or (2) the gas will expand and, if an ignition source is present, create a flash fire. The Contractor shall follow the Draft Health and Safety contract terms (Appendix E), specifically Clause 7 (Monitoring Systems and Alarms) to limit health and safety impacts.		None required other than strict adherence to the health and safety policy.

Pipelines	Job creation & Imported labor	✔	See Gas Well Drilling above.		None
Field Infrastructure	Job creation & Imported labor	✔	See Gas Well Drilling above.		None
Water Supply	Over extraction of water resources		Over extraction of groundwater may have negative impacts on the local population.	✔	The water availability of the Qarakent aquifer should be assessed further.
Gas Processing Plant	Job creation & Imported labor	✔	See Gas Well Drilling above.		None
	Health and safety issues		Operation of a gas processing plant involves multiple health and safety risks.	✔	Assessment of the potential health and safety risks and preparation of a management plan to mitigate these risks.
Power Plant	Job creation	✔	See Gas Well Drilling above.		None
	Health & safety issues		Operation of a 200MW Power Plant involves multiple health and safety risks.	✔	Assessment of the potential health and safety risks and preparation of a management plan by the IPP to mitigate these risks.
	Imported labor	✔	The power plant will be operated by an IPP, as such the decisions regarding employment of local staff is largely their decision and out of the scope of this study.		None
	Induced growth		Once complete, the region will have access to a constant supply of electricity which will, in all likelihood, lead to population expansion as the economy improves. This will lead to pressure on other resources such as water supply, infrastructure and social services.	✔	The potential induced growth impacts should be studied further in the project EA as part of an assessment of cumulative impacts.
Substations	Job creation & Imported labor	✔	See Gas Well Drilling above.		None
Transmission Lines	Job creation & Imported labor	✔	See Gas Well Drilling above.		None
	Health and safety		Construction and maintenance of transmission lines involves multiple health and safety risks.	✔	Assessment of the potential health and safety risks and preparation of a management plan to mitigate these risks.

Noise & Vibration					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Above			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling	Flaring	✔	Gas well drilling activities may include flaring, although this has yet to be determined. Flaring does result in increased noise levels, however, the Bashikurd and Juma well sites are located at least three kilometers from any settlement and more than twenty kilometers from Sheberghan and as such noise from flaring will not impact upon any sensitive receptors or settlements.		None
	Construction & Operations noise	✔	Construction of the well drilling components and the actual well drilling itself will result in elevated levels of noise. Noise from drilling at other similar projects has been measured as 115 dBA at the source to above 55 dBA at distances 1,800 feet (549 meters). However, as stated above, the distance of these activities from any sensitive receptors precludes the need for any mitigation measures. However, workers exposed to high levels of noise should be provided with appropriate noise protection devices for ears.		None
Pipelines	Construction noise	✔	The location of the pipelines away from sensitive receptors precludes the need for noise mitigation with the exception of noise protection devices for workers during the construction phase. There will be no operational noise impacts with the exception of any short term localized maintenance works.		None
Field Infrastructure	Construction & Operations noise	✔	The location of the field infrastructure away from sensitive receptors precludes the need for noise mitigation with the exception of noise protection devices for workers during the construction phase.		None
Water Supply	Construction & Operations noise	✔	Pump house equipment may result in some slightly elevated noise levels. However, the fact that the pumps are enclosed within a building and by siting these facilities away from residential areas, any noise related impacts will		None

			be minimal.		
Gas Processing Plant	Construction & Operations noise	✔	Construction and operation of the gas processing facility and the Power Plant will lead to elevated noise levels at the site. However, the site is located adjacent to the former gas processing plant more than three kilometers from the nearest residential areas. As such, there will be no significant noise or vibration impacts to sensitive receptors or settlements. However, workers exposed to high levels of noise should be provided with appropriate noise protection devices for ears. This issue will be included within the health and safety requirements of the project EA.		None
Power Plant	Construction & Operations noise	✔			
Substations	None identified	✔	No significant noise impacts identified.		None
Transmission Lines	Construction blasting and drilling	✔	It is possible that blasting and drilling activities will be required during the construction of the foundations for transmission line towers. This may impact upon sensitive receptors, depending on the location of the lines. Noise and blasting impacts can be mitigated by incorporating the following conditions in Contractors contracts: • The contractor should prepare a blast plan prior to the commencement of works. The plan, which shall be approved by the construction supervision consultant / engineer, should ensure that: - Before the firing of any blast, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material, to prevent fly rock that may result in damage to life or property. - The contractor shall protect all overhead and underground utilities prior to blasting and immediately repair or replace any damaged by the blasting operations. - Warning signs and public notification are required to avoid all risks to the public that use the roadway.		None

			- Blasting shall be restricted to the times specified by the engineer - The contractor shall use the utmost care so as not to endanger life or property, or disturb materials outside the limits of the excavation. - When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time, and workers shall be stationed to warn people before firing any blasts. The warning signs will state the time and date of each blast. - The contractor is forewarned that existing residential and commercial properties may be located in close proximity of the blast and that these properties shall be protected. The contractor shall be responsible for all damage to these properties, including providing suitable temporary housing to residents or business occupants until repair work is completed.		
	Operations noise including Corona Discharge	✔	Operational noise impacts will be negligible with the exception of any short-term localized maintenance works. In addition, it is possible that corona discharge noise could become a nuisance if located close to residential areas. However, this issue can be reduced by increasing the spacing between the conductors, increasing the diameter of the conductor, using bundled conductors, or by using corona rings or grading rings.		

Historic and Cultural Resources					
Potential Impacts		Impacts Avoided or Otherwise Mitigated by Measures Outlined Below			Aspects Requiring Further Analysis in the EA (other than verification of provisions in contract documents)
		Yes	Description of Issue and Mitigation	No Insufficient Data	
Gas Well Drilling Pipelines Field Infrastructure Water Supply Gas Processing Plant Power Plant Substations Transmission Lines	None identified	✔	No historic and cultural resources identified within the project Area. However, chance finds of archeological items could occur. Accordingly, contractors contracts shall include the following: • In the event of unanticipated discoveries of cultural or historic artifacts (movable or immovable) in the course of the work, the sub-contractor shall take all necessary measures to protect the findings and shall notify the contractor and provincial-level representatives of the archaeological committee and the Ministry of Youth and Culture. If continuation of the work would endanger the finding, project work shall be suspended until a solution for preservation of the artifacts is agreed upon.		None

5.4 Cumulative, Indirect and Induced Impacts

5.4.1 Cumulative Impacts

The project comprises all of the elements to take natural gas from the ground to the consumer in a useable form. As such, there are no significant cumulative impacts of the project as all the components required to make this happen are included within this report. For example, the project does not intend to just drill for gas. If this were the case a cumulative impact would be the burning of the gas and its associated emissions from the power plant using the gas.

If one potential cumulative impact should be discussed it is the issue of climate change. The project will result in the combustion of a significant quantity of natural gas, which will emit carbon dioxide, a greenhouse gas, to the atmosphere. Greenhouse gases are considered to be one of the fundamental reasons of climate change. One power plant on its own will not affect global levels of greenhouse gases, but when combined with other fossil fuel burning power plants the impacts are significant. However, when considering the case of Afghanistan and climate change we should note that most of Afghanistan's internal power sources are renewable in the form of hydropower. According to the UN Afghanistan's actual contribution to global greenhouse gas emissions is one of the lowest in the world - 814,000 tons, slightly more than the Faroe Islands (Pakistan by comparison emits 164,000,000 tons annually). As such, the construction of one 200MW gas fired power plant will not have significant impacts to global climate change. There is little potential for climate change to impact negatively on the project itself. Any change in temperature by a few degrees, plus or minus is not anticipated to impact negatively on supplies of gas or infrastructure as are any increases or decreases in rainfall.

5.4.2 Indirect and Induced Impacts

The project will result in an increased supply of power within Afghanistan. It is assumed that some power will be used locally, and as such this will stimulate the local economy, which does not currently have a reliable supply of power. Lack of power prevents any significant form of industrial activity, meaning that Afghanistan has to import most of its produced goods. Lack of power also affects agriculture, which needs power to run production facilities, and cold storage which in turn improves the life span of fruits and vegetables. Lack of power also limits access to media, which is a powerful source of education via news programs and the internet. Accordingly, when power becomes available on a constant basis rapid growth is predicted within the industrial and agricultural sectors. This will lead to induced growth within Sheberghan and other towns and villages receiving power from the project. Induced growth could result in a strain on public services, such as health and educational facilities which may not be equipped to service a growing population. This issue will be assessed further at the EIA stage to determine what impacts induced growth could have in the region and potential measures to manage this issue.

6 Conclusions and Recommendations

6.1 Issues to Be Eliminated from Further Study

The following issues have been identified that have less than significant impacts and, given the application of the aforementioned mitigation measures, can be eliminated from further study at the EA stage of the project.

- Cultural and Historical Resources – No cultural or historical resources identified within the project Area.
- Protected Areas – No Protected Areas identified within 100 kilometers of the project Area.
- Noise and Vibration – no sensitive receptors within the vicinity of project components (excluding transmission lines)

6.2 Issues to receive further Consideration during the EA Process

The following issues have been identified that may result in significant environmental impacts if the project proceeds. Further assessment and studies of these issues are required at the EA stage of the project to fully quantify and mitigate the potential impacts.

- Soils – Potential issues relating to soil contamination, spills and leaks of hazardous materials and the use of productive lands;
- Seismicity and Geology – Issues relate to re-injection of gases and gas leaks
- Water Resources – Potential impacts may occur to aquifers, surface water courses and to water users;
- Air Quality and Climate – Potential impacts to be studied further include atmospheric emissions from operations of the power plant and gas processing plant.
- Flora and Fauna – Potential impacts to desert fauna and the ecology of surface water courses;
- Waste Management and Hazardous Materials – Issues relating to hazardous materials and waste, general waste management and PCBs;
- Socio-economic issues – Impacts include health and safety issues, induced growth and the over extraction of water resources;
- Infrastructure – Potential impacts to irrigation networks and;
- Land Use – Potential issues include impacts to productive land and property and depletion of water resources.

6.3 Project Components Requiring EA

6.3.1 Gas Well Drilling

This scoping study indicates that all activities relating to gas wells can be mitigated via the measures outlined within this study and incorporation of the mitigation measures within contracts as specified within this study. No further assessment of this activity is warranted.

6.3.2 Pipelines and Field Infrastructure

The scoping study has indicated elements of this portion of the project require further assessment at the EA stage of the project. Accordingly, as this component will be assessed as part of the USAID EA, of which the scope of works it outlined below.

6.3.3 Water Supply

This report has also indicated that this portion of the project require further assessment at the EA stage of the project due to the uncertainty over water supply and use. Accordingly, as this component will be assessed as part of the USAID EA, of which the scope of works it outlined below.

6.3.4 Gas Processing Plant

Numerous potential environmental impacts have been identified associated with this USAID funded activity that require further study, as such this project component will be assessed as a core part of the USAID funded EA.

6.3.5 200MW Power Plant

As with the gas processing plant, several potential environmental impacts have been identified that cannot be mitigated at this stage of the project without further assessment. This portion of the project will be funded by an IPP and potentially OPIC. As such, the responsibility for the preparation of this EA will be with the developers.

6.3.6 Substations

The Scoping Study has indicated elements of this portion of the project require further assessment at the EA stage of the project. Accordingly, as this component will be assessed as part of the USAID EA, of which the scope of works it outlined below.

6.3.7 Transmission Lines

The transmission line component of the project has been reviewed in this scoping study as it helps to understand the potential impacts of the project in its entirety. However, it should be noted that the Transmission Line components will not be studied as part of the SGGA EA, rather, they will be reviewed in detail by a separate Environmental Assessment process under the direction of the ADB (as this component is ADB funded). It is assumed that this EA, or IEE, will be undertaken in parallel with the SGGA EA and as such the findings of the ADB study will most likely be included within the SGGA EA as an Annex. This is assumed to be the most practical option as it avoids two agencies spending time and resources on two separate assessments of the same project.

6.4 Proposed Approach to Address Significant Issues

The Ministry of Mines, supported by AEAI, shall start the EA process for the components indicated above as soon as the scoping statement approval has been received from the Bureau Environment Officer (BEO) in Washington and from NEPA in Kabul. This is anticipated to be during late winter 2013. The EA will then be prepared within a timescale of three to four months, whereupon it will be submitted to the Mission Environment Office in Kabul, and NEPA for review, comment and approval.

AEAI will review the expected impacts of constructing the specific components of the project. The EA will be prepared based on physical examination of the project Area and its environs and well as review of existing environmental documents, engineering plans and equipment selection decisions.

Project works will be consistent with applicable local regulations and routine best management practices will be employed. The EA will follow the 22 CFR 216 guidelines as well as the NEPA guidelines and will incorporate World Bank and IFC Environmental Assessment & EHS regulations and guidelines as best practice. The EA will also identify commitments on the part of any other project proponents to mitigate any potential concerns. Adherence to these commitments during construction and operation will minimize the potential for any adverse environmental impacts.

6.5 Scope of Works and Schedule for the EA

As stated above, the EA will comply with the environmental regulations of USAID and NEPA and will adopt World Bank and IFC EHS Guidelines as best practice. Accordingly the Scope of Work outlined below shall be followed.

6.5.1 General Scope of Work

The broad scope of the work is to carry out Environment Impact Assessment of the Sheberghan Gas Processing Plant and the pipelines and field work that transmit the sour gas to the facility to the Processing Plan and the Sub-stations. The assessment shall include a review of positive and negative impacts and the preparation of an Environmental Management Plan (EMP) to mitigate the adverse effects, including the socio-economic aspects for project affected people. The scope also includes preparation of monitoring plan for implementation of EMP.

6.5.2 Study Area

The study area is classified as follows:

- Pipelines and Field Infrastructure – The area includes a corridor 100 meters wide, or 50 meters either side of the pipelines.
- Gas Processing Plant – To assess impacts on the ground the study area shall include the processing plant itself, an area one kilometer in radius from the plant. To assess potential impacts to air, the study area should be extended to an area 20 kilometers radius from the Plant.
- Sub-stations – The study area shall comprise an area fifty meters radius of the substation.

6.5.3 Site Visits

The Consultants should undertake several site visits as follows to the site of the gas processing plant and also to the sub-station sites. It may not be feasible to undertake a survey of the pipeline route and field infrastructure locations at this stage of the project due to potential impacts from UXO. The site visits shall include at least two rounds of stakeholder consultations and described below.

6.5.4 Public Consultations

Two rounds of public consultations shall be undertaken by the consultant. The first will include consultations with stakeholders in Sheberghan as part of a public meeting. DABS will arrange the meeting which to be held within a public facility in Sheberghan. Villagers shall be informed of the meeting two weeks prior to the meeting date and the meeting shall be open for any person to attend. The purpose of the first round of consultations is to introduce the project to the local population and explain the project actions and to ascertain the local opinions regarding the project and its potential impacts. A second round of consultation will be held on completion of the Draft EIA. The meeting will again take the form of a public meeting open to all. The purpose of the second round consultations will be to discuss the findings of the EIA and its recommended mitigation measures. The results of all consultations shall be included within the report including a list of participants and meeting dates.

6.5.5 EIA

The EIA itself shall comprise the following tasks:

1. Update Project Description – The Consultant shall update the project description to include precise details of the scope of works for the gas processing plant, pipelines and sub-stations. This should include diagrams and maps indicating processes and locations of facilities.

2. Review Project Alternatives – This section of the report should comprise and update of the alternatives section within the Scoping Study. The section should discuss any additional alternatives that have been assessed relating to locations, technologies, etc.
3. Review Existing Baseline Data – The Consultant shall undertake a detailed desk-top study of existing data and consult with relevant agencies to obtain additional data.
4. Site Visits – The Consultant shall undertake site visits as necessary to assess the existing condition on the ground. This activity can be combined with the Public Consultations.
5. Additional Studies – External specialists shall be contracted to undertake the following studies:
    - Hydrological study (including baseline water quality monitoring). The purpose of this study is to assess the hydrogeological conditions of the project area and the potential impacts of the project. For the purpose of this study it is recommended that one international hydrology expert be engaged. The final scope of works for this study will be completed by the AEAI Environmental Specialist after the first site visit as part of the EIA to determine sampling locations. The cost of this study is not anticipated to exceed $ (financial information omitted).
    - Soil Sampling – An external consultant shall be engaged to assess the soil conditions within the proposed location of the gas processing plant. The detailed Scope of Work for this activity will be prepared by the AEAI Environmental Specialist after the first site visit, including parameters to be monitored and locations. As an indicator, approximately 20 – 30 samples are anticipated comprising 20 parameters across the site. It is assumed that the samples will be sent to a laboratory for assessment outside of Afghanistan. The costs of this study shall not exceed $ (financial information omitted).
    - Dispersion Modeling – To assess impacts to air quality a consultant shall be engaged to model emissions to the atmosphere. The precise scope of works for this activity will be prepared by the AEAI environmental specialist during the EIA phase of the project. Costs of this task are not anticipated to exceed $ (financial information omitted).
6. Consultations – The Consultant shall undertake consultations as outlined above.
7. Report Preparation – The Consultant shall prepare a draft report within eight to ten weeks after completion of the first site visit and consultations. The report shall include the findings of the external specialists. The draft report shall be sent to USAID for review and shall be used as the basis for the second round of consultations. The comments received on the draft report from USAID and consultations shall be in the final EIA which shall be reviewed and approved by USAID REA and BEO.

6.5.6 Report

The EA shall follow the EA requirements of USAID and NEPA (see Exhibit 6-1 for full requirements of each Donor / Agency), as such, as an indicator, the contents shall include at least the following:

1. Summary. The summary shall stress the major conclusions, areas of controversy, if any, and the issues to be resolved.
2. Policy, legal, and administrative framework. Discusses the policy, legal, and administrative framework within which the EA is carried out. Explains the environmental requirements of any co-financiers. Identifies relevant international environmental agreements to which the country is a party.
3. Purpose. The Environmental Assessment shall briefly specify the underlying purpose and need to which the donors and agencies are responding.
4. Project description. Concisely describes the proposed project and its geographic, ecological, social, and temporal context, including any offsite investments that may be required. Indicates the need for any resettlement plan or indigenous peoples development plan. Includes a map showing the project site and the project's area of influence.

5. Alternatives Including the Proposed Action. This section shall present the environmental impacts of the proposal and its alternatives in comparative form, thereby sharpening the issues and providing a clear basis for choice among options by the decision-maker.
6. Affected Environment/Baseline Data. The Environmental Assessment shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in the Environmental Assessment shall be commensurate with the significance of the impact with less important material summarized, consolidated or simply referenced.
7. Environmental impacts / Environmental Consequences. Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any residual negative impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention.
8. Environmental management plan (EMP). Covers mitigation measures, monitoring, and institutional strengthening.
9. Appendix - List of EA report preparers. Individuals and organizations.
10. Appendix – References. Written materials both published and unpublished, used in study preparation.
11. Appendix - Record of interagency and consultation meetings. Including consultations for obtaining the informed views of the affected people and local nongovernmental organizations (NGOs). The record specifies any means other than consultations (e.g., surveys) that were used to obtain the views of affected groups and local NGOs. An identification of ministries, institutions, authorities, stakeholders, organizations, communities and other bodies and persons from which either a separate authorization is required or that are likely to be affected by implementation of the proposed project, policy, plan or activity.

6.5.7 Schedule

The schedule for completion of the EIA is attached as Exhibit 6-2 below.

Exhibit 6-1: EA Requirements by Donor

USAID	NEPA	World Bank	OPIC
The Environmental Assessment shall be based upon the scoping statement and shall address the following elements, as appropriate: 1. Summary. The summary shall stress the major conclusions, areas of controversy, if any, and the issues to be resolved. 2. Purpose. The Environmental Assessment shall briefly specify the underlying purpose and need to which the Agency is responding in proposing the alternatives including the proposed action. 12. Alternatives Including the Proposed Action. This section should present the environmental impacts of the proposal and its alternatives in comparative form, thereby sharpening the issues and providing a clear basis for choice among options by the decision-maker. This section should explore and evaluate reasonable alternatives and briefly discuss the reasons for eliminating those alternatives which were not included in the detailed study; devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits; include the alternative of no action; identify the Agency's preferred alternative or alternatives, if one or more exists; include appropriate mitigation measures not already included in the proposed	1. A full description of the project, plan, policy or activity and the aim or aims it is intended to achieve; 2. The likely environmental impacts and benefits, including cumulative impacts and benefits, of the project, plan, policy or activity on soil, water, air, forests, climate, human health, animals and plants, landscape, archaeological property, cultural heritage, cultural values, social and economic well-being and livelihoods, human settlements (including involuntary resettlement) and their interactions; 3. The likely environmental impacts and benefits of alternative means of carrying out the project, plan, policy or activity, including the preferred means and the alternative of not undertaking the project, plan, policy or activity at all; 4. The likely environmental impacts of alternatives to the project, plan, policy or activity that would achieve the same aim as the project, plan, policy or activity was intended to achieve; 5. All relevant measures that could be undertaken to avoid, remedy or mitigate any significant adverse effects that could be caused by the project, plan, policy or activity; 6. All relevant measures that will be taken to monitor the likely environmental impacts and benefits of implementation of the project, plan, policy or activity on	1. *Executive summary*. Concisely discusses significant findings and recommended actions. 2. *Policy, legal, and administrative framework*. Discusses the policy, legal, and administrative framework within which the EA is carried out. Explains the environmental requirements of any co-financiers. Identifies relevant international environmental agreements to which the country is a party. 3. *Project description*. Concisely describes the proposed project and its geographic, ecological, social, and temporal context, including any offsite investments that may be required (e.g., dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement plan or indigenous peoples development plan[2] (see also subparagraph (h)(v) below). Normally includes a map showing the project site and the project's area of influence. 4. *Baseline data*. Assesses the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. Also takes into account current and proposed development activities within the project area but not directly connected to the	Greenfield Category A projects and significant expansions or modifications of existing projects require the submission of a full-scale ESIA following the requirements of the IFC Performance Standard 1 (extracted from Guidance Note 1) as follows: 1. Initial screening of the project and scoping of the assessment process; Examination of alternatives; Stakeholder identification (focusing on those directly affected) and gathering of environmental and social baseline data; 2. Impact identification, prediction, and analysis; 3. Generation of mitigation or management measures and actions; 4. Significance of impacts and evaluation of residual impacts; and 5. Documentation of the assessment process (i.e., ESIA report). 6. The ESIA must conform to the requirements of the host country's environmental assessment laws and regulations, including the relevant disclosure of information and public consultation requirements.

action or alternatives. 13. Affected Environment. The Environmental Assessment shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in the Environmental Assessment shall be commensurate with the significance of the impact with less important material summarized, consolidated or simply referenced. 14. Environmental Consequences. This section forms the analytic basis for the comparisons under paragraph (c)(3) of this section. It will include the environmental impacts of the alternatives including the proposed action; any adverse effects that cannot be avoided should the proposed action be implemented; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. It should not duplicate discussions in paragraph (c)(3) of this section. This section of the Environmental Assessment should include discussions of direct effects and their significance; indirect effects and their significance; possible conflicts between the proposed action and land	affected persons; and 7. Any other information prescribed by NEPA or by regulation; and 8. An identification of ministries, institutions, authorities, stakeholders, organizations, communities and other bodies and persons from which either a separate authorization is required or that are likely to be affected by implementation of the proposed project, policy, plan or activity.	project. Data should be relevant to decisions about project location, design, operation, or mitigation measures. The section indicates the accuracy, reliability, and sources of the data. 5. *Environmental impacts*. Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any residual negative impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention. 6. *Analysis of alternatives*.[3] Systematically compares feasible alternatives to the proposed project site, technology, design, and operation--including the "without project" situation--in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and justifies recommended emission levels and approaches to	

use plans, policies and controls for the areas concerned; energy requirements and conservation potential of various alternatives and mitigation measures; natural or depletable resource requirements and conservation potential of various requirements and mitigation measures; urban quality; historic and cultural resources and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures; and means to mitigate adverse environmental impacts. 15. (List of Preparers. The Environmental Assessment shall list the names and qualifications (expertise, experience, professional discipline) of the persons primarily responsible for preparing the Environmental Assessment or significant background papers. 16. Appendix. An appendix may be prepared.		pollution prevention and abatement. 7. *Environmental management plan (EMP)*. Covers mitigation measures, monitoring, and institutional strengthening; see outline in OP 4.01, Annex C. 8. List of EA report preparers--individuals and organizations. 9. References--written materials both published and unpublished, used in study preparation. 10. Record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local nongovernmental organizations (NGOs). The record specifies any means other than consultations (e.g., surveys) that were used to obtain the views of affected groups and local NGOs. 11. Tables presenting the relevant data referred to or summarized in the main text. List of associated reports (e.g., resettlement plan or indigenous peoples development plan).	

Exhibit 6-2: EIA Schedule

#	Action	Description	Responsibility	Duration	Estimated Schedule
1	Scoping Study	The Scoping Study will be submitted to USAID for final review and comment.	USAID	Two weeks	Submitted December 2012, approved February 2013.
2	Commencement of EA	Development of EA template and preparation of sections relating to items such as Legal, Policy and Administrative Framework. This time will also serve as the period to arrange the specifics of the technical studies.	AEAI Environmental Specialist	Two – three weeks	February 2013.
4	Site Visit	Site Visit, this will include additional Stakeholder Consultations at the site and meeting is Kabul with the project Team to discuss the technical aspects of the project.	AEAI Environmental Specialist	Two – three weeks	March 2013.
5	Technical Studies	Technical studies will include: • Hydrological study (including baseline water quality monitoring) • Soil Sampling • Dispersion Modeling	AEAI Technical Consultants	Four weeks	April 2013.
6	Report Preparations	The report will take between 8-10 weeks to complete depending on the information received from the technical studies and also bearing in mid the report will be structured to meet the demands of multiple donors which is a fairly complex and unique task.	AEAI Environmental Specialist	Eight to ten weeks	May - July 2013.
7	Submission of draft document	For review and approval by NEPA & USAID.	USAID, NEPA.	One Month	August 2013.
8	Document Edits	Editing the final document after comments from donors / agencies	AEAI Environmental Specialist	One week	August 2013
9	Document approved	Final document approval from all donors / agencies.	USAID, NEPA.	One week	September 2013

7 Annex A: NEPA Screening/Scoping Requirements

Annex 3 – Information to be supplied by Proponents

The following is guidance on the information that should be provided by proponents to NEPA. Proponents may choose to submit more information dependent on the project type. However, if insufficient information is provided then the EIA process cannot be commenced by NEPA. Therefore adherence to this guidance would be advisable.

The Proponent: Name, address, telephone, email and contact point for further queries, for the individual or organisation proposing the project

The Project: Brief description of the nature and purpose of the project. Outline plans or drawings. Size of the project in terms of, for example, site area, size of structures, throughput, input and output, cost, duration. Programme for implementation including construction, commissioning, operation, decommissioning, restoration, after-use.
Scale of construction activities required.

The Location: A map and brief description of the site and its surrounding area showing physical, natural and man-made features such as topography, land cover and land use (including sensitive areas such as housing, schools, recreation areas); physical/spatial planning policies or zoning; areas or features designated for their nature conservation, landscape, historic, cultural or agricultural importance; water features including groundwater and flood protection zones; planned future developments.

Potential Sources of Impact: Completion of a Rapid Environmental Assessment[6] should provide insight into the potential sources of impact. Any further information which provides detail on the following factors would be useful; emissions to air land or water or any residues that may arise from construction and operation activities and the proposed methods of discharge or disposal, any noise, vibration or heat generated from the project, hazardous or raw materials to be used or stored at the site and procedures for safe management and requirements for raw materials and energy and their likely sources.

Mitigation: Brief description of any measures the developer proposes to use to reduce, avoid or offset significant adverse effects would be useful.

Other information which may be useful:
- identification of other permits required for the project;
- relationship of the project to other existing or planned activities;
- other activities which may be required or may occur as a consequence of the project (*e.g.* extraction of minerals, new water supply, generation or transmission of power, road construction, housing, economic development)
- planned future developments on or around the site;
- additional demand for services such as sewage treatment or waste collection and disposal generated by the project;
- photographs of the site and its surroundings.
- alternative sites, processes or environmental mitigation measures considered by the developer.

[6] An REA is a checklist of potential impacts arising from a project. Checklists are developed for specific sectors and will be available at NEPA.

8 Annex B: USAID Scoping Requirements[7]

After a Positive Threshold Decision has been made, or a determination is made under the pesticide procedures set forth in §216.3(b) that an Environmental Assessment or Environmental Impact Statement is required, the originator of the action shall commence the process of identifying the significant issues relating to the proposed action and of determining the scope of the issues to be addressed in the Environmental Assessment or Environmental Impact Statement. The originator of an action within the classes of actions described in §216.2(d) shall commence this scoping process as soon as practicable. Persons having expertise relevant to the environmental aspects of the proposed action shall also participate in this scoping process. (Participants may include but are not limited to representatives of host governments, public and private institutions, the A.I.D. Mission staff and contractors.) This process shall result in a written statement which shall include the following matters:

a. A determination of the scope and significance of issues to be analyzed in the Environmental Assessment or Impact Statement, including direct and indirect effects of the project on the environment.
b. Identification and elimination from detailed study of the issues that are not significant or have been covered by earlier environmental review, or approved design considerations, narrowing the discussion of these issues to a brief presentation of why they will not have a significant effect on the environment.
c. A description of
    1. the timing of the preparation of environmental analyses, including phasing if appropriate,
    2. variations required in the format of the Environmental Assessment, and
    3. the tentative planning and decision-making schedule; and
    4. A description of how the analysis will be conducted and the disciplines that will participate in the analysis.
d. These written statements shall be reviewed and approved by the Bureau Environmental Officer.
e. Circulation of Scoping Statement. To assist in the preparation of an Environmental Assessment, the Bureau Environmental Officer may circulate copies of the written statement, together with a request for written comments, within thirty days, to selected federal agencies if that Officer believes comments by such federal agencies will be useful in the preparation of an Environmental Assessment. Comments received from reviewing federal agencies will be considered in the preparation of the Environmental Assessment and in the formulation of the design and implementation of the project, and will, together with the scoping statement, be included in the project file.
f. Change in Threshold Decision. If it becomes evident that the action will not have a significant effect on the environment (i.e., will not cause significant harm to the environment), the Positive Threshold Decision may be withdrawn with the concurrence of the Bureau Environmental Officer. In the case of an action included in §216.2(d)(2), the request for withdrawal shall be made to the Bureau Environmental Officer.

[7] http://www.usaid.gov/our_work/environment/compliance/22cfr216.htm

9 Annex C: IFC Performance Standard 1, Guidance Note 1, Requirements for ESIA

Guidance Note 1
Assessment and Management of Environmental and Social Risks and Impacts
January 1, 2012

Risks and Impacts Identification Methods and Assessment Tools

GN22. The risks and impacts identification process should include all the necessary steps and methods that are required to screen, identify, analyze, measure, or assess, in quantitative terms to the extent possible, the potential risks and adverse impacts (including environmental, social, health, safety, labor and security) associated with the projects to be financed. It is expected that the client will apply methods and assessment tools, consistent with current good international industry practice, which are appropriate and relevant to the type of project to be financed. Those methods include, but are not limited to (i) full-scale Environmental and Social Impact Assessments (ESIAs); (ii) limited or focused environmental and/or social assessments; (iii) straightforward application of environmental siting, pollution standards, design criteria, or construction standards; (iv) where relevant, targeted environmental and social studies such as health impact assessments, or risk/hazard operation studies for certain activities; and (v) environmental and social due diligence and audits.

Environmental and Social Impact Assessments

GN23. For certain projects, and particularly for greenfield investments and projects (including, but not limited to, major expansion or transformation-conversion activities) involving specifically identified physical elements, aspects and facilities that are likely to generate potentially significant adverse environmental and social risks and impacts, the client should conduct a comprehensive full-scale ESIA. The key process elements of an ESIA generally consist of (i) initial screening of the project and scoping of the assessment process; (ii) examination of alternatives; (iii) stakeholder identification (focusing on those directly affected) and gathering of environmental and social baseline data; (iv) impact identification, prediction, and analysis; (v) generation of mitigation or management measures and actions; (vi) significance of impacts and evaluation of residual impacts; and (vii) documentation of the assessment process (i.e., ESIA report). The breadth, depth and type of analysis should be proportionate to the nature and scale of the proposed project's potential impacts as identified during the course of the assessment process. The ESIA must conform to the requirements of the host country's environmental assessment laws and regulations, including the relevant disclosure of information and public consultation requirements, and should be developed following principles of good international industry practice (see Bibliography for further guidance).

GN24. The ESIA process predicts and assesses the project's potential adverse impacts and risks, in quantitative terms to the extent possible. It evaluates environmental and social risks and impacts from associated facilities and other third party activities. The ESIA identifies and defines a set of environmental and social mitigation and management measures to be taken during the implementation of the project to avoid, minimize, or compensate/offset for risks and adverse environmental and social impacts, in the order of priority, and their timelines; it also identifies any residual negative impacts that cannot be mitigated (see also paragraphs GN60–GN61 on the application of the mitigation hierarchy). The desired outcomes of the mitigation and management measures should be set as measurable events to the extent possible, such as performance indicators, targets or acceptance criteria that can be tracked over defined time periods. The process indicates the responsibilities required for implementation of the mitigation and management program. The ESIA also identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention. For those projects with potential significant adverse impacts predominantly in the social area (e.g., involuntary resettlement), the impacts and risks identification process should largely focus on generating appropriate social baseline data, impacts analysis, and mitigation measures (e.g., Resettlement Action Plan).

GN25. For greenfield developments, the ESIA includes an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on feasible alternatives to the proposed project. This

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10 Annex D – Socio-Economic Data

10.1 General Information

10.1.1 Geography

Jawjzan Province is situated in the Northern part of Afghanistan, bordering Turkmenistan in the North, Balkh Province in the East, Sar-e-Pul Province in the South and Faryab Province in the West. The province covers an area of 10326 km2. More than one quarter of the province is mountainous or semi mountainous terrain (29.4%) while more than two thirds of the area is made up of flat land (68.9%), as the following table shows:

Topography type						
	Flat	Mountainous	Semi Mountainous	Semi Flat	Not Reported	TOTAL
Percent	68.8%	22.4%	7.0%	1.0%	.8%	100.0%

Source: CSO/UNFPA, Socio Economic and Demographic Profile

The province is divided into 11 Districts. The provincial capital is Sheberghan which has a population of about 148329 inhabitants

10.1.2 Demography and Population

Jawjzan has a total population of 426,987. There are 50,900 households in the province, and households on average have 7 members. The following table shows the population by district.

Population by District			
District	Number of males	Number of females	Total population
Sheberghan- Jawjzan	74355	73974	148329
Aghche	21045	21016	42061
Faiz Abad	17295	16674	33969
Mardian	13115	13211	26326
Mangjik	16092	15400	31492
Gharghin	10128	9750	19878
Khomiab	6420	6097	12517
Ghoshtipe	12738	12193	24931
Darzab	18867	18318	37185
Khaje Dokoh	9799	9573	19372
Khanegha	15569	15358	30927
Total	215423	211564	426987

Source: CSO/UNFPA, Socio Economic and Demographic Profile

Around 80% of the population of Jawjzan lives in rural districts while 20% lives in urban areas. Around 50% of the population is male and 50% is female. The major ethnic groups living in Jawjzan province are Uzbek and Turkmen followed by Tajik, Pashtun and Arab. Uzbek is spoken by the largest proportion of population (39.5%). Turkmen comes second with 28.7% of population. Pashtu and Dari are spoken respectively by 17.2% and 12.1% of the total population.

Jawjzan province also has a population of Kuchis or nomads whose numbers vary in different seasons. In winter 76,850 individuals, or 3.2% of the overall Kuchi population, stay in Jawjzan living in 20 communities which are all settled. Some 170 households move into Jawjzan in the summer. 2780 households are also currently living in camps for Internally Displaced Persons (IDP) The Kuchi population in the summer is 81,480 individuals.

10.2 Current State of Development in the Province

10.2.1 Infrastructure and Natural Resources

The provision of basic infrastructure such as water and sanitation, energy, transport and communications is one of the key elements necessary to provide the building blocks for private sector expansion, equitable economic growth, increased employment and accelerated agricultural productivity.

In Jawjzan province, on average only 24% of households use safe drinking water. This rises to 64% in the urban area, and falls to just 6% in rural areas. Almost nine in every ten households have direct access to their main source of drinking water within their community (88%), however around one in ten households has to travel for up to an hour to access drinking water (8%), and for 3% travel to access drinking water can take up to 6 hours as the table below shows:

Time required accessing main source of drinking water				
	In community	Less than 1 hour	1-3 hours	3-6 hours
Percent	88%	8%	0%	3%

Source: NRVA 2005

On average only 15% of households have access to safe toilet facilities. The situation is better in the urban area, where 33% of households have safe toilets, but this is true for only 10% of rural households. The following table shows the kinds of toilet facilities used by households in the province:

Toilet facilities used by households						
	None/ bush open field/	Dearan / Sahrah (area in compound but not pit)	Open pit	Traditional covered latrine	Improved latrine	Flush latrine
Percent	17%	4%	11%	53%	14%	1%

Source: NRVA 2005

On average 42% of households in Jawjzan province have access to electricity with the majority of these relying on public electricity. Access to electricity is much greater in the urban area where 99% of households have access to electricity, however this figure falls to just 25% in rural areas.

The transport infrastructure in Jawjzan is reasonably well developed, with 45% of roads in the province able to take car traffic in all seasons, and 42% able to take car traffic in some seasons. However, in about one-eighth of the province there are no roads at all (12.1%), as shown in the following table:

Roads Type				
District	Cars all season	Cars some seasons	No roads	Not Reported
Sheberghan_-Jawjzan	61.5%	35.9%	.0%	2.6%
Aghche	21.1%	68.4%	10.5%	.0%

Faiz Abad	63.6%	30.9%	5.5%	.0%
Mardian	39.3%	60.7%	.0%	.0%
Mangjik	61.8%	38.2%	.0%	.0%
Gharghin	66.7%	.0%	.0%	33.3%
Khomiab	100.0%	.0%	.0%	.0%
Ghoshtipe	32.5%	55.0%	12.5%	.0%
Darz ab	13.6%	33.9%	50.8%	1.7%
Khaje Dokoh	87.0%	13.0%	.0%	.0%
Khanegha	18.2%	65.9%	15.9%	.0%
Total	45.1%	41.8%	12.1%	1.0%

Source: CSO (Analysis by AIRD)

The following table indicates road travel times between the provincial capital, Sheberghan and the major district centers in the province, and other key provincial centers in the region.

Road Travel Times			
From	To	Time	Road Condition
Sheberghan	Mazar	2 hrs	Paved road
Sheberghan	Kabul	10 hrs	Paved road
Sheberghan	Faiz Abad	1hrs	Paved road
Sheberghan	Aqcha	40 min	Paved road
Sheberghan	Mardyan	1hrs	Graveled road
Sheberghan	Mingajik	1hr 30min	Graveled road
Sheberghan	Khanaqa	45 min	Paved and graveled
Sheberghan	Qarqeen	3 hrs 30min	Graveled road
Sheberghan	Qosh Tepa	3 hrs	Graveled road
Sheberghan	Darzab	4hrs	Graveled road
Sheberghan	Khoja Du Koh	40 min	Paved and graveled road

Source: UNAMA

As far as telecommunications is concerned, both Roshan and AWCC are present only in the provincial capital, the city of Sheberghan.

10.2.2 Economic Governance and Private Sector Development

Creating the conditions in which a dynamic and competitive private sector can flourish, is key to promoting economic growth, employment creation and poverty reduction. Jawjzan is an agricultural province which is rich with natural resources such as oil and gas.

Agriculture is a major source of revenue for 48% of households in Jawjzan province, including 67% of rural households and 8% of households in the urban area. Thirty nine percent of rural households and 9% of urban households own or manage agricultural land or garden plots. However, almost three quarters of households in the urban area (74%) and one quarter of households in rural areas (26%) derive some income from trade and services. Around a third of households in both urban (32%) and

rural (38%) areas earn income through non-farm related labor. Livestock also accounts for income for one-sixth of rural households (16%) as the following table shows:

Sources of income reported by households			
Source of income	Rural (%)	Urban (%)	Total (%)
Agriculture	67	8	48
Livestock	16	2	18
Opium	1	0	1
Trade and Services	26	74	37
Manufacture	31	15	25
Non-Farm Labor	38	32	37
Remittances	1	1	1
Other	3	5	3

Source: NRVA 2005

In 2005 there were 12 agricultural cooperatives active in Jawjzan involving 597 members. This was four times more people than in 2003 when the figure was only 150 members. In 2005 agricultural cooperatives controlled a total of 3969 Ha of land and achieved a surplus of products for sale of 5,000 tons. As a result of this, each member held a share in the capital of the cooperative to the value of 460,500Afs.

Industrial commodities such as cotton, sugar, sesame, tobacco, olives and sharsham appear to occupy a relatively substantial number of villages. Sesame is produced in 180 villages, cotton is produced in 79 villages and tobacco is produced in 58 villages. Qush Tepa and Darzab are major producers of all three crops.

Small industries are scarce in Jawjzan. Karakul skin is produced in Darzab, Mingajik, Qush Tepa and Kwajah Dukoh. Silk is mostly produced in Mingajik. Carpets, rugs, jewelry and shawls are the common handicrafts of the province. Sheberghan, Faizabad, and Khanaqa are major prouducers of these handicrafts. Carpets are produced in Mardyan, Mingajik, Darzab and Qush Peta. The last three districts also produce jewelry and shawls.

In 2005, 45% of households in Jawjzan reported taking out loans. Of these households, a small percentage used these loans to invest in economic activity such as agricultural inputs (1%) and business investment (2%).

10.2.3 Agriculture and Rural Development

Enhancing licit agricultural productivity, creating incentives for non-farm investment, developing rural infrastructure, and supporting access to skills development and financial services will allow individuals, households and communities to participate licitly and productively in the economy. As agriculture represents the major source of income for nearly half the households in the province, rural development will be a key element of progress in Jawjzan.

The most important field crops grown in Jawjzan province include wheat and barley, melon, watermelon and maize. The most common crops grown in garden plots include grapes (73%) and vegetables (23%). Almost all households with access to fertilizer use this on field crops (97%) and to a much lesser

degree on garden plots (2%), although a very small number of households use fertilizer on both field and garden (2%). The main types of fertilizer used by households in the province are shown in the following table:

Main Types Of Fertilizer Used By Households					
Human	Animal	Urea			DAP
%	%	%	Average Kg per Household	%	Average Kg per Household
0	76	26	216.2 Kg	21	155.4Kg

Source: NRVA 2005

On average 74% of households in the province have access to irrigated land, whereas almost one third of rural households (30%) and 38% of urban households have access to rain fed land as shown in the following table:

Households (%) access to irrigated and rain fed land			
	Rural	Urban	Average
Access to irrigated land	75	66	74
Access to rain fed land	30	38	31

Source: NRVA 2005

Fifty five percent of rural households, 98% of Kuchi households and 15% of households in urban areas in the province own livestock or poultry. The most commonly owned livestock are, donkey, goats, sheep and cattle as the following table shows:

Households (%) owning poultry and livestock				
Livestock	Kuchi	Rural	Urban	Average
Cattle	47	33	11	30
Oxen	8	8	1	6
Horses	15	5	1	7
Donkey	92	33	2	42
Camel	53	9	0	21
Goats	77	24	3	35
Sheep	77	17	6	33
Poultry	47	25	8	27

Source: NRVA 2005

10.2.4 Education

Ensuring good quality education and equitable access to education and skills are some of the important ways to raise human capital, reduce poverty and facilitate economic growth. The overall literacy rate in Jawjzan province is 31%, however, while two-fifth of men are literate (40%), this is true for just over two tenths of women (21%). In the population aged between 15 and 24 the situation for men is slightly better with 46% literacy, whereas for women the figure shows little change (22%). The Kuchi population

in the province has particularly low levels of literacy with just 1.6% of men and 0.1% of women able to read and write.

On average 40% of children between 6 and 13 are enrolled in school, however, again the figure is around half of boys (45%) and one third of girls (33%). Amongst the Kuchi population, one in fifty boys (2%) and no girls (0%) attend school in Jawjzan during the winter and summer months.

Overall there are 203 primary and secondary schools in the province catering for 104899 students. Boys account for 63% of students and 80% of schools are boys' schools. There are 3348 teachers working in schools in the Jawjzan province, of whom 41% are women.

Primary and Secondary Education						
	Schools		Students		Teachers	
	boys	girls	boys	girls	male	female
Primary	99	32	56750	35909	-	-
Secondary	63	9	9334	2906	-	-
Total	162	41	66084	38815	1970	1378
	203		104899		3348	

Source: CSO Afghanistan Statistical Yearbook 2006

Access to primary schools is good for most children, however one third of students have to travel up to five kilometers to reach their closest primary school and one in six has to travel more than ten kilometers. Access to secondary schools is more difficult than to primary schools. Again one-third of students have to travel up to five kilometers to reach their closest secondary schools but around a quarter of students have to travel more than ten kilometers. Only one in five students has a high school located less than five kilometers away. Around a quarter of students (23%) have to travel 5-10 kilometers and a further quarter of students, have to travel more than ten kilometers to reach their nearest high school.

Jawjzan province also has higher education facilities. The high education institute of Jawjzan has faculties of science, social sciences, geology and mining and chemical technology. In 2005 there were 959 students enrolled at the university 557 men (58%) and 402 women (42%). Of those 368 students were in their first year, 295 men (80%) and 73 women (20%). Seventy five male students live in dormitories provided by the University.

There is a vocational high school in Jawjzan, Abu Muslim Khurasani Vocational High School, with 8 teachers catering for a total of 74 students, all of whom are men, and a Vocational High School of Gas and Oil with 16 teachers, 5 of whom are female, and 168 male students. In 2005, 15 students graduated from Abu Muslim Khurasani Vocational High School and 23 students graduated from Jawjzan Vocational High School of Gas and Oil. There is also a teacher training institute which had 444 students in 2005, 62% of whom were women and 38% men.

10.2.5 Health

Ensuring the availability of basic health and hospital services, and developing human resources in the health sector is essential to reduce the incidence of disease, increase life expectancy and enable the whole population to participate in sustainable development. A basic infrastructure of health services

exists in Jawjzan province. In 2005 there were 10 health centers and 6 hospitals with a total of 264 beds. There were also 178 doctors and 299 nurses employed by the Ministry of Health working in the province, which represented a 50% increase in the number of doctors and a 69% increase in the number of nurses compared to 2003. The major health facilities in the province are shown in the following table:

Health Services (Hospitals and Clinics by Districts)			
Hospitals		Clinics	
Name	Location	Name	Location
Darzab	Bazar Gud Qala/ Darzab	Bala Mardyan	Bala Mardyan village
Qushtepa	Bazar Qosh Tepa	Mardyan	Mardyan
Gerquduq	Gerquduq	Jangal Aragh	Jangal Aragh
Mangajik	Charshanghu	Qarqeen	Khantipa village
Aqcha	Aqcha	Qarance	Qarance village
Jeza	Jeza village	Khwoja du Koh	Khwoja du Koh
Khan Aqa	Khanaqa village	Khwoja du Koh	Khazal Ayaq
Fazabad	Sanses village	City clinics	Shibirghan

Source: UNAMA

The province also has 98 pharmacies of which 95 are owned privately and 3 are run by the government. Pharmacies are present only in 14 villages and 42% of the population has to travel more than ten kilometers to reach to the nearest pharmacies.

The majority of communities do not have a health worker permanently present in their community. Seventy three percent of men's shura and 75% of women's shura reported that there was no community health worker present, and both groups most commonly said that hospital is their closest health facility. Only 3.9% of the population have a health center and 3.5% have a dispensary within their village. Around half the population seeking medical attention must travel more than ten kilometers (46% for health centers and 43% for dispensaries).

10.2.6 Social Protection

Building the capacities, opportunities and security of extremely poor and vulnerable Afghans through a process of economic empowerment is essential in order to reduce poverty and increase self-reliance. The level of economic hardship in Jawjzan is reasonably high. More than one third of the households in the province (38%) report having problems satisfying their food needs at least three to six times a year, and a further one quarter of households face this problem up to three times a year (26%), as the following table shows:

Problems satisfying food need of the household during the last year					
	Never	Rarely (1-3 times)	Sometimes (3-6 times)	Often (few times a month)	Mostly (happens a lot)
Households (%)	26	26	38	7	2

Source: NRVA 2005

Around one fifth (19%) of the population in the province is estimated to receive less than the minimum daily caloric intake necessary to maintain good health. This figure is lower for the rural population

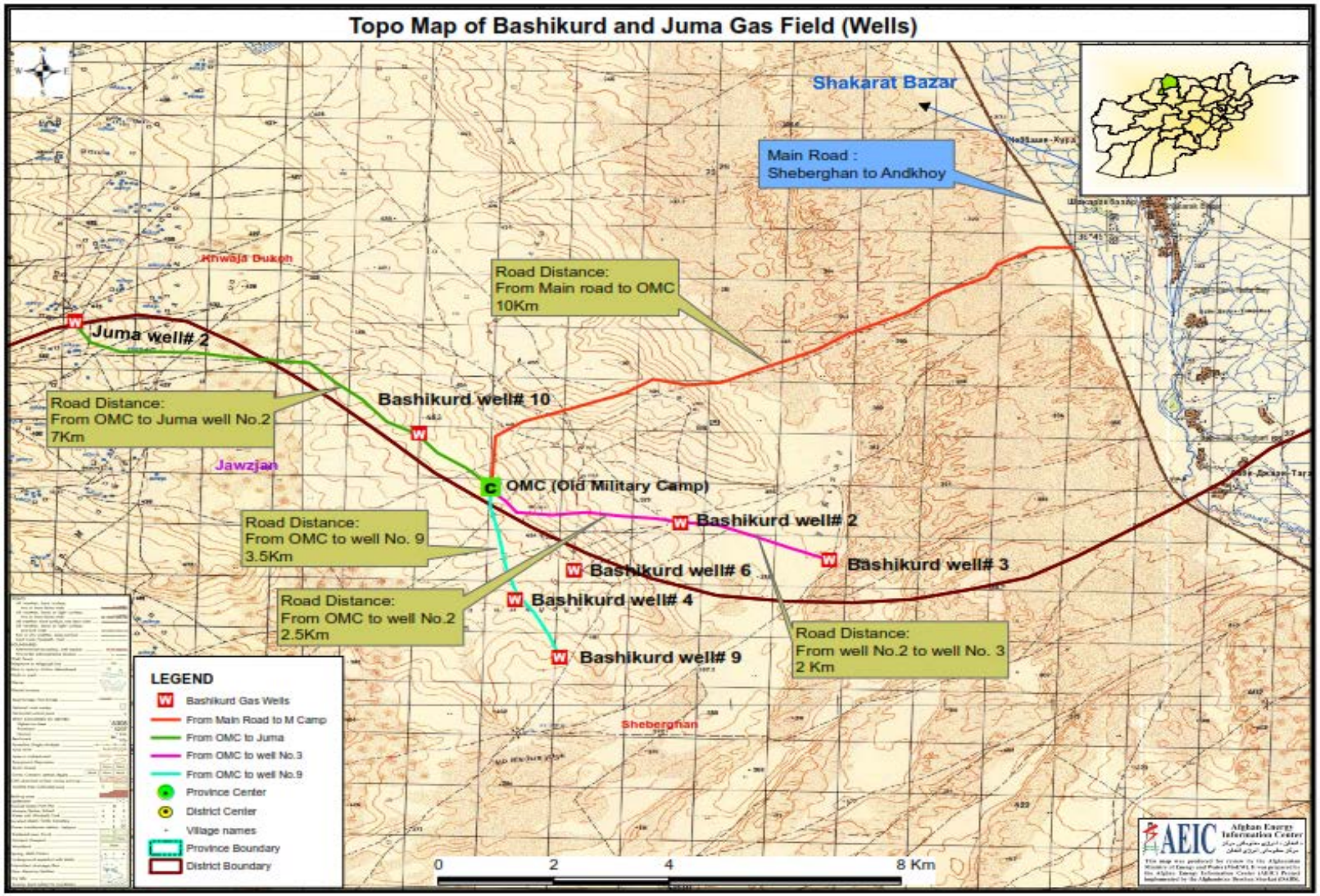
(16%) than those people living in the urban area (27%). In both rural and urban areas around half the population has low dietary diversity and poor or very poor food consumption (43%) as shown below:

Food consumption classification for all households				
	Low dietary diversity		Better dietary diversity	
Households (%)	Very poor food consumption	Poor food consumption	Slightly better food consumption	Better food consumption
Rural	16	21	46	18
Total	14	29	44	19

Source: NRVA 2005

In 2005, 21% of the population of Jawjzan province received allocations of food aid, which reached a total of 87,803 beneficiaries. In addition, of the 45% of households who reported taking out loans, 59% said that the main use of their largest loan was to buy food.

11 Annex E – Topography



12 Annex F

Draft Contract Provisions for Well Services for Well Services Contract,
Juma/Bashikurd Field

Particular Conditions of Contract,
Part B, Clause 21, Schedule1, Part 1
Ministry Environmental
Policies

12.1 General Provisions

12.1.1 Definitions

"Barrel" means a standard barrel of 42 U.S. gallons (158.9 liters).

"Best Available and Safest Technologies" means the equipment, procedures and practices which an experienced, competent and prudent international Contractor would use when engaged in a similar activity under similar circumstances and in accordance with International Oilfield Practices.

"Fresh Water" means potable water or other water capable of being used for domestic, agricultural, livestock, commercial, or industrial uses.

"Freshwater Zone" means any geologic formation known or likely to contain Fresh Water in usable amounts.

"Hazardous Limit of H_2S" means a concentration of hydrogen sulfide equal to or greater than fifty parts per million.

"International Oilfield Practice" means any principle, practice or procedure which is generally applied by the international Hydrocarbons industry as good, safe, efficient and necessary in the carrying out of exploration, development or production operations and shall include, without limitation, any principle, practice or procedure which has been approved by the regulatory bodies or internationally recognized organizations described in Clause 1.2, and not in conflict with the Law.

"Laws" means the treaties, laws and regulations of Afghanistan, including, without limitation, the Hydrocarbon Law, the Hydrocarbon Regulations, and the Environmental Protection Law.

"Major Environmental Incident" means (i) fires, explosions and blowouts that occurred during the conduct of Hydrocarbons Operations and/or (ii) significant spills of Oil or other Hazardous Substances.

"Major Health and Safety Incident "means (i) an incident due to Hydrocarbon Operations resulting in death or serious injury; or (ii) catastrophic failure of health and safety equipment used in Hydrocarbon Operations, which results in a Major Environmental Incident.

"Ministry" means the Ministry of Mines of the Islamic Republic of Afghanistan.

"Hydrocarbons" means petroleum and gas and their derivatives.

"Hydrocarbon Operations" means all activities conducted in connection with this Contract.

"Hydrocarbon Waste" means wastes generated during the conduct of Hydrocarbon Operations, which are uniquely associated with and intrinsic to such operations, and include, but are not limited to,

produced water, drilling fluids and drill cuttings, well completion, treatment and stimulation fluids, workover waste, sanitary waste and other substances and materials available for discharge.

"Significant Spill" means any unauthorized discharge of oil, brine or chemical exceeding 0.5 barrels which is in or likely to enter, water or any discharge of oil or brine onto land exceeding ten barrels per incident or 0.5 barrels of chemical per incident.

"Subsurface Safety Devices" means any downhole mechanical device which is designed to shut off well flow in the event of an emergency and may consist of either surface or subsurface controlled subsurface safety valves, an injection valve, a tubing valve, a tubing or annular subsurface safety device and any associated valve lock or landing nipple.

"Threshold Limit of H_2S" means an open atmosphere concentration of 20 parts per million.

12.1.2 Reference Standards

1. The standards, codes, certification and certification procedures, practices and guidance documents of internationally recognized standardization and certification bodies and agencies that have been accepted by hydrocarbon, environmental, safety and health regulators in jurisdictions including the United States of America, the United Kingdom, Canada, Australia, Norway, or the Netherlands may be used by an Contractor in determining appropriate standards and certification for its Hydrocarbon Operations. The event that any document conflicts with the Hydrocarbon, environmental, safety, or health Laws of Afghanistan and such document and laws and/or regulations cannot be reconciled, the Laws shall control.
2. Contractor may rely upon compliance with the reference standards used in the countries listed in 1.2.1 and the standards, codes, certification and certification procedures, and guidance documents prepared by the following named organizations to demonstrate compliance with these policies and Best Available and Safest Technologies. The organizations are: International Association of Drilling Contractors (IADC), International Association of Geophysical Contractors (IAGC), International Association of Hydrocarbons Producers (OGP), United Nations (UN), American Petroleum Institute (API), International Organization for Standardization (ISO), Society of Petroleum Engineers (SPE), World Petroleum Congress (WPC), International Maritime Organization (IMO), Lloyd's Register, American Bureau of Standards (ABS), Den Norsk Veritas (DNV), The Institute of Petroleum (IP) and the European Union (EU).
3. The application of Best Available and Safest Technologies to existing Hydrocarbon Operations shall also take into account practicability, economic feasibility and potential safety, health and environmental costs and benefits to the territory of Afghanistan.

12.1.3 General Standard

To the extent not specifically prescribed in these policies or the reference standards set out in 1.2 of these policies, Contractors shall conduct all Hydrocarbon Operations as a reasonable prudent Contractor would do under the same or similar circumstances, including exercising reasonable diligence in exploring for and developing Hydrocarbon resources.

12.2 General Requirements

12.2.1 Conduct of Operations

The Contractor shall conduct all Hydrocarbon Operations in accordance with the provisions of this Clause 21, Part 1, all other requirements of this Contract, and the applicable Laws.

12.2.2 Standard of Care

All Hydrocarbon Operations shall be conducted with due regard for and in compliance with, International Oilfield Practice. Whenever practical, the Contractor shall use the Best Available and Safest Technologies in order to conserve natural resources, protect subsurface resources, protect the health and safety of the public and workers, and protect the environment.

12.2.3 Well Control

Contractor shall take necessary precautions to keep wells under control at all times. Whenever practical, Contractor shall utilize the Best Available and Safest Technologies in order to enhance the evaluation of conditions of abnormal pressure and to minimize the potential for uncontrolled well flow. The Contractor shall use personnel who are trained and competent and shall use and maintain equipment and material necessary to assure the safety and protection of personnel, equipment, natural resources and the environment.

12.2.4 Casing

Contractor, in accordance with the approved designs under this Contract, shall case all wells with a sufficient number of strings of casing and use a sufficient quality and quantity of cement on each string of casing in a manner necessary to prevent release of fluids from any stratum through the wellbore, prevent communication between separate strata, protect underground sources of fresh, potable water or water usable for agricultural or other purposes, and geothermal resources from contamination, support unconsolidated sediments and otherwise provide a means of control of the formation pressures and fluids.

12.2.5 Blowout Prevention Systems

1. Blowout Prevention Systems and system components (BOP) shall be designed, installed, used, maintained and tested to assure well control.
2. The rated working pressure of any BOP component shall exceed the anticipated wellhead pressure to which it may be subjected.
3. A BOP system shall consist of an appropriate number of hydraulically operated preventers equipped with either pipe, blind or blind-shear rams, and shall be arranged in the stack to assure well control under anticipated conditions. The BOP system may also include an annular (bag-type) preventer.
4. BOP pressure testing shall be conducted at all customary intervals prior to and during drilling operations in accordance with International Oilfield Practice. Prior to conducting high pressure tests, BOPs shall be subjected to 100 bars low pressure test. BOPs shall then be subjected to a high pressure test with water to the casing/wellhead pressure. Subsequent pressure tests shall be to the maximum anticipated wellhead pressure. Annular type BOPs shall be tested to 70 percent of its rated working pressure.

12.2.6 Mud Program

1. The quantities, characteristics, use and testing procedures of drilling mud and the related drilling procedures shall be designed and implemented to prevent the loss of well control and to safeguard hole conditions necessary for proper evaluation of the formation. Drilling mud shall be properly conditioned and circulated in accordance with International Oilfield Practice. The Contractor shall maintain inventories of mud, mud materials and additives at the drill site sufficient to maintain well control at all times.
2. Mud analysis and monitoring equipment shall be maintained on the drilling rig at all times and mud tests shall be performed as conditions warrant. Mud testing shall be conducted in

accordance with International Oilfield Practice and shall include mud density, viscosity, gel strength, and such other tests as the Contractor deems necessary. A mud-gas separator and degasser shall be installed in the mud system after the setting of surface casing. This equipment shall be maintained for use throughout the further drilling of each well.

12.3 Tubing and Wellhead Equipment

12.3.1 Tubing

1. Contractor shall:
   (a) ensure that all tubing has the necessary strength and pressure integrity and is otherwise suitable for its intended use; and
   (b) conduct integrity testing in the event of prolonged operations.
2. All wells shall be completed with tubing installed unless an exception to such requirement has been approved by the Ministry.

12.3.2 Article 3.2. Wellhead Equipment

1. Contractor shall:
   (a) ensure that wellheads are equipped for pressure monitoring and that such monitoring occurs on a regular basis; and
   (b) ensure that the wellhead, tree and related equipment have a pressure rating that is greater than the applicable shut-in tubing pressure.
2. The wellhead, tree and related equipment have to be designed, installed and maintained to achieve full pressure control.

12.4 Production Safety Systems

12.4.1 General Requirements

1. Production safety systems shall be designed, installed and operated in a manner to assure protection of the health and safety of the public and workers.
2. The documents referenced in Sub-clause 1.2 of this Clause 1 shall be used to determine an appropriate standard for the design, installation and operation of Subsurface Safety Devices and surface production facilities.

12.4.2 Subsurface Safety Systems and Surface Facilities

1. In high risk environments, such as wells with dangerous concentrations of hydrogen sulfide (H_2S) or carbon dioxide (CO_2), all tubing installations open to hydrocarbon bearing zones shall be equipped with Subsurface Safety Devices according to International Oilfield Practice, unless Contractor demonstrates to the Ministry that the well is incapable of natural flow to the surface.
2. All surface production facilities including, without limitation, separators, treaters, compressors, headers, and flow lines shall be designed, installed and operated in a manner to assure protection of the environment, the health and safety of the public and workers and to prevent unauthorized disposal of Hydrocarbons Waste.

12.4.3 Pressure Testing

Where applicable, Contractor shall conduct pressure integrity, and non-destructive tests on all production equipment in accordance with International Oilfield Practice. In the event of indication of a leak or improper seal, the equipment shall be repaired, replaced or abandoned at Contractor's discretion. Additional remedial action shall be taken until a satisfactory pressure test is obtained.

12.4.4 Corrosion Mitigation

Contractor shall use effective means of mitigating, monitoring and controlling corrosion caused by corrosive gases (H_2S and CO_2) in both the downhole and surface portions of a production system. The Contractor shall take specific corrosion monitoring and mitigation measures in areas of unusually severe corrosion where accumulation of water and/or higher concentrations of corrosive gases exist.

12.5 Environmental Protection

12.5.1 Conduct of Operations

Contractor shall conduct all Hydrocarbon Operations in accordance with the Laws, these policies, and International Oilfield Practice.

12.5.2 Environmental Impact Assessments and Environmental Protection Plans

Contractor shall prepare and present such environmental impact scoping studies, environmental impact assessments, environmental protection and impact mitigation plans, and other such studies or reports as may be required by the Contract, applicable Laws, or order of the Ministry in the form and with the content as required. Contractor shall deliver a copy of each such document to the Ministry.

12.5.3 Monitoring

In connection with all Hydrocarbon Operations Contractor shall prepare and present to the Ministry an environmental monitoring plan with which it will comply during the Hydrocarbon Operation. At a minimum, the monitoring plan shall establish methods and practices for the continuous monitoring of the impact of Hydrocarbon Operations on:

(a) surface and groundwater quality and quantity;
(b) soils;
(c) flora and fauna, including species endangerment;
(d) cultural heritage sites and natural monuments; and
(e) air quality.

12.5.4 Spill Contingency Plan

1. Submission
   The Contractor shall submit to the Ministry a spill contingency plan for any Hydrocarbon Operation that could potentially result in a spill of Hydrocarbons, chemicals, or produced water. A spill shall include the uncontrolled release of gaseous Hydrocarbons, H_2S, CO_2, or other potentially toxic or corrosive gases.
2. Plan Modifications
   A Spill Contingency Plan shall be reviewed and updated as necessary by Contractor or when required by the Ministry. All modifications to a spill contingency plan that might materially affect the Contractor's response capabilities must be approved by the Ministry.
3. Plan Information
   A proposed Spill Contingency Plan shall include the following, if applicable:
   (a) a map of the area of operations showing the location of proximal population centers, special ecological zones and protected natural territories, potential storage and disposal sites for contaminated fuel, and Hydrocarbons Waste and chemicals;
   (b) a range of worst case spill scenarios that may conceivably arise during Hydrocarbons Operations, including the type of failure, volume, rate direction of flow and containment locations, containment, dispersal or removal;
   (c) the identification, location and general inventory of spill response equipment and a list of trained personnel available for initiating response and procedures to be employed in

responding to continuous oil discharges and spills of short duration and for reporting spills to the Ministry;

(d) description of simulated training exercises used by the Contractor to verify response times from equipment and personnel locations to each facility of the Contractor where spills are most likely to occur or when special ecological conditions exist;

(e) a written dispersant plan including a list of dispersants that may be used, if applicable, and an assessment of their effectiveness when applied to different situations and a summary of their toxicity, chemical composition and properties if available;

(f) a procedure for inspecting oil spill response facilities, supplies and equipment, along with the manner of record keeping of these inspections;

(g) a list of names, company positions or job responsibilities, addresses, phone and facsimile numbers and electronic mail address of responsible employees of the Contractor;

(h) appropriate containment and /or diversionary structures or equipment to prevent discharged oil or other substances from escaping further to surface waters or on the land surface, including containment for storage tanks and equipment;

(i) the telephone number of the Contractor's spill response coordinator and other persons who will act as coordinator in the absence of the spill response coordinator;

(j) the procedure to be used by the Contractor to ensure at least one person trained in appropriate spill response is at a facility at all times to avoid delay in initial response and notification;

(k) a list of local and national government personnel, provided by the Ministry after approval of the spill contingency plan, including their phone numbers, who will participate in on-scene investigation and observe spill clean-up activities, as well as coordinate with any relevant governmental entities; and

(l) any other relevant requirement reasonably requested by the Ministry.

4. Notice of a Significant Spill.
    1. Contractor shall, as soon as is practicable but in no event later than 24 hours of discovery of any Significant Spill, provide an oral or written notice to the Ministry. Oral notices shall be followed promptly written notices to the Ministry.
    2. The notice of a Significant Spill shall contain the following information:
        (a) the location(s) of the spill(s) by well number or geographical coordinates;
        (b) the estimated volume of spillage and the nature of the spillage (oil, produced water, acid, gases, or other materials that are identified as having a negative impact on the environment);
        (c) the status of the Contractor's response at the time of first notice.
        (d) In addition to the notice of a Significant Spill required of this article, Contractor shall submit periodic monitoring reports to the Ministry concerning Significant Spills until it is determined that a harmful quantity of oil or other dangerous substances is no longer present.
    3. Significant Oil Spill monitoring reports shall be submitted on a weekly basis or at less frequent intervals as agreed upon by the Ministry depending on the seriousness of the spill
5. Spill Response and Cleanup Procedures
    1. Contractor shall take immediate measures to contain and clean any spill after its discovery according to an approved spill contingency plan, especially the spillage of oil, produced water, or chemicals into any water body or drainages.
    2. The Ministry shall allow Contractor to take immediate measures to contain and clean any spill, unless it is determined that Contractor is unable to implement the spill contingency plan approved by the Ministry or an alternate plan that addresses the special conditions at the spill site. In the event of a determination of Contractor's inability to act, the Ministry may assume management and implementation of an appropriate spill contingency plan.

3. Contractor may use alternate procedures for containment, mitigation or cleanup, including chemicals, absorbents and other materials, if the alternate procedure meets the objectives of the spill contingency plan.

12.6 Hydrocarbon Waste Management

12.6.1 General Requirements

1. Contractor shall store, transport and dispose of all Hydrocarbons Waste and other waste in such a manner as not to cause damage to life, health, property, underground or surface sources of fresh, potable water or water useful for other purposes, cultural heritage sites and natural monuments, or endanger the wellbeing of the employees of the Contractor or members of the public.
2. Where practicable, Contractor should take measures to reduce and recycle Hydrocarbon Waste.

12.6.2 Hydrocarbon Waste Disposal Plan

1. Prior to the commencement of Hydrocarbon Operations, the Contractor shall submit a hydrocarbons waste disposal plan to the Ministry for approval. No disposal of Hydrocarbon Waste shall take place unless until the plan is approved.
2. A proposed Hydrocarbon Waste Disposal Plan shall include the following:
   (a) a description of procedures for controlling and disposing of all Hydrocarbon Waste that is likely to be generated in the course of the proposed Hydrocarbons Operation;
   (b) a description of all Hydrocarbon Wastes and their estimated quantities to be treated, transported, handled, stored and disposed of during proposed Hydrocarbon Operations and the type of facilities to be used for each activity, including a brief flow diagram of the treatment, neutralization processes and description of the methods used; and
   (c) any other relevant requirement reasonably requested by the Ministry relating to disposal of Hydrocarbon Waste or other kind of waste.

12.6.3 Hydrocarbon Waste Injection

1. Contractor may not inject Hydrocarbon Waste or any other materials, including separated H_2S, CO_2, or other toxic or corrosive substances, into the subsurface without the prior written consent of the Ministry pursuant to a written application and plan that clearly identifies:
   (a) the name, description and depth of the formation into which Hydrocarbons Waste is to be injected;
   (b) description and depth of all underground sources of fresh, potable water and water for hydro-therapeutic use that may be affected by the proposed operation;
   (c) where practicable, a chemical analysis of the water in the injection formation and the fracture pressure or fracture gradient of the injection formation;
   (d) a base plat covering the area of the proposed Hydrocarbons Waste injection well(s) showing the location of each proposed well, the purpose of the well, i.e. disposal or injection and the location of all Hydrocarbons wells;
   (e) where practicable, a resistivity log, run from the bottom of the surface casing to total depth of the disposal/injection well or wells;
   (f) a full description of the casing in the Hydrocarbons Waste injection well(s) with a schematic drawing showing all casing strings with cement quality and tops;
   (g) a diagram of the surface facility showing all pipelines and tanks associated with the system;
   (h) a listing of all sources of fluid, by well, to be injected;
   (i) the estimated minimum and maximum amount of fluid to be injected daily with anticipated wellhead injection pressures;
   (j) any other relevant requirement reasonably requested by the Ministry relating to Hydrocarbons Waste injection.

2. In conducting injection, Contractor shall:
   a. ensure that all wells are designed, constructed, cased, cemented and maintained with due regard to International Oilfield Practices and to protect adequately underground and surface sources of fresh, potable water or water useful for other purposes;
   b. carry out a pressure integrity test in each injection well every two years. The results of these tests shall be reported to the Ministry. Contractor shall notify Ministry one week prior to conducting the periodic test to allow the Ministry to attend and witness the test. In lieu of a pressure integrity test, Contractor shall monitor the pressure in the casing, tubing and annulus during injection operations and record it on a monthly basis. The Contractor shall report this information annually to the Ministry.
   c. report any significant changes in the operating wellhead injection pressures or other monitoring data, required in Sub-clause 5 of this Clause 6 that might indicate a defect in pressure integrity, to the Ministry within 24 hours of discovery along with a description of actions being taken by to correct the problem.

12.6.4 Produced Water Discharge

1. Prior to disposal of produced water Contractor shall treat it to prevent oil and condensate from entering a pit or offshore environment.
2. Produced water may be disposed of as follows:
   (a) injection into a well according to the requirements of Sub-clause 6.3;
   (b) evaporation/percolation in a properly permitted lined or unlined pit;
   (c) for produced waters with less than 5,000 mg/l total dissolved solids, disposal by road spreading on roads outside sensitive areas, if authorized by the Ministry. Road spreading shall not result in pooling or runoff of Produced Water and the adjacent soils shall meet concentrations allowed by the Laws.
3. Water produced during Hydrocarbon Operations may be reused for enhanced recovery, drilling and other purposes in a manner consistent with the International Oilfield Practice and in consideration of water quality standards under the Laws.

12.6.5 Chemical Storage. Contractor shall:

1. store hazardous chemicals that require special handling or are toxic to humans (acids, detergents, etc.) in safe facilities with limited access;
2. record the general quantity of all such chemicals; and
3. mark points of storage of chemicals and their qualities on storage area plans at each storage site. Such plans shall be posted in a conspicuous location readily accessible to emergency response authorities and shall also be provided to such authorities.

12.6.6 Drilling Fluids

1. The use of closed loop systems for the handling of drilling fluids is encouraged. If the use of such a system is not practicable, above ground tanks or excavated pits may be used. Pits shall be constructed, maintained, and closed in compliance with Clause 7.5.
2. Contractor shall report to the Ministry the content of a drilling fluids and additives, including concentrations, and shall provide materials data sheets for each drilling fluid component. Drilling fluid composition, as actually used in Hydrocarbon Operations, shall conform to the toxicity limits, if any, established by the Afghan National Environmental Protection Agency or other governmental authority with jurisdiction, the Ministry, or to International Oilfield Practices.
3. If drilling fluid residuals after dewatering are not disposed of as pit contents residuals as provided in Sub-clause 7.5.8, drilling fluid residuals exceeding applicable limits for toxicity established by the Laws or International Oilfield Practice shall be removed and disposed of by a person or firm that is a licensed waste management company, or, if such a licensed disposal is not reasonably available, as directed by the Ministry or the National Environmental Protection Agency. Drilling

fluids or drilling fluid residuals not exceeding toxicity limits may be disposed of by burial at the drillsite in the same or similar manner to that provided in Sub-clause 7.5.8 for the burial of drill fluid residuals contained in pits.

12.6.7 Naturally Occurring Radioactive Materials (NORM)

1. The Contractor shall monitor cuttings and produced water to determine the presence of material containing naturally occurring radioactive material ("NORM"). If levels above those stated in Sub-Clause 6.7.2 are detected, Contractor shall record the depth and formation from which the materials appear to occur, and attempt to isolate cuttings and produced water from such formation, and notify the Ministry for approval to dispose of the NORM in accordance with the Laws or International Oilfield Practice.
2. The Contractor is not required to notify the Ministry, isolate or specially dispose of cuttings, produced water, or other Hydrocarbon waste material if the material contains, or is contaminated at, concentrations of:
   a. 30 picocuries per gram (pCi/gm) or less of radium-226 or radium-228 in:
      i. soil, averaged over any 100 square meters (m^2) and averaged over the first 15 centimeters (cm) of soil below the surface; or
      ii. other media; or
   b. 150 pCi or less per gram of any other NORM radionuclide in:
      i. soil, averaged over any 100 m^2 and averaged over the first 15 cm of soil below the surface, provided that these concentrations are not exceeded; or
      ii. other media, provided that these concentrations are not exceeded.

12.7 Surface Operations

1. This Clause 7 applies to surface activities, including construction, maintenance, and abandonment of roads, facilities, and drillsites conducted in connection with Hydrocarbon Operations.
2. Construction, Site Clearing, and Restoration.
   a. Contractor shall mark areas to be cleared or prepared prior to commencing work in order to minimize surface impact and reduce erosion to the extent possible.
   b. In works conducted on areas not currently being used for Hydrocarbon Operations (for example, new wellsites, gathering line routes, tank and surface treatment equipment locations), Contractor shall take the follow actions to minimize surface impacts:
      i. in vegetated areas, remove and stockpile topsoil and stabilize the storage area, including diversion for storm water;
      ii. to the extent feasible, avoid removal of any trees or other large perennial vegetation;
      iii. avoid damage or alteration to pre-existing works, such as irrigation ditches and gates, power lines, and fields or other agricultural works, if in use or likely to be used within two years after the completion of Hydrocarbon Operations;
      iv. if damage to or alteration of works described in the preceding sub-clause (c) cannot reasonably be avoided, Contractor shall make arrangements with the owner or possessor of the works for moving the works to a location where they will not be affected by Hydrocarbon Operations at the particular site or replacing the works after the completion of Hydrocarbon Operations at the particular site;
      v. where feasible, retain grassed or vegetated areas downslope of the particular site to reduce the velocity of runoff for reduction of erosion and sediment movement;
      vi. after rains or snow melt, inspect the performance of erosion and sediment controls, and maintain or improve such controls if required.
   c. Drillsites, well locations, and storage areas for liquid Hydrocarbons or produced water shall be surrounded by impermeable berms of sufficient height and design to:

i. prevent the encroachment of storm water runoff to enter the location;
ii. contain the maximum amount of liquid Hydrocarbons, drilling fluids, or produced water that would reasonably be anticipated to be discharged or released during a period of one week in the event of (i) loss of well control, (ii) overflow or rupture of any storage, reserve, or settling pit or tank, or (iii) spill of drilling fluids, chemicals, or other substances; and/or
iii. contain an amount of fluids equal to the volume of the largest storage tank or structure at the location.

d. Roads within the area of Hydrocarbon Operations shall be designed and constructed in accordance with the Contractor designs approved by Ministry, and maintained and used:
i. at such width and type of construction to accommodate the all reasonably anticipated movement of equipment and vehicles at each stage of the particular Hydrocarbon Operation;
ii. in such a manner as prevent (i) the flooding of lands adjoining the roads during normal rainfall or snow melt, (ii) causing erosion; and (iii) to the extent practicable, interference with the usual and customary movement of persons, livestock, or wildlife;
iii. to avoid, to the extent practicable, (i) passage closer than 500 meters of any established habitations, (ii) commercial buildings in use by persons other than Contractor personnel or Ministry personnel, or (iii) military or law enforcement facilities;
iv. in such a manner as to reduce dust that might adversely affect nearby habitations, commercial or industrial buildings, or other human activity by such means as (i) proper maintenance, including gravelling, grading, and watering, and (ii) requiring Contractor vehicles to travel at low speeds to minimize dust.

3. Reserve, Storage, Settling, and Other Pits
a. Pits used for conduct of Hydrocarbons Operations shall be constructed and operated to prevent communication with surface or ground water or contamination of soil resources through seepage, flooding, or other release of materials.
b. Pits should be constructed in compliance with the Laws and International Oilfield Practice, including assurance of:
i. sufficient size for adequate storage until closure, taking into consideration historical precipitation patterns;
ii. such depth that the bottom does not penetrate ground water, or such that the pit contents do not adversely impact ground or surface water;
iii. that berm height, slope and materials are structurally sound and the pit integrity is not compromised by terrain or breached by heavy rains, winds, seepage, or other natural forces;
iv. adequate design if a salt section is anticipated or oil-based muds are used during a drilling program;
v. where applicable, adequate fencing, netting, caging and/or any other method to secure a pit to protect the public, domestic animals and wildlife.
c. The use of alternatives to excavated production pits, such as process modification or above ground tanks, are encouraged to reduce adverse impacts.
d. All production pits, including pits used for skimming, settling, storage and/or evaporation of produced water, shall be adequately lined with natural or synthetic materials that are compatible with expected pit contents. Liners are not required if Contractor demonstrates through natural clay testing that the soil in a pit is impermeable.
e. The Ministry may require Contractor to line reserve pits used for storage of additional drilling fluids, disposal of wastes generated during drilling operations and initial completion procedures, and workover pits used for containment of liquids during the performance of

remedial operations of a producing well if the Ministry determines that there is a potential for adverse impact to surface or ground water or any environmentally sensitive area.

f. Special purpose pits such as blowdown and basic sediment pits, with exception of emergency pits constructed during initial response to spills, or flare pits where there is no risk of condensate accumulation, shall be lined.
g. Contractor shall conduct inspections and monitoring at regular intervals or as necessary to ensure that pits meet all operating and structural integrity requirements and to ensure that pit contents do not adversely impact ground or surface water.
h. Upon completion of Hydrocarbon Operations during which pits have been used, Contractor shall close all pits within sixty days of cessation of their use, in accordance with the following procedures and International Oil Field Practices:
    i. all contents of the pit shall be dewatered, provided that if weather conditions do not allow dewatering to be completed by evaporation within sixty days, the Ministry may allow such further time as is reasonable if the pits are protected in compliance with Sub-clause 7.5.2(e) and appropriate signs, as prescribed by the Ministry, are posted at the pit warning of the applicable hazards;
    ii. the contents of the pit are tested and the test reports submitted to the Ministry;
    iii. drilling fluids, drilling fluid components, and liquid Hydrocarbons have been recovered for reuse or other appropriate disposition to the greatest degree practicable;
    iv. prior to closure the residual contents of the pit have been mixed with subsoil or inert materials and compacted; and
    v. the pit residual contents are covered with not less than one meter of subsoil, compacted, and covered with available topsoil.
    vi. residual pit contents exceeding applicable limits for toxicity established by the Laws or International Oilfield Practice shall be removed and disposed of by a person or firm that is a licensed waste management company, or, if such a licensed disposal is not reasonably available, as directed by the Ministry or the National Environmental Protection Agency.

12.8 Water Protection

12.8.1 Groundwater Supply and Protection

1. The Ministry may designate the source of any groundwater to be used by Contractor for Hydrocarbon Operations. If the Ministry does not designate a ground water source, the Contractor may, on approval of the Ministry, procure groundwater for Hydrocarbon Operations by purchase from a third party or by drilling water supply wells.
2. If the Contractor proposes to drill water supply wells, it shall submit to the Ministry a request for approval with the following information:
    a. a plat depicting the geographical coordinates of the proposed well or wells;
    b. the depth and thickness of the water productive zone of the geologic horizon or stratum and depth of the proposed source of the water;
    c. the amount of water to be extracted from the proposed well or wells;
    d. the predicted quality of the water to be extracted;
    e. data from the Water Resources division of the Afghan Geological Survey, in the form and content required by the Ministry, showing the following:
        i. the depth and thickness of the water productive zone of the geologic horizon or stratum, of the proposed source of the water, and the areal extent of the water productive zone;
        ii. the estimated quality and volume of water that could probably be produced from the proposed well;
        iii. the location of all known wells within three kilometers currently producing water from the zone that is the proposed source of the water;

iv. a statement of the potential impact of the withdrawal of the volume of water proposed on other users of that water source.

f. Contractor's proposed design of the well, including specifically the means of assuring that the operation of the well will not contaminate, diminish, or otherwise adversely affect water-productive or Hydrocarbon productive zones expected to be encountered in the proposed well.

3. The information required to be provided by the Water Resources Division of the Afghan Geological Survey is not required if Contractor proposes to obtain brine or water that is not Fresh Water from a well or wells previously drilled for Hydrocarbon exploration or exploitation and not currently being used for Hydrocarbon production, provided that the Contractor must demonstrate to the Ministry that such well or wells is adequately cased and cemented so as to prevent the contamination of a Freshwater Zone or Zones.
4. The Contractor shall, prior to commencing Hydrocarbon Operations to drill a new well or to re-enter or deepen an existing well:
   a. obtain from the Water Resources Division of the Afghan Geological Survey, the depth, thickness, and physical characteristics of all known Freshwater Zones;
   b. case and cement any well drilled, re-entered, or worked over during Hydrocarbon Operations in such as manner as to protect any Freshwater Zones identified by the Afghan Geological Survey from contamination or other damage, in accordance with the casing and cementing requirements of Sub-clause 2.4; and
   c. In any well that is already cased, perform such tests and procedures to assure that the existing casing and cementing is adequate to protect any Freshwater Zone identified by the Afghan Geological Survey.
5. The Contractor shall, in conducting Hydrocarbon Operations, monitor the results of drilling or re-entry operations in order to detect Freshwater Zones, and take all reasonable steps, through the mud program, casing and cementing, or otherwise to protect Freshwater Zones detected.
6. The Contractor shall regularly monitor, either directly, in cooperation with the owners or operators thereof, or through governmental bodies with jurisdiction for operating or monitoring thereof, any Fresh Water wells that it reasonably believes may be affected by Hydrocarbon Operations.

12.8.2 Surface Water Supply and Protection

1. Contractor shall not use water from a surface source in Hydrocarbon Operations without first having obtained:
   a. the express written consent of the owner, and if different from the owner, the lawful current user or users of such source;
   b. the express written authorization of the Ministry; and
   c. the express written authorization of all governmental authorities with lawful jurisdiction, to use water from the specific surface source.
2. In addition to taking all actions described in these Policies related to the prevention of pollution and erosion caused by or associated with Hydrocarbon Operations, Contractor shall take all further steps available to prevent the discharge of drilling fluids, produced water, liquid Hydrocarbons, chemicals, and other toxic or contaminating substances into any body of surface water or permanent or seasonal wetlands, or into drainages of any body of surface water or permanent or seasonal wetlands.

12.9 Air Quality

1. Contractor shall comply with all air quality control and monitoring requirements of the applicable approved environmental protection plan, with the Laws relating to air quality, and applicable International Oilfield Practices.

2. The Contractor shall use reasonable efforts to reduce potentially harmful emissions to the air from Hydrocarbon Operations by:
   a. minimizing the venting or flaring of gaseous Hydrocarbons and associated gases;
   b. using gaseous Hydrocarbons that would otherwise be vented or flared for operations fuel; and
   c. when economically feasible, use low sulfur and low aromatic diesel fuel for generators and other equipment, and employing appropriate pollution control devices.

12.10 Cultural and Natural Heritage Protection

12.10.1 General Requirements

The Contractor shall fully comply with the Laws relating to the identification, protection, and preservation of items and sites of cultural and natural heritage, and use reasonable efforts for the early detection of sites and items of cultural and natural heritage sites and natural monuments that may be of interest to Afghanistan, including conducting a preliminary visual survey of the locations of Hydrocarbon Operations prior to the commencement of operations on those locations.

12.10.2 Notification

Contractor shall notify the Ministry and any other authorities with lawful jurisdiction within forty-eight hours of the discovery of any of the following:

1. evidence of human activity appearing to be older than two hundred years:
2. rare or unusual geological, rock or mineral formations and structures;
3. meteorites;
4. extraordinary paleontological remains, fossils or fossil impressions, either vertebrate and invertebrate;
5. human graves or human remains;
6. any other objects or sites of potentially significant cultural, historical, or natural heritage sites, natural monuments and other objects that represent significant scientific or cultural interest.

12.10.3 Subsurface Discoveries

If mineral deposits or geothermal resources that may have commercial value are encountered during conduct of Hydrocarbons Operations, the Contractor shall:

1. promptly inform the Ministry of such encounters;
2. collect cutting samples and determine their depth below surface; and
3. submit such samples to the Ministry, however, the Ministry shall not suspend Hydrocarbons Operations on account of any such discovery of deposits.

12.10.4 Suspension of Surface Operations

1. The Ministry may suspend Contractor's construction or excavation activities for a reasonable time period on locations directly impacting discoveries described in this Clause 10, until the Ministry receives the results of an expert evaluation of such discovery.
2. Within twenty days of notification of a discovery, the Ministry shall perform an expert evaluation of the discovery and notify the Contractor if the discovery requires any modifications to its planned Hydrocarbon Operations. Such modifications may include:
   (a) relocating the surface facility to a location outside the discovery area;
   (b) Incorporating closer surveillance for additional discoveries during further surface operations development of the construction of pipelines, excavations or storage areas.
3. If requested to do so by Contractor, the Ministry shall obtain from competent sources and provide to the Contractor an inventory of all known locations of items specified in Sub-clauses 10.2 and 10.4 prior to the commencement of surface operations.

12.11 Mines, Unexploded Ordnance

Contractor shall notify the Ministry and the provincial military and police immediately if mines or unexploded ordnance is located, immediately cease operations in the area, evacuate all personnel at least two kilometers from the location of the mine or unexploded ordnance, and take all possible steps to keep any person or vehicle from entering the evacuated area other than persons qualified to deal with the object(s).

12.12 Solid Waste

1. Contractor shall be responsible for minimizing and managing non-Hydrocarbon waste at all locations used by it in connection with Hydrocarbon Operations, in compliance with this Clause 12, the Laws and International Oilfield Practice.
2. Solid Waste Disposal
    a. The Contractor shall assure that solid waste at all locations used for Hydrocarbon Operations shall be collected and disposed of in a safe and sanitary manner that contains it to the locations and prevents scattering.
    b. Solid waste shall be handled in the following manner:
        i. Solid waste shall be placed in secure covered bins that minimize scattering and the presence of flies, rats, and other vermin.
        ii. If such service is available, Contractor shall arrange for the collection and disposal of waste at a suitable landfill or other disposal site at least weekly. If such service is not available, solid waste may be burned in a pit constructed to minimize the scattering of waste, fire risk, and offensive smells to any nearby habitations.
        iii. If any persons in the area of operations are gathering solid waste or rubbish for recycling or reuse, the Contractor shall permit them, in a manner consistent with good security practices, to gather non-hazardous solid waste or rubbish generated by Hydrocarbon Operations. The Contractor is encouraged, but not required, to sort recyclable solid waste or rubbish (for example, plastics) to assist such persons.
        iv. Hazardous waste, such as used lubricating oils or radiator coolant, shall be collected and disposed of at a licensed disposal facility. If no such facility is reasonably available, such materials may be disposed of in drill fluid pits or tanks for later disposal with residual drill fluids.
        v. The Contractor prohibit its personnel from dropping or throwing any rubbish, cigarettes, cigars, or other waste from vehicles or onto the ground and shall keep its operational locations, including road, free from trash and rubbish.

12.13 Abandonment and Reclamation Requirements

12.13.1 General Requirements

At the conclusion of Hydrocarbon Operations, Contractor is required to plug and abandon all well bores and remove all facilities not taken over by the Ministry or another Contractor, clear all obstructions created by it on the area on which Hydrocarbon Operations were conducted, and reclaim all Hydrocarbon Operations locations from which facilities were removed.

12.13.2 Abandonment of Wells, General Requirements

1. Contractor shall plug and abandon all wells in a manner to assure downhole isolation of Hydrocarbon zones and protection of Freshwater Zones. No well shall be plugged and abandoned except on express written direction of the Ministry.
2. Contractor, as part of plugging and permanent abandonment of a well, shall cut the casing at least two meters below the estimated restored surface level and run cement to a depth of at least

three meters below the top of the cut casing. The top of the casing shall be permanently sealed by a steel plate welded onto the top of the casing and marked so as to indicate clearly that removal of the welded plate may result in injury or death.

3. All temporarily abandoned wells shall have a metal sign affixed to the wellhead or tree clearly indicating the name and number of the well, the name of the Contractor (or, if the well is taken over by the Ministry, showing the name of the Ministry), and marked so as to indicate clearly that removing or tampering with the wellhead, tree, or other surface equipment may result in injury or death.

12.13.3 Ministry Approval of Abandonment.

Prior to commencing abandonment operations, the Contractor shall submit to the Ministry the following information:

(a) the well name and number with a statement detailing the reason for abandonment including supportive well logs and test data;
(b) a schematic and brief description of the abandonment procedures including data on plugs, cementing procedures, casing removal and other pertinent information; and
(c) a description of the facilities to be abandoned, together with a reclamation plan for sites from which the facilities are to be removed.

12.13.4 Surface Reclamation

1. At the conclusion of Hydrocarbon Operations, Contractor shall remove all temporary structures at locations used for Hydrocarbon Operations, except those designated by the Ministry to remain in place.
2. All field roads used for Hydrocarbons Operations shall be left in good and usable condition, and the Contractor shall gravel, grade, and repair the roads after Contractor has completed use of the roads.
3. At completed wells ready for production or temporarily abandoned, the Contractor shall leave the well pad, laydown and turning areas, and work areas smoothed and in good condition for subsequent operations, provided that pits shall be closed as provided in Sub-clause 7.5.8.
4. The Contractor's camp location shall be cleared of equipment and temporary structures, subject to Ministry designation pursuant to Sub-clause 12.5.1, and either reclaimed or left in good condition for subsequent operational use, as directed by the Ministry. However, septic system soak pits and waste burn pits shall be disinfected with lime or other suitable disinfectant, knocked in, filled with subsoil, compacted to prevent settling, and covered with not less than 50 centimeters of topsoil. Concrete septic tanks shall be emptied, disinfected with lime or other suitable disinfectant, filled with subsoil, compacted to prevent settling, and their location marked.
5. At permanently plugged and abandoned wells and at any other locations used for Hydrocarbon Operations and not reserved by the Ministry for future use shall be reclaimed as follows:
    a. Pits shall be covered as provided in Sub-clause 7.5.8.
    b. All solid waste, rubbish, and trash shall be removed and properly disposed of as provided in these Policies.
    c. Berms shall be leveled and normal surface drainage restored except where special measures are employed to prevent soil erosion.
    d. Graveled and other compact areas shall be ripped to a sufficient depth to permit water and air penetration.
    e. Reserved topsoil, if any, shall be spread and leveled in such a way as to prevent compaction.
    f. To the extent practicable, the location shall be seeded with plants native to the location, or left in such a condition that natural re-establishment of local vegetation shall occur.

12.14 Environmental Training

12.14.1 General Requirements

Each Contractor shall develop and implement an environmental training program, or implement its existing environmental training program to train appropriate Contractor and Contractor's subcontractor's personnel in the following:

(a) the Contractor's environmental policy, objectives and procedures;
(b) environmental regulations for Afghanistan;
(c) technical environmental training in the management of air quality, water quality, waste, hazardous material handling;
(d) training relative to the Contractor's approved environmental protection plan, if any;
(e) training relative to the Contractor's Spill Response Plan;
(f) training relative to the principles of quality control and quality assurance as it applies to investigations, monitoring, sample collection, transportation and analysis. Such training activities may be done by outside sources at the choice of the Contractor;
(g) any other relevant requirement reasonably requested by the Ministry relating to environmental training.

12.14.2 Training Records

The Contractor shall maintain training records that summarize all training activities. Documentation and records of training activities shall be available for inspection by the Ministry during business hours.

13 Annex G

Draft Contract Provisions for Well Services for Well Services Contract, Juma/Bashikurd Field

Particular Conditions of Contract,
Part B, Clause 21, Schedule1, Part 2
Ministry Health and Safety
Policies

13.1 General Requirements

13.1.1 Definitions

"Barrel" means a standard barrel of 42 U.S. gallons (158.9 liters).

"Best Available and Safest Technologies" means the equipment, procedures and practices which an experienced, competent and prudent international Contractor would use when engaged in a similar activity under similar circumstances and in accordance with International Oilfield Practices.

"Fresh Water" means potable water or other water capable of being used for domestic, agricultural, livestock, commercial, or industrial uses.

"Freshwater Zone" means any geologic formation known or likely to contain Fresh Water in usable amounts.

"Hazardous Limit of H_2S" means a concentration of hydrogen sulfide equal to or greater than 20 parts per million.

"International Oilfield Practice" means any principle, practice or procedure which is generally applied by the international Hydrocarbons industry as good, safe, efficient and necessary in the carrying out of exploration, development or production operations and shall include, without limitation, any principle, practice or procedure which has been approved by the internationally recognized organizations and is not in conflict with the Law.

"Laws" means the treaties, laws and regulations of Afghanistan, including, without limitation, the Hydrocarbon Law, the Hydrocarbon Regulations, and the Environmental Protection Law.

"Major Environmental Incident" means (i) fires, explosions and blowouts that occurred during the conduct of Hydrocarbons Operations and/or (ii) significant spills of Oil or other Hazardous Substances.

"Major Health and Safety Incident "means (i) an incident due to Hydrocarbon Operations resulting in death or serious injury; or (ii) catastrophic failure of health and safety equipment used in Hydrocarbon Operations, which results in a Major Environmental Incident.

"Ministry" means the Ministry of Mines of the Islamic Republic of Afghanistan.

"Hydrocarbons" means petroleum and gas and their derivatives.

"Hydrocarbon Operations" means, for purposes of these policies, all physical activity and operations related to the exploration for, development of, and production of Hydrocarbons, including, without limitation, drilling, re-entry, workover, completion of wells, field separation, and transportation to the point of sale or delivery of Hydrocarbons.

"Hydrocarbon Waste" means wastes generated during the conduct of Hydrocarbon Operations, which are uniquely associated with and intrinsic to Hydrocarbon Exploration, Development or Production Operations and include, but are not limited to, produced water, drilling fluids and drill cuttings, well completion, treatment and stimulation fluids, workover waste, sanitary waste and other substances and materials available for discharge.

"Contractor" means the person, legal or natural, conducting Hydrocarbons Operations, including both the person or persons with legal control of such Hydrocarbons Operations and the person or persons actually conducting the Hydrocarbons Operations.

"Routine Workover Operations" means any of the following: Hydrocarbon Operations conducted on a well with a tree installed: cutting paraffin; removing and setting wellbore equipment that can be removed by wireline operations; bailing sand; swabbing; pressure surveys; scale or corrosion treatment; caliper and gauge surveys; corrosion inhibitor treatment; removing or replacing subsurface pumps; through-tubing logging (diagnostics); wireline fishing; and setting and retrieving other subsurface flow control devices.

"Safety and Health Plan" means a written document prepared by an Contractor and submitted to the Ministry for approval describing, in compliance with these Policies, the Laws, and International Oilfield Practice, the plans and procedures to be used by the Contractor in the course of conducting Hydrocarbon Operations for assuring the safety and health of Contractor's personnel and the general public, together with all amendments, changes, and revisions to the Plan For safety plans, training and accident response

"Significant Spill" means any unauthorized discharge of oil, brine or chemical exceeding 0.5 barrels which is in, or likely to enter, water or any discharge of oil or brine onto land exceeding ten (10) barrels per incident or 0.5 barrels of chemical per incident.

"Subsurface Safety Devices" means any downhole mechanical device which is designed to shut off well flow in the event of an emergency and may consist of either surface or subsurface controlled subsurface safety valves, an injection valve, a tubing valve, a tubing or annular subsurface safety device and any associated valve lock or landing nipple.

"Threshold Limit of H_2S" means the acceptable ceiling concentration of 20 parts per million for eight-hour exposure based on a 40-hour week.

13.1.2 Reference Standards

1. The standards, codes, certification and certification procedures, practices and guidance documents of internationally recognized standardization and certification bodies and agencies that have been accepted by Hydrocarbon, environmental, safety and health regulators in jurisdictions including the United States of America, the United Kingdom, Canada, Australia, Norway, or the Netherlands may be used by an Contractor in determining appropriate standards and certification for its Hydrocarbon Operations. The event that any document conflicts with the Hydrocarbon, environmental, safety, or health Laws of Afghanistan and such document and laws and/or regulations cannot be reconciled, the Laws shall control.
2. Contractor may rely upon compliance with the reference standards used in the countries listed in 1.2.1 and the standards, codes, certification and certification procedures, and guidance documents prepared by the following named organizations to demonstrate compliance with these policies and Best Available and Safest Technologies. The organizations are: International

Association of Drilling Contractors (IADC), International Association of Geophysical Contractors (IAGC), International Association of Hydrocarbons Producers (OGP), United Nations (UN), American Petroleum Institute (API), International Organization for Standardization (ISO), Society of Petroleum Engineers (SPE), World Petroleum Congress (WPC), International Maritime Organization (IMO), Lloyd's Register, American Bureau of Standards (ABS), Den Norsk Veritas (DNV), The Institute of Petroleum (IP) and the European Union (EU).

3. The application of Best Available and Safest Technologies to existing Hydrocarbon Operations shall also take into account practicability, economic feasibility and potential safety, health and environmental costs and benefits to the territory of Afghanistan.

13.1.3 Conduct of Operations

The Contractor shall conduct all Hydrocarbons Operations in accordance with an applicable Safety and Health Plan, these Policies, and the Laws. All Safety and Health Plans shall be developed and implemented using the Best Available and Safest Technologies and with due regard for, and in compliance with, International Oilfield Practice. Safety and Health Plans shall be developed in a manner to:

(a) protect the health and safety of workers and the general public;
(b) ensure the safe operation of equipment;
(c) require mandatory reporting of accidents and hazardous conditions; and
(d) provide an appropriate level of safety and health training to workers.

13.2 Safety and Health Plan

13.2.1 Submission

Prior to commencing Hydrocarbon Operations, Contractor shall submit a Safety and Health Plan to the Ministry for review by the Ministry.

13.2.2 Safety and Health Plan Information

Proposed Safety and Health Plans shall include, at a minimum, the following information.

1. Safety, training and incident response plans:
    a. a description of safety plans, measures and procedures that will be performed by the Contractor or required of third party subcontractors during the conduct of Hydrocarbon Operations;
    b. a description of training programs, frequency of training and safety manuals that will be provided by the Contractor to its personnel or required to be provided by third party subcontractors during the conduct of Hydrocarbons Operations;
    c. a list of names, company positions or job responsibilities, addresses, phone and facsimile numbers and electronic mail addresses, if applicable, of the persons responsible for all safety issues including safety training;
    d. a list of names, company positions or job responsibilities, addresses, phone and facsimile numbers and electronic mail addresses, if applicable, of the persons responsible for accident response;
    e. a description of accident response facilities to be used and supervisory staff responsible for investigations that will be performed by the Contractor or required of third party subcontractors in the event of a Major Health and Safety Incident during the conduct of Hydrocarbons Operations. Any Major Health and Safety Incident shall be reported pursuant to the requirements of Clause 8 of these Policies.
2. Hazardous substances and conditions plans:

(a) a description of general emergency response measures that will be organized or performed by the Contractor or required of third party subcontractors in the event of a spill or escape of Hazardous Substances during the conduct of Hydrocarbons Operations; and
(b) a general description of emergency response measures that will be organized or performed by the Contractor or required of third party subcontractors in the event of a fire, explosion or other hazardous condition during the conduct of Hydrocarbons Operations.

3. Workplace safety and condition environment plans:

13.3 Emergency Action

In the event of an emergency involving possible danger to life, health or property, the Contractor shall undertake all necessary actions required to mitigate such danger whether or not such action is included in an approved Safety and Health Plan. The Contractor shall promptly inform the Ministry and other relevant State authorities of such actions.

13.4 Specific Operational Requirements

13.4.1 Training Programs, Safety Manuals and Emergency Drills

1. Contractor shall ensure that all workers receive continuing safety training, instructions on safety issues and education, and verify through testing such knowledge in compliance with the Safety and Health Plan that is sufficient in scope to enable the worker to perform their required functions in a safe and workmanlike manner.
2. Contractor shall provide every worker with relevant written safety and health handbooks in the primary language or languages used by such workers.
3. Contractor shall ensure that equipment and locations have appropriate written instructions or warnings in the primary language or languages used by Contractor personnel, and with generally recognized warning symbols regarding dangers and the safe and proper use of all equipment and personal protective device requirements according to International Oilfield Practice.
4. Contractor shall develop, implement and practice at regular intervals emergency drills in compliance with the approved Safety and Health Plan that are sufficient in scope to provide training for all likely occurrences. Such drills shall include, without limitation, emergency procedures related to well control, fire, explosion, emergency evacuation, medical emergencies and the unexpected release of Hazardous Substances. The execution of such drills shall be documented in the Contractor's records.

13.4.2 Hydrogen Sulfide

1. The Contractor shall take all necessary precautions and measures to protect workers, the general public and the environment against exposure to concentrations of hydrogen sulfide in excess of the Threshold Limit of H_2S, including the prominent placing of warning signs at distances that might be exposed to concentrations in excess of Hazardous Limit of H_2S in the event of a release of hydrogen sulfide.
2. In those fields and facilities where, in the Contractor's opinion, the presence of H_2S is possible, the Safety and Health Plan shall include a hydrogen sulfide safety plan that shall contain, without limitation, safety procedures, training programs, emergency drill procedures and a recommended inventory and description of all prevention and protection equipment. In addition, the hydrogen sulfide safety plan shall identify the job positions responsible for implementation of plan procedures and the specific duties, responsibilities and operating procedures that shall be implemented when a concentration of hydrogen sulfide is detected in the atmosphere that exceeds the Hazardous Limit of H_2S.
3. The Contractor shall promptly notify the Ministry in the event of a release of hydrogen sulfide to the atmosphere that exceeds Hazardous Limit of H_2S.

4. The Contractor shall ensure that all blowout preventers, well heads and other equipment and materials are corrosion resistant.
5. The Contractor shall install, operate and maintain a hydrogen sulfide monitoring and detection system that initiates both audible and visual alarms throughout the affected area when the concentration of hydrogen sulfide in the atmosphere exceeds the Threshold Limit of H_2S.

13.4.3 Flaring and Venting of Gas Containing Hydrogen Sulfide

1. Venting of gas containing H_2S is not allowed except for life threatening situations or minor releases during maintenance, malfunctions or disruptions and repair activities that do not result in the atmospheric concentration of H_2S of 20 parts per million or higher within 20 meters of the point of release.
2. The Ministry may, for safety or air pollution purposes, restrict the flaring of gas containing H_2S.

13.4.4 Records Regarding Hydrogen Sulfide

The Contractor must prepare and submit to the Ministry not later than fifteen days after the end of each calendar quarter reports detailing gas flaring or venting and liquid hydrocarbon burning for each facility. The records must include for the preceding calendar quarter, at a minimum:

a. estimated daily volumes of gas flared or vented and liquid hydrocarbons burned;
b. estimates of the number of hours per day of flaring, venting, or burning of liquid hydrocarbons;
c. reasons for flaring, venting, or burning; and
d. estimated volumes of flared and vented gas containing H_2S and the concentration of H_2S in the gas flared.

13.5 Facility Requirements

1. All facilities used in Hydrocarbon Operations shall be designed, fabricated, installed and maintained to ensure their structural integrity and to protect the safety and health of workers and the general public.
2. Work areas shall be designed, fabricated, installed and maintained to ensure the safety and health of the workers. Contractor shall provide its personnel with reasonable protection, as required by International Oilfield Practice and the Laws, against:
   (a) extreme weather conditions;
   (b) damaging noise and dangerous heat levels;
   (c) dangerous exposure to flammable or explosive levels of gas or other hazardous vapors; and
   (d) fire and explosion according to International Oilfield Practice as specified in the Health and Safety Plan.
3. Hazardous or dangerous areas shall be clearly marked in the primary language or languages used by Contractor's personnel or other persons likely to be in the areas on a regular basis and with generally recognized warning symbols.
4. Machinery, tools, pipes, tanks and other related equipment shall be fit for the purpose for which it is intended. Where practical, open, moving or revolving parts shall be fenced, jacketed, provided with mechanical guards, or screened as appropriate.
5. All electrical equipment shall be fit for the purpose for which it is intended. Maintenance of electrical equipment shall be performed at regular intervals according to the manufacturer's recommendations or the Contractor's experience in order to minimize the risk of fire or explosion.

13.5.1 Sanitary Waste Systems

1. Contractor shall construct and maintain sanitary facilities at each location used by it during the term of Hydrocarbon Operations for accommodation of personnel, ablution, and food preparation and dining. The disposal system shall consist of:

a. pipes impervious to water, installed and maintained to prevent leakage, connected to a suitably constructed septic tank;
b. a soak pit system adequate to process the waste anticipated during all reasonably anticipated weather conditions.

2. Contractor shall regularly inspect and maintain the sanitary facilities, including emptying of the septic tank by qualified personnel and suitable equipment, as needed.
3. Contractor shall, at a minimum, place portable chemical toilets at drillsites and other work locations, or may construct and maintain a septic system at work locations. The portable toilets shall be properly maintained and serviced.
4. If authorized by the Ministry, a dry or composting sanitary system. Latrines, slit trench, or pits shall not be permitted.
5. All septic tanks and soak pits shall be placed, constructed, and maintained so as to prevent any contamination of Fresh Water sources, whether or not currently used as a Fresh Water source for any purpose.

13.6 Personal Protection Equipment

1. Contractor shall provide personal protection equipment to protect all workers against likely risks to safety and health.
2. In compliance with International Oilfield Practices and where work conditions require, the minimum set of personal protection equipment for workers shall include:
   (a) hard hat;
   (b) protective footwear with steel toe-caps;
   (c) spark or flame retardant overalls or other work clothing, as appropriate;
   (d) gloves;
   (e) eye protection;
   (f) hearing protectors;
   (g) a personal flotation device where appropriate; and
   (h) where appropriate, breathing apparatus positioned to be readily available to all personnel in the event of a release of toxic or corrosive gases or liquids.
3. All personal protection equipment shall be inspected periodically and maintained in good, usable condition and, if not regularly used, it shall be located in a readily accessible area.

13.7 Monitoring Systems and Alarms

1. Monitoring systems and alarms shall be installed, located, maintained and operated in fields, facilities and support operations in accordance with International Oilfield Practice.
2. Where work conditions require, Contractor shall install, maintain and operate an automatic monitoring system capable of detecting and responding to the presence of fire, flame, heat or smoke by initiating the appropriate alarms and responses.
3. Contractor shall install, maintain and operate an automatic monitoring system capable of detecting and responding to the presence of toxic or flammable gas or vapor by initiating the appropriate alarms and responses.
4. Contractor shall install, maintain and operate backup monitoring systems capable of alerting workers in the event a primary monitoring system fails or shuts down.
5. Contractor shall ensure that all critical monitoring systems remain operational in the event of a primary power failure, whether primary power is provided by mains service or by Contractor.

13.8 Reporting

Contractor shall prepare and maintain full and complete records of all relevant activities related to the safety and health of workers and the general public, including incidents of serious personal injury, fire or explosion, spillage or escape of hazardous substances, or the unsafe operation of equipment and

shall deliver to the Ministry all such information and reports not less than fifteen days after the occurrence of any incident described in this Clause 8.